Report No: 113223/ 12143a

WORKING FOR WETLANDS REHABILITATION PROGRAMME, LIMPOPO

FINAL REHABILITATION PLAN

PROJECT: SOUTINI-BALENI B82G

JULY 2019

Agriculture, Forestry and Fisheries
Environmental Affairs
Water Affairs and Sanitation

Working for Wetlands

EXPANDED PUBLIC WORKS PROGRAMME
Creating opportunities towards human fullfilment

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REHABILITATION PLAN FOR THE SOUTINI-BALENI WETLAND PROJECT, LIMPOPO: PLANNING YEAR 2018/2019
AS PART OF
THE WORKING FOR WETLANDS PROGRAMME
FOR THE
DEPARTMENT OF ENVIRONMENTAL AFFAIRS
DIRECTORATE: WORKING FOR WETLANDS

MAIN REPORT
JULY 2019

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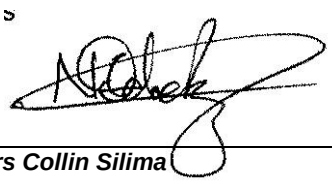
WfWetlands Approval			
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WORKING FOR WETLANDS: CONTEXT DOCUMENT

1. Introduction

Working for Wetlands (WfWetlands) is a government programme managed by the Natural Resource Management Programme (NRM) of the Department of Environmental Affairs and is a joint initiative with the Departments of Water and Sanitation (DWS), and Agriculture, Forestry and Fisheries (DAFF). In this way the programme is an expression of the overlapping wetland-related mandates of the three parent departments, and besides giving effect to a range of policy objectives, it also honours South Africa's commitments under several international agreements, especially the Ramsar Convention on Wetlands.

The programme is mandated to protect pristine wetlands, promote their wise-use and rehabilitate those that are damaged throughout South Africa, with an emphasis on complying with the principles of the Expanded Public Works Programme (EPWP) and using only local Small, Medium and Micro Enterprises (SMMEs). The EPWP seeks to draw significant numbers of unemployed people into the productive sector of the economy, gaining skills while they work and increasing their capacity to earn an income.

2. Wetlands and their importance

Once considered valueless wastelands that needed to be drained or converted to more useful land use purposes, wetlands are now seen in an entirely different light. Today wetlands are more commonly perceived as natural assets and natural infrastructure able to provide a range of products, functions and services free of charge.

That which actually constitutes a wetland is often not fully understood. Common misconceptions have been that wetlands must be wet, must have a river running through them, or must always be situated in low-lying areas. The definition of a wetland is much broader and more textured: they are characterised more by soil properties and flora than by an abundance of water.

The National Water Act, No. 36 of 1998 defines a wetland as:

> *"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".*

The Ramsar Convention defines wetlands as:

> *"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6m" (Article 1, Ramsar Convention on Wetlands. 1971).*

Wetlands can therefore be seasonal and may experience regular dry spells (sometimes even staying dry for up to several years), or they can be frequently or permanently wet. Wetlands can occur in a variety of locations across the landscape (**Plate A**) and may even occur at the top of a hill, nowhere near a river. A pan, for example, is a wetland which forms in a depression. Wetlands also come in many sizes; they can be as small as a few square metres (e.g. at a low point along the side of a road) or cover a significant portion of a country (e.g. the Okavango Delta).

Plate A: A large, seasonal wetland identifiable by the characteristic flora. This wetland contained no surface water at the time of the photograph

Wetland ecosystems provide a range of ecological and social services which benefit people, society and the economy at large:

- Improving the ecological health of an ecosystem by performing many functions that include flood control, water purification, sediment and nutrient retention and export, recharge of groundwater, as well as acting as vital habitats for diverse plant and animal species.
- Providing ecological infrastructure replacing the need for municipal infrastructure by providing the same or better benefit at a fraction of the cost, for example:
    - The movement of water in the landscape is slowed down by wetlands, which offers the dual benefit of flood control as well as a means of purification.
    - The slow movement of water allows heavier impurities to settle and phreatic vegetation and micro-bacteria the opportunity to remove pollutants and nutrients.
- Functioning as valuable open spaces and create recreational opportunities for people that include hiking along wetlands, fishing, boating, and bird-watching.
- Having cultural and spiritual significance for the communities living nearby. Commercially, products such as reeds and peat are also harvested from wetlands (**Plate B**).

Plate B: Commercial products made by locals from reeds harvested from wetlands

Wetlands are thus considered to be critically important ecosystems as they provide both direct and indirect benefits to the environment and society.

3. Wetland degradation

It has been estimated that originally over 10% of the Republic of South Africa (RSA) was covered by wetlands. However, this figure decreases significantly every year owing to unsustainable land-use practices. It is estimated that more than 50% of South Africa's wetlands have been destroyed through drainage of wetlands for crops and pastures, poorly managed burning regimes, overgrazing, disturbances to wetland soils, vegetation clearing as well as industrial and urban development (including mining activities).

Although wetlands are high-value ecosystems that make up only a small fraction of the country, they rank among the most threatened ecosystems in South Africa. According to a recent Council of Scientific Research (CSIR) study (Nel and Driver, 2012), South Africa's remaining wetlands were identified as the most threatened of all South Africa's ecosystems, with 48% of wetland ecosystem types being critically endangered, 12% endangered and 5% vulnerable. Only 11% of wetland ecosystem types are well protected, with 71% not protected at all.

The remaining wetland systems suffer from severe erosion and sedimentation, undesirable plant species and aquatic fauna infestations, unsustainable exploitation, artificial drainage and damming, and pollution. The continued degradation of wetlands will impact on biodiversity, ecological function, and the provision of ecosystem services with subsequent impacts on livelihoods and economic activity, as well as health and wellbeing of communities. In the absence of functional wetlands, the carbon cycle, the nutrient cycle and the water cycle would be significantly altered, mostly detrimentally.

Wetland conservation and rehabilitation should be at the heart of water management. It is necessary to prioritise South Africa's remaining wetlands such that those that offer valuable ecosystem services and are least impacted by current pressures or threats are offered immediate attention to avoid further loss, conversion or degradation.

4. The Working for Wetlands Programme

South Africa is a dry country but is endowed with exceptionally rich biodiversity. The nation has a pressing reason to value the water-related services that wetlands provide. It is estimated that by 2025, South Africa will be one of fourteen African countries classified as "*subject to water scarcity*" (UNESCO, 2000). The conservation of wetlands is fundamental to the sustainable management of water quality and quantity, and wetland rehabilitation is therefore essential to conserving water resources in South Africa.

The guiding principles of the National Water Act, No. 36 of 1998, recognise the need to protect water resources. In responding to the challenge of stemming the loss of wetlands and maintaining and enhancing the benefits they provide, government has recognised that, in order to be truly effective, strategies for wetland conservation need to include a combination of proactive measures for maintaining healthy wetlands, together with interventions for rehabilitating those that have been degraded. These objectives are currently being expressed in a coordinated and innovative way through the WfWetlands Programme.

Working for Wetlands pursues its mandate of wetland protection, wise use and rehabilitation in a manner that maximises employment creation, supports small emerging businesses, and transfers skills amongst vulnerable and marginalised groups. In the 15 years since 2004, the WfWetlands Programme has invested over R 1.1 billion in wetland rehabilitation and has been involved in about 1 500 wetlands, thereby improving or securing the health of over 70 000 hectares of wetland environment. The WfWetlands Programme has a current budget of just over R 130 million per annum, of which 35% is allocated directly to paying wages. Being part of the EPWP, the WfWetlands Programme has created more than 34 000 jobs and over 3.2 million person-days of paid work. The local teams are made up of a minimum of 55% women, 65% youth and 2% disabled persons.

Wetlands are not easy ecosystems to map at a broad scale as they are numerous, often small and difficult to recognise and delineate on remotely sensed imagery such as satellite photos. The WfWetlands Programme houses the National Wetlands Inventory Project (NWI) which aims to provide clarity on the extent, distribution and condition of South Africa's wetlands. The project clarifies how many and which rivers and wetlands have to be maintained in a natural condition to sustain economic and social development, while still conserving South Africa's freshwater biodiversity.

The National Freshwater Ecosystem Priority Areas (NFEPA) has used the NWI data to produce the most comprehensive national wetland map to date, called the NFEPA Atlas. This atlas enables the planning of wetland rehabilitation on a catchment scale.

Other activities that form part of the WfWetlands Programme include:

- Raising awareness of wetlands among workers, landowners and the general public; and
- Providing adult basic education and training, and technical skills transfer (in line with the emphasis of the EPWP on training, the WfWetlands Programme has provided 225 000 days of training in vocation and life skills).

5. Rehabilitation interventions

The successful rehabilitation of a wetland requires that the cause of damage or degradation is addressed, and that the natural flow patterns of the wetland system are re-established (flow is encouraged to disperse rather than to concentrate). Approximately 800 interventions are implemented every year in the WfWetlands Programme. The key purposes of implementing interventions include:

- Restoration of hydrological integrity (e.g. raising the general water table or redistributing the water across the wetland area);
- Recreation of wetland habitat towards the conservation of biodiversity; and
- Job creation and social upliftment.

Typical activities undertaken within the projects include:

- Plugging artificial drainage channels created by development or historical agricultural practices to drain wetland areas for other land use purposes;
- Constructing structures (gabions, berms, weirs) to divert or redistribute water to more natural flow paths, or to prevent erosion by unnatural flow rates that have resulted from unsustainable land use practices or development; and
- Removing invasive alien or undesirable plant species from wetlands and their immediate catchments (in conjunction with the Working for Water initiative).

Methods of wetland rehabilitation may include hard engineering interventions such as:

- Earth berms or gabion systems to block artificial channels that drain water from or divert polluted water to the wetland;
- Concrete and gabion weirs to act as settling ponds, to reduce flow velocity or to re-disperse water across former wetland areas thereby re-establishing natural flow paths;
- Earth or gabion structure plugs to raise channel floors and reduce water velocity;
- Concrete or gabion structures to stabilise head-cut or other erosion and prevent gullies;
- Concrete and/or reno mattress strips as road crossings to address channels and erosion in wetlands from vehicles; and
- Gabion structures (mattresses, blankets or baskets) to provide a platform for the growth of desired wetland vegetation.

Soft engineering interventions also offer successful rehabilitation methods, and the following are often used together with the hard engineering interventions:

- The use of biodegradable or natural soil retention systems such as eco-logs, Macmat-R plant plugs, grass or hay bales, and brush-packing techniques;
- The re-vegetation of stabilised areas with appropriate wetland and riparian plant species;
- Alien invasive plant clearing, which is an important part of wetland rehabilitation (this is supported by the Working for Water Programme).
- Fencing off sensitive areas within the wetland to keep grazers out and to allow for the re-establishment of vegetation;

- The removal of undesirable plant and animal species; and
- In some wetlands, it may be possible to involve the community to develop a management plan for wise use within a wetland. This can involve capacity building through educating and training the community members who would monitor the progress. A plan could involve measures such as rotational grazing with long term benefits for rangeland quality.

6. Programme, projects and phases

In order to manage the **WfWetlands Programme**, wetlands have been grouped into "projects", and each **Wetland Project** encompasses several smaller wetland systems which are each divided into smaller, more manageable and homogenous wetland units. A Wetland Project may be located within one or more quaternary catchments within a Province. The WfWetlands Programme is currently managing 48 Wetland Projects countrywide, and rehabilitation activities range from stabilising degradation to the more ambitious restoration of wetlands to their original conditions.

Each Wetland Project is managed in three phases (as shown in the flow diagram in **Plate C**) over a two-year cycle. The first two phases straddle the first year of the cycle and involve planning, identification, design and authorisation of interventions. The third phase is implementation, which takes place during the second year.

In order to undertake these three phases, a collaborative team has been established as follows. The **Programme Team** currently comprises two subdirectories: a) Implementation and After Care and b) Planning, Monitoring and Evaluation. The Assistant Directors for Wetlands Programmes (ASDs) [1] report to the Implementation and After Care Deputy Director and are responsible for the identification and implementation of projects in their regions. The Programme Team is further supported by a small team that fulfil various roles such as Geographical Information Systems (GIS) and training. Independent Design Engineers and Environmental Assessment Practitioners (EAPs) are appointed to undertake the planning, design and authorisation components of the project. The project team is assisted by a number of wetland specialists who provide scientific insight into the operation of wetlands and bring expert and often local knowledge to the project teams. They are also assisted by the landowners and implementers who have valuable local knowledge of these wetlands.

The first phase is the identification of suitable wetlands which require intervention. The purpose of Phase 1 and the associated reporting is to identify:

- Priority catchments and associated wetlands/ sites within which rehabilitation work needs to be undertaken; and
- Key stakeholders who will provide meaningful input into the planning phases and wetland selection processes, and who will review and comment on the rehabilitation proposals.

Phase 1 commences with a catchment and wetland prioritisation process for every province. The Wetland Specialist responsible for a particular province undertakes a desktop study to determine the most suitable wetlands for the WfWetlands rehabilitation efforts. The involvement of Provincial Wetland Forums and other key stakeholders is a critical component of the wetland identification processes since these stakeholders are representative of diverse groups with shared interests (e.g. from government institutions to amateur ecological enthusiasts). This phase also involves initial communication with local land-owners and other Interested and Affected Parties (I&APs) to gauge the social benefits of the work. Aerial surveys of the areas in question may be undertaken, as well as limited fieldwork investigations or site visits to confirm the inclusion of certain wetland projects or units. Once wetlands have been prioritised and agreed on by the various parties, specific rehabilitation objectives are determined for each wetland following a rapid wetland assessment undertaken by the Wetland Specialist.

Phase 2 requires site visits attended by the fieldwork team comprising a Wetland Specialist, a Design Engineer, an EAP, and an ASD. Other interested stakeholders or authorities, landowners and in some instances the Implementing Agents (IAs) may also attend the site visits. This allows for a highly collaborative approach, as options are discussed by experts from different scientific disciplines, as well as local inhabitants with deep anecdotal knowledge. While on site, rehabilitation opportunities are investigated. The details of the proposed interventions are discussed, some survey work

[1] Previously referred to as Provincial Coordinators (PCs).

is undertaken by the engineers, and Global Positioning System (GPS) coordinates and digital photographs are taken for record purposes. Furthermore, appropriate dimensions of the locations are recorded in order to design and calculate quantities for the interventions. At the end of the site visit the rehabilitation objectives together with the location layout of the proposed interventions are agreed upon by the project team.

During Phase 2, monitoring systems are put in place to support the continuous evaluation of the interventions. The systems monitor both the environmental and social benefits of the interventions. As part of the Phase 2 site visit, a maintenance inventory of any existing interventions that are damaged and/or failing and thus requiring maintenance is compiled by the ASD, in consultation with the Design Engineer.

Based on certain criteria and data measurements (water volumes, flow rates, and soil types); the availability of materials such as rock; labour intensive targets; maintenance requirements etc., the interventions are then designed. Bills of quantity are calculated for the designs and cost estimates made. Maintenance requirements for existing interventions in the assessed wetlands are similarly detailed and the costs calculated. The Design Engineer also reviews and, if necessary, adjusts any previously planned interventions that are included into the historical Rehabilitation Plans.

Phase 2 also comprises a reporting component where Rehabilitation Plans are prepared for each Wetland Project. The Rehabilitation Plans include details of each intervention to be implemented, preliminary construction drawings and all necessary documentation required by applicable legislation. The Rehabilitation Plans are reviewed by various government departments, stakeholders and the general public before a specific subset of interventions are selected for implementation.

Landowner consent is an important component of each phase in each Wetland Project. The flow diagram, **Plate C**, demonstrates the point at which various consent forms must be approved via signature from the directly affected landowner. The ASDs are responsible for undertaking the necessary landowner engagement and for ensuring that the requisite landowner consent forms required as part of Phase 1 and 2 of this project are signed.

Without these signed consent forms the WfWetlands Programme will not be able to implement rehabilitation interventions on the affected property.

Phase 3 requires that certain Environmental Authorisations are obtained before work can commence in the wetlands (please see subsequent sections of this document for detail on Environmental Authorisations). Upon approval of the wetland Rehabilitation Plans by DEA, the work detailed for the project will be implemented within a year with on-going monitoring being undertaken thereafter. The Rehabilitation Plans are the primary working document for the implementation of the project via the construction/ undertaking of interventions[2] listed in the Plan.

It is typically at this point in the process when the final construction drawings are issued to the IAs. Seventeen IAs are currently employed in the WfWetlands Programme and are responsible for employing contractors and their teams (workers) to construct the interventions detailed in each of the Rehabilitation Plans. For all interventions that are based on engineering designs (typically hard engineered interventions), the Design Engineer is required to visit the site before construction commences to ensure that the original design is still appropriate in the dynamic and ever-changing wetland system. The Design Engineer will assist the IAs in pegging and setting-out interventions. The setting-out activities often coincide with the Phase 1 activities for the next planning cycle. Phase 3 concludes with the construction of the interventions, but there is an on-going monitoring and auditing process that ensures the quality of interventions, the rectification of any problems, and the feedback to the design team regarding lessons learnt.

[2] This could include soft options such as alien clearing or eco-logs, as well as hard structures for example weirs.

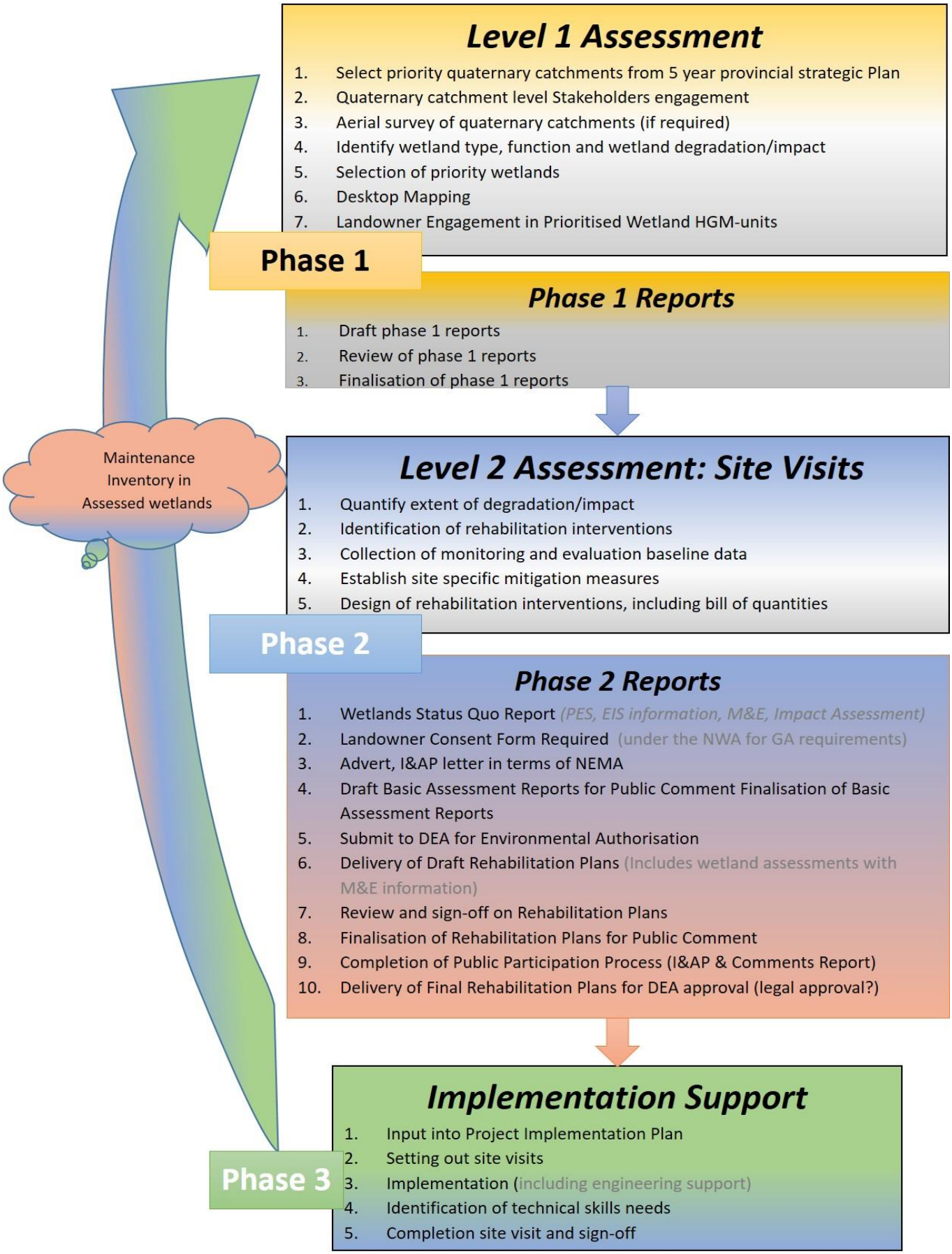

Plate C: The Working for Wetlands planning process (Phase 1 to Phase 3)

Rehabilitation work within floodplain systems

Based on lessons learnt and project team discussions held during the National Prioritisation workshop in November 2010 the WfWetlands Programme took an in-principle decision regarding work within floodplain systems.

Recognising the ecosystem services provided by floodplain wetlands and the extent to which they have been transformed, WfWetlands do not intend to stop undertaking rehabilitation work in floodplains entirely. Instead, WfWetlands propose to adopt an approach to the rehabilitation of floodplain areas that takes into account the following guiding principles:

a) As a general rule, avoid constructing hard interventions within an active floodplain channel; and rather
b) Explore rehabilitation opportunities on the floodplain surface using smaller (possibly more) softer engineering options outside of the main channel.

When rehabilitation within a floodplain setting is being contemplated, it will be necessary to allocate additional planning resources, including the necessary specialist expertise towards ensuring an adequate understanding of the system and appropriate design of the interventions.

7. Environmental legislation

One of the core purposes of the WfWetlands Programme is the preservation of South Africa's valuable wetland systems through rehabilitation and restoration.

South Africa has rigorous and comprehensive environmental legislation aimed at preventing degradation of the environment, including damage to wetland systems. The following legislation is of relevance:

- The National Environmental Management Act, No. 107 of 1998 (NEMA), as amended
- The National Water Act, No.36 of 1998 (NWA)
- The National Heritage Resources Act, No. 25 of 1999 (NHRA)

Development proposals within or near any wetland system are subject to thorough bio-physical and socio-economic assessment as mandatory processes of related legislation. These processes are required to prevent degradation of the environment and to ensure sustainable and environmentally conscientious development.

The WfWetlands Programme requires that both hard and soft interventions are implemented in the wetland system, and it is the activities associated with the construction of these interventions that triggers requirements for various authorisations, licenses or permits. However, it is important to note that the very objective of the WfWetlands Programme is to improve both environmental and social circumstances. The WfWetlands Programme gives effect to a range of policy objectives of environmental legislation, and also honours South Africa's commitments under several international agreements, especially the Ramsar Convention on Wetlands.

Table A: List of applicable legislation

Title of legislation, policy or guideline	Administering authority	Date
The Constitution of South Africa, Act No.108 of 1996	National Government	1996
National Environmental Management Act, No.107 of 1998	Department of Environmental Affairs	1998
The National Water Act, No. 36 of 1998	Department of Water and Sanitation	1998
Conservation of Agricultural Resources Act, No. 43 of 1983	Department of Agriculture, Forestry & Fisheries	1983
National Heritage Resources Act, No. 25 of 1999	National Heritage Resources Agency	1999
World Heritage Conventions Act, No. 49 of 1999	Department of Environmental Affairs	1999
The National Environmental Management: Biodiversity Act, No. 10 of 2004	Department of Environmental Affairs	2004
National Environmental Management: Protected Areas Act, No. 57 of 2003	Department of Environmental Affairs	2003
The Mountain Catchments Areas Act, No. 63 of 1970	Department of Water and Sanitation	1970
EIA Guideline Series, in particular: • Guideline 5 – Companion to the NEMA EIA Regulations, 2010 (DEA, October 2012) • Guideline 7 – Public Participation in the EIA process, 2012 (DEA, October 2012) • Guideline 9 - Guideline on Need and Desirability, 2010 (DEA, October 2014)	Department of Environmental Affairs	2012 - 2014
International Conventions, in particular: • The Ramsar Convention • Convention on Biological Diversity • United Nations Conventions to Combat Desertification • New Partnership for Africa's Development (NEPAD) • The World Summit on Sustainable Development (WSSD)	International Conventions	N/A

Of particular relevance in **Table A** is the following legislation and the WfWetlands Programme has put systems in place to achieve compliance:

- The National Environmental Management Act, No. 107 of 1998 (NEMA), as amended
    - In terms of the 2014 Environmental Impact Assessment Regulations pursuant to the NEMA, certain activities that may have a detrimental impact on the environment (termed Listed Activities) require an Environmental Authorisation (EA) from the DEA. The implementation of interventions will trigger NEMA Listing Notices 1 and 3 (G.N. R983 and G.N R985 respectively). In order to meet the requirements of these Regulations, it is necessary to undertake a Basic Assessment (BA) Process and apply for an EA. This was previously undertaken on an annual basis per Province for each individual wetland unit. However as of 2014, applications were submitted (per Province) for wetland systems, allowing WfWetlands to undertake planning in subsequent years within these wetlands without having to undertake a BA process. The rehabilitation plans still however require approval from the competent authority (i.e. DEA).
    - **Basic Assessment Reports** (BARs) were prepared for each Province where work is proposed by the WfWetlands Programme. These BARs will present all Wetland Projects that are proposed in a particular province, together with information regarding the quaternary catchments and the wetlands that have been prioritised for the next few planning cycles (anywhere from one to three planning cycles depending on the information gained through the Catchment Prioritisation Process). The EA's will be inclusive of all Listed Activities that may be triggered and will essentially authorise any typical wetland rehabilitation activities required during the WfWetlands Programme implementation phase. Note that certain Listed

Activities have been excluded from the Basic Assessment as they fall under the ambit of a 'maintenance management plan' in the form of the Rehabilitation Plan for each project and are therefore subject to exclusion. The impacts thereof have however been considered within the respective Rehabilitation Plans.

- A condition of the EA's is that **Rehabilitation Plans** will be prepared every year after sufficient field work has been undertaken in the wetlands that have an EA. These Rehabilitation Plans will be made available to registered Interested and Affected Parties (I&APs) before being submitted to DEA for approval. The Rehabilitation Plans will describe the combination and number of interventions selected to meet the rehabilitation objectives for each Wetland Project, as well as an indication of the approximate location and approximate dimensions (including footprint) of each intervention.

- The National Water Act, No.36 of 1998 (NWA)
  - In terms of Section 39 of the NWA, a General authorisation[3] (GA) has been granted for certain activities that are listed under the NWA that usually require a Water Use License; as long as these activities are undertaken for wetland rehabilitation. These activities include '*impeding or diverting the flow of water in a watercourse*[4]' and '*altering the bed, banks, course or characteristics of a watercourse*[5]' where they are specifically undertaken for the purposes of rehabilitating[6] a wetland for conservation purposes. The WfWetlands Programme is required to register the 'water use' in terms of the GA.

- The National Heritage Resources Act, No. 25 of 1999 (NHRA)
  - In terms of Section 38 of the NHRA; any person who intends to undertake a development as categorised in the NHRA must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely the South African Heritage Resources Agency (SAHRA) or the relevant provincial heritage agency. These agencies would in turn indicate whether or not a full Heritage Impact Assessment (HIA) would need to be undertaken. Should a permit be required for the damaging or removal of specific heritage resources, a separate application will be submitted to SAHRA or the relevant provincial heritage agency for the approval of such an activity. WfWetlands has engaged with SAHRA regarding the wetland planning process and has committed to achieving full compliance with the heritage act over the next few years.

[3]Government Notice No. 1198, 18 December 2009

[4]Section 21(c) of the NWA, No. 36 of 1998

[5]Section 21(i) of the NWA, No. 36 of 1998

[6]Defined in the NWA as "*the process of reinstating natural ecological driving forces within part of the whole of a degraded watercourse to recover former or desired ecosystem structure, function, biotic composition and associated ecosystem services*".

TABLE OF CONTENTS

Appendices

List of Figures

List of Tables

i. CONTEXT OF THE INFORMATION CONTAINED IN THIS REHABILITATION PLAN

Approach to the NEMA Environmental Process
The legislation protecting the environment in South Africa was not written with the intention of preventing wetland rehabilitation efforts, but rather at curtailing development in sensitive environments. It is important to remember that the Working for Wetlands (WfWetlands) Programme is not a development proposal, and although this programme technically requires authorisations, licenses and permits, such rehabilitation projects were never meant to be sent through legislative processes aimed at preventing negative environmental impact. In terms of the environmental management principles of the National Environmental Management Act, No. 107 of 1998 (NEMA), as amended, certain activities that may have a detrimental impact on the environment (termed Listed Activities) require Environmental Authorisation (EA) from DEA. The WfWetlands Programme will require that interventions be implemented and/or constructed in the wetland systems to ultimately restore some of the more natural wetland functions that have been lost to unsustainable land use practices or development. The implementation of interventions will trigger Listing Notices 1 and 3 (GN R 983 and GN R 985, as amended, respectively). In order to meet the requirements of the Regulations pursuant to NEMA, it was necessary to undertake a Basic Assessment Process as outlined in Part 2 and Appendix 1 of GN R 982. Basic Assessment Report (BARs) were prepared and these reports presented all Wetland Projects for each Province, together with information regarding the quaternary catchments and the wetlands that were prioritised for the next few planning cycles (anywhere from one to three planning cycles depending on the information gained through the Catchment Prioritisation Process). Rehabilitation Plans, associated with the Wetland Projects described in the BARs, have also been prepared and provide detail on the wetland problems, proposed rehabilitation interventions and rehabilitation objectives. These reports are also subject to a 30-day public comment period after which it is submitted to DEA for approval.

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iii. ABBREVIATIONS

ASD	Assistant Director: Wetlands Programmes[7]
BAR	Basic Assessment Report
BGIS	Biodiversity Geographical Information System
BMP	Best Management Practice
CARA	Conservation of Agricultural Resources Act
EMPr	Environmental Management Programme
CPP	Catchment Prioritisation Process
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation in terms of the NEMA
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EPWP	Expanded Public Works Programme
GA	General authorisation in terms of the NWA
GIS	Geographical Information System
GPS	Global Positioning System
HGM	Hydrogeomorphic [unit]
HIA	Heritage Impact Assessment
IA	Implementing Agent
I&APs	Interested and Affected Parties
IDP	Integrated Development Plans
LUI	Land Use Incentive Programme
M&E	Monitoring and Evaluation
MAP	Mean Annual Precipitation
MoU	Memorandum of Understanding
NEMA	National Environmental Management Act (Act 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act
NRM	Natural Resource Management Programmes
NWA	National Water Act (Act 36 of 1998)
NWI	National Wetlands Inventory
PET	Potential Evapotranspiration
PIP	Project Implementation Plan
PPP	Public Participation Process
RSA	Republic of South Africa
SANParks	South African National Parks
SAHRA	South African Heritage Resources Agency
SMME	Small, Medium and Micro Enterprises
UNESCO	United Nations Educational, Scientific and Cultural Organization
WfWetlands	Working for Wetlands

[7] Previously referred to as the Provincial Coordinator (PC).

iv. GLOSSARY OF TERMS

Bedrock: The solid rock that underlies unconsolidated material, such as soil, sand, clay, or gravel (Cowden and Kotze, 2008).

Basic Assessment Report (BAR): A report as required in terms of the 2014 EIA Regulations, of the National Environmental Management Act, No. 107 of 1998 (NEMA), that describes the proposed activities and their potential impacts.

Best Management Practice (BMP): Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWetlands implementers. Such practices are informed by applied research.

Biophysical: The biological and physical components of the environment (Cowden and Kotze, 2008).

Catchment: All the land area from mountaintop to seashore which is drained by a single river and its tributaries. Each catchment in South Africa has been subdivided into secondary catchments, which in turn have been divided into tertiary catchments. Finally, all tertiary catchments have been divided into interconnected quaternary catchments. A total of 1946 quaternary catchments have been identified for South Africa. These subdivided catchments provide the main basis on which catchments are subdivided for integrated catchment planning and management (Cowden and Kotze, 2008).

Environmental Assessment Practitioner (EAP): The individual responsible for the planning, management and coordination of the environmental impact assessments, strategic environmental assessments, environmental management plans and/or other appropriate environmental instruments introduced through regulations of NEMA.

Ecosystem Services or 'eco services': The services such as sediment trapping or water supply, supplied by an ecosystem (in this case a wetland ecosystem).

Environmental Impact Assessment (EIA): A study of the environmental consequences of a proposed course of action via the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental Management Programme (EMPr): A detailed plan of action to organise and co-ordinate environmental mitigation, rehabilitation and monitoring during the implementation and maintenance of interventions identified under the WfWetlands Programme such that positive impacts are enhanced and negative impacts are avoided/minimised.

Interested and Affected Parties (I&APs): People and organizations that have interest(s) in the proposed activities, also referred to as stakeholders.

Environmental Impact: An environmental change caused by some human act.

Implementer: The person or organisation responsible for the construction of WfWetlands rehabilitation interventions.

Intervention: A method of wetland rehabilitation that aims to address the objectives of the particular wetland system, namely to restore the hydrological integrity of the system and support associated biodiversity. It can be in the form of a hard (structures made of hard materials which are fixed (e.g. a concrete weir) or soft intervention (e.g. re-vegetation).

Mitigation: Actions to reduce the impact of a particular activity.

Maintenance: The replacement, repair or the reconstruction of an existing structure within the same footprint, in the same location, having the same capacity and performing the same function as the previous structure ('like for like').

Public Participation Process (PPP): A process of involving the public in order to identify issues and concerns, and obtain feedback on options and impacts associated with a proposed project, programme or development. Public Participation Process in terms of NEMA refers to: a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to specific project matters.

Project: An area of WfWetlands intervention generally defined by a quaternary catchment or similar management unit such as a national park in which a single implementer operates.

Quaternary Catchment: "A fourth order catchment in a hierarchal classification system in which a primary catchment is the major unit" and that is also the "principal water management unit in South Africa" (DWS, 2011).

Rehabilitation: In the context of wetlands, refers to re-instating the driving ecological forces (including hydrological, geomorphological and biological processes) that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers.

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Wetland: "Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils." (National Water Act, 36 of 1998) **and** "Land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants living there" (Cowden and Kotze, 2008).

v. ASSUMPTIONS AND LIMITATIONS

In compiling this report, the following has been assumed:

- The information provided in this report is based on site visits that have been undertaken by the project team (Environmental Assessment Practitioner (EAP), Engineer, Wetland Specialist, the Assistant Directors for Wetlands Programmes (ASD)) and their subsequent input into the Reporting, which includes intervention design drawings, the wetland *status quo* report, in addition to input from the ASD. It is understood that this information is sufficient for the authorisation processes and associated Phase 3 (Implementation phase). This data and relevant information has informed the findings and conclusions of this report.
- Information contained in this Report will be used during Phase 3 to guide and inform the Implementing Agents on design and construction specifications as part of Phase 3. Implementing Agents will thus use this Rehabilitation Plan and the information contained herein when constructing all interventions, the designs of which have been included in this Report.
- The ASDs will be undertaking the landowner engagement and have obtained the requisite landowner consent forms required as part of Phase 1 and 2 of this project.
- The WfWetlands Programme has provided all relevant information and documentation required to compile this Rehabilitation Plan.
- Rehabilitation activities should not be carried out until the Wetland Rehabilitation Plan has been approved by DEA and formally signed off by WfWetlands.
- The implementation of this Rehabilitation Plan must take into account all relevant provisions of Working for Wetlands Best Management Practices (BMPs), the generic Environmental Management Programme (EMPr), as well as specific recommendations of the Basic Assessments and the requirements of the Environmental Authorisation (EA) for the all stages of the project.
- The requirement to spend at least 42% on wages out of the project budget has been taken into consideration by the project team during the planning process for wetland rehabilitation.
- Should it be necessary to exclude interventions from the Rehabilitation Plan, the prioritisation of interventions across the project should strictly be followed.

vi. GAPS IN KNOWLEDGE

- The information in this Report is based on existing available information and input from the ASD, the specialist wetland specialists, the Engineer, the EAP as well as comments from Interested and Affected Parties (I&APs). Until this Report has been finalised and signed off by WfWetlands, the content of the Report should be considered as preliminary.
- Designs for the rehabilitation interventions have been developed for site conditions as at the time of the planning site visits. Should site conditions change before the designs are implemented, changes to the design and the positions thereof may be necessary. In this case, project implementers may require the assistance of a professional engineer.
- The cost of construction at each project location will vary due to factors such as the local cost and availability of material, transport distances etc. The unit costs have been agreed with the ASDs based on their knowledge of past projects and therefore include an allowance for escalation.
- The labour intensive targets identified in this project are based on assumed productivity rates for various components of the construction process. This will vary in practise and will require regular monitoring to ensure that labour targets are attained.

This Report must be read in conjunction with the following reports for this project:

1. 2018/2019 Limpopo Basic Assessment Report, and
2. Soutini-Baleni Wetland Status Quo Report (2019) (**Appendix A** of this report).

vii. DISCLAIMER

- This Rehabilitation Plan is for the Soutini-Baleni Wetland Project in the Limpopo Province. The plan is to be used to implement the interventions identified as necessary to rehabilitate the Soutini-Baleni wetlands and is to be approved by the DEA as part of the environmental authorisation process required in terms of Government Notice Regulation 982 of 4 December 2014, as amended (GN R982).
- The intervention points and wetland boundary polygons provided in this report are based on the shapefiles that have been provided by the wetland specialist. All reasonable efforts have been made to ensure that the data is accurate. However, Aurecon does not accept responsibility for any remaining inaccuracies in the spatial data provided to us, which may be reflected in this report.
- Aurecon accepts responsibility for the engineering design to the extent that this is based on available information. The available information is limited to what could be interpreted during a single site visit of no longer than a few hours. No geotechnical, topographical, geomorphologic and other engineering related surveys have been undertaken to inform the design. This is non-standard engineering practice and therefore Aurecon is indemnified by the Client and does not accept responsibility for the associated risk of failure from the above limitations or any damages that may occur.
- This Rehabilitation Plan must not be amended without prior consultation and approval from DEA, the responsible EAP, Engineer, ASD and the WfWetlands Deputy Director for Planning, Monitoring and Evaluation.
- All changes to site instructions and/or construction drawings after the commencement of interventions must be motivated using the standard change request form supplemented with additional information as necessary.
- Aurecon is indemnified against any associated damages and accepts no liability associated with the construction and implementation of engineering interventions due to Aurecon being instructed to have limited contact with the implementer during the construction phase resulting in our inability to diligently supervise and assess any progress.
- The Client confirms that by accepting these drawings or reports, he acknowledges and accepts the abovementioned limitation of Aurecon's liability.

viii. DISTRIBUTION LIST

NAME	TITLE	FOR ACTION	FOR INFORMATION	RECEIVED PRIOR TO RELEASE
PROPONENT				
Dr Farai Tererai	Deputy Director: Planning, Monitoring and Evaluation	✓		✓
Dr Piet Louis Grundling	Deputy Director: Project Implementation	✓		✓
Mrs Colin Silima	Assistant Director: Wetlands Programmes	✓		✓
NATIONAL STAKEHOLDERS				
Refer to **Appendix G**			✓(E-copy of Rehab Plan)	
PROVINCIAL STAKEHOLDERS & I&APs				
Refer to **Appendix G**			✓(E-mail notification)	
LANDOWNERS				
Refer to **Appendix E**			✓(E-copy of Rehab Plan)	

1 INTRODUCTION

1.1 Document outline

This document comprises the Rehabilitation Plan for the Soutini-Baleni Wetland Project identified as part of the Working for Wetlands Programme (WfWetlands). The Rehabilitation Plan is the primary working document for the implementation (construction/undertaking) of planned interventions in 2019/20, which are necessary to meet the wetland rehabilitation objectives that have been determined in earlier phases of the WfWetlands Programme. The Soutini-Baleni Rehabilitation Plan includes the following wetland systems:

- Soutini-Baleni 01
- Soutini-Baleni 02
- Soutini-Baleni 03
- Soutini-Baleni 04

The outline of this document is as follows:

- **Chapter 1:** This introductory section provides an outline of the document structure as well as contextualising the document within the legal environmental authorisation processes.
- **Chapter 2**: This section on project context provides a brief summary of the WfWetlands Programme, including the typical rehabilitation methods and intervention options used to date. This section also provides more detail on the Soutini-Baleni Wetland Project, including the selection of wetlands and their priority rating in the Province.
- **Chapter 3:** This section discusses the general methodologies for selecting and prioritising wetlands, through to designing interventions and developing the Rehabilitation Plan.
- **Chapter 4:** This section focusses on four hydro-geomorphic (HGM) units within the Soutini-Baleni wetland system and includes a description of the wetland, motivation for the wetland selection, summary of the problems, and outline the main rehabilitation objectives. A table of the proposed interventions is provided together with any specific Environmental Management Plan (EMPr) issues to be considered during implementation. The section also includes the baseline data needed to undertake future monitoring of the interventions.

A Report on the current status of the HGM units are included as **Appendix A** of this report and should be consulted for the detailed findings of the site investigations. The General Construction Notes are included as **Appendix B** and describe construction methods for various interventions. The specific Interventions and Design Drawings (as well as site specific mitigation measures) are available in **Appendix C** in the form of an Intervention Booklet. The Environmental Authorisation (EA), would be included in **Appendix D**, and the Landowner Agreement is available in **Appendix E**. **Appendix F** of this report includes a copy of the generic EMPr. The national and provincial stakeholder databases are available in **Appendix G**. **Appendix H** contains the CV of the Environmental Assessment Practitioner.

1.2 Environmental Authorisation

The Soutini-Baleni Wetland Project was the subject of a Basic Assessment Process in terms of the Environmental Impact Assessment (EIA) Regulations (GN R983 of 4 December 2014) of the National Environmental Management Act (Act 107 of 1998) (NEMA), which culminated in the compilation of a Basic Assessment Report (BAR) and this Rehabilitation. It is intended that this Rehabilitation Plan is read in conjunction with the 2018/2019 Limpopo Basic Assessment Report and requires that the Rehabilitation Plan be circulated to Registered Interested and Affected Parties (I&APs) and directly affected landowners for comment before being submitted to the DEA for approval. The public participation process for the Rehabilitation Plan and the BAR was combined and allowed registered I&APs a 30-day period to review and provide comment on the documents. The work detailed for the project will be implemented within a year of obtaining the necessary approvals for the Rehabilitation Plan, and on-going monitoring of the interventions will be undertaken from thereafter.

2 PROJECT CONTEXT

2.1 Working for Wetlands programme overview

The WfWetlands Programme is a government programme (similar to Working for Water, Working on Fire and Working for Ecosystems) managed under the Natural Resource Management Programmes (NRM) of the Department of Environmental Affairs and is a joint initiative with the Departments of Water and Sanitation (DWS), and Agriculture and Forestry and Fisheries (DAFF). It forms part of the Expanded Public Works Programme (EPWP).

The vision of the WfWetlands Programme is to facilitate the protection, conservation, rehabilitation and sustainable use of wetlands in South Africa, in accordance with national policies and commitment to international conventions and regional relationships. The main objective of the programme is wetland conservation in South Africa, and this is conducted in a way that ensures poverty reduction through employment and skills development amongst vulnerable and marginalised groups.

As an EPWP, the WfWetlands Programme seeks to draw significant numbers of unemployed into the productive sector of the economy. These individuals gain skills while they work thus increasing their capacity to earn an income. Rehabilitation efforts are thus focused on wetland conservation and the appropriate use of wetlands in a way that attempts to maximise employment creation, support for small business and the transfer of skills to the unemployed and poor.

In the 15 years since 2004, the WfWetlands Programme has invested over R1.1 billion in wetland rehabilitation and has been involved in approximately 1 500 wetlands, thereby improving or securing the health of over 70 000 hectares of wetland environment. The WfWetlands Programme has created more than 34 000 jobs and over 3.2 million person-days of paid work. Local people are recruited to work and targets for employment specify that the programme's workforce should comprise at least 55% women, 65% youth and 2% people with disabilities.

2.1.1 Programme, projects and phases

In order to manage the WfWetlands Programme, wetlands that have been prioritised and identified for rehabilitation have been grouped into "Wetland Projects" within each Province. Each Wetland Project encompasses several wetland systems which are each divided into smaller, more manageable and homogenous wetland units. As a result, a Wetland Project may be located within one or more quaternary catchments within a Province.

Each Project is managed in three phases over a two-year cycle. The first two phases (Phase 1 and Phase 2) straddle the first year of the cycle and involve planning, identification, design and authorisation of interventions. The third phase (Phase 3) is implementation of specific interventions to achieve rehabilitation, and this takes place during the second year. The WfWetlands Programme is currently managing 48 Wetland Projects countrywide, and approximately 800 interventions within these Wetland Projects will be implemented to meet the objectives of the Programme.

2.1.2 Methods of rehabilitation

The successful rehabilitation of a wetland requires that the cause of damage or degradation is addressed, and that the natural flow patterns of the wetland system are re-established (flow is encouraged to disperse rather than to concentrate). The main aims of the WfWetlands Programme are:

- Restoration of hydrological integrity (e.g. raising the general water table or redistributing the water across the wetland area); and

- Recreation of wetland habitat towards the conservation of biodiversity.

Rehabilitation activities range from stabilising degradation to the more ambitious restoration of wetlands to their original conditions. Typical activities within the Wetland Projects include:

- Plugging artificial drainage channels created by development or historical agricultural practices to drain wetland areas for other land use purposes;
- Constructing structures (gabions, berms, and weirs) to divert or redistribute water to more natural flow paths, or to prevent erosion by unnatural flow rates that have resulted from unsustainable land use practices or development; and
- Removing invasive alien or undesirable plant species from wetlands and their immediate catchments as part of the Working for Water Programme.

2.1.3 Intervention options

Methods of wetland rehabilitation may include hard engineering interventions such as:

- Earth berms in conjunction with gabion systems to block artificial channels that drain water from or divert polluted water to the wetland;
- Concrete weirs to act as settling ponds, to reduce flow velocity or to re-disperse water across former wetland areas thereby re-establishing natural flow paths;
- Concrete, earth or gabion structure plugs to raise channel floors and reduce water velocity;
- Concrete or gabion structures to stabilise head-cut or other erosion and prevent gullies; and
- Gabion structures (mattresses, blankets or baskets) to provide a platform for the growth of desired wetland vegetation.

Soft engineering interventions also offer successful rehabilitation methods, and the following are often used together with the hard engineering interventions:

- The revegetation of stabilised areas with appropriate wetland and riparian plant species;
- Fencing off sensitive areas within the wetland to keep grazers out and to allow for vegetation to become re-established;
- The use of biodegradable or natural soil retention systems such as eco-logs, plant plugs, grass or hay bales, and brush-packing techniques; and
- The removal of undesirable plant and animal species as part of the Working for Water initiative. Alien invasive plant clearing is an important part of wetland rehabilitation.

For more information on the WfWetlands Programme, please refer to the WfWetlands Context Document included in the front of this report.

2.2 Project team

The project team currently comprises a Director and three Deputy Directors who oversee the WfWetlands Programme and Assistant Directors for Wetlands Programmes (ASDs) who oversee the identification and implementation of projects in their regions. They are supported by a small team who fulfil various roles such administration, Geographical Information Systems (GIS) and training.

Aurecon South Africa (Pty) Ltd (Aurecon) has been appointed to undertake the project activities and associated reporting required by the WfWetlands Programme. The Aurecon team comprises Design Engineers and Environmental Assessment Practitioners (EAPs) who undertake the planning, design and authorisation components of the project. The Aurecon Team, in partnership with GroundTruth, is assisted by an external team of Wetland Specialists who provide scientific insight into the operation of wetlands and bring expert and often local knowledge of the wetlands. The project team is also

complimented by the WfWetlands ASDs who are each responsible for provincial planning and implementation. The team responsible for the field work specific to this Rehabilitation Plan is listed in Section 3.3.1.

2.3 Limpopo Wetland Projects

WfWetlands has been rehabilitating wetlands in the Limpopo province for over ten years. The Soutini-Baleni project focusses on wetlands within the B82G catchment and was identified as a new project during the 2018/2019 planning cycle. The study area is situated south-west of Giyani, near Baleni Camp. It falls under the Mopani District Municipality, Greater Tzaneen Local Municipality, Limpopo Province. The land has a fairly high concentration of relatively large wetlands between Letsitele and Thabina River in the south west of the catchment, (Visioning the future of the Letaba catchment – the 12 Integrated Units of Analysis (IUAs) in perspective, 2018 [online]). The wetland is in the upper reaches of the catchment on the Pietersburg plateau and Lowveld hydrogeological region where slopes are gentle, and rainfall is higher (The South African State of Rivers Report: Letaba and Luvuvhu Rivers, 2018 [online]). The most culturally and geo-hydrologically interesting systems that occur in the catchment are the two thermal spring systems one at Eiland (Hans Merensky Nature Reserve) and the other (Soutini-Baleni) close to the banks of Klein Letaba River in its middle reaches (DWAFF, 2006). This wetland is particularly culturally significant and is thought to be one of the few remaining undeveloped hot springs in South Africa where traditional Tsonga salt making activities take place (Provincial Gazette for Limpopo No. 1333, 2007).

The following quaternary catchments and associated wetland systems were identified for the 2018/2019 planning cycle in the Limpopo Province (Figure 1), which were the subject of a Basic Assessment Process as explained in **Section 1.2** above. Note that the wetlands indicated with an asterisk (*) were not included in the BAR as they either (a) received Environmental Authorisation in 2017 (see Appendix D).

Table 1: Limpopo Wetland Projects

Project Name	Wetland System
A. Soutini-Baleni	A (i). Soutini-Baleni 01
	A (ii). Soutini-Baleni 02
	A (iii). Soutini-Baleni 03
	A (iv) Soutini-Baleni 04
B. Waterberg	B (i). Nyahalwe*

An EIA application (to undertake a Basic Assessment Process) will be lodged with the National DEA in June 2019 for the undertaking of listed activities in terms of NEMA. The authorisation process is currently underway and will permit the WfWetlands Programme to undertake wetland rehabilitation in the above-mentioned wetland systems within the Limpopo Province should a positive EA be issued. This EA will be included in Appendix D of this report as soon as it is available. No wetland rehabilitation work that constitutes a Listed Activity in terms of Regulations pursuant to NEMA may be undertaken until such time as this Rehabilitation Plan has been approved by the DEA, and the approval is included in Appendix D.

2.3.1 The Soutini-Baleni Wetland Project

The Soutini-Baleni wetland system was brought to the attention of WfWetlands by Hosi Mahumani. Upon investigation, it was determined that the wetland system consists of multiple warm water mires (i.e. thermal springs), which are globally recognised as rare. These mires are currently under threat from

erosion and overgrazing. Furthermore, the wetland is also culturally significant and used as a traditional Tsonga salt mining site. It is located approximately 20km southeast from the town of Giyani and falls within the borders of the Giyani Municipal District. The district is bordered in the east by the Kruger National Park, in the south by the Groot Letaba River and in the north by the Shingwedzi River (Linström, 2018).

The climate of the area is typical of the Savanna biome. There is little rainfall throughout the year. It is a summer rainfall area with very dry winters and is generally frost-free, although frost sometimes occurs in the low-lying areas. The mean monthly minimum and maximum temperatures are 9˚C and 32.1˚C in June and January, while the annual average is 22.2˚C; and the mean annual precipitation is 527mm, (Linström, 2018).

Four HGM units were identified within the Soutini-Baleni wetland system as shown in **Table 2**.

Table 2: Location of the identified HGM units within the Soutini-Baleni project area

Wetland Number	Wetland Name	Latitude	Longitude
B82G-01	Soutini-Baleni 01	23°25'14.46"S	30°54'39.82"E
B82G-02	Soutini-Baleni 02	23°25'9.88"S	30°54'43.92"E
B82G-03	Soutini-Baleni 03	23°25'16.12"S	30°54'54.70"E
B82G-04	Soutini-Baleni 04	23°25'16.46"S	30°54'57.61"E

The proposed rehabilitation of the Soutini-Baleni wetland system would prevent further erosion and sedimentation impacts within the system, control the spread of invasive alien plants and improve water quality as well as the conservation of habitat and species in the area.

2.3.2 Project Scope

The scope of this Wetland Project is detailed in the table below (**Table 3**):

Table 3: Project Scope

Province & Wetland Project	Limpopo: Soutini-Baleni
Quaternary Catchment	B82G
Quaternary Catchment area (Ha)	21.8
Nearest Town/s	Giyani
Partnership	Mahumani Traditional Authority
Number of wetlands identified during the assessment	4
Wetland names	Soutini-Baleni 01 - 04
Extension of existing work	No
Work to commence at new wetlands in 2019/ 2020	Yes
Available budget for new interventions	TBC
Estimated cost of new interventions[8]	TBC

[8] These values are subject to change and should be seen as indicative only.

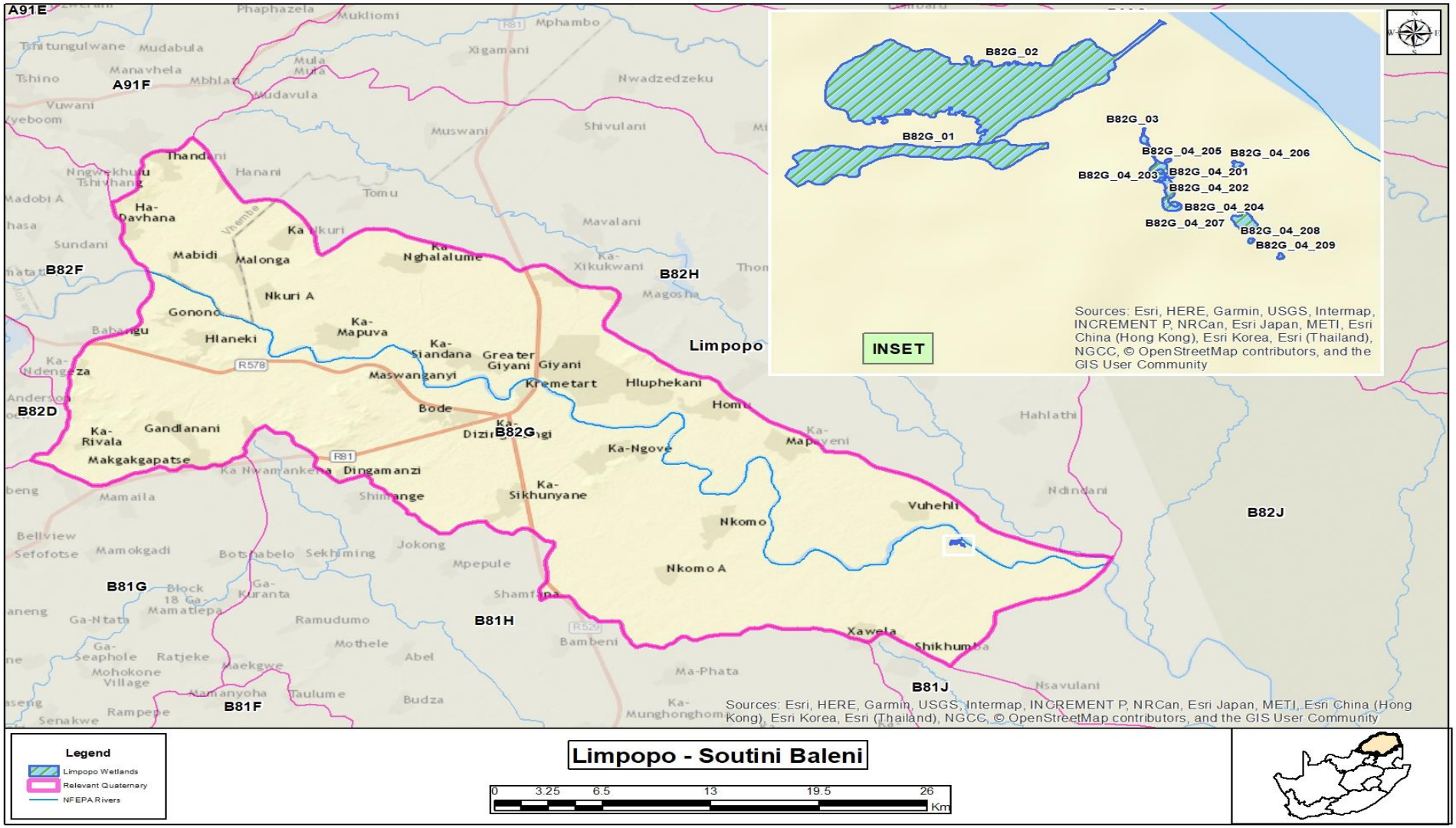

Figure 1: Topographic map showing the location of Soutini-Baleni 01 to 04 (B82G-01 – B82G-04)

2.3.3 Prioritisation of wetlands

The “priority” as depicted in the table below indicates the relative importance of each wetland within the wetland project (Soutini-Baleni Wetland Project) as a whole. Based on the wetland status quo report and the order of implementation of the rehabilitation interventions detailed in Chapter 4, the wetlands have been prioritised for rehabilitation in the following order (**Table 4**):

Table 4: Prioritisation of wetlands

Priority	Wetland number	Wetland name
1	B82G-01	Soutini-Baleni 01
2	B82G-02	Soutini-Baleni 02
3	B82G-03	Soutini-Baleni 03
4	B82G-04	Soutini-Baleni 04

2.3.4 Projected rehabilitation indicators

The rehabilitation planning process relies on the measurement of wetland ecological integrity based on the assessment of the hydrology, geomorphology and vegetation characteristics of the specified systems. In theory this information can be converted into a hectare equivalent which can serve as a baseline against which hectare equivalents of wetland habitat gained or secured through rehabilitation can be compared. In practice, the level of confidence associated with interpretations of this nature is usually low and difficult to defend and hence should be interpreted with great caution. For example, this approach should not be followed where a large wetland complex with many contiguous tributary arms of unknown size are present upstream. Similarly, the area of wetland gained should not be determined if there isn’t good knowledge of inter alia the hydrogeological characteristics of both the bedrock and unconsolidated sedimentary cover. For wetlands that are assessed in detail using the Wet-Health methodology, the number of hectare equivalents gained through rehabilitation can be used as an indicator of rehabilitation success within each system (**Table 5**). The success of rehabilitation in wetlands that are not assessed in detail (such as those where only soft options, or IAP control and revegetation will occur) cannot be measured in this way, but the number of wetlands rehabilitated in this manner should be recorded.

Table 5: Projected Values

Wetland Number	HGM unit type	Overall hectares	Area influenced (ha)	Hectare equivalents secured
B82G-01	Valley bottom	1.6	1.2	0.3
B82G-02	Seep connected to stream	5.7	3.5	1.3
B82G-03	Seep connected to stream	0.5	0.9	0.2
B82G-04	Seep	0.5	0.4	0.2

Please note that important factors such as biodiversity, species habitat, sense of place cultural significance etc. are not incorporated into hectare equivalents and therefore the full value of the system is not quantified. For the purpose of this report and due to the reasons above, the above table only reflects the amount of hectare equivalents likely to be gained and/or secured as a result of the planned interventions.

3 GENERAL METHODOLOGY

Each Wetland Project is managed in three phases over a two-year cycle as shown in the flow diagram in **Figure 2** below. The first two phases straddle the first year of the cycle and involve planning, identification, design and authorisation of interventions. The third phase is implementation, which takes place during the second year.

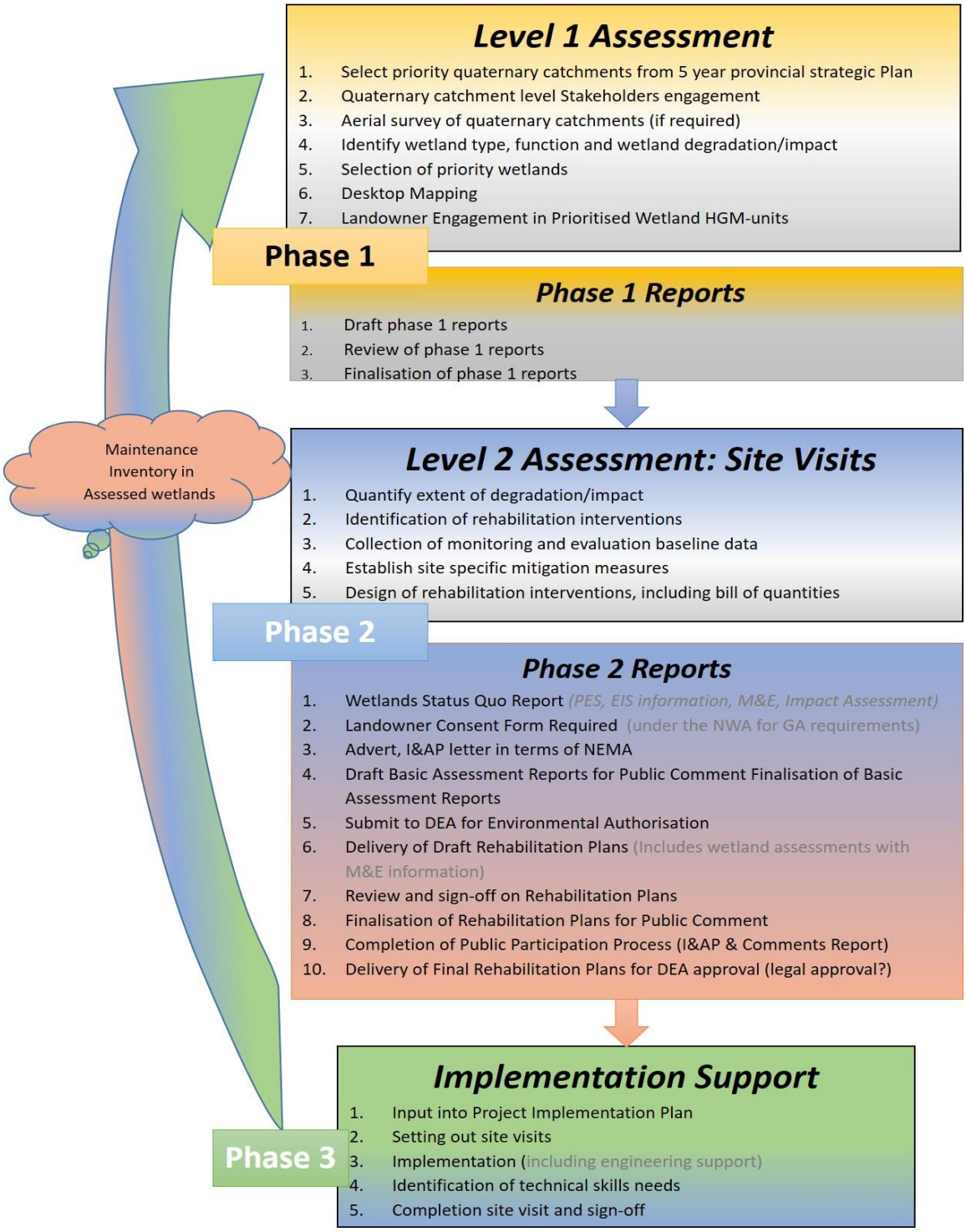

Figure 2: The three phases that must be undertaken for the successful rehabilitation of wetlands

3.1 Landowner consent

The flow diagram (refer to Figure 2) clearly demonstrates the point at which various consent forms must be approved via signature from the directly affected landowner. For this project, the ASD is responsible for undertaking the necessary landowner engagement and for ensuring that the requisite landowner consent forms required as part of Phase 1 and 2 of this project are signed.

Refer to **Appendix E** for a copy of the landowner agreements.

3.2 Phase 1

As mentioned earlier, representatives of WfWetlands undertook an initial site visit to the wetlands identified in Table 2 and identified the wetlands in the Soutini-Baleni area as a priority for the current planning year. An initial site visit was also undertaken by the Wetland Specialist to form a better understanding of the environment and socio-economic conditions affecting the wetlands.

3.3 Phase 2

3.3.1 Site visits

Phase 2 required site visits attended by the fieldwork team comprising a Wetland Specialist, a Design Engineer, an EAP and an ASD. Landowner representatives also participated in the site visit. This allowed for a highly collaborative approach to be used, as options were discussed by experts from different scientific disciplines, as well as local inhabitants with deep anecdotal knowledge. The site visit took place from 16 – 18 October 2018.

The following team members attended the site visits:

- Collin Silima (ASD)
- Cilliers Blaauw (Engineer)
- Anton Linström (Wetland Specialist)
- Franci Gresse (EAP)

The team was assisted by Mr Samuel Mabunda of the Mahumani Traditional Authority. At the end of the site visit the rehabilitation objectives together with the location layout of the proposed interventions were agreed upon by the project team.

The time and resources required to determine the current status of the wetlands was generally limited, and thus a rapid procedure was adopted to assist the project team in systematically carrying out the assessments under constraints. The procedure was based on the following steps:

a. Assess impacts and threats

The following steps were used by the Wetland Specialist to assess the impacts and threats within each wetland system:

- Describing the hydro-geomorphic setting of the wetland according to Kotze *et al*. (2008);
- Assessing the overall health of the wetland at a Level 2 using WET-Health (Macfarlane *et al*., 2007); and
- Identifying specific impacts and/or threats (based on the wetland status quo reports) to be addressed by structural rehabilitation and describing in more detail where necessary. For

example, for head-cut erosion, the specific dimensions and level of activity of head-cuts would be described.

b. Set rehabilitation objectives and choose appropriate measures for achieving the objectives

Rehabilitation objectives were informed by the above assessments (*e.g*. if the primary threat to the wetland was identified as head-cut erosion threatening to propagate through the wetland then an appropriate rehabilitation objective would be to halt propagation of the erosion head-cut). The engineer was assisted by the Wetland Specialist in selecting appropriate interventions to achieve the identified rehabilitation objectives.

c. Assess the likely contribution of rehabilitation interventions to wetland health and ecosystem delivery

An assessment was undertaken of the predicted contribution that the identified rehabilitation interventions will make to improving wetland health and ecosystem services delivery by addressing the identified impacts/threats. Without these assessments, a wetland rehabilitation programme is unlikely to have a well-informed basis on which to improve the "return on investment" (with return being measured in terms of wetland health and ecosystem services delivery). This is directly linked into the WfWetlands Monitoring and Evaluation (M&E) Framework. The following steps were followed to assess the contribution of rehabilitation interventions within each wetland system:

- The spatial area likely to be affected by the proposed intervention/s was identified; and
- The benefits that were likely to result from achievement of the rehabilitation objective/s were determined in terms of the integrity of the affected area of the wetland (using WET-Health) and the ecosystem services that the area delivers (using WET-Ecoservices: Kotze *et al.*, 2008).

The same approach was used for the assessment of the different threats/impacts that would be addressed through rehabilitation. In this instance, the situation without rehabilitation (i.e. no intervention or *status quo*) was compared to the situation with rehabilitation. For assessing the effect on wetland health, wetlands were scored with and without rehabilitation on a scale of 0 (critically altered) to 10 (pristine), and this was undertaken for the hydrology, geomorphology and vegetation components of wetland health.

The benefit achieved is the improvement in relation to the maximum score. For example, in areas threatened by head-cut erosion which are to be rehabilitated by halting the spreading of the head-cut, the benefits in terms of health would be determined based on the difference between the current health and the projected health if the head-cut proceeded to erode through the threatened area. In such a case, stopping the expansion of the head-cut would presumably secure the current situation.

Refer to **Appendix A** which contains the Wetland Status Quo Report/s.

3.3.2 Identification and location of intervention designs

The project teams evaluated the various rehabilitation intervention options available and selected the most appropriate to achieve the rehabilitation objectives for the wetland. Choices of intervention options were also informed by the increased labour component as required by DEA. Agreed cost/benefit ratios in terms of 'Rands per hectare of rehabilitated wetland' were taken into account, along with operational considerations and larger scale project objectives.

After the appropriate intervention options were selected by the planning team, the engineer, in consultation with the Wetland Specialist determined the most appropriate designs and locations for the identified interventions in order to achieve the rehabilitation objectives for the wetland in question. GPS

coordinates and digital photographs – sufficiently detailed to clearly identify the selected locations were then taken for record purposes. Appropriate dimensions of the locations were measured in order to be able to design and calculate quantities for the interventions.

i. Intervention naming convention

The accepted **naming convention** which has been applied to all interventions (old and new) is explained below with examples being provided as well.

A00A-00-000-00 (new),

A00A-00-000-01 (maintenance), where

Number	Explanation		
A00A	quaternary number		
00	wetland number		
200	intervention number with the '**200**' included for differentiation from previous interventions		
00	**New** intervention	**01**	**Maintenance** to intervention

An additional two digits will therefore be added to the end of each of the intervention numbers to indicate maintenance on this specific intervention and/or whether the structure is new (00) for tracking purposes. All new interventions will have a default of 00. Should built structures require maintenance, they would be numbered numerically beginning with '01' e.g. 01, 02, 03, etc. for each year that maintenance is undertaken on the intervention. In addition, the new naming convention also added a '200' digit in the front of the intervention number to avoid confusion from previously named interventions.

3.3.3 Collection of monitoring & evaluation (M&E) baseline and basic assessment data

In accordance with WET-Rehab-Evaluate (Cowden and Kotze, 2008) the collection of baseline monitoring information is important to allow for the evaluation of the performance of wetland rehabilitation activities. Monitoring and evaluation facilitate the dissemination of lessons learnt and provide a means of reporting on the success of specific wetland rehabilitation initiatives. The monitoring and evaluation (M&E) of an identified wetland rehabilitation project's performance is therefore considered vital to inform the evaluation of wetland rehabilitation success. Baseline monitoring needs to be carried out prior to the implementation of rehabilitation activities to provide comparable data for monitoring at a later stage, following the wetland rehabilitation. While the engineer was working on measurement of the intervention locations, the Wetland Specialist gathered the additional data required for M&E baselines which included the following:

- Photographs and GPS co-ordinates of the identified problems;
- Fixed-point photography (in accordance with the guidelines outlined in WET-Rehab-Evaluate: Cowden and Kotze, 2008);
- WET-Health information (allowing the comparison of wetland ecological integrity before and after rehabilitation activities); and
- Details relating to the calculation of estimated hectare equivalents.

Any additional data/information required for the assessment of the potential impacts of the proposed interventions and construction activities was also collected by the Wetland Specialist and the EAP to inform the Basic Assessments.

3.3.4 Engineering design

The detailed procedure followed by the engineers is described in the Engineering Design Brief, which documents the procedure agreed upon by Aurecon and WfWetlands. The document also addresses important issues such as risk and liability. A summary of the process followed for the engineering design is described below:

- Construction materials were selected based on a range of site specific criteria including expected velocities, availability of materials such as rock, labour intensive targets, maintenance requirements etc.
- Interventions were designed based on the above to meet the objectives for wetland rehabilitation.
- The intervention designs were drafted to show, at a minimum, a plan view, a longitudinal section and front elevation at appropriate scales, and appropriate dimensions. A legend indicating basket sizes was included for gabion structures to improve design clarity for the implementers.
- Maintenance requirements for existing interventions in the assessed wetlands were similarly detailed and the anticipated costs calculated.

The engineer also reviewed and, if necessary, adjusted any previously planned interventions that are included into the current Rehabilitation Plan.

3.3.5 Development of the Rehabilitation Plan

The standardised Rehabilitation Plan format has been approved by the WfWetlands Programme Deputy Director for Planning, Monitoring and Evaluation. Summaries of the wetland prioritisation, problems and rehabilitation objectives are documented in the Rehabilitation Plan. Reports on the current status of the wetland, based on, *inter alia*, the information collected during the implementation of WET-Tools, were prepared by the Wetland Specialist, and are included as **Appendix A** to this report.

This Rehabilitation Plan was submitted to the WfWetlands ASD, Wetland Specialist, Engineer and Tswelopele for review before it was made available to stakeholders for comment. Any comments received during the comments period will be taken into account in the finalisation of the Rehabilitation Plan.

3.3.6 Reporting Format

All relevant information acquired during the assessments and field visits has been included in this document and its appendices.

- All intervention locations are given in geographical coordinates, (Degrees, Minutes and Seconds), based on the WGS84 datum.
- Mapping was done in Albers Equal Area Conic projection, WGS84 datum. The grids displayed on all maps are geographic and measured in Degrees Minutes and Seconds. The scale bar on each map is based on Albers Equal Area Conic projection and measured in metres.

4 SOUTINI-BALENI 01 - 04

The assessment of the Soutini-Baleni wetlands, their problems, and the development of the rehabilitation objectives are described in detail in **Appendix A**: Wetland Status Quo Report. The following subsections provide a brief summary for these wetlands.

4.1 Landowner details

The Project area is located on communal land owned by the Mahumani Traditional Authority. The Hosi contacted WfWetlands directly for assistance with wetland rehabilitation activities at Soutini-Baleni. Consent for the prosed wetland rehabilitation activities (subject to the approval of the Rehabilitation Plans) is available in **Appendix E**.

Table 6: Soutini-Baleni 01 - 04 Landowner and SG Key

Wetland Number	Property SG Key	Owner / Trust	Consent Obtained
B82G-01	T0LT00000000046500024[9]	Mahumani Traditional Authority (Hosi AK Mahumani)	08 September 2018
B82G-02			
B82G-03			
B82G-04			

4.2 Wetland details

The project area is situated on the southern bank of the Klein Letaba River, approximately 40 km south-east of Giyani in Limpopo, on land belonging to the Mahumani Traditional Authority. The Soutini-Baleni project area is located within the upper reaches of the Klein Letaba River catchment. **Table 7** provides a summary of the wetland details.

Table 7: Summary of the wetland details

Wetland Name	Soutini-Baleni			
Wetland Number	B82G-01	B82G-02	B82G-03	B82G-04
River System Name	Wetland feeds into an unnamed ephemeral stream that flows into the Klein Letaba River			
Land Use in Catchment	Subsistence farming (Cattle, donkey and goat farming)			
Land Use in Wetland	Communal Land, subsistence Farming, grazing, Salt-mining and tourism			
No. of Properties Intersecting Wetland Area	1			
Date of Planning Site Visit	15 – 18 October 2018			
Wetland Assessor(s)	Anton Linström			
Wetland size	1.2 ha	5.7 ha	0.0246 ha	0.12 ha

[9] Communal land also registered as a South African Heritage Site with the provincial heritage authority.

4.2.1 Motivation for selection

The Soutini-Baleni wetland system consists of 12 mires that are fed by warm water (up to 34ºC) and can also be referred to as thermal springs. Peat domes have formed over the spring "eye" and has a thickness of 0.3 – 1.2m. These mires are globally rare and there is an estimate of 50 thermal springs in South Africa, some with organic deposits. Furthermore, the wetland system falls within a type 1 Critical Biodiversity Area due to the site being located within 1km of the Klein Letaba River, its functionality as a river connectivity corridor and the habitat type (i.e. Lowveld Rugged Mopaneveld).

Culturally, the mire is significant due to its mythical character and is a traditional Tsonga salt manufacturing site on the bank of the Klein Letaba River which provides valuable resources to the local communities and has been declared a Natural Heritage Site of Provincial Significance (GN R92 of 2007).

4.2.2 Description

The mean monthly minimum and maximum temperatures at the study site itself are 9˚C and 32.1˚C in June and January respectively, while the annual average is 22.2˚C. The mean annual precipitation is 527 mm (WorldClim database, Hijmans *et al.*, 2005). The topography of the area is largely underlain by leucocratic biotite granite of vaalian age and sparse portions of grey biotite gneiss and migmatite of the goudplaats gneiss with altitudes between 250 – 550m above sea level, the landscape comprises slightly too extremely irregular plains with sometimes steep slopes and a number of prominent hills. The quaternary catchment is characterised by red soils with high base status. The soils are classed as freely drained, structureless soils (Linström, 2018).

The vegetation type is described as Lowveld Rugged Mopaneveld according to Mucina and Rutherford (2206) and is not listed as threatened. The vegetation usually comprises dense shrubs with occasional trees and a sparse ground layer. Woody plants can become particularly dense where fire is excluded by very rocky terrain, such as in the vicinity of the Olifants River. Vegetation is more open in the north-eastern parts of this unit outside the Kruger National Park (Linström, 2018).

The wetland system is located within the Klein Letaba Sub-water Management Area (WMA) and the Luvuhu and Letaba WMAs. The wetland system feeds into an unnamed ephemeral stream that flows into the Klein Letaba River. The Klein Letaba River has a D present ecological state (PES) rating and is largely modified. It also falls within an Upstream Management Area, which requires human activities to be managed to prevent degradation of downstream freshwater ecosystem priority areas (FEPAs) fish support areas. As mentioned earlier, the Soutini-Baleni wetland system consists of 12 mires that are fed by warm water (up to 34ºC) and are globally rare. Two of the four HGM units can be described as seeps connected to a stream (B82G-02 and B82G-03), with the remaining units a valley bottom wetland (B82G-01) and a Seep wetland (B82G-04) (Linström, 2018).

The Soutini-Baleni mire is also culturally significant due to its mythical character and is a traditional Tsonga salt manufacturing site on the bank of the Klein Letaba River which provides valuable resources to the local communities. Several concentrations of potshards and ash were found around the wetland as well as the remains of an old hut adjacent to a large donga that is threatening the site.

4.2.3 Site photos

The section of wetland B82G-01 upstream of the road crossing is overgrazed and has limited ground cover (left). The wetland is also receiving sediment from the terrestrial area upstream of the wetland (right).

The section of wetland B82G-01 downstream of the road crossing is overgrazed and has deep erosion dongas forming.

Wetland B82G-02 is a hillslope seep that is heavily grazed.


Wetland B82G-02: Open water body at the thermal mire (left) and a peat sample (right)


Wetland B82G-03 includes a peat dome (yellow circle in photo on left) that is threatened by headcut erosion (right)


Wetland B82G-04 consist of a series of peat domes that are threatened by trampling and overgrazing.


The Soutini-Baleni wetland system has great cultural significance and is used for traditional salt mining.

Potshards where found scattered across the area.

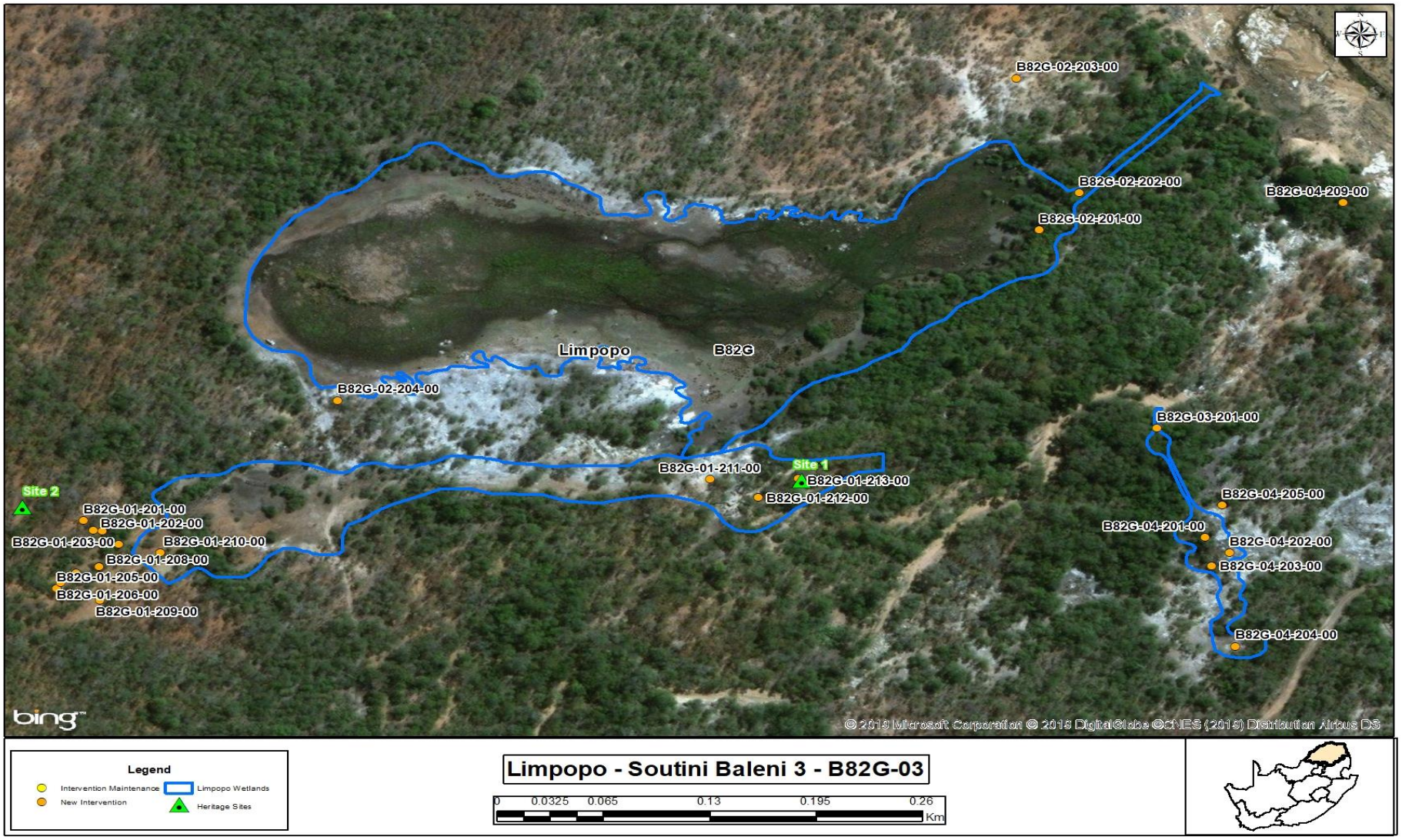

Figure 3: Soutini-Baleni wetlands showing, planned interventions and two thermal spring systems

4.3 Wetland problems[10]

The wetland's catchment has been impacted and changed due to overgrazing and trampling. Bare surfaces have formed and are contributing to sedimentation in the wetland area. Cattle tracks, a road crossing and donga erosion (head-cut erosion), etc. has also affected the hydrology, geomorphology and vegetation of the area.

The biophysical drivers of the wetlands in the Soutini-Baleni wetland system have been impacted upon by historical activities and will be further impacted upon into the future, including inter alia:

- Shallow preferential flow paths;
- Surface/rill erosion;
- Channel erosion with head-cut features;
- Livestock and game paths traversing the wetland area, resulting in preferential flows;
- Road traversing the wetland area, resulting in preferential flows;
- Road crossing;
- Grazing and trampling; and
- Burn regime.

Historical and current activities and such impacts will continue in the near future without rehabilitation. Wetland rehabilitation will secure the system and improve wetland functioning and integrity.

4.4 Rehabilitation objectives

The main aim of the rehabilitation work in Soutini-Baleni wetlands for 2018/2019 planning cycle is to address the problems that impact the wetland system's hydrology, geomorphology and its vegetation. To counteract these impacts and to prevent further degradation a set of objectives and strategies have been identified (Table 8). The proposed rehabilitation interventions will not only affect the ecological integrity of the broader wetland system but will also have a number of positive impacts on the supply of goods and services provided by the wetland.

Table 8: Summary of rehabilitation objectives and strategies for the Soutini-Baleni wetlands

Rehabilitation objective	Rehabilitation strategy
Soutini-Baleni 01: B82G-01	
• Stabilise wetland habitat in this sediment-driven environment. • Promote longitudinal and lateral hydrological processes. • Reinstate some of the hydrological features lost due to domestic water usage from the wetland. • Protect the wetland from degradation. • Promote habitat integrity.	• Construct interventions to re-instate more natural water distribution and retention patterns, improving the overall functioning of the wetland and associated habitat for important wetland-dependent biota. • Raise the water table to rehydrate areas adjacent to the drainage channels. • Rehydrate portions of the target area that contain shallow eroded areas and improve the ecological integrity and ecosystem functioning of the target area. • Stabilise eroded outlet area of the wetland. • Deactivate and stabilise head-cut erosion in drainage channels.

[10] Information taken from Linström, 2018.

Rehabilitation objective	Rehabilitation strategy
Soutini-Baleni 02: B82G-02	
• Reinstate the hydrology of this wetland and ensure diffuse flow through the system. • Rehydrate the areas adjacent to the artificial drains. • Enhance the wetland's flood attenuation function. • Decrease the number of cattle that graze and trample the main 'eye' area. • Restore habitat for the establishment and increased growth of obligate species and thereby increase the vegetation cover of a section of the wetland. • Stabilise erosion features in the developed channel and furrows, thereby protecting the ecological integrity and ecosystem functioning of the target area.	• Protect the 'eye' area to create an environment conducive to the recovery of hydrophytic vegetation composition, abundance and cover. • Lift the water table to re-instate more natural water distribution and retention patterns, improving the overall functioning of the wetland and associated habitat for important wetland-dependent biota. • Rehydrate areas by raising the water table adjacent to the drainage channels. • Construct interventions to deactivate and stabilise head-cut erosion in drainage channels. • Reduce storm water velocity by increasing obstacles in drains.
Soutini-Baleni 03: B82G-03	
• Improve the ecological integrity and ecosystem functioning. • Rehydrate portions of the target area impacted by erosion. • Promote habitat integrity. • Create an environment conducive for the establishment of hydrophytic vegetation.	• Re-instate more natural water distribution and retention patterns, improving the overall functioning of the wetland and associated habitat for important wetland-dependent biota. • Rehydrate areas adjacent to the eroded channels. • Stabilise the head-cut features with eco-logs to improve the ecological integrity and ecosystem functioning.
Soutini-Baleni 04: B82G-04	
• Reinstate some of the hydrological features lost due to grazing and trampling. • Protect and improve the ecological integrity and ecosystem functioning of the target areas. • Stabilise mire features in the wetland to promote the succession of peat formation. • Create an environment conducive for the establishment of hydrophytic vegetation.	• Make use of brush-packing to prevent cattle entering these springs and allowing the re-instatement of more natural water distribution and retention patterns, improving the overall functioning of the wetland and associated habitat for important wetland-dependent biota.

4.5 Summary of proposed interventions

An Intervention Booklet is included as **Appendix C** of this report. The booklet will be used on site by the implementers and provides detailed design information on each intervention proposed in this planning cycle. For the purposes of this report, the interventions contained within the booklet are summarised in **Table 9** below. The "implementation order" as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first).

*Please note that the location of the interventions (**Figures 6 - 8**) may change slightly as a result of changes in the landscape (due to continued erosion, for example) that may occur during the time period between the initial planning site visit and the actual implementation of the interventions. It is therefore important to note that the coordinates and the intervention designs provided in the Intervention Booklet (**Appendix C**) may need to be adjusted slightly at the time of implementation.*

4.5.1 Design selection and sizing

The objectives of the interventions are to stabilise instream erosion and trap sediment and, in some instances, raise the water level within the wetland area. A variety of soft interventions were selected to prevent erosion and trap sediment in lower flow energy sections. These include earth works for sloping, covering areas with brush packs, ecologs and rock packs to stabilise surfaces by trapping sediment to promote further vegetation stabilisation as well as re-vegetation. A few hard interventions have been proposed such as stone masonry and gabions to stabilise higher energy environments and prevent further incision and erosion of the channel. The simplicity of the type of intervention, quantity and cost of material to be introduced to the site were all taken into consideration in selection and sizing of the interventions.

Table 9: Summary of the interventions identified for the Soutini-Baleni wetlands

Intervention Structure Type	Intervention Number	Objectives	Implementation Order
Soutini-Baleni 01 (B82G-01)			
Rock / Gravel Pack	**B82G-01-201-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	1
Rock / Gravel Pack	**B82G-01-202-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	2
Rock / Gravel Pack	**B82G-01-203-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	3
Rock / Gravel Pack	**B82G-01-204-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	4
Rock / Gravel Pack	**B82G-01-205-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	5
Brush Pack	**B82G-01-206-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	6
Rock / Gravel Pack	**B82G-01-207-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	7
Rock / Gravel Pack	**B82G-01-208-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	8

Intervention Structure Type	Intervention Number	Objectives	Implementation Order
Brush Pack	**B82G-02-209-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	9
Brush Pack	**B82G-01-210-00**	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.	10
Rock / Gravel Pack	**B82G-01-211-00**	• Stabilise disturbed environment. • Prevent any potential head-cuts and erosion. • Prevent further sediment deposition downstream. • Create environment for indigenous vegetation to re-establish.	11
Rock / Gravel Pack	**B82G-01-212-00**	• Provide control over water flow. • Prevent directional flows in artificial drain. • Restore disturbed environment. • Revegetate for stability. • Prevent future degradation.	12
Stone Masonry Gabions	**B82G-01-213-00**	• Stabilise high-energy environment. • Control water flow. • Prevent further incision and erosion of the channel. • Lift water table and hydrate upstream and adjacent area. • Rehydrate wetland soils. • Take control of water through gabion. • Release water in a controlled manner.	13
Soutini-Baleni 02 (B82G-02)			
Rock/ Gravel Pack	**B82G-02-201-00**	• Stabilise disturbed environment. • Prevent any potential head-cuts and erosion. • Prevent further sediment deposition downstream. • Create environment for indigenous vegetation to re-establish.	1
Silt Fences	**B82G-02-202-00**	• Construct silt fencing. • Break water energy flows and create low energy environments to promote the sediment deposition. • Create environment for vegetation to establish. • Provide cover for disturbed areas, with brush packs. • Create a favourable environment for vegetation to re-establish.	2
Rock/Gravel Pack	**B82G-02-203-00**	• Stabilise disturbed environment. • Prevent any potential head-cuts and erosion.	3

Intervention Structure Type	Intervention Number	Objectives	Implementation Order
		• Prevent further sediment deposition downstream. • Create environment for indigenous vegetation to re-establish.	
Earth Works	**B82G-02-204-00**	• Take control over water flow. • Restore disturbed environment. • Re-vegetate to stabilise. • Prevent future degradation.	4
Cattle fence with pathway	**B82G-02-205-00**	• Construct cattle fence, to control their movement. • Prevent trampling and destruction of sensitive 'eye' area.	5
Soutini-Baleni 03 (B82G-03)			
Ecologs	**B82G-03-201-00**	• Stabilise disturbed environment. • Discontinue directional flows. • Slow water down and prevent erosion. • Create environment for indigenous vegetation to re-establish.	1
Ecologs	**B82G-03-202-00**	• Stabilise disturbed environment. • Discontinue directional flows. • Slow water down and prevent erosion. • Create environment for indigenous vegetation to re-establish.	2
Soutini-Baleni 04 (B82G-04)			
Brush Packing	**B82G-04-201-00**	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.	1
Brush Packing	**B82G-04-202-00**	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.	2
Brush Packing	**B82G-04-203-00**	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.	3
Brush Packing	**B82G-04-204-00**	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.	4
Brush Packing	**B82G-04-205-00**	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.	5

Intervention Structure Type	Intervention Number	Objectives	Implementation Order
Brush Packing	**B82G-04-206-00**	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.	6
Brush Packing	**B82G-04-207-00**	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.	7
Brush Packing	**B82G-04-208-00**	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.	8
Brush Packing	**B82G-04-209-00**	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.	9

Figure 4: Wetland map, B82G-01, with proposed new wetland interventions indicated

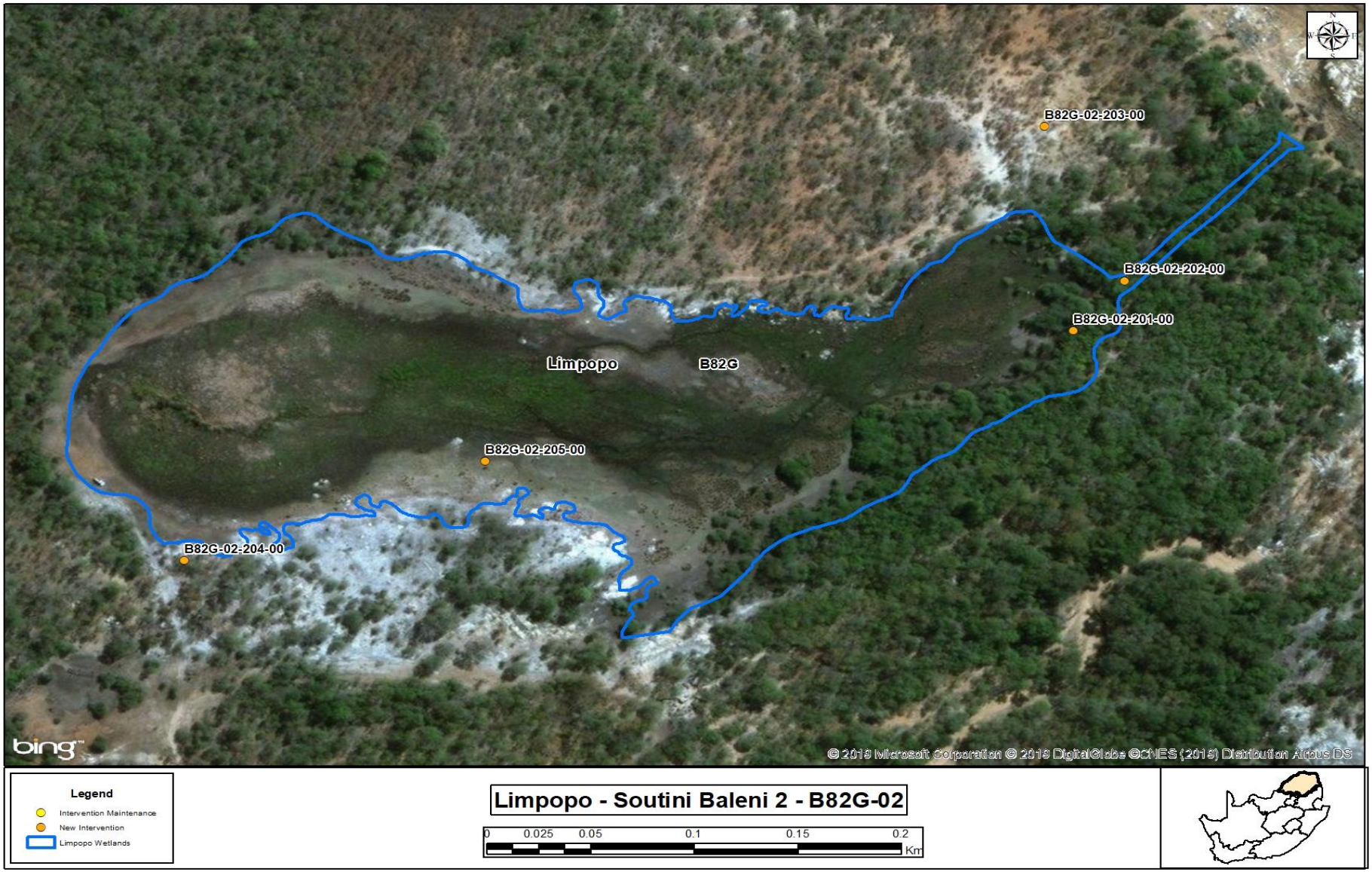

Figure 5: Wetland map, B82G-02, with proposed new wetland interventions indicated

Figure 6: Wetland map, B82G-03, with proposed new wetland interventions indicated

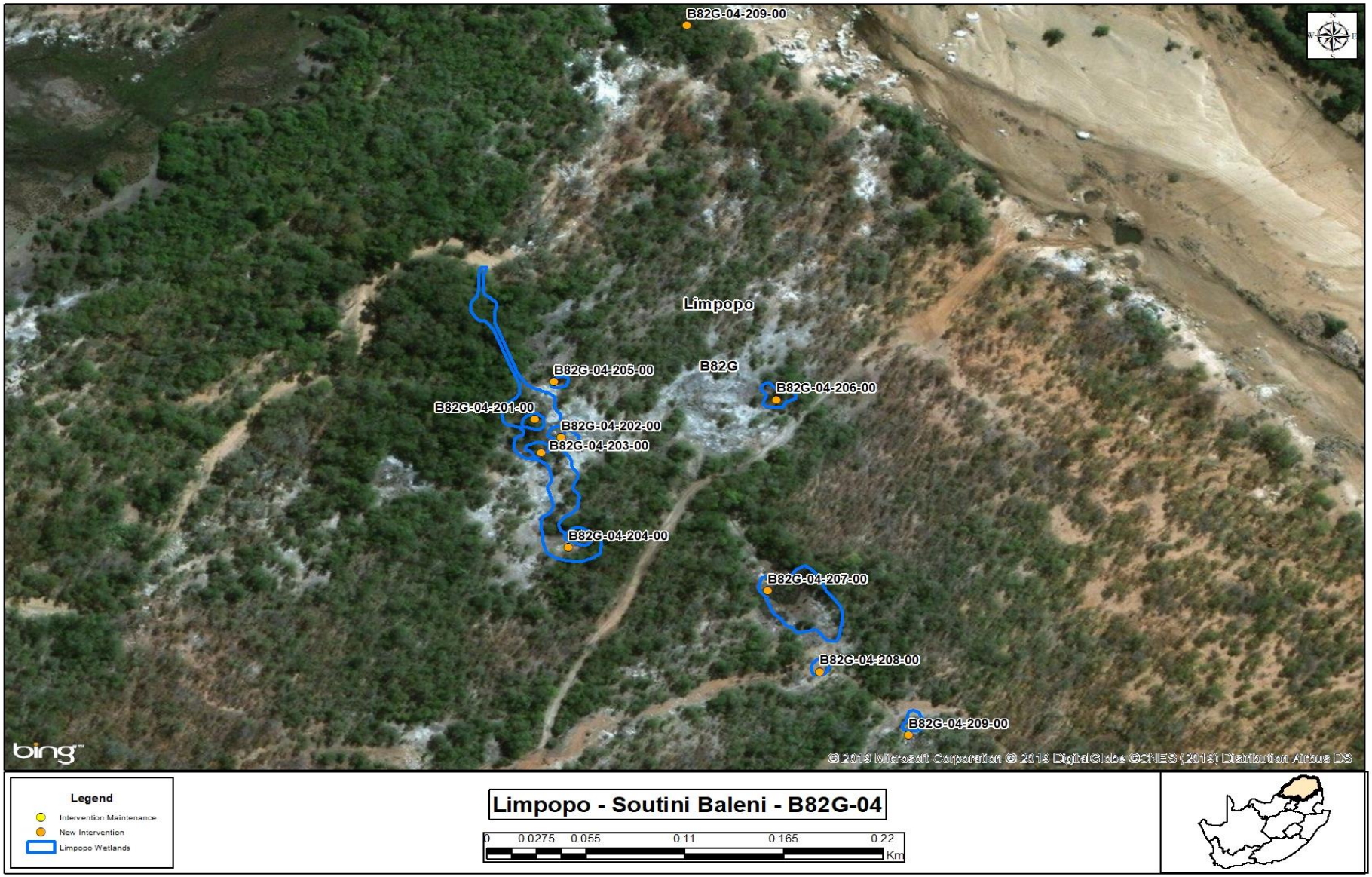

Figure 7: Wetland map, B82G-04, with proposed new wetland interventions indicated

4.6 Environmental Management Programmes issues

The proposed rehabilitation is to be undertaken on communal land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the EMPr, the recommendations of the approved Basic Assessments and Environmental Authorisation for the project. The Intervention Booklet, Environmental Authorisation and EMPr are included as **Appendices C, D and F** of this report, respectively, and shall accompany the Implementers to site. Note that site specific mitigation measures have been included in the intervention booklet (Appendix C).

4.7 Rehabilitation Monitoring

The collection of baseline information was carried out to be able to monitor and evaluate the effectiveness of the interventions, and to indicate any changes in the system associated with the wetland rehabilitation activities.

4.7.1 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes three years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the Soutini-Baleni wetlands (also refer to **Appendix A**):

Table 10: Summary of present wetland health of B82G-01 based on the Wet-Health assessment

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		1.6		
Impact Scores	**Hydrology**	4.0	3.5	6.5
	Geomorphology	2.1	1.0	2.6
	Vegetation	4.3	3.2	4.5
	Overall	3.5	2.7	4.8
Ecological Category		**C**	**C**	**D**
Hectare equivalents		1.0	1.2	0.8
Hectare Equivalents Gained or Secured		0.3		

Table 11: Summary of present wetland health of B82G-02 based on the Wet-Health assessment

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		5.7		
Impact Scores	**Hydrology**	6.5	5.0	6.5
	Geomorphology	2.5	1.5	3.0
	Vegetation	7.7	4.7	8.7
	Overall	5.7	3.9	6.1
Ecological Category		**D**	**C**	**E**
Hectare equivalents		2.4	3.5	2.2
Hectare Equivalents Gained or Secured		1.3		

Table 12: Summary of present wetland health of B82G-03-201 based on the Wet-Health assessment

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		0.5*		
Impact Scores	**Hydrology**	1.0	1.0	3.0
	Geomorphology	1.0	0.7	0.8
	Vegetation	1.3	1.1	1.5
	Overall	1.1	0.9	1.9
Ecological Category		**B**	**A**	**B**
Hectare equivalents		0.4	0.5	0.4
Hectare Equivalents Gained or Secured		0.1		

* Please take note that the actual size in 219m^2, Wet Health works with a minimum size of 0.5ha

Table 13: Summary of present wetland health of B82G-03-202 based on the Wet-Health assessment

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		0.5*		
Impact Scores	**Hydrology**	3.0	1.0	3.0
	Geomorphology	1.1	0.8	1.7
	Vegetation	2.0	1.3	2.1
	Overall	2.2	1.0	2.4
Ecological Category		**C**	**B**	**C**
Hectare equivalents		0.4	0.4	0.4
Hectare Equivalents Gained or Secured		0.1		

* Please take note that the actual size in 219m^2, Wet Health works with a minimum size of 0.5ha

Table 14: Summary of present wetland health of B82G-04 based on the Wet-Health assessment

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		0.5		
Impact Scores	**Hydrology**	5.0	3.0	6.5
	Geomorphology	2.1	0.9	3.2
	Vegetation	5.6	3.2	7.2
	Overall	4.3	2.5	5.7
Ecological Category		**D**	**C**	**D**
Hectare equivalents		3.8	0.4	0.2
Hectare Equivalents Gained or Secured		0.2		

4.7.2 Monitoring and evaluation sites: B82G[11]

The hillslope seep wetland provides an opportunity to monitor and evaluate the outcome of the rehabilitation strategy. The following intervention sites (**Table 15**) were identified for monitoring, by means of fixed monitoring photo points:

- B82G-01-212-00
- B82G-01-213-00
- B82G-02-201-00
- B82G-02-202-00
- B82G-02-205-00
- B82G-03-202-00
- B82G-03-203-00

Table 15: Monitoring and evaluation details for Soutini-Baleni

Intervention No.	Location	Cardinal Direction
B82G-01-212-00	23°25'15.20"S 30°54'44.80"E	North East
		

[11] Taken directly from Linström, 2018.

Intervention No.	Location	Cardinal Direction
B82G-01-213-00	23°25'15.20"S 30°54'44.80"E	North-East

B82G-02-201-00	23°25'8.04"S 30°54'51.97"E	North -West

B82G-02-202-00	23°25'6.53"S 30°54'53.67"E	South-West

B82G-02-205-00	23°25'10.49"S 30°54'35.51"E	East

B82G-03-202-00	25° 14’37.85” S 03°02’13.64” E	South-East

B82G-03-203-00	25° 26’41.65” S 03° 58’16.31” E	South East

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APPENDIX A
WETLAND STATUS QUO REPORT

WORKING FOR WETLANDS

PROVINCE: Limpopo

PROJECT: Soutini-Baleni

Phase 2: Wetland Status Quo Report

DRAFT

December 2018

wet-earth eco-specs

Report Reference: Baleni
B82G: 01-03

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Approval			
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Table of Contents

List of Tables

List of Figures

List of Acronyms

Acronym	Explanation
C-Plan	Conservation Plan (typically in the form of a spatial dataset at a provincial level)
DEA	Department of Environmental Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation (previously referred to as the Department of Water Affairs and Forestry)
EC	Ecological Category
EI	Ecological Importance
EIS	Ecological Importance and Sensitivity
ES	Ecological Sensitivity
EPWP	Expanded Public Works Programme
GDARD	Gauteng Department of Agriculture and Rural Development
HGM unit	Hydro-geomorphic unit
IHI	Index of Habitat Integrity
IDPs	Integrated Development Plans
NRM	Natural Resource Management Programme
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
WfWetlands	Working for Wetlands
WMA	Water Management Area

Glossary of Terms

Term	Explanation
Biota	All the plants and animals inhabiting an area.
Catchment	A drainage basin or land area with convergent contour lines where water flow starts and accumulates to form a drainage network. Also referred to as a watershed (specifically in the US), but a watershed can also refer to a catchment divide.
Catchment divide	Divisions between catchments, located on areas with divergent contour lines.
Channelled valley bottom wetland (HGM unit)	A valley bottom wetland with a river channel running through it. Channelled valley bottom wetlands are characterised by their position on valley floors and the absence of characteristic floodplain features. Dominant water inputs to these wetlands are from the river channel flowing through the wetland either as surface flow resulting from flooding or as subsurface flow, and/or from adjacent valley side slopes (as overland flow or interflow), (Ollis *et al*. 2013).
Depression wetland (HGM unit)	An inland aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. Dominant water sources are precipitation, groundwater discharge, interflow and diffuse (or concentrated) overland flow. Dominant hydrodynamics are primarily seasonal with resultant vertical fluctuations (Ollis *et al*., 2013).
Diversity	A combination of the number of taxa and the relative abundance of those taxa. A variety of diversity indexes have been developed to calculate diversity.
Ecosystem	Any unit that includes all the organisms that function together in a given area interacting with the physical environment so that a flow of energy leads to clearly defined biotic structure and cycling of materials between living and non-living parts (Odum 1983).
Ecoregion	A region defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, and other ecologically relevant variables.
Floodplain wetland (HGM unit)	A wetland area within a floodplain. Water and sediment input to these wetlands is mainly via overspill from a river channel during flooding. Floodplains consist of gently sloping land adjacent to, and formed by, an alluvial river channel (Ollis *et al*., 2013).
Habitat	The sum of the physical, chemical, and biological environment occupied by individuals of a particular species, population, or community.
Head-cut	An erosion feature that can develop within a channel, at the proximal end of a channel, or on an unchannelled slope. They are the precursors to channel development as head-cut migration creates or extends channels.
Hillslope seep wetland (HGM unit)	See seep wetland
Hydro-geomorphic	A type of aquatic ecosystem distinguished primarily on the basis of landform (shape and setting), hydrological characteristics (nature of

Term	Explanation
Biota	All the plants and animals inhabiting an area.
Hydromorphic soil	Soils with features that have developed under anaerobic conditions due to a fluctuating water table or longer periods of saturation.
Hydrophyte	Plant species that are adapted to wetter areas and can therefore grow in water or soils that are at least periodically saturated and/or inundated. Can also refer to facultative and obligate hydrophyte species to help indicate the gradient of wetness to which a particular species is adapted.
Instream habitat	Includes the physical structure of a watercourse and the associated vegetation in relation to the bed of the watercourse (National Water Act, Act No. 36 of 1998), (NWA).
Pan wetland	See depression wetland.
Reference site	A minimally impaired site that is representative of the expected ecological conditions and integrity of other sites of the same type and region.
Riparian habitat/zone/area	The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent, and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas (NWA).
River	A linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river includes both the active channel and the riparian zone (Ollis *et al*., 2013)
Seep wetland (HGM unit)	Wetland area located on gently to steeply sloping land and dominated by the colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope. Seeps are often located on the side-slopes of a valley, but they do not typically extend onto a valley floor. Water inputs are primarily via subsurface flows from an up-slope direction.
Thermal Spring	A spring with water temperatures above its surroundings
Unchannelled valley bottom wetland (HGM unit)	A valley bottom wetland without a river channel running through it. These wetlands are characterised by their location on valley floors, an absence of distinct channel banks, and the prevalence of diffuse flows. Water inputs are typically from an upstream channel and seepage from adjacent valley side slopes, if present.
Watercourse	Watercourse definitions as provided in the NWA: • A river or spring; • A natural channel in which water flows regularly or intermittently; • A wetland, lake or dam into which, or from which, water flows and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse. • A reference to a watercourse includes, where relevant, its bed and banks.
Wetland	Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal

Term	Explanation
Biota	All the plants and animals inhabiting an area.
	circumstances supports or would support vegetation typically adapted to life in saturated soil (NWA).
Wetland flat (HGM unit)	A level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or bench. Closed elevation contours are not evident around the edge of a wetland flat. They are characterised by the dominance of vertical water movements associated with precipitation, groundwater inflow, infiltration and evaporation. Horizontal water movements within these wetlands, if present, are multi-directional, due to the lack of any significant change in gradient within the wetland (Ollis *et al*., 2013).

1. OVERVIEW OF WORKING FOR WETLANDS

Working for Wetlands (WfWetlands) is a government programme managed under the Natural Resource Management Programme (NRM) of the Department of Environmental Affairs. It is a joint initiative with the Departments of Water and Sanitation (DWS), and Agriculture, Forestry and Fisheries (DAFF). In this way the programme is an expression of the overlapping wetland-related mandates of the three parent departments, and besides giving effect to a range of policy objectives, it also honours South Africa's commitments under several international agreements, especially the Ramsar Convention on Wetlands and climate conventions.

The programme is mandated to protect pristine wetlands, promote their wise-use and rehabilitate those that are degraded throughout South Africa. The restoration component of the programme functions within the principles of the Expanded Public Works Programme (EPWP) seeking to draw significant numbers of unemployed people into the productive sector of the economy, gaining skills while they work and increasing their capacity to earn an income.

1.1 Objectives of Working for Wetlands

WfWetlands engages with provinces, especially government departments and agencies responsible for biodiversity and environment, and municipalities through individual projects. A stronger working relationship with these spheres of government is being promoted through the programme's emphasis on partnerships. Compatibility with Integrated Development Plans (IDPs) and rehabilitation project objectives will be a particular area of future focus. WfWetlands encourages municipalities to participate in provincial wetland forums because they are the platform for the roll-out of all the programme's processes, including planning for future work. Provincial wetland forums also offer support from the government departments and private sectors that are represented. Partnerships with non-governmental organisations and the private sector are also critical, requiring collaboration and cooperation with a wider range of stakeholders and role players in the wetland management field. The newly identified strategic framework of WfWetlands has underlined the need for a more refined process, resulting in the programme embarking on catchment-scale planning. Catchment-scale planning seeks to promote ecosystem-scale outcomes, long-term custodianship, and embedding of rehabilitation in broader local institutions and frameworks. The recent move to a systematic wetland rehabilitation planning process has provided a fertile and conducive platform for partnerships to be formed and/or strengthened as it draws in a much wider stakeholder base. This is in line with NRM's objective to increase its footprint through Land User Incentive based projects.

1.2 Relevant legislation, policies and guidelines applicable to the project

WfWetlands operates within the context of the Constitution (1996), whereby everyone has the right to an environment that is not harmful to their health and wellbeing, and that is protected. The following national legislation, amongst others, are thus applicable:

- National Environmental Management Act, Act No. 107 of1998, as amended (NEMA)

- National Environmental Management: Biodiversity Act, Act No 10 of 2004 (NEMBA)
- National Water Act, Act No. 36 of 1998 (NWA)
- Conservation of Agricultural Resources Act, Act No. 43 of 1983 (CARA)

This legislation both directs WfWetlands in its vision and objectives and regulates the wetland rehabilitation activities which WfWetlands carries out. WfWetlands has put systems in place to achieve compliance with all applicable legislation. For example, Basic Assessments for Environmental Authorisation are carried out for all listed activities involved in wetland rehabilitation to comply with NEMA and a Memorandum of Agreement is in place with DWS to ensure compliance with the water licensing requirements of the NWA.

1.3 Introduction to the Study Area

Location

The study area is situated approximately 24 km south-east of the town of Giyani and about 26 km south-east of the R81, with the village of Vuhehli lying about 3 km to the north-west (Figure 1-1). The study area is situated in Limpopo Province and falls under the Mopani District Municipality, Greater Giyani Local Municipality. It lies within the farm Greater Giyani 891 LT.

Figure 1-1: Google Earth image showing the study area in relation to the surrounding towns, villages and roads; the inset map shows the study area in greater detail

Land-Use

According to the 2013/2014 land-cover data, the study area is completely natural with no transformed areas (Figure 1-2). The surrounding area is also largely natural, with cultivation and urban development being the primary land uses, as well as some very small patches of mining (Figure 1-2).

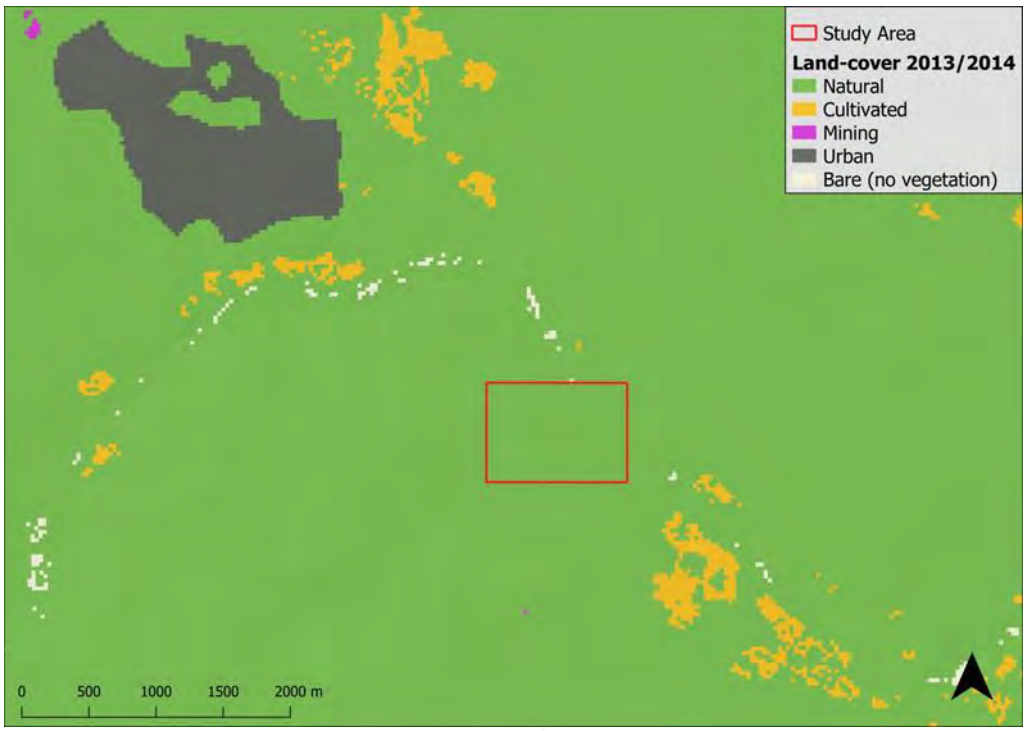


Figure 1-2: The 2013/2014 land-cover data showing the different land-uses within the study area and surrounds

Vegetation Units

According to Mucina & Rutherford (2006), the study area falls within the Lowveld Rugged Mopaneveld vegetation unit (SVmp6; Figure 1-3). The following description applies to the unit as a whole and is taken from Mucina & Rutherford (2006).

Lowveld Rugged Mopaneveld has an altitude range of 250–550 m. The landscape comprises slightly too extremely irregular plains with sometimes steep slopes and a number of prominent hills. The area around the Olifants River has more dissected and steeper slopes than the northern part of this unit. The vegetation usually comprises dense shrubs with occasional trees and a sparse ground layer. Woody plants can become particularly dense where fire is excluded by very rocky terrain, such as in the vicinity of the Olifants River. Vegetation is more open in the north-eastern parts of this unit outside the Kruger National Park. It is a summer rainfall area with very dry winters and is generally frost-free, although frost sometimes occurs in the low-lying areas. The conservation target is 19%. Some 34% is statutorily conserved; with at least an additional 5% conserved in private reserves. About 20% is already transformed, mainly by cultivation, as well as some urban and built-up areas. The vegetation occurring outside the conserved areas is under pressure

from high-density rural human population and associated urban sprawl and agricultural activities. Some areas experience moderate erosion.

Mean monthly minimum and maximum temperatures at the study site itself are 9˚C and 32.1˚C in June and January respectively, while the annual average is 22.2˚C; the mean annual precipitation is 527 mm (WorldClim database, Hijmans *et al.*, 2005).

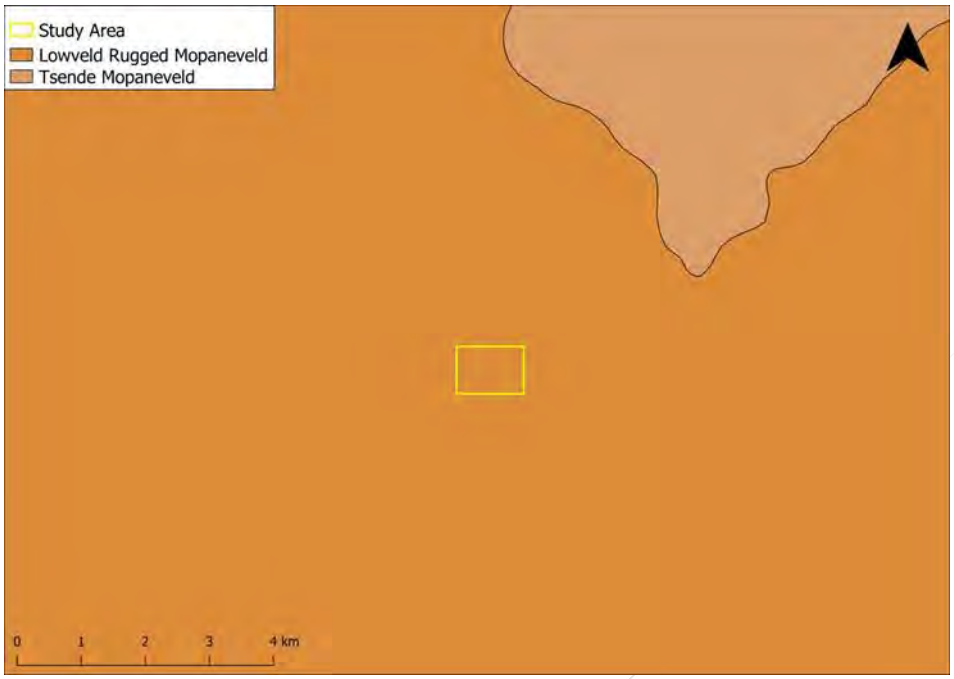


Figure 1-3: The position of the study area in relation to the surrounding vegetation units

Land Types

The study area falls within land type Ae318 (Figure 1-4). The geology is described as follows: “Grey biotite gneiss and migmatite of the Goudplaats Gneiss with, in the west, leucocratic biotite granite of Vaalian age; common diabase dykes”, while the soils are described as: “Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)” (Land Type Survey Staff, 1972–2006).

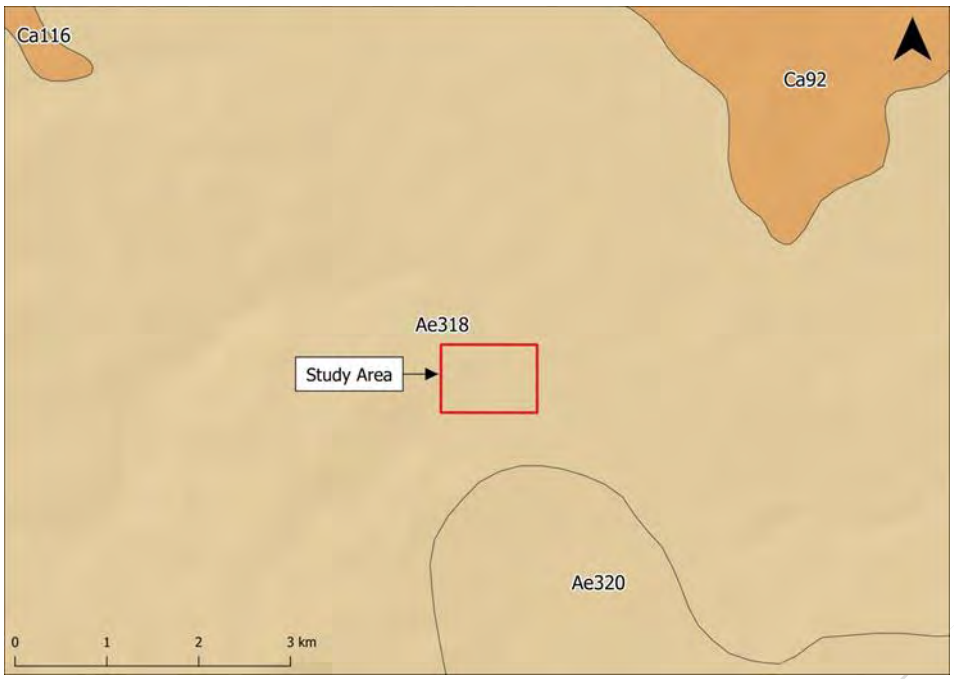


Figure 1-4: Study area in relation to the land types in the vicinity

Freshwater Desktop Assessment

This desktop assessment is based on a combination of the NFEPA project (National Freshwater Ecosystem Priority Areas; Nel *et al.*, 2011), the 2014 PES (Present Ecological State) for South African rivers (Department of Water and Sanitation [DWS], 2014), the new National Wetland Map 5 (Van Deventer *et al.*, 2018) and the wetland probability maps for Limpopo (i.e. modelled wetlands; Dr Nacelle Collins; FS DESTEA). Although the Limpopo Conservation Plan version 2 included aquatic features, these were not separated from terrestrial features and are thus not included here (and they were regardless largely based on the NFEPA project; Desmet *et al.*, 2013). The NFEPA project identifies FEPAs (Freshwater Ecosystem Priority Areas), which are rivers, wetlands and estuaries that need to remain in a good condition to conserve freshwater ecosystems and protect water resources for human use (Nel *et al.*, 2011). The river maps for this desktop assessment are based on two river layers: a 1:50 000 river layer for Limpopo, and the NFEPA river layer (1:500 000), which was used in the 2014 PES assessment. The PES assessment uses 6 categories ranging from 'A' (natural) to 'F' (critically modified); DWS, 2014. The National Wetland Map 5 and wetland probability maps represent the most recent wetland maps for South Africa, and as such were used instead of the NFEPA wetland maps for this desktop assessment.

The study area falls within quaternary catchment B82G, which forms part of the Klein Letaba Sub-water Management Area (Figure 1-5), and the Luvuvhu and Letaba Water Management Area.

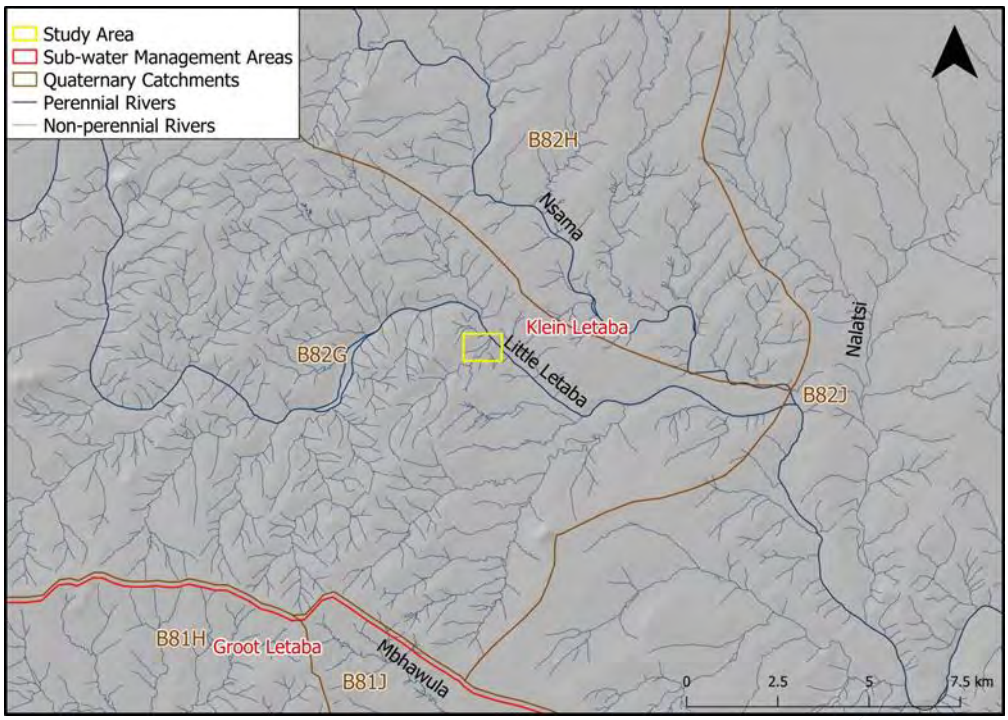


Figure 1-5: The study area in relation to sub-water management areas, quaternary catchments and rivers

One perennial river, the Little Letaba River, flows through the study site, as well as several non-perennial rivers (Figure 1-5 & Figure 1-6). According to the 2014 PES for South African rivers, the Little Letaba River has a PES of 'D' (i.e. Largely Modified: a large loss of natural habitat, biota and basic ecosystem functions has occurred). According to the NFEPA river classification, the study area falls within an Upstream Management Area. Upstream Management Areas are sub-quaternary catchments where human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas (Nel *et al.*, 2011). According to the National Wetland Map 5/ wetland probability map, the only wetland within the study area is classified as "River" (i.e. riverine wetland; Figure 1-6).

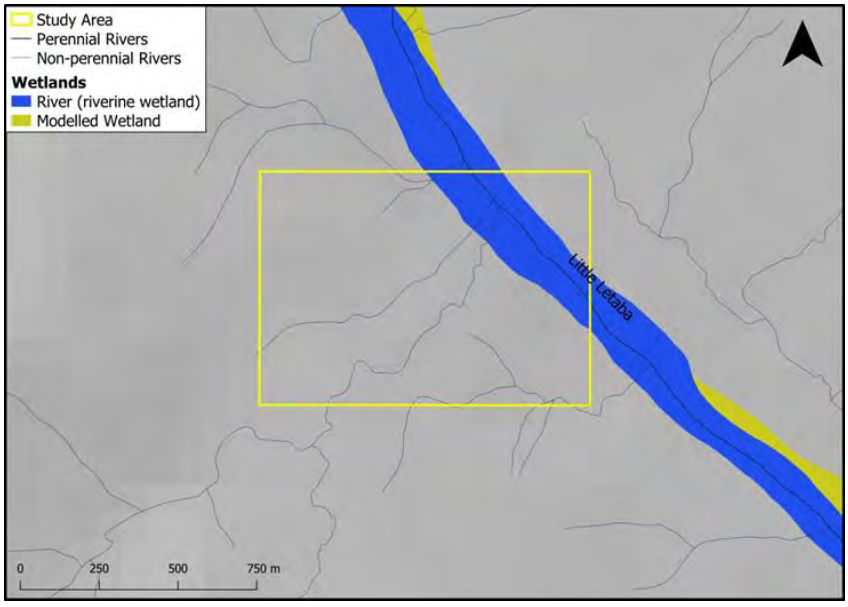


Figure 1-6: The study area in relation to rivers and wetlands

2. METHODOLOGY

The rehabilitation of freshwater ecosystems is considered to be a complex undertaking and the planning process involves multiple disciplines. The relevant components of the following methodology were adopted for the project and comprise multiple steps.

2.1 Assessment of wetland functioning and condition

Determining the impacts on the wetland habitat requires the assessment and understanding of the levels of functioning and condition/integrity of the wetlands for the current and post-rehabilitation scenarios.

2.1.1 Assessment of wetland functioning

To quantify the level of functioning of the wetland systems, and to highlight their relative importance in providing ecosystem benefits and services at a landscape level, a WET-EcoServices (Kotze *et al.,* 2007) assessment was performed for the current and post-rehabilitation scenarios for all the high priority wetland systems identified during the WfWetlands Phase 1 planning phase. The WET-EcoServices assessment technique focuses on assessing the extent to which a benefit is being supplied by the wetland habitat, based on both:

- The opportunity for the wetland to provide the benefits; and
- The effectiveness of the particular wetland in providing the benefit.

Ecosystem services, which include direct and indirect benefits to society and the surrounding landscape, were assessed by rating various characteristics of the wetland and its surrounding catchment, based on the following scale:

- Low (0);
- Moderately Low (1);
- Intermediate (2);
- Moderately High (3); and
- High (4)

The scores obtained from these ratings for the wetland systems were then incorporated into WET-EcoServices score for each of the fifteen ecosystem services (Table 2.1).

Table 2-1: Ecosystem services supplied by wetlands (Kotze *et al.,* 2007, p14)

Ecosystem services	**Indirect benefits**	**Regulating and supporting benefits**	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream
			Stream flow regulation		Sustaining stream flow during low flow periods
			Water quality enhancement benefits	Sediment trapping	The trapping and retention in the wetland of sediment carried by runoff waters
				Phosphate assimilation	Removal by the wetland of phosphates carried by runoff waters
				Nitrate assimilation	Removal by the wetland of nitrates carried by runoff waters

				Toxicant assimilation	Removal by the wetland of toxicants (e.g. metals, biocides and salts) carried by runoff waters
				Erosion control	Controlling of erosion at the wetland site, principally through the protection provided by vegetation
			Carbon storage		The trapping of carbon by the wetland, principally as soil organic matter
	Direct benefits		**Biodiversity maintenance**		Through the provision of habitat and maintenance of natural process by the wetland, a contribution is made to maintaining biodiversity
		Provisioning benefits	Provision of water for human use		The provision of water extracted directly from the wetland for domestic, agricultural or other purposes
			Provision of harvestable resources		The provision of natural resources from the wetland, including livestock grazing, craft plants, fish, etc.
			Provision of cultivated foods		The provision of areas in the wetland favourable for the cultivation of foods
		Cultural benefits	Cultural heritage		Places of special cultural significance in the wetland, e.g. for baptism or gathering of culturally significant plants
			Tourism and recreation		Sites of value for tourism and recreation in the wetland, often associated with scenic beauty and abundant birdlife
			Education and research		Sites of value in the wetland for education or research

2.1.2 Ecological importance and sensitivity

In accordance with DWAF (1999), the ecological importance of a water resource provides an expression of its importance to the maintenance of ecological diversity and functioning at a local and a wider level. As WET-EcoServices does not provide a consolidated score that can be used as a target, the assessment scores were incorporated into the Ecological Importance and Sensitivity (EIS) assessment framework to provide an EIS score based on scores for ecological importance and sensitivity, hydro-functional importance, and direct human benefits (DWA, 2013). Table 2.2 provides an overview of the ratings used to interpret the derived EIS scores.

Table 2-2 Ecological Importance and Sensitivity Classes

Ecological Importance and Sensitivity Categories	Range of EIS Score	EIS Class
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these systems 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.	4	**A**
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quality and quantity of water in major rivers.	>3 and <4	**B**
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems 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.	>2 and </=3	**C**
Low/Marginal: Wetlands that is not ecologically important and sensitive at any scale. The biodiversity of these systems 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.	>1 and </=2	**D**
None: Wetlands that are rarely sensitive to changes in water quality/hydrological regime.	0	**E**

2.1.3 Assessment of wetland condition/integrity

To determine the level of ecological integrity, a WET-Health (MacFarlane *et al.*, 2007) assessment was performed for the current, post-rehabilitation and without rehabilitation scenarios for the wetland systems (where appropriate). The WET-Health assessment technique gives an indication of the deviation of the system from the wetlands' natural reference condition for the following biophysical drivers:

- Hydrology - defined as the distribution and movement of water through a wetland and its soils;
- Geomorphology - defined as the distribution and retention patterns of sediment within the wetland; and
- Vegetation - defined as the vegetation's structural and compositional state.

The impacts on the wetlands, determined by features of the wetlands and their catchments, were scored based on the impact scores and then represented as Present State Categories (PES) as outlined in WET-Health (Table 2.3).

Table 2-3 Impact scores and present state categories for describing the integrity of wetlands (MacFarlane *et al*., 2007)

Impact Category	Description	Impact Score Range (0-10)	Present State Category
None	Unmodified, natural.	0-0.9	**A**
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitat and biota may have taken place.	1-1.9	**B**
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitat has taken place but the natural habitat remains predominantly intact.	2-3.9	**C**
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	**D**
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable.	6-7.9	**E**
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	**F**

The scores for hydrology, geomorphology and vegetation were simplified into a composite impact score, using the predetermined ratio of 3:2:2 (MacFarlane *et al.,* 2007) respectively for the three components. The composite impact score was used to derive a health score that then provided the basis for the calculation of hectare equivalents (also referred to as functional area), which can be described as the health of a wetland expressed as an area (Kotze and Ellery 2009).

2.2 Monitoring and Evaluation

The monitoring and evaluation of the wetlands relies on collecting relevant baseline information, with the collected data including fixed point photographs. Furthermore, it should include the summary of the systems to be rehabilitated, including:

- number of wetlands to be rehabilitated;
- number of HGM units to be rehabilitated;
- hectare equivalents gained/secured due to the rehabilitation; and
- area (hectares) influenced by the proposed rehabilitation activities.

2.2.1 Fixed Point Photography/ Site Photographs

Pre-implementation photographs were recorded for the wetland and/or wetland complex, as outlined in WET-RehabEvaluate (Cowden and Kotze, 2009), to provide a visual baseline of the system prior to the implementation of the proposed rehabilitation activities. Visual monitoring can then be undertaken in subsequent years to document changes to the system.

2.2.2 Wetland Assessments

The ecological integrity and functioning of the wetlands should be monitored using the WET-Health (Macfarlane *et al.,* 2007) and WET-EcoServices (Kotze *et al.,* 2007) assessment techniques. The assessments undertaken for the Phase 2 planning will form the baseline data of the systems from which future assessments of the systems can be based.

3. ASSUMPTIONS AND LIMITATIONS

The following limitations were placed on the wetland ecosystem and biodiversity study of this project:

- A single baseline assessment was conducted, thus limiting the amount of biota identified at the site;
- Accuracy of the maps, aquatic ecosystems, routes and desktop assessments were made using the current 1:50 000 topographical map series of South Africa;
- Accuracy of Global Positioning System (GPS) coordinates was limited to 15 m accuracy in the field;
- Delineations and related spatial data generated will be supplied in GIS (shape file) format only and can thus be used for conceptual planning only and not detailed design. If the client requires that data be accurate to detailed design level, this can be negotiated and budgeted for separately;
- Only accessible wetland areas were assessed;
- Wetland boundaries are estimated, based primarily on desktop information and limited field verification;
- Assessment of impacts and rehabilitation outcomes are informed by a structured process, but are based on professional judgement since no data (to our knowledge) exists prior to the developments which have already taken place on the site with which the current status can be compared, rather than an exact science (e.g. no supplementary monitoring of actual vegetation sampling was undertaken to assess the current mix of species within different areas);
- The assessment of importance and sensitivity is based on available desktop information and limited interactions with local stakeholders.
- Time and costs related to surveys have been calculated based on the proposed area (route) as indicated by the client;
- Whilst every care is taken to ensure that the data presented is qualitatively adequate, inevitably conditions are never such that that is entirely possible. Under the circumstances, it must be pointed out that the nature of the vegetation, the time of year, human intervention and the like, limit the veracity of the material presented.

4. WETLAND DESCRIPTION

The Soutini-Baleni wetlands can be described as mires that are fed by warm water and can also be referred to as thermal springs. These mires are globally rare and there is an estimate of 50 thermal springs in South Africa, some with organic deposits (Grootjans, *et al.* 2010).

Besides the mires, a valley bottom wetland is situated adjacent to the larger mire and drains into an ephemeral stream which transects the study area. This ephemeral stream has serious bank erosion.

Thermal springs originate from rainwater that percolates into permeable rocks or joints and becomes heated underground. The water reaches substantial depths and its temperature increases at a rate of 2–3°C per 100 m due to the geothermal gradient. Convection currents in the groundwater are created when the heated water expands and rises. A thermal spring is sometimes formed when the heated groundwater in an aquifer encounters a fracture zone or an aquitard such as a dyke which forces it to rise to the surface (Grootjans, *et al.* 2010).

The local community and WfWetlands drew the attention to the Soutini-Baleni thermal mire since it had been damaged by cattle (trampling and overgrazing) and therefore measures to protect this mire from total destruction needed to be determined. The local ladies from the salt works also collect water/sand from the outskirts of the wetland and are dependent on a healthy system to be able to continue producing salt. The objective of this wetland rehabilitation plan is to restore vegetation cover and prevent any potential erosion that may degrade the integrity of these unique wetland systems.

A total of 12 ‘eyes’ occur in an oval area of approximately 31 ha and are fed by thermal water reaching up to 34°C (Figure 4-1 and Figure 4-2). One big mire comprises 1.4 ha, while the rest are small (1–15 m in diameter). The peat thickness ranges from 0.3 –1.2 m. These ‘eyes’ form domes which are raised above the natural ground level of their surroundings. Some of the domes have dried out completely and others are severely impacted and show signs of erosion due to water flow and trampling by cattle, donkeys and goats. The mires lie in an oval shape area, possibly supporting the hypothesis that the water originates from deep aquifers which discharge at geological faults (the same conclusions made by Grootjans, *et al*. (2010).

It is important to highlight the fact that we know very little about the geo-hydro mechanisms driving these unique mire ‘eyes’ and there is a need for more research in this regard. The high temperatures and mineral content do create an environment conducive to the formation of peat. To what extent does the redox contribute to the microbes contributing towards the build-up of organic material? This is an important question, which, if answered, could contribute towards the management of these unique systems.

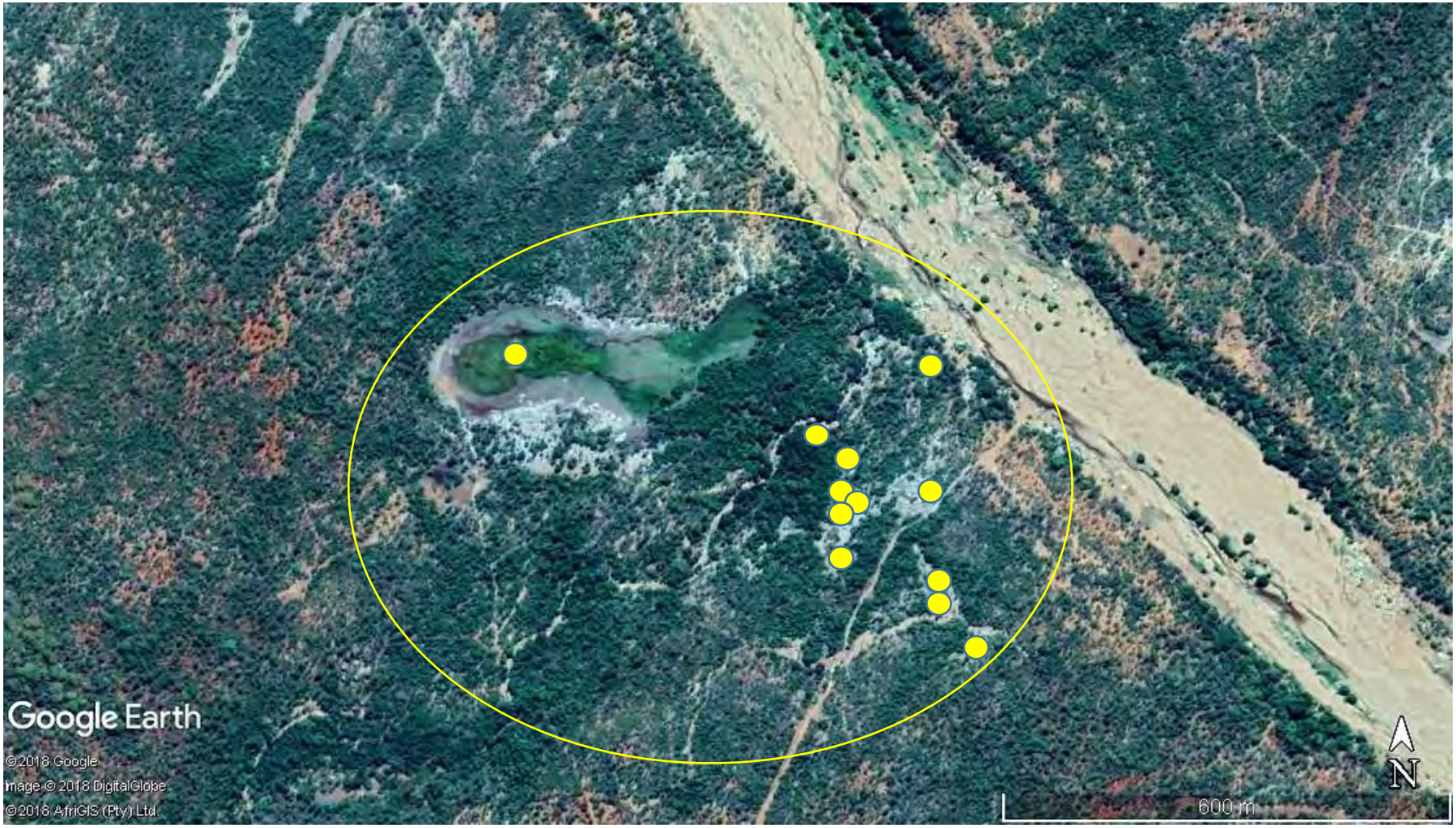


Figure 4-1: Map showing the locations of the springs marked in yellow

Elevated dome behind the cattle

Raised dome in a forested area (also called the 'Magic Mountain')

Small dome with degraded surroundings

Dome trampled and grazed by cattle

A unique mire found on the slope of the macro bank of the Klein Letaba River

Figure 4-2: Examples of mires in the area

Table 4-1 Project area description for each quaternary catchment included in the study

Province	Limpopo
Quaternary Catchment	B82G
Project Name	Soutini-Baleni
Land Owner / Partnership	Government Communal Land
Planning Phase	2
Nearest Town	Giyani
Previous Work	Yes, site visit by WfWetlands personnel (Dr. P-L Grundling compiled a KML list of potential rehabilitation areas)
Project Description	Wetland Rehabilitation

4.1 Wetlands Identified for Rehabilitation Assessment

The identified wetlands are valley bottom wetlands and mire 'eyes', the outflow of which drains towards the Klein Letaba River (Table 4-2). These wetland systems consist of a valley bottom system and hillslope seep wetlands identified as thermal 'eyes'.

Table 4-2 Identified wetlands based on agreement between SANBI and WfWetlands

Wetland Number	Wetland Name	Hydrogeomorphic Unit	Area (ha)
B82G-01	Soutini-Baleni	Valley bottom	1.6
B82G-02	Soutini-Baleni	Seep connected to a stream	5.7
B82G-03	Soutini-Baleni	Seeps (two) connected to a stream	704 m^2
B82G-04	Soutini-Baleni	Seeps (nine)	0.84 ha

4.1.1 Soutini Baleni Wetland (B82G-01)

4.1.1.1 Wetland Details

Table 4-3 B82G-01 wetland details (Figure 4-3 and Figure 4-4)

Wetland Name	Soutini Baleni
Wetland Number/Label	B82G-01
GPS Location	S23 25 15.5 E30 54 32.3
River System Name	Wetland feeds into an unnamed ephemeral stream that flows into the Klein Letaba River
Land Use in catchment	Cattle, donkey and goat farming
Land Use in wetland	Grazing
Date of wetland assessment	15 October 2018
Wetland Type (HGM unit)	Valley bottom
Wetland Catchment Size (ha)	21.8
Wetland Target Area Size (ha)	1.6
Wetland Slope (%)	0.6

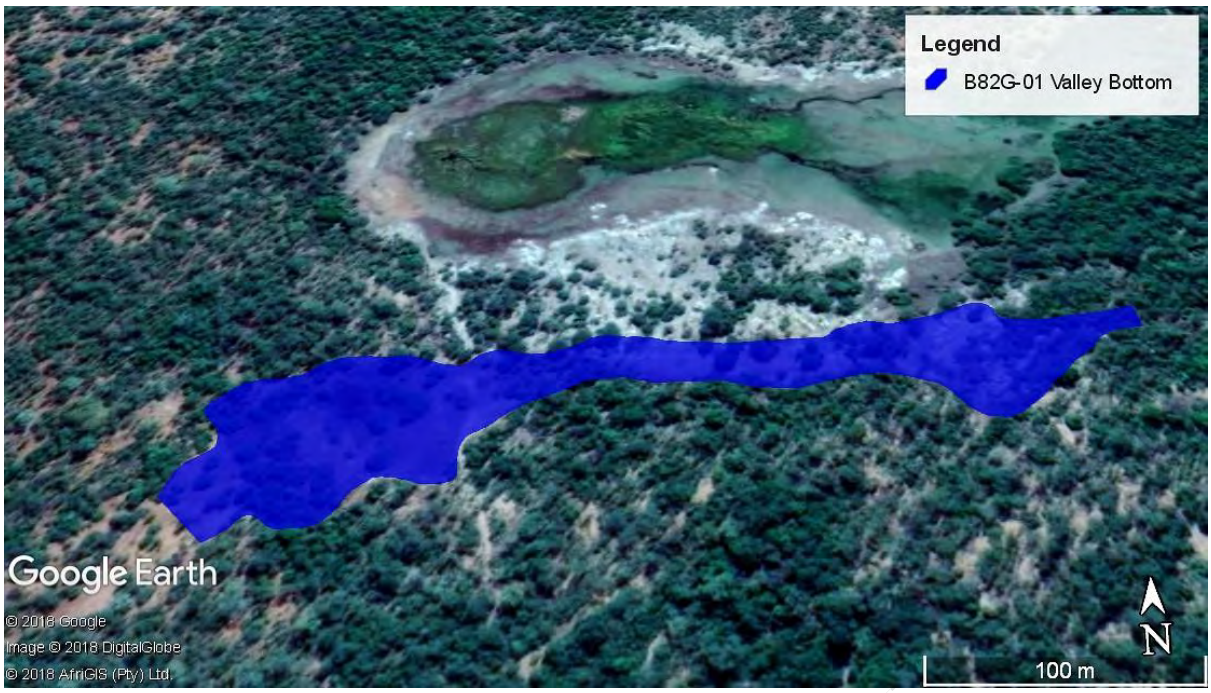


Figure 4-3: Aerial view of B82G-01 Soutini-Baleni valley bottom wetland

Figure 4-4: Panoramic view (Photo) of the B82G-01 valley bottom wetland

4.1.1.2 Wetland Characteristics

This is a valley bottom wetland draining towards the Klein Letaba River. The target area for rehabilitation of the wetland is estimated to be 1.6 ha in size. The catchment is approximately 21.8 ha, of which the wetland comprises approximately 7.3% of the total area. The slope of this wetland is 2.4%. It should be noted that the size of the wetland is estimated within the demarcated study area.

The dominant vegetation within the wetland area is tree and shrubs, sedge and grass species, which are often indicative of moist soils in this dry environment. In the wetter patches the dominant vegetation includes: *Schoenoplectus brachyceras, Juncus effusus, Kyllinga erecta,* etc. Within the open channel areas (the more drier areas), the following species are plentiful: many woody species occur such as *Acacia karroo, A. nigrescens, Euclea divinorum, Colophospermum mopane*, *Searsia sp., Gymnosporia buxifolia,*

Spirostachys africana, Schotia brachypetala, Philenoptera violacea, etc. Grass species such as *Aristida congesta, Setaria sphacelata* and *Cynodon dactylon* also occurred in places.

The slope of the wetland's catchment is reasonably in places, but flattens out towards the valley bottom wetland. The upper portion of the wetland's catchment has indications of road crossings, livestock grazing and trampling, etc. Overgrazing and trampling occur in places, and all potentially contribute towards the degradation of the catchment.

The following impacts to the wetland were identified:

- Grazing and trampling have caused erosion in places. This has also resulted in hardening of surfaces, producing preferential flows in places. Less vegetation has decreased habitat availability reducing the wetland's biodiversity integrity.
- A road crossing the wetland acts somewhat as a barrier and has a bit of an influence on its hydrology. This may result in concentrated flows downstream that result in erosion and desiccation.

Figure 4-5 illustrates identified problems that will be targeted for wetland rehabilitation action. These problems include desiccation of wetland areas, channel erosion, head-cut erosion, a road crossing, alien plant species, etc.

Bare, eroded surface area in the catchment

Road crossing wetland area

Shallow channel eroded areas in wetland

Head-cut erosion

Figure 4-5: Current wetland impacts within the wetland B82G-01 downstream of the road crossing

4.1.1.3 Benchmark or reference state of Wetland B82G-01

To assess the entrepreneurial impact on a wetland, the ecological condition and integrity is measured against a minimally impacted site that represents the same type of wetland in the region/area. The determined reference conditions of the target area are described in Table 4-4.

Table 4-4 Wetland B82G-01 reference benchmark state

Characteristic	Description
HGM Unit	Valley bottom wetland
Wetness Regime	Dominated by seasonal wet conditions with temporarily wet areas. It appears that these wet zones occur in the valley bottom with few seep areas on the side. This wetland is of a dry nature and is seasonally driven.
Hydrology	The catchment of the wetland is undulated and conveys water via ephemeral channels towards the gently sloped target wetland area. The key driver is the longitudinal flows with secondary lateral flows to the wetland.
Geomorphology	The catchment is undulated with a low gradient and during seasonal rains the water spreads out and eventually flows into the shallow channels towards the wetland. The water becomes sinuous and sluggish and deposits the sediment it carries. Degradation does occur and it is expected that some alluvial material will exit the system again. Dykes occur in the target wetland area with the build-up of fluvial material in places.
Vegetation	The vegetation component is dominated by grass and sedge species of a facultative nature. Woody species occur sporadically in the channel. Alien species, including ruderal and agrestal weeds would be absent.

sinuous

4.1.2 Soutini-Baleni Wetland (B82G-02)

4.1.2.1 Wetland Details

Table 4-5 B82G-29 wetland details

Wetland Name	Soutini-Baleni
Wetland Number/Label	B82G-02
GPS Location	S 23 25 163 E 30 54 654
River System Name	Wetland feeds into an unnamed ephemeral stream and flows into the Klein Letaba River
Land Use in catchment	Cattle, donkey and goat farming
Land Use in wetland	Grazing (with trampling)
Date of wetland assessment	15 October 2018
Wetland Type (HGM unit)	Hillslope seep
Wetland Catchment Size (ha)	19.8
Wetland Target Area Size (ha)	5.7
Wetland Slope (%)	1.3

The target wetland is a hillslope seep wetland (Figure 4-6 and Figure 4-7). This wetland is situated in the B82G quaternary catchment, draining north towards the Klein Letaba River.

Figure 4-6: Aerial view of the Soutini-Baleni mire B82G-29 hillslope seep wetland

Figure 4-7: Panoramic view of the B82G-29 hillslope seep wetland

4.1.2.2 Wetland Characteristics

This is a hillslope seep wetland connected to the Klein Letaba River downstream. The wetland is overgrazed and trampled with little vegetation cover. In the permanently wet areas, *Typha capensis* and sedge vegetation that is adapted to survive in permanently wet conditions occur. Some indigenous woody vegetation occurs along the edges of this wetland. The targeted wetland within the study area is estimated to be 5.7ha in size. The catchment is approximately 19.8ha, of which the wetland comprises approximately 28.8% of the total area.

The thermal eye wetland has been severely impacted by grazing and trampling and, to a lesser extent, by a road around the wetland area. This has resulted in the degradation of this thermal eye impacting the wetland's hydric and vegetation features. The key hydrological driver is water that originates from deep aquifers which discharge on the surface.

The permanent flow of water derived from aquifers of a high temperature and mineral content create an environment that supports a monospecific vegetation stand consisting of *Typha capensis, Thelypteris confluence, Leptochloa fusca and Bolboschoenus maritimus,* etc. In the drier wetland areas, the abundant species include: *Cynodon dactylon, Aristida congesta, Persicaria decipiens, Setaria sphacelata, etc.* which are especially common along the edge of the wetland.

Due to the permanently wet conditions and the presence of possible artesian eyes the formation of peat is expected. In Figure 4-8 a peat sample is shown and has a depth of up to 1.4m.

Figure 4-8: Sample of peat found in Hillslope Seep Wetland B82G-02

Figure 4-9 illustrates identified problems that will be targeted for wetland rehabilitation action.

Overgrazed and trampled area with preferential flows

Road crossing through edge of wetland

Trampled outflow area of wetland

Donga erosion in the outflow of wetland

Donga erosion in the outflow of wetland

Overgrazed and trampled wetland area

Figure 4-9: Current wetland impacts within the B82G-2 seep wetland

4.1.2.3 Benchmark or reference state of Wetland B82G-02

To assess the entrepreneurial impact on a wetland, the ecological condition and integrity is measured against a minimally impacted site that represents the same type of wetland in the region/area. The determined reference conditions of the target area are described in Table 4-6.

Table 4-6 Wetland B82G-02 reference benchmark state

Characteristic	Description
HGM Unit	Hillslope seep feeding a stream
Wetness Regime	Dominated by permanently wet conditions with some seasonal and temporarily wet conditions along the edges of the wetland. The key driver is groundwater originating from a deep aquifer and feeding the wetland that drains towards the Klein Letaba River.
Hydrology	Groundwater feeds this wetland, resulting in permanently wet conditions. It is expected that this can be an artesian spring forming a peat dome. It can possibly be described as a thermal spring that drains towards the Klein Letaba River.
Geomorphology	The wetland is situated on a gentle slope of 1.3% with a thermal spring in the upper part of the wetland system. No preferential flows are expected. High organic soils occur in places, on top of chert and quartz. No erosion or sediment deposition is expected.
Vegetation	Obligate and facultative hydrophyte species would dominate the system. It is expected that low species diversity will occur in this wet, acidic soils. Alien species, including ruderal and agrestal weeds would be absent.

4.1.3 Soutini-Baleni Wetland (B82G-03)

4.1.3.1 Wetland Details

The focal wetland hydromorphic unit in the B82G-03 wetland (Table 4-7) comprises two hillslope seep wetlands (Figure 4-10 and Figure 4-11), feeding a stream.

Table 4-7 B82G-03 wetland details

Wetland Name	Soutini Baleni	
Wetland Number/Label	B82G-03	
GPS Location	201	202
	S23 25 223 E30 54 893	S23°25'8.17" E30°54'57.27"
River System Name	Seep connected to an unknown ephemeral stream	Seep connected to the Klein Letaba River
Land Use in catchment	Communal land with roads, cattle, donkey and goat farming and salt mining	
Land Use in wetland	Grazing and trampling	
Date of wetland assessment	15 October 2018	
Wetland Type (HGM unit)	Hillslope seep wetland connected to a stream	
Wetland Catchment Size (ha)	Not applicable	
Wetland Size (m^2)	219	127
Wetland Slope (%)	3.2	4.5

Figure 4-10: Aerial view of the B82G-03 hillslope seep wetlands

B82G-03: 201 Raised dome of peat

B82G-03: 201 Visual from the bottom upstream

B82G-03: 202 Seep with peat against slope of the macro-channel bank

Figure 4-11: Visuals of the B82G-03: 201-202 hillslope seep wetlands

4.1.3.2 Wetland Characteristics

These are two hillslope seep wetlands connected to watercourses. The wetlands are well covered with ferns and some sedge species that are adapted to survive in permanently wet conditions. The wetlands are estimated to be respectively 219m^2 and 127m^2 in size. The catchments are forested woodland with grazing and trampling. Historic sand mining occurred in the area which is of an archaeological nature and artefacts occur in the area.

Wetland B82G-02 is in a natural state with good vegetation cover. The fern *Thelypteris confluence* is monospecific with several other hydrophytes such as the exotic *Nasturtium officinale*. The grass *Koeleria capensis* is also dominant. The seepage mire has a dome that is much higher than the surrounding natural ground level. The tree, *Acacia sieberiana,* is growing inside the dome in permanently wet conditions. Due to disturbances such as grazing and trampling, several exotic species have also found their way into the wetland habitat, these include: *Tagetes minutes, Verbena bonariensis* and *Nasturtium officinale*. At the lower end of this wetland head cut-erosion occurs. Visuals of these impacts can be seen in Figure 4-12.

Nasturtium officinale (Watercress)

Spirodela polyrhiza (Duckweed)

Eroded areas at the lower end of Wetland 03: 202

Head cut erosion in Wetland 03: 201

Figure 4-12: Exotic vegetation and evidence of erosion in the wetland

4.1.3.3 Benchmark or reference state of Wetland B82G-03

To assess the entrepreneurial impact on a wetland, the ecological condition and integrity is measured against a minimally impacted site that represents the same type of wetland in the region/area. The determined reference conditions of the target area are described in Table 4-8

Table 4-8 Wetland B82G-03 reference benchmark state

Characteristic	Description
HGM Unit	Hillslope seep feeding a stream (mire spring)
Wetness Regime	Dominated by permanently wet conditions. The key driver is the underground water feeding the wetland.
Hydrology	The wetland's catchment in its natural state would have conveyed water via sub-surface drainage feeding into the wetland area. It appears that the wetland is fed by underground water of an artisanal nature, forming a dome that is covered with obligate vegetation. The water then flows down towards the watercourse.
Geomorphology	The catchment would have had a gentle slope feeding into the wetland. No erosion is expected with no silt plumes in the wetland.
Vegetation	The vegetation composition would most likely have been dominated by obligate and facultative wetland species. Alien species, including ruderal and agrestal weeds would be absent.

4.1.4 Soutini-Baleni Wetland (B82G-04)

4.1.4.1 Wetland Details

Table 4-9 B82G-04 wetland details

Wetland Name	Soutini-Baleni
Wetland Number/Label	B82G-04
GPS Location	23°25.276' S 30°54.965' E
River System Name	Hillslope seep (springs)
Land Use in catchment	Communal land with stock farming
Land Use in wetland	Communal land, cattle, donkey and goat farming
Date of wetland assessment	15 October 2018
Wetland Type (HGM unit)	Hillslope seep wetlands
Wetland Catchment Size (ha)	Not applicable
Wetland Size (m^2 & ha)	50.5m^2 to 0.12ha
Wetland Slope (%)	Not applicable

The target wetland comprises nine seep wetlands (Figure 4-13 and Figure 4-14).

Figure 4-13: Aerial view of the Soutini-Baleni B82G-04:201_209 Seep Wetlands

Figure 4-14: Panoramic views of B82G-04 seep wetlands, please note the raised dome feature in each of these

4.1.4.2 Wetland Characteristics

These seep wetlands (B82G-04: 201-209) are unevenly distributed on a granite crest. It appears that they are of an artisanal nature due to the appearance of small domes as a result of pressure from below (Figure 4-15). The key hydrological driver is water that originates from deep aquifers which discharge on the surface. Trampling and grazing have a detrimental effect on the integrity of these systems with little vegetation cover remaining. In the permanently wet areas, sedge and graminoids, adapted to survive in permanently wet conditions, are dominant. Some indigenous woody vegetation occurs along the edges of these wetlands.

The permanence of water derived from the aquifers, of high temperatures and mineral content create an environment that supports monospecific vegetation stands consisting of *Leersia hexandra, Thelypteris confluence, Leptochloa fusca and Bolboschoenus maritimus,* etc. In the drier wetland areas, the abundant species include: *Cynodon dactylon, Aristida congesta, etc.* especially common along the edge of the wetland.

Trampling in eye causes hummock features

Trampling and overgrazing

Dry eye feature with overgrazing impact evident

Trampling and overgrazing in and along the edge of this wetland

Figure 4-15: Identified problems that will be targeted for wetland rehabilitation action.

4.1.4.3 Benchmark or reference state of Wetland B82G-04

To assess the entrepreneurial impact on a wetland, the ecological condition and integrity is measured against a minimally impacted site that represents the same type of wetland in the region/area. The determined reference conditions of the target area are described in Table 4-10.

Table 4-10 Wetland B82G-04 reference benchmark state

Characteristic	Description
HGM Unit	Seep wetlands (springs with domes)
Wetness Regime	Dominated by permanently wet conditions with some seasonal and temporarily wet conditions along the edges of the wetland. The key driver is groundwater originating from a deep aquifer and feeding the wetland.
Hydrology	Groundwater feeds this wetland, resulting in permanently wet conditions. It is expected that this is an artesian spring forming a peat dome.
Geomorphology	These wetlands are situated on a granite crest. No preferential flows are expected. High organic soils occur in the centre of these wetlands. No erosion or sediment deposition is expected.
Vegetation	Obligate and facultative hydrophyte species would dominate the system. It is expected that some woody species would also grow in and along the edge of these systems. Good vegetation cover is expected up to the edges of these systems. It is expected that low species diversity will occur due to the permanent wet and high acidity soils. Alien species, including ruderal and agrestal weeds would be absent.

5. STUDY RESULTS

5.1 Wetland B82G–01

5.1.1 Wetland ecological functioning

The proposed rehabilitation interventions will not only affect the ecological integrity of the broader wetland system, but will also have several positive impacts on the supply of goods and services provided by the wetland. Details of anticipated changes in the delivery of wetland services are summarised in Table 5-1, below.

Table 5-1 Wetland functioning for wetland B82G-01

Soutini Baleni Wetland				
Ecosystem Service		**Current State**	**Post-rehab**	**Comments**
		Importance Score	**Change Score (%)**	
Regulatory and Supporting Services	Flood Attenuation	1.6	2.1	Stabilisation of eroded areas and the increase in vegetation cover will hydrate desiccated areas and will increase ability to attenuate floods.
	Stream Flow Regulation	2.0	0.0	No change expected.
	Sediment Trapping	3.3	-14.3	Due to stabilisation of dry channels in the catchment, less sediment is anticipated in the wetland; therefore this wetland will have less sediment to trap.
	Phosphate Trapping	2.3	-6.0	Due to stabilisation of dry channels in the catchment, less sediment and phosphates are anticipated in the wetland; therefore this wetland will have less phosphate to trap.
	Nitrate Removal	2.2	4.2	Cattle and donkeys occur beyond and within the wetland and by spreading the water and increasing hydrated wetland areas it is expected that there would be a reasonable improvement.
	Toxicant Removal	2.0	-5.1	Due to stabilisation of dry channels in the catchment, less sediment and toxicants are anticipated in the wetland; therefore this wetland will have less toxicant to trap.
	Erosion Control	2.0	17.9	Stabilisation of eroded head-cuts, an increase in vegetation cover and rehydration will increase ability of wetland to stabilise current and prevent future erosion.
	Carbon Storage	1.3	8.3	The reinstatement of natural hydrological conditions within the system would improve the potential for carbon storage in the seasonal and permanent zones.
	Biodiversity Maintenance	2.2	4.2	With the re-establishment of wetland habitat, more and improved biodiversity would flourish within the area.
Provisioning Services	Water Supply	1.0	0.0	NA
	Harvestable Natural Resources	3.0	0	NA
	Cultivated Foods	1.4	0	NA
Cultural Services	Socio-Cultural Significance	2.3	0	NA
	Tourism and Recreation	0.7	0	NA
	Education and Research	0.3	12.5	By implementing the rehabilitation program, survey data would be available for further research.

5.1.2 Ecological importance and sensitivity (EIS) of wetland B82G-01

Based on an understanding of the goods and services provided by the wetland, the EIS assessment indicates that this wetland has a "C" importance and sensitivity (Table 5-2). The wetland is considered to be ecologically important and sensitive. The biodiversity of this system may be sensitive to flow and habitat modifications. This wetland is important and will play a role in moderating the quality and quantity of water for the aquatic systems downstream.

It is expected that after rehabilitation the EIS assessment will increase while remaining within the "Moderate" C importance and sensitivity range. The rehabilitation interventions will increase wetland habitat and escalate opportunities for growth diversity to take place. Water regulation and flood attenuation will also benefit from the rehabilitation, improving hydrological integrity. Details of scores for each component assessed are included in Table 5-2, below.

Table 5-2 Summary of the EIS Scores for wetland B82G-01

	B82G-01	
	Current	**Post-rehab**
Ecological Importance and Sensitivity	1.8	1.8
Hydro-functional Importance	1.4	1.9
Direct Human Benefits	0.2	0.5
Overall Importance and Sensitivity Score	**1.1**	**1.4**
Overall Importance and Sensitivity Category	**C**	**C**

5.1.3 Wetland B82G-01 ecological integrity assessment (PES)

The ecological integrity or PES of the wetland was assessed for the hydrology, geomorphology and vegetation components. The impacts to these aspects are measured and demonstrated in Figure 5-1. The integrity of the biophysical components of the wetland was assessed for the current and post-rehabilitation scenarios (Table 5-6). The assessment results of the hydrological, geomorphic and vegetation components are outlined in the following sections.

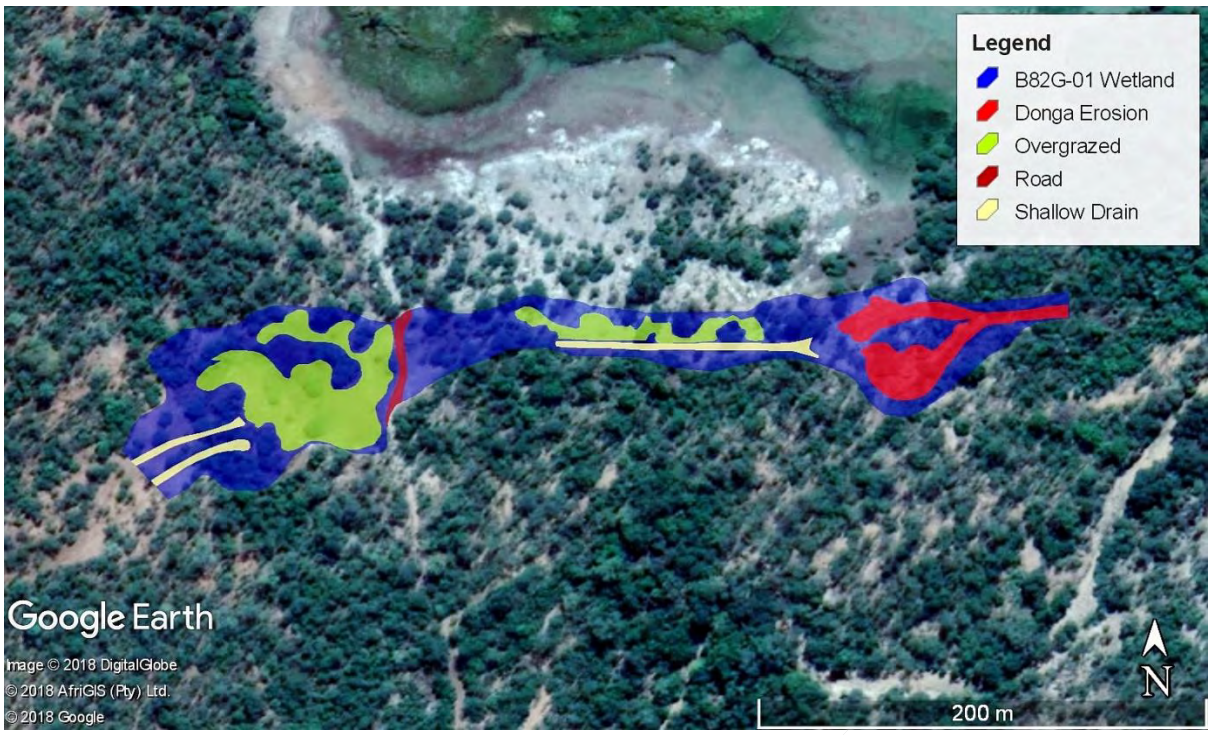


Figure 5-1: Impacts identified that can have a detrimental effect on the wetland

5.1.4 Assessment of the current hydrological impacts

The level of impacts and threats to the wetland hydrology are presented in Table 5-3 below. The hydrological condition of the wetland can be categorised as being a "D" that reflects a large change in ecosystem processes and loss of natural habitat has occurred. Due to grazing and trampling and a road crossing, changes to water inputs from the catchment and in the wetland have occurred. Loads of sediment were transported into the wetland area. The downstream area of the wetland is desiccated due to incisions from head-cut erosion finding its way upstream into the wetland. It appears that with rehabilitation the PES category can be improved from a D to a C.

Table 5-3 Hydrological Impact Scores and PES categories for wetland B82G-01

HGM Unit	B82G-01	Post Rehab
Impact Type	**Impact Score**	**Impact Score**
Changes in water inputs	2.5	3.3
Changes in water distribution and retention patterns	3.6	1.5
Combined Hydrology Impact Score	**4.0**	**3.5**
PES Category	**D**	**C**

5.1.5 Assessment of the current geomorphic impacts

Current impacts to geomorphological integrity include an increase in runoff (hardened surfaces, grazing, trampling, roads, etc). Given these impacts, the current geomorphic integrity is regarded as moderately modified with some loss of natural habitat. A slight

change in ecosystem processes is discernible (Table 5-4). It is possible that with rehabilitation this PES category can be raised to a B.

Table 5-4 Geomorphological Impact Scores and PES categories for wetland B82G-01

HGM Unit	B82G-01	Post Rehab
Impact Type	**Impact Score**	**Impact Score**
Erosional	1.6	1.0
Depositional	0.5	0.4
Combined Impact Score	**2.1**	**1.0**
PES Category	**C**	**B**

5.1.6 Assessment of the current vegetation impacts

Due to changes in hydrology and flow patterns caused by drainage, the desiccation effect of the head-cut erosion together with grazing and trampling, indications are that directional changes in wetland vegetation have occurred. The current state of vegetation is regarded as largely modified and a loss of habitat has occurred. The vegetation integrity can thus be described as a "D" PES Category. Further details of this assessment are provided in Table **5-5** below.

Disturbance units identified, namely flooding by desiccated areas adjacent to the head-cut erosion, shallow drains, the road crossing area, and grazing and trampling. These units consist of habitat reflecting similar characteristics as per the outcome of water distribution and retention patterns. The PES category of a D can be improved to a C if rehabilitation measures were to be implemented.

Table 5-5 Vegetation Impact Scores and PES categories for wetland B82G-01

HGM Unit	B82G-01	Post Rehab
Disturbance Class	**Impact Score**	**Impact Score**
Road	0.03	0.03
Donga Erosion	1	0.5
Shallow Drains	0.13	0.09
Overgrazed and trampled	2	2.0
Remainder	0.14	0.57
Impact Score	**4.3**	**3.2**
PES Category	**D**	**C**

5.1.7 Overall current state impacts

For ease of interpretation the scores for hydrology, geomorphology and vegetation are simplified into a composite impact score for the HGM units by weighting the scores obtained as outlined in Macfarlane et al. (2007).

The wetland's catchment is impacted by overgrazing and trampling with bare surface areas contributing towards the source of sedimentation in the wetland area. Grazing and trampling

(cattle tracks in the wetland have resulted in preferential flow areas), a road crossing and donga erosion (head-cut erosion), etc. affects the hydrology, geomorphology and vegetation. Desiccated areas associated with drainage channels have caused notable changes. This has resulted in a wetland that can currently be described as being in a "C" PES Category or moderately modified (Table 5-6). The threats pose a problem for the near future if no intervention is implemented. With rehabilitation it is expected that the wetland's integrity will improve to a higher "C" PES Category.

Table 5-6 Overall current wetland impact scores and PES categories for wetland B82G-01

Wetland B82G-01	Current	Post Rehab
Hydrology	4.0	3.5
Geomorphology	2.1	1.0
Vegetation	4.3	3.2
Overall	3.5	2.7
Ecological Condition	**C**	**C**

5.2 Wetland B82G–02

5.2.1 Wetland ecological functioning

The proposed rehabilitation interventions will not only affect the ecological integrity of the broader wetland system, but will also have several positive impacts on the supply of goods and services provided by the wetland. Details of anticipated changes in the delivery of wetland services are summarised in Table 5-7 below.

Table 5-7 Wetland functioning for wetlands B82G-02

Soutini Baleni Wetland				
Ecosystem Service		**Current State Importance Score**	**Post-rehab Change Score (%)**	**Comments**
Regulatory and Supporting Services	Flood Attenuation	1.3	3.1	Water percolating from underground will be contained by an improved vegetation roughness coefficient.
	Stream Flow Regulation	3.0	0.0	NA
	Sediment Trapping	1.8	1.6	NA
	Phosphate Trapping	2.0	4.7	By spreading the water and increasing hydrated wetland areas it is anticipated that there would be a reasonable improvement.
	Nitrate Removal	3.2	4.2	By spreading the water and increasing hydrated wetland areas it is anticipated that there would be a reasonable improvement.
	Toxicant Removal	2.3	4.0	By spreading the water and increasing hydrated wetland areas a reasonable improvement would be expected.
	Erosion Control	2.1	14.3	Partial stabilisation of vegetation cover and resultant contribution toward rehydration will increase ability to prevent future erosion.
	Carbon Storage	3.3	8.3	The reinstatement of the peat forming vegetation will also improve the natural hydrological conditions within the system and therefore improve the potential for carbon storage in the seasonal and permanent zones.
	Biodiversity Maintenance	3.5	0.0	NA
Provisioning Services	Water Supply	1.5	0	NA
	Harvestable Natural Resources	3.4	0	NA
	Cultivated Foods	2.3	0	NA
Cultural Services	Socio-Cultural Significance	4.0	0	NA
	Tourism and Recreation	2.6	10.7	By increasing the wetland area and improving its integrity, an improved wetland would be expected, being more accessible and therefore exposing its value to visitors to the area.
	Education and Research	2.0	25.0	The wetland rehabilitation program will provide the opportunity for further research and education.

5.2.2 Ecological importance and sensitivity for wetland B82G-02

Based on an understanding of the goods and services provided by the wetland, the EIS assessment indicates that this wetland has a "B" importance and sensitivity classification (Table 5-8). This wetland is considered to be ecologically important and sensitive. The biodiversity of the wetland is usually very sensitive to flow and habitat modifications. It plays a role in moderating the quantity and quality of water draining towards the Klein Letaba River.

It is anticipated that after rehabilitation the EIS assessment can increase from a "B" to an "A" importance and sensitivity category. After rehabilitation, this wetland should be considered to be ecologically important and sensitive on a national or even an international scale. Its biodiversity is sensitive to flow and habitat modifications. Rehabilitation of the habitat of its main source will reinstate the formation of peat and should contribute towards its integrity and add to its value on all levels. Details of scores for each component assessed are included in Table 5-8, below.

Table 5-8 Summary of the EIS Scores for wetland B82G-02

	B82G-02	
	Current	**Post-rehab**
Ecological Importance and Sensitivity	2.8	3.0
Hydro-functional Importance	1.9	2.6
Direct Human Benefits	2.7	3.2
Overall Importance and Sensitivity Score	**2.5**	**3.2**
Overall Importance and Sensitivity Category	**High (B)**	**Very High (A)**

5.2.3 Wetland ecological integrity assessment

The ecological integrity or PES of the wetland was assessed for the hydrology, geomorphology and vegetation components. A visual of impacts is presented in Figure 5-2. The integrity of the biophysical components of the wetland was assessed for the current, post-rehabilitation and without rehabilitation scenarios (Table 6-3). The assessment results of the hydrological, geomorphic and vegetation components are outlined in the following sections.

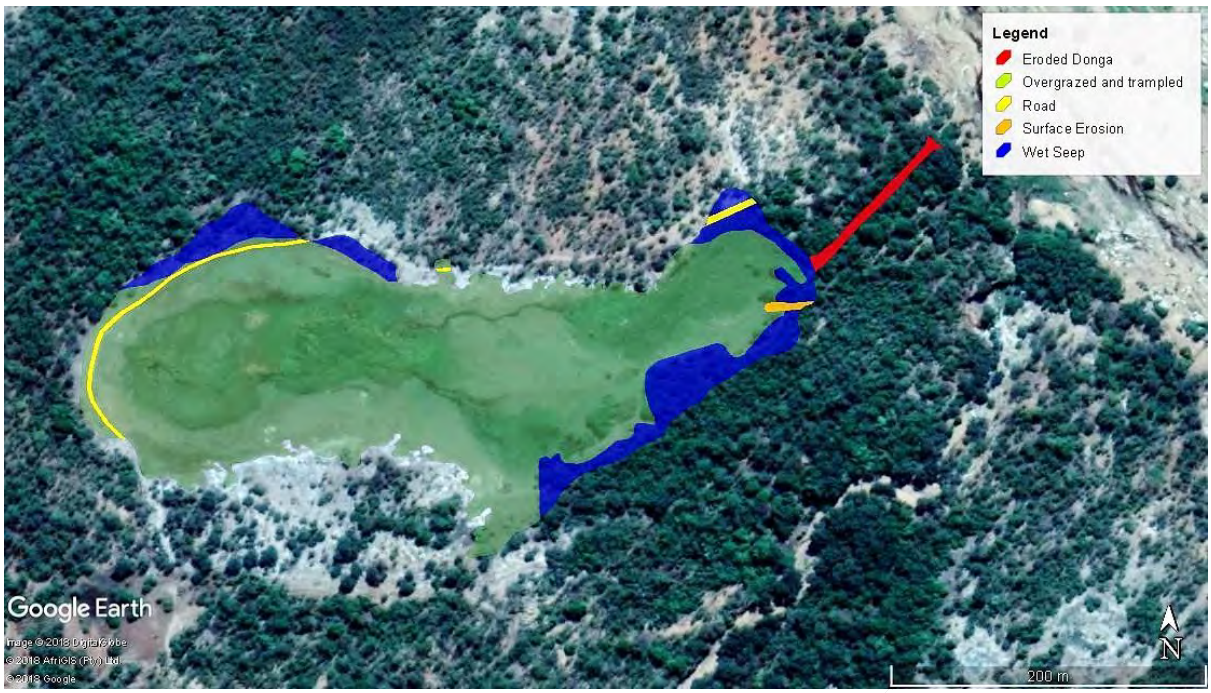


Figure 5-2: Aerial map presenting the impacts that may degrade the wetland's integrity

5.2.4 Assessment of the current hydrological impacts

The level of impacts and threats to the wetland hydrology is presented in Table 5-9. The hydrology of the wetland assessed indicates that a large change in ecosystem processes and loss of natural habitat and biota has occurred and therefore it is rated as largely modified ("E" PES Category). It appears that *in situ* impacts have a major effect on the wetland. Catchment and *in situ* impacts include: two-spoor road, cattle paths, salt soil collecting as well as grazing and trampling.

There are, in addition, identifiable impacts within the wetland unit itself which are currently affecting drainage flow patterns and retention. These impacts include overgrazing and preferential flows along cattle paths traversing wetland areas, vegetation clearing in places, as a result of salt mining - the collection of soil containing minerals, etc.

It is anticipated that with rehabilitation the system will improve from an E to a D (Table 5-9).

Table 5-9 Hydrological Impact Scores and PES categories for wetland B82G-02

HGM Unit	B82G-02	Post rehab
Impact Type	**Impact Score**	**Impact Score**
Changes in water inputs	0.0	0.0
Changes in water distribution and retention patterns	6.5	4.6
Combined Hydrology Impact Score	**6.5**	**4.6**
PES Category	**E**	**D**

5.2.5 Assessment of the current geomorphic impacts

The current impacts to the wetland's geomorphological integrity are limited to increased runoff (overgrazing and trampling and road crossings, etc.).

Given these impacts, the current geomorphic integrity is regarded as moderately modified, with a change in ecosystem processes and a loss of natural habitat as reflected by a "C" PES Category. This has resulted in preferential flows and loss of habitat causing degradation of the wetland system.

The geomorphology is assessed to be moderately modified. A change in ecosystem processes and loss of natural habitat and biota has occurred. The wetland now has a "C" Category classification for Geomorphology as reflected in Table 5-10. With rehabilitation its integrity can increase to that of a "B" PES category.

Table 5-10 Geomorphological Impact Scores and PES categories for wetland B82G-02

HGM Unit	B82G-02	Post Rehab
Impact Type	**Impact Score**	**Impact Score**
Erosional Features	1.0	0.5
Loss of organic material	1.5	1.0
Combined Impact Score	**2.5**	**1.5**
PES Category	**C**	**B**

5.2.6 Assessment of the current vegetation impacts

Indications are that a large area of the wetland has been exposed to disturbance with the result that there has been a change to the vegetation composition; species abundance and cover over time (see underlined score in Table 5-11). Due to changes in hydrology and flow patterns caused by the grazing and trampling, indications are that directional changes in wetland vegetation have occurred. Fortunately, large areas of vegetation cover (although the roughness coefficient is low) in the wetland remain, which contributes towards a level of integrity. The current change in the vegetation component is great, with a great loss of wetland/natural habitat, as described by an "E" PES Category. Further details of this assessment are provided in Table 5-11 below. With rehabilitation this wetland's integrity can increase to that of a "D" PES Category.

Table 5-11 Vegetation Impact Scores and PES categories for wetland B82G-02

HGM Unit	B82G-02	Post Rehab
Disturbance Class	**Impact Score**	**Impact Score**
Road	0.02	0.02
Donga Erosion	1.36	0.68
Surface Erosion	0.01	0.00
Overgrazed and trampled	**6.31**	3.16
Remainder	0.00	0.00
Impact Score	**7.7**	**4.7**
PES Category	**E**	**D**

5.2.7 Overall current state impacts

For ease of interpretation the scores for hydrology, geomorphology and vegetation are simplified into a composite impact score for the HGM units by weighting the scores obtained as outlined in Macfarlane et al. (2007).

A summary of the overall results from the current scenario are outlined below (Table 5-12). The assessment of the wetland habitat under current conditions identified modifications which have caused notable changes to the three components of wetland health:

- Overgrazing
- Trampling
- Preferential flow patterns due to cattle paths
- Donga and surface erosion at the lower end of the wetland

The threats pose a problem for the wetland's integrity in the near future if no intervention is implemented.

Table 5-12 Overall current wetland impact scores and PES categories for wetland B82G-02

Wetland B82G-02	Current	Post Rehab
Hydrology	6.5	5.0
Geomorphology	2.5	1.5
Vegetation	7.7	4.7
Overall	5.7	3.9
Ecological Condition	**D**	**C**

5.3 Wetland B82G–03

5.3.1 Wetland ecological functioning

The proposed rehabilitation interventions will not only affect the ecological integrity of the broader wetland system, but will also have several positive impacts on the supply of goods and services provided by the wetland. Details of anticipated changes in the delivery of wetland services are summarised in Table 5-13, below.

Table 5-13 Wetland functioning for wetlands B82G-03

Soutini Baleni Wetland				
Ecosystem Service		**Current State Importance Score**	**Post-rehab Change Score (%)**	**Comments**
Regulatory and Supporting Services	Flood Attenuation	1.5	3.1	The stabilisation and deactivation of drains would contribute to a more secure wetland environment.
	Stream Flow Regulation	3.0	4.2	The stabilisation and deactivation of drains would contribute towards increasing the retention time of water flowing through the system.
	Sediment Trapping	1.8	1.6	The increased retention time and distribution of water throughout the wetland would increase the potential for sediment retention.
	Phosphate Trapping	2.4	0.5	By spreading the water and increasing hydrated wetland areas it is anticipated that there would be a reasonable improvement.
	Nitrate Removal	3.5	0.0	No change expected.
	Toxicant Removal	2.6	0.4	By spreading the water and increasing hydrated wetland areas a reasonable improvement would be anticipated.
	Erosion Control	2.5	10.7	Stabilisation and rehydration will increase ability to prevent future erosion
	Carbon Storage	3.3	8.3	The reinstatement of natural hydrological conditions within the system would improve the potential for carbon storage in the seasonal and permanent zones.
	Biodiversity Maintenance	3.0	-2.1	With the re-establishment of wetland habitat in a monospecific environment it is expected that less diversity may occur. It is known that in a peat habitat less diversity occurs compared with adjacent terrestrial environments.
Provisioning Services	Water Supply	1.2	0.0	NA
	Harvestable Natural Resources	1.8	0.0	NA
	Cultivated Foods	3.5	0.0	NA
Cultural Services	Socio-Cultural Significance	4.0	0.0	NA
	Tourism and Recreation	1.0	3.6	Improving the wetland's integrity would contribute towards its scenic beauty. These newly found wetland systems are unique and would draw tourists to the area.
	Education and Research	1.0	62.5	By implementing the rehabilitation program, survey data would be available for further research.

5.3.2 Ecological importance and sensitivity

Based on an understanding of the goods and services provided by the wetland, the EIS assessment indicates that these wetlands have a "C" importance and sensitivity (Table 5-14). Thus, these wetlands are considered to be ecologically important and sensitive on a provincial scale. The biodiversity is reasonably sensitive to flow and habitat modifications. This wetland plays a role in moderating the quantity and quality of water towards the watercourses downstream.

It is expected that after rehabilitation the EIS assessment can increase from a "C" to a "B" importance and sensitivity classification. After rehabilitation, once the drains have been stabilised, these wetlands should be considered to be ecologically important and sensitive. Details of scores for each component assessed are included in Table 5-14, below.

Table 5-14: Summary of the EIS Scores for wetland B82G-03

	B82G-03	
	Current	**Post-rehab**
Ecological Importance and Sensitivity	2.0	2.0
Hydro-functional Importance	2.3	2.9
Direct Human Benefits	1.2	2.3
Overall Importance and Sensitivity Score	**1.8**	**2.4**
Overall Importance and Sensitivity Category	**C**	**B**

5.3.3 Wetland ecological integrity assessment

The ecological integrity or PES of the wetland was assessed for the hydrology, geomorphology and vegetation components. The integrity of the biophysical components of the wetland was assessed for the current, post-rehabilitation and without rehabilitation scenarios (Table 6-5). A visual of the location of impacts can be seen in Figure 5-3. The assessment results of the hydrological, geomorphic and vegetation components are outlined in the following sections.

Wetland B82G-03: 201	Wetland B82G-03: 202
 Head-cut erosion	 Head-cut erosion
	 Head-cut erosion

Figure 5-3: Visuals indicating disturbances that can impact negatively on the wetland's integrity

5.3.4 Assessment of the current hydrological impacts for wetland B82G-03: 201

The level of impacts and threats to the wetland hydrology is presented in Table 5-15 below. The hydrology of the wetland area assessed can be categorised as largely natural **("B" PES Category**), with few modifications although a slight change in ecosystem processes is discernible and a small loss of habitat and biota has taken place. Catchment-related impacts have had little to no effect on the wetland's integrity.

There are, in addition, identifiable impacts within the wetland unit itself which are currently affecting drainage flow patterns and retention within the wetland. These include head-cut erosion and perhaps high-flow events occurring in the waterways downstream of these systems.

Table 5-15 Hydrological Impact Scores and PES categories

HGM Unit	B82G-02: 201	Post rehab
Impact Type	**Impact Score**	**Impact Score**
Changes in water inputs	0.0	0.0
Changes in water distribution and retention patterns	1.9	1.3
Combined Hydrology Impact Score	**1.0**	**1.0**

PES Category	**B**	**B**

5.3.5 Assessment of the current geomorphic impacts

Current impacts to geomorphological integrity are limited to erosion and the result thereof in losing organic matter. Given these impacts, the current geomorphic integrity is regarded as largely natural with few modifications, and only a slight change in ecosystem processes with a small loss of natural habitat and is reflected as a "B" PES Category (Table 5-16). Should the proposed interventions forming part of the rehabilitation proposal be implemented, the integrity of the geomorphic ensemble could increase to an 'A' PES Category.

Table 5-16 Geomorphological Impact Scores and PES categories

HGM Unit	**B82G-03: 201**	**Post Rehab**
Impact Type	**Impact Score**	**Impact Score**
Erosional Features	0.5	0.4
Loss of organic material	0.5	0.4
Combined Impact Score	**1.0**	**0.7**
PES Category	**B**	**A**

5.3.6 Assessment of the current vegetation impacts

Since there has been little change to the hydrology and geomorphology, this wetland's vegetation remains largely intact. The current state of vegetation is regarded as being largely natural with only a slight change in ecosystem processes and a small loss of natural habitat. The PES Category for this system as a result is a 'B' Category (Table 5-17).

The vegetation is monospecific which is characteristic of a mire system and is dominated by the fern, *Thelypteris confluens.* With rehabilitation, a slight improvement it is expected, which would contribute to a more stable environment.

Table 5-17 Vegetation Impact Scores and PES categories

HGM Unit	**B82G-03: 201**	**Post Rehab**
Disturbance Class	**Impact Score**	**Impact Score**
Head-Cut Erosion	0.16	0.16
Remainder	0.92	0.92
Impact Score	**1.3**	**1.1**
PES Category	**B**	**B**

5.3.7 Overall current state impacts

For ease of interpretation the scores for hydrology, geomorphology and vegetation are simplified into a composite impact score for the HGM units by weighting the scores obtained as outlined in Macfarlane et al. (2007).

A summary of the overall results from the current scenario are outlined below (Table 5-6). The assessment of the wetland habitat under current conditions identified modifications which include:

- Drains (desiccated areas)

- Desiccation of wetland area

Stabilising the eroded areas and preventing the desiccation of mire habitat should secure the future of this system. An improvement in its PES category to that of an 'A' is expected.

Table 5-18 Overall current wetland impact scores and PES categories

Wetland B82G-03: 201	Current	Post Rehab
Hydrology	1.0	1.0
Geomorphology	0.6	0.3
Vegetation	1.3	1.1
Overall	1.0	0.8
Ecological Condition	**B**	**A**

5.3.8 Assessment of the current hydrological impacts for wetland B82G-03: 202

The level of impacts and threats to the wetland hydrology is presented in Table 5-15 below. The hydrology of the wetland area assessed can be categorised as moderately modified (**"C" PES Category**), with few modifications, although a slight change in ecosystem processes is discernible and a small loss of habitat and biota has taken place. Catchment-related impacts have had little to no effect on the wetland's integrity.

There are, in addition, identifiable impacts within the wetland unit itself which are currently affecting drainage flow patterns and retention within the wetland. These include head-cut erosion in the downstream section of the wetland and this may be related to high-flow events occurring in the Klein Letaba River. Please take note that this mire occurs on the macro-bank of the Klein Letaba River, this is indeed a unique feature.

Table 5-19 Hydrological Impact Scores and PES categories

HGM Unit	B82G-02: 202	Post rehab
Impact Type	**Impact Score**	**Impact Score**
Changes in water inputs	0.0	0.0
Changes in water distribution and retention patterns	2.5	1.6
Combined Hydrology Impact Score	**3.0**	**1.0**
PES Category	**C**	**B**

5.3.9 Assessment of the current geomorphic impacts

The current geomorphic integrity is regarded as slightly modified, with a small change in ecosystem processes and some loss of natural habitat having taken place and is reflected as a "B" PES Category (Table 5-16). Some erosion in the form of head-cuts are present in the lower section of the mire and it appears that some peat has desiccated, with a resultant loss of organic material. The proposed interventions could contribute towards the stabilisation of the eroded area and the overall integrity could improve to an 'A' PES Category.

Table 5-20 Geomorphological Impact Scores and PES categories

HGM Unit	B82G-03: 202	Post Rehab
Impact Type	**Impact Score**	**Impact Score**
Erosional Features	0.8	0.6
Loss of organic material	0.3	0.2
Combined Impact Score	**1.1**	**0.8**
PES Category	**B**	**A**

5.3.10 Assessment of the current vegetation impacts

The changes in hydrology and geomorphology have resulted in directional changes in the wetland vegetation, especially in the desiccated areas where the erosion has occurred. Fortunately, large areas of natural mire habitat remain, which contributes towards a good level of integrity. The current state of vegetation is regarded as moderately modified, with some loss of wetland/natural habitat, as described by a "C" PES Category. Details are provided in Table 5-17. The integrity of this system could be improved to a "B" PES Category.

Table 5-21 Vegetation Impact Scores and PES categories

HGM Unit	B82G-03: 202	Post Rehab
Disturbance Class	**Impact Score**	**Impact Score**
Head Cut Erosion	1.12	0.42
Remainder	0.86	0.86
Impact Score	**2.0**	**1.3**
PES Category	**C**	**B**

5.3.11 Overall current state impacts

A summary of the overall results from the current scenario are outlined below (Table 5-6). The assessment of the wetland habitat under current conditions identified modifications which include:

- Head-cut erosion (desiccated areas)
- Desiccation of wetland area

Table 5-22 Overall current wetland impact scores and PES categories

Wetland B82G-03: 202	Current	Post Rehab
Hydrology	3.0	1.0
Geomorphology	1.1	0.8
Vegetation	2.0	1.3
Overall	2.2	1.0
Ecological Condition	**C**	**B**

5.4 Wetland B82G–04

5.4.1 Wetland ecological functioning

Entrepreneurial activities in the form of stock farming and the construction of roads have affected the ecological integrity of the wetland systems; however, these wetlands continue to supply several goods and services. The rehabilitation interventions propose to support and improve on the wetland's ability to provide these services. Details of anticipated changes in the delivery of wetland services are summarised in Table 5-1 below.

Table 5-23 Wetland functioning for wetlands B82G-04

Soutini Baleni Wetland				
Ecosystem Service		**Current State Importance Score**	**Post-rehab Change Score (%)**	**Comments**
Regulatory and Supporting Services	Flood Attenuation	2.3	6.3	With the improvement of habitat, and vegetation cover, it is anticipated that flows from these springs will be attenuated.
	Stream Flow Regulation	2.5	4.2	The stabilisation and deactivation of drains would contribute towards increasing the retention time of water coming from these springs.
	Sediment Trapping	1.9	4.2	The increased retention time and distribution of water from the springs would increase the potential for sediment retention.
	Phosphate Trapping	1.8	16.3	By spreading the water and increasing hydrated wetland areas it is anticipated that there would be a reasonable improvement.
	Nitrate Removal	3.0	12.5	By spreading the water and increasing hydrated wetland areas it is anticipated that there would be a reasonable improvement.
	Toxicant Removal	2.1	13.5	By spreading the water and increasing hydrated wetland areas a reasonable improvement would be anticipated.
	Erosion Control	2.3	32.1	Stabilisation and rehydration will increase ability to prevent future erosion
	Carbon Storage	2.7	25.0	The reinstatement of natural hydrological conditions within the system would improve the potential for carbon storage.
	Biodiversity Maintenance	2.8	6.3	With the re-establishment of wetland habitat, more and improved biodiversity would flourish within the area.
Provisioning Services	Water Supply	0.9	0.7	Restoring habitat will ensure that more water is available.
	Natural Resources	3.0	0	NA
	Cultivated Foods	3.5	0	NA
Cultural Services	Socio-Cultural Significance	2.0	0	NA
	Tourism and Recreation	0.7	7.1	Improving the wetland's integrity would contribute towards its scenic beauty. Now that these systems have been identified it is expected that they will attract tourists.
	Education and Research	0.8	68.8	By implementing the rehabilitation program, survey data would be available for further research.

5.4.2 Ecological importance and sensitivity

Based on an understanding of the goods and services provided by the wetland, the EIS assessment indicates that this wetland has a "D" importance and sensitivity (Table 5-14). Thus, this wetland is not considered to be ecologically important and sensitive. The biodiversity is not usually sensitive to flow and habitat modifications. This wetland plays an insignificant role in moderating the quantity and quality of water towards the Klein Letaba river downstream. However, it is expected that water from this mineral-rich source contributes towards the availability of salt in the area.

It is expected that after rehabilitation the EIS assessment can increase from a "D" to a "C" importance and sensitivity classification. After rehabilitation, once the vegetation cover has been re-established, this wetland should be considered to be ecologically important and sensitive. Details of scores for each component assessed are included in Table 5-24, below.

Table 5-24: Summary of the EIS Scores for wetland B82G-04

	B82G-04	
	Current	**Post-rehab**
Ecological Importance and Sensitivity	1.3	2.0
Hydro-functional Importance	1.5	2.7
Direct Human Benefits	0.3	0.8
Overall Importance and Sensitivity Score	**1.1**	**1.8**
Overall Importance and Sensitivity Category	**D**	**C**

5.4.3 Wetland ecological integrity assessment

The ecological integrity or PES of these springs was assessed for the hydrology, geomorphology and vegetation components. A total of nine springs occur in the area, reasonably close to each other and they are all similar in nature (Figure 5-4). It appears that these springs are all impacted by similar aspects such as grazing and trampling. The integrity of the biophysical components of these springs was assessed for the current, post-rehabilitation and without rehabilitation scenarios (Table 6-5). The assessment results are outlined in the following sections.

Figure 5-4: Visuals of several seepage wetland springs indicating signs of overgrazing and trampling that can impact negatively on the wetland's integrity

5.4.4 Assessment of the current hydrological impacts for wetland B82G-04

The level of impacts and threats to the wetland hydrology is presented in Table 5-25 below. The hydrology of the wetland area assessed can be categorised as largely modified ("D" PES Category), with a large change in ecological processes and loss of natural habitat. Cattle grazing and trampling have had a large impact on these wetlands, affecting drainage flow patterns and retention within the wetland. Little vegetation cover remains and preferential flows due to cattle tracks have disrupted the hydrology of these systems.

Table 5-25 Hydrological Impact Scores and PES categories

HGM Unit	B82G-04	Post rehab
Impact Type	**Impact Score**	**Impact Score**
Changes in water inputs	0.0	0.0
Changes in water distribution and retention patterns	5.6	3.2
Combined Hydrology Impact Score	**5.0**	**3.0**
PES Category	**D**	**C**

5.4.5 Assessment of the current geomorphic impacts

Current impacts to geomorphological integrity are limited to overgrazed areas with high losses of organic material (peat). Given these impacts, the current geomorphic integrity is regarded as moderately modified, with a change in ecosystem processes and loss of some natural habitat having taken place with some natural habitat remaining intact and is reflected as a "C" PES Category (Table 5-16).

The proposed rehabilitation interventions could support these systems and increase their integrity to that of an 'A' PES Category.

Table 5-26 Geomorphological Impact Scores and PES categories

HGM Unit	B82G-04	Post Rehab
Impact Type	**Impact Score**	**Impact Score**
Erosional Features	0.0	0.0
Loss of organic material	2.1	0.9
Combined Impact Score	**2.1**	**0.9**
PES Category	**C**	**A**

5.4.6 Assessment of the current vegetation impacts

The changes in hydrology and geomorphology as a result of historic cultivation, overgrazing, an incorrect burn regime, alien vegetation and road crossings, etc. indicates that directional changes in wetland vegetation have occurred. However, some areas of natural seep wetland remain, which contributes towards a reasonable level of integrity. The current state of vegetation is regarded as moderately modified, with some loss of wetland/natural habitat, as described by a "C" PES Category. Details are provided in Table 5-17.

In this wetland two disturbance units were identified, namely overgrazing and trampling. These units consist of habitat reflecting similar characteristics as per the outcome of water distribution and retention patterns.

Table 5-27 Vegetation Impact Scores and PES categories

HGM Unit	B82G-04	Post Rehab
Disturbance Class	**Impact Score**	**Impact Score**
Overgrazing and trampling	5.6	3.2
Remainder	0.0	0.0
Impact Score	**5.6**	**3.2**
PES Category	**D**	**C**

5.4.7 Overall current state impacts

For ease of interpretation, the scores for hydrology, geomorphology and vegetation are simplified into a composite impact score for the HGM units by weighting the scores obtained as outlined in Macfarlane et al. (2007).

A summary of the overall results from the current scenario are outlined below (Table 5-6). The assessment of the wetland habitat under current conditions identified modifications which include:

- Grazing and trampling (desiccated areas)
- Due to the loss of groundcover (due to overgrazing and trampling) increased the desiccation of wetland areas

With the proposed rehabilitation, it is anticipated that with improved vegetation cover, these springs can improve to a "C" PES category.

Table 5-28 Overall current wetland impact scores and PES categories

Wetland B82G-04	Current	Post Rehab
Hydrology	5.0	3.0
Geomorphology	2.1	0.9
Vegetation	5.6	3.2
Overall	4.3	2.5
Ecological Condition	**D**	**C**

6. CONCEPT WETLAND REHABILITATION INTERVENTIONS

Wetland rehabilitation can be described as a process by which the causes and symptoms of the wetland degradation are addressed, ensuring the wetland integrity and functionality are maintained and/or improved to a desired state. A proactive approach in terms of corrective interventions is recommended to address the impacts within the wetland systems. The following section describes the rehabilitation of the wetland ecosystems, including the objectives, which attempt to maximise the levels of ecosystem functioning and integrity. The planning of the rehabilitation interventions was carried out by a wetland specialist in conjunction with a civil/agricultural engineer (Aurecon), Provincial Coordinator of WfWetlands as well as an Environmental Assessment Practitioner (EAP from Aurecon).

6.1 Wetland B82G–01

6.1.1 Wetland problems within Wetland B82G-01

The biophysical drivers of the wetland in the Soutini-Baleni area have been impacted by historical and current activities and such impacts will continue in the near future, these include *inter alia* (Figure 6-1):

- Shallow preferential flow paths
- Surface/rill erosion
- Channel erosion with head-cut features
- Livestock and game paths traversing the wetland area, resulting in preferential flows
- Road traversing the wetland area, resulting in preferential flows

Bare surface areas with dry drainage lines contributing towards sediment loads in the wetland

Road crossing wetland area

Sediment loads entering wetland area

Shallow preferential flow paths

Head-cut erosion in the downstream portion of the wetland

Deep channel at the outlet of the wetland

Figure 6-1: Wetland problems in the target area B82G-01

6.1.2 Wetland rehabilitation aims and objectives within the Wetland B82G-01

With the implementation of wetland rehabilitation, it is important to set aims and objectives for the planned rehabilitation in accordance with WET-RehabPlan (Kotze *et al.*, 2009).

Aim:

- Indications are that this system is sediment-driven due to the loads of sediment visible in the wetland. With careful planning, the rehabilitation will not prevent sediment from moving through the system. However, the aim would be to secure and stabilise wetland habitat in this sediment-driven environment;
- Promote longitudinal and lateral hydrological processes;
- Re-wet portions of the target area that contain shallow eroded areas and improve the ecological integrity and ecosystem functioning of the target area;
- Deactivate and stabilise head-cut erosion in drainage channels;
- Promote indigenous vegetation wellness; and
- Stabilise eroded outlet area of the wetland.

Objectives:

- Construct interventions to re-instate more natural water distribution and retention patterns, improving the overall functioning of the wetland and associated habitat for important wetland-dependant biota;
- Raise the water table to rehydrate areas adjacent to the drainage channels; and
- Promote habitat integrity.

6.1.3 Wetland rehabilitation strategy for Wetland B82G-01

The valley bottom floodplain wetland is situated at the downstream end of its catchment. The catchment has anthropological activities in the form of cattle farming. These activities have impacted the wetland system's hydrology, geomorphology and its vegetation. To counteract these impacts and to prevent further degradation, some of the hydrological features that have been lost need to be reinstated and portions of the target area that contain eroded areas need to be re-wetted and the ecological integrity and ecosystem functioning of the target area needs to be improved.

To address the above aims, several interventions will be necessary to support and help the wetland habitat rehabilitate closer to the once pristine habitat it was before human intervention.

To stabilise dry ephemeral drainage lines, rock and gravel packs are proposed. This will break the speed of water and promote the built-up of sediment and organic material that will create habitat for vegetation to re-establish. The head-cut erosion will also be stabilised with rock packs. A stone-masonry gabion structure is proposed to stabilise the eroded exit channel, protecting it and providing water flow control by releasing water in a regulated

manner. This will prevent further incision of the existing channel and lateral erosion of the channel banks.

The effect of the proposed rehabilitation strategy and interventions on the wetland has been assessed by predicting the anticipated future outcomes of the wetland with and without rehabilitation (Table 6-1 and Figure 6-2). This was used to estimate hectare equivalents that would be rehabilitated and/or secured through planned wetland rehabilitation activities. Based on the Wet-Health assessments undertaken, it is predicted that an improvement of 0.3 ha equivalent will be achieved through planned interventions identified for the wetland (B82G-01).

Table 6-1: Summary of anticipated outcomes from implementation of planned interventions on the wetland (B82G-01)

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		1.6		
Impact Scores	**Hydrology**	4.0	3.5	6.5
	Geomorphology	2.1	1.0	2.6
	Vegetation	4.3	3.2	4.5
	Overall	3.5	2.7	4.8
Ecological Category		**C**	**C**	**D**
Hectare equivalents		1.0	1.2	0.8
Hectare Equivalents Gained or Secured		0.3		

Figure 6-2: Locations of the proposed interventions of the B82G-01 wetland upstream of the road crossing

6.1.3.1 Wetland rehabilitation interventions for Wetland B82G-01

Table 6-2 Wetland B82G-01 intervention list

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-01-201	 Surface erosion in dry drainage channel	• Stabilise disturbed environment • Stabilise slope • Promote revegetation in upstream area • Prevent current and future erosion	Rock/Gravel Pack	S23 25 15.5 E30 54 32.3	1
B82G-01-202	 Surface erosion in dry drainage channel		Rock/Gravel Pack	S23 25 15.7 E30 54 32.5	2

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-01-203	 Surface erosion in dry drainage channel		Rock/Gravel Pack	S23 25 15.8 E30 54 32.7	3
B82G-01-204	 Surface erosion in dry drainage channel		Rock/Gravel Pack	S23 25 16.1 E30 54 33.0	4
B82G-01-205	 Surface erosion in dry drainage channel		Rock/Gravel Pack	S23 25 17.1 E30 54 31.8	5

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-01-206	 Surface erosion in dry drainage channel		Rock/Gravel Pack with brush packing	S23 25 17.0 E30 54 31.9	6
B82G-01-207	 Surface erosion in dry drainage channel		Rock/Gravel Pack	S23 25 16.7 E30 54 32.2	7
B82G-01-208	 Surface erosion in dry drainage channel		Rock/Gravel Pack with brush packing	S23 25 16.6 E30 54 32.6	8

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-01-209	 Surface erosion in dry drainage channel		Brush Pack	S23 25 17.4 E30 54 32.6	9
B82G-01-210	 Shallow surface erosion	• Stabilise disturbed environment • Stabilise slope • Promote revegetation in upstream area • Prevent current and future erosion	Brush Pack	S23 25 16.3 E30 54 33.8	10
B82G-01-211	 Head-cut donga erosion	• Stabilise disturbed environment • Prevent any potential head-cuts and erosion • Prevent further sediment deposition downstream • Create environment for indigenous vegetation to re-establish	Rock/Gravel Pack	S23 25 14.56 E30 54 4.7	11

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-01-212	 Head-cut donga erosion	• Provide control over water flow. • Prevent directional flows in drains and dongas • Restore disturbed environment • Revegetate for stability • Prevent future degradation	Rock/Gravel Pack	S23 25 15.0 E30 54 45.7	12
B82G-01-213	 Eroded channel	• Stabilise high-energy environment • Control water flow • Prevent further incision and erosion of the channel • Lift water table and hydrate upstream and adjacent area • Re-hydrate wet soils • Take control of water through gabion • Release water in a controlled manner	Stone Masonry Gabions	S23 25 08.8 E30 54 51.2	13

6.1.4 Monitoring and Evaluation

The hillslope seep wetland provides an opportunity to monitor and evaluate the outcome of the rehabilitation strategy. For the purpose of monitoring, by means of fixed monitoring photo points, the following intervention sites B82G-01-203, B82G-01-207, B82G-01-217 and B82G-01-237 were identified. The visuals and site information are depicted in Figure 6-3 below.

Intervention No.	Location	Cardinal Direction
B82G-01-212	23° 25.252' S 30° 54.747' E	North East
		
B82G-01-213	23° 25.242 'S 30° 54.771 'E	East
		

Figure 6-3: Site information and reference photos for future monitoring purposes

6.2 Wetland B82G–02

6.2.1 Wetland problems within Wetland B82G-02

The main impacts to this wetland unit are associated with cattle grazing and trampling that has significantly affected water distribution and retention patterns in the wetland. Other significant impacts include:

- Soil enrichment from cattle manure and urine;
- Road crossing;

- Grazing and trampling; and
- Salt mining.

6.2.2 Wetland rehabilitation aims and objectives within the Wetland B82G-02

With the implementation of wetland rehabilitation, it is important to set aims and objectives for the planned rehabilitation in accordance with WET-RehabPlan (Kotze *et al.*, 2009).

Aim:

- Reinstate the hydrology of this wetland and ensure diffuse flow through the system;
- Re-hydrate the areas adjacent to the dongas and eroded areas;
- Enhance the wetland's flood attenuation function;
- Decrease the number of cattle that graze and trample the main 'eye' area;
- Restore habitat for the establishment and increased growth of obligate species and thereby increase the vegetation cover of a section of the wetland; and
- Stabilise erosion features in the developed channel and furrows, thereby protecting the ecological integrity and ecosystem functioning of the target area.

Objectives:

- Protect the 'eye' area to create an environment conducive to the recovery of hydrophytic vegetation composition, abundance and cover;
- Lift the water table to re-instate more natural water distribution and retention patterns, improving the overall functioning of the wetland and associated habitat for important wetland-dependant biota;
- Rehydrate areas by raising the water table adjacent to the drainage channels;
- Construct interventions to deactivate and stabilise head-cut erosion in drainage channels;
- Reduce storm water velocity by increasing obstacles in drains; and
- The implementation of the above it is expected to improve the wetland habitat integrity.

6.2.3 Wetland rehabilitation strategy for Wetland B82G-02

The target area of this seep wetland includes the whole of this unique thermal spring. The catchment is in a good condition, despite the grazing and trampling of cattle. This has resulted in various impacts adjacent to and within the wetland. To counteract these impacts and to prevent further degradation, the proposed strategy would reinstate good vegetation cover around the 'eye' areas, stabilising the drains and by improving the ecological integrity and ecosystem functioning of the wetland.

To address the above aims, several interventions will be necessary to support and help the wetland habitat rehabilitate closer to the once pristine habitat it was. Furthermore, to stabilise the drains at the outlets and by lifting the water table to hydrate the surrounding environment, high-energy flows and future erosion would be prevented.

To re-instate more natural water distribution and retention patterns, a cattle fence needs to be constructed to protect the main 'eye' region. This will also serve to enhance vegetation growth to the benefit of the mire, allowing for the re-establishment of peat formation. Remnants of old fence posts are present onsite, emphasising that traditionally the management of this 'eye' was considered important, providing protection from overgrazing and the resultant trampling (Figure 6-4).

Figure 6-4: Fence posts still visible, indicating that fences were used in the past and clear cattle trampling visible in this picture

The effect of the proposed rehabilitation strategy and interventions on the wetland has been assessed by predicting the anticipated future outcomes of the wetland with and without rehabilitation (Table 6-3). This was used to estimate hectare equivalents that would be rehabilitated and/or secured through planned wetland rehabilitation activities. Based on the Wet-Health assessments undertaken, it is predicted that an improvement of 1.3 ha equivalent will be achieved through planned interventions identified for the wetland (B82G-02).

Table 6-3: Summary of anticipated outcomes from implementation of planned interventions on the wetland (B82G-02)

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		5.7		
Impact Scores	**Hydrology**	6.5	5.0	6.5
	Geomorphology	2.5	1.5	3.0
	Vegetation	7.7	4.7	8.7
	Overall	5.7	3.9	6.1
Ecological Category		**D**	**C**	**E**
Hectare equivalents		2.4	3.5	2.2
Hectare Equivalents Gained or Secured		1.3		

Figure 6-5: Location of the proposed interventions of the B82G-02 wetland

6.2.3.1 Wetland rehabilitation interventions for Wetland B82G-02

Table 6-4 Wetland B82G-02 intervention list

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-02-201	 Eroded head-cut feature 201 (a)  Rill erosion 201 (b)	• Stabilise disturbed environment • Prevent any potential head-cuts and erosion • Prevent further sediment deposition downstream • Create environment for indigenous vegetation to re-establish	Rock/ Gravel Pack	S23 25 06.3 E30 54 53.8	1

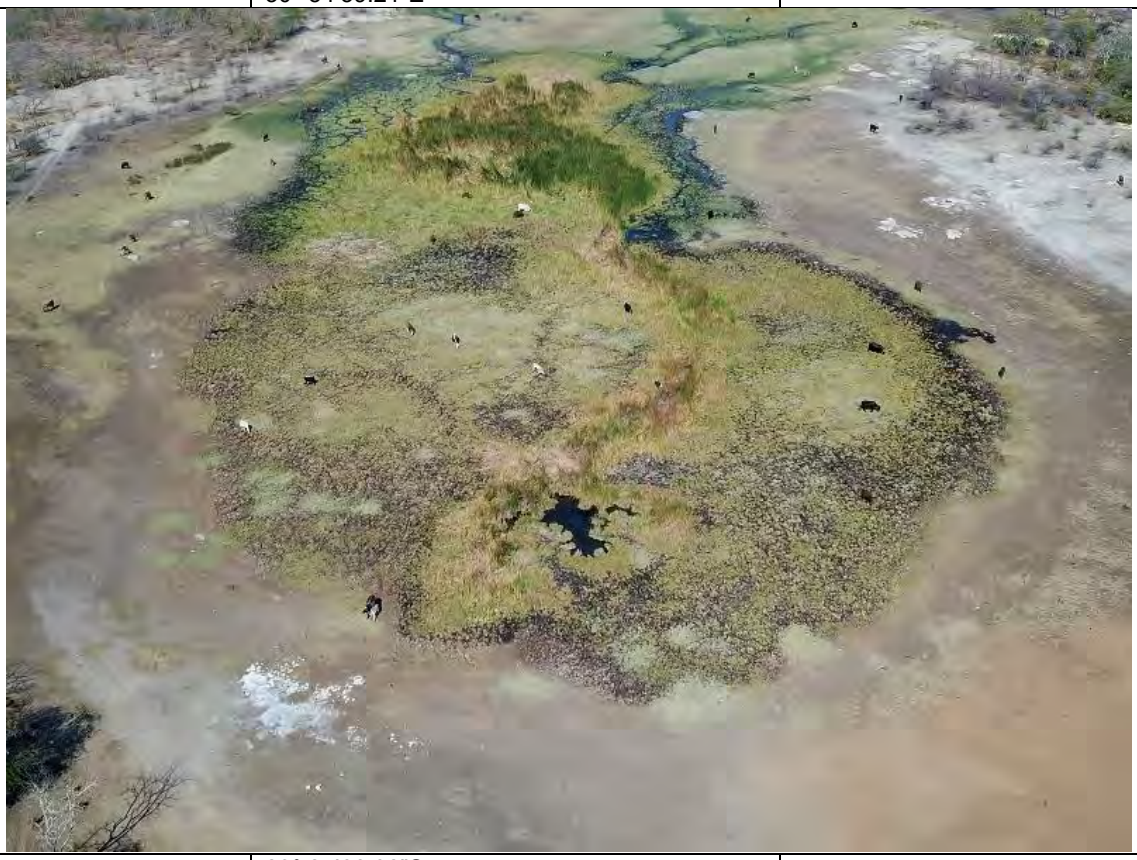
Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-02-202	 Eroded donga	• Construct silt fencing • Break water energy flows and create low energy environments to promote the sediment deposition • Create environment for vegetation to establish • Provide cover for disturbed areas, with brush packs • Create a favourable environment for vegetation to re-establish	Silt Fences	S23 25 05.3 E30 54 50.8	2
B82G-02-203	 Surface erosion	• Stabilise disturbed environment • Prevent any potential head-cuts and erosion • Prevent further sediment deposition downstream • Create environment for indigenous vegetation to re-establish	Rock/Gravel Pack	S23 25 05.8 E30 54 51.4	3
B82G-02-204	 Surface erosion	• Restore natural flow patterns • Restore disturbed environment • Re-vegetate to stabilise • Prevent future degradation	Earth Works	S23 25 12.7 E30 54 37.3	4

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-02-205	 Overgrazed and trampled 'eye area'	• Construct cattle fence, to control access and grazing patterns • Prevent trampling and destruction of sensitive 'eye' area	Cattle Fence	S23 25 10.99 E 30 54 42.07	5

6.2.4 Monitoring and Evaluation

The hillslope seep wetland provides an opportunity to monitor and evaluate the outcome of the rehabilitation strategy. For the purpose of monitoring, by means of fixed monitoring photo points, the following intervention sites B82G-02-202, B82G-02-208 and B82G-02-210 were identified. The visuals and site information are depicted in Figure 6-3 below.

Intervention No.	Location	Cardinal Direction
B82G-02-205	23° 25'09.80"S 30° 54'39.21"E	East



B82G-02-201	23° 25'08.02"S 30° 54'51.57"E	North West

B82G-02-202	23° 25'06.56"S 30° 54'53.02"E	South West
		

Figure 6-6: Site information and reference photos for future monitoring purposes

6.3 Wetland B82G–03

6.3.1 Wetland problems within Wetland B82G-03

It is anticipated that the main impacts to these wetlands are associated with high flows from the watercourses it flows into. This resulted in the formation of head-cut erosion at the downstream end of the wetlands.

6.3.2 Wetland rehabilitation aims and objectives within the Wetland B82G-03

With the implementation of wetland rehabilitation, it is important to set aims and objectives for the planned rehabilitation in accordance with WET-RehabPlan (Kotze *et al.*, 2009).

Aim:

- Stabilise the head-cut features with eco-logs to improve the ecological integrity and ecosystem functioning; and
- Re-wet portions of the target area impacted by erosion.

Objectives:

- To re-instate more natural water distribution and retention patterns, improving the overall functioning of the wetland and associated habitat for important wetland-dependant biota;
- Rehydrate areas adjacent to the eroded channels;
- Create an environment conducive for the establishment of hydrophytic vegetation; and
- Promote habitat integrity.

6.3.3 Wetland rehabilitation strategy for Wetland B82G-03

The targeted hillslope seep wetlands are situated at the mid-slope end of the riparian areas. Wetland 03-202 is located within the macro-channel bank of the Klein Letaba River which makes this system unique. Due to the underground water supply to these systems, it appears that the catchment's activities do not impact directly on these systems. However, head-cut erosion does occur at the lower end of these wetlands and to counteract this and prevent further degradation, the aim is to reinstate some of the hydrological features that have been lost, while also re-wetting portions of the target area and improving the ecological integrity and ecosystem functioning of the target area.

To address the above aim, interventions will be necessary to support and help the wetland habitat rehabilitate close to the once pristine habitat it was before human intervention. To re-instate a more natural water distribution and retention pattern, several eco-logs need to be constructed to stabilise and hydrate the surrounding environment. This will discontinue directional flows and prevent future erosion.

The effect of the proposed rehabilitation strategy and interventions on the wetland has been assessed by predicting the anticipated future outcomes of the wetland with and without rehabilitation (Table 6-5). This was used to estimate hectare equivalents that would be rehabilitated and/or secured through planned wetland rehabilitation activities. Based on the Wet-Health assessments undertaken, it is predicted that an improvement of 0.1 ha equivalent will be achieved through planned interventions identified for the wetland (B82G-03).

Table 6-5: Summary of anticipated outcomes from implementation of planned interventions on the wetland B82G-03-201

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		*0.5		
Impact Scores	**Hydrology**	1.0	1.0	3.0
	Geomorphology	1.0	0.7	0.8
	Vegetation	1.3	1.1	1.5
	Overall	1.1	0.9	1.9
Ecological Category		**B**	**A**	**B**
Hectare equivalents		0.4	0.5	0.4
Hectare Equivalents Gained or Secured		0.1		

* Please take note that the actual size in 219m², Wet Health works with a minimum size of 0.5ha

Table 6-6: Summary of anticipated outcomes from implementation of planned interventions on the wetland (B82G-03: 202)

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		0.5		
Impact Scores	**Hydrology**	3.0	1.0	3.0
	Geomorphology	1.1	0.8	1.7
	Vegetation	2.0	1.3	2.1
	Overall	2.2	1.0	2.4
Ecological Category		**C**	**B**	**C**
Hectare equivalents		0.4	0.4	0.4
Hectare Equivalents Gained or Secured		0.1		

* Please take note that the actual size in 127m^2, Wet Health works with a minimum size of 0.5ha

Figure 6-7: Location of Wetland B82G-03-201 and B82G-03-202

6.3.3.1 Wetland rehabilitation interventions

Table 6-7 Wetland B82G-03 intervention list

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-03-201	 Drain from dam to wetland	• Stabilise disturbed environment • Discontinue directional flows • Slow water down and prevent erosion • Create environment for indigenous vegetation to re-establish	Eco-logs	S23 25 13.38 E30 54 53.58	1
B82G-03-202	  Disturbed surface areas of the seep wetland	• Stabilise disturbed environment • Discontinue directional flows • Slow water down and prevent erosion • Create environment for indigenous vegetation to re-establish	Eco-logs	S23 25 8.17 E30 54 57.27	2

6.3.4 Monitoring and Evaluation

The hillslope seep wetlands provide an opportunity to monitor and evaluate the outcome of the rehabilitation strategy. For the purpose of monitoring, by means of fixed monitoring photo points, the following intervention sites B82G-03-202 and B82G-03-203 were identified. The visuals and site information are depicted in Figure 6-8.

Intervention No.	**Location**	**Cardinal Direction**
B82G-03-203	25° 26'41.65" 'S 03° 58'16.31" 'E	South East
		
B82G-03-202	25° 14'37.85" 'S 03° 02'13.64" 'E	South East
		

Figure 6-8: Wetland B82G-03 information and reference photos for future monitoring purposes

6.4 Wetland B82G–04

6.4.1 Wetland problems within Wetland B82G-04

The main impacts to this wetland unit are associated with historic cultivation that has significantly affected water distribution and retention patterns in the wetland. Other significant impacts include:

- Grazing and trampling; and
- Burn regime.

6.4.2 Wetland rehabilitation aims and objectives within the Wetland B82G-04

With the implementation of wetland rehabilitation, it is important to set aims and objectives for the planned rehabilitation in accordance with WET-RehabPlan (Kotze *et al.*, 2009).

Aim:

- Reinstate some of the hydrological features lost due to grazing and trampling;
- Protect and improve the ecological integrity and ecosystem functioning of the target areas; and
- Stabilise mire features in the wetland to promote the succession of peat formation

Objectives:

- Make use of brush-packing to prevent cattle entering these springs, and allowing the re-instatement of more natural water distribution and retention patterns, improving the overall functioning of the wetland and associated habitat for important wetland-dependant biota;
- Brush packing will contribute to rehydrating trampled areas; and
- Create an environment conducive for the establishment of hydrophytic vegetation.

6.4.3 Wetland rehabilitation strategy for Wetland B82G-04

It appears that the key hydrological driver is water that originates from deep aquifers which discharge on the surface. Trampling and grazing have a detrimental effect on the integrity of these systems, with little vegetation cover. In the permanently wet areas, sedge and graminoids, that are adapted to survive in permanently wet conditions, are dominant. Some indigenous woody vegetation occurs in and along the edges of these wetlands.

The catchment activities, besides those of trampling and grazing, have little impact on these systems. To counter the trampling and overgrazing and prevent further degradation, the aim would be to reinstate some of the hydrological features previously lost, while also re-wetting portions of the target area to improve the ecological integrity and ecosystem functioning of the target area.

To address the above aims, brush-packing will be necessary to support and help the wetland habitat to rehabilitate closer to the once pristine habitat by limiting access to grazers.

The effect of the proposed rehabilitation strategy and interventions on the wetland has been assessed by predicting the anticipated future outcomes of the wetland with and without rehabilitation (Table 6-8). This was used to estimate hectare equivalents that would be rehabilitated and/or secured through planned wetland rehabilitation activities. Based on the Wet-Health assessments undertaken, it is predicted that an improvement of 0.2 ha equivalent will be achieved through planned interventions identified for the wetland (B82G-04).

Table 6-8: Summary of anticipated outcomes from implementation of planned interventions on the wetland (B82G-04)

		Status Quo	With Rehabilitation	Without Rehabilitation
Size of wetland (Ha)		0.5		
Impact Scores	**Hydrology**	5.0	3.0	6.5
	Geomorphology	2.1	0.9	3.2
	Vegetation	5.6	3.2	7.2
	Overall	4.3	2.5	5.7
Ecological Category		**D**	**C**	**D**
Hectare equivalents		3.8	0.4	0.2
Hectare Equivalents Gained or Secured		0.2		

Figure 6-9: Locations of the proposed interventions in Wetland B82G-04

6.4.3.1 Wetland rehabilitation interventions

Table 6-9 Wetland B82G-04 intervention list

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-04-201	 Overgrazing and trampling	• Stabilise disturbed environment • Stabilise slope • Promote revegetation in upstream area • Prevent current and future erosion	Brush Pack	S23 25 15.90 E30 54 54.54	1
B82G-04-202	 Overgrazing and trampling		Brush Pack	S23 25 16.26 E30 54 55.02	2
B82G-04-203	 Overgrazing and trampling		Brush Pack	S23 25 16.56 E30 54 54.66	3

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-04-204	 Overgrazing and trampling		Brush Pack	S23 25 18.42 E30 54 55.14	4
B82G-04-205	 Overgrazing and trampling		Brush Pack	S23 25 15.16 E30 54 54.89	5
B82G-04-206	 Overgrazing and trampling		Brush Pack	S23 25 15.52 E30 54 58.89	6
B82G-04-207	 Overgrazing and trampling		Brush Pack	S23 25 19.27 E30 54 58.74	7

Intervention Number	Impact/Visual	Objective of intervention	Intervention Type	Location	Priority
B82G-04-208	 Overgrazing and trampling		Brush Pack	S23 25 20.86 E30 54 59.67	8
B82G-04-209	 Overgrazing and trampling		Brush Pack	S23 25 21.95 E30 55 01.40	9

6.4.4 Monitoring and Evaluation

The hillslope seep wetland provides an opportunity to monitor and evaluate the outcome of the rehabilitation strategy. For the purpose of monitoring, by means of fixed monitoring photo points, the following intervention sites B82G-04-202 and B82G-04-203 were identified. The visuals and site information are depicted in Figure 6-8.

Intervention No.	**Location**	**Cardinal Direction**
B82G-04-203	25° 26.41.65" 'S 03° 58.16.31" 'E	South East
		
B82G-04-202	25° 14.37.85" 'S 03° 02.13.64" 'E	South East
		

Figure 6-10: Wetland B82G-04 information and reference photos for future monitoring purposes

6.5 Acknowledgements

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APPENDIX B

GENERAL CONSTRUCTION NOTES

(Ignore notes which are inapplicable)

1. **Occupational health and safety is a priority!** All necessary precautionary measures must be undertaken to ensure safety of the team. Particular attention must be given to deep excavations where gentle sloping back of soil or shoring must be applied to prevent possible soil collapse. Where risks are foreseen, these must be reported to the Occupational Health and Safety Agent employed by SANBI, who may need to seek further advice. In addition, no excavated earth or other materials should be stockpiled within a distance of one metre from the edge of any excavation. The one metre wide strip along the edges of all sides of an excavation should at all times be kept clear of objects such as lumps of clay, rocks or tools that could injure workers in the excavation if they were to fall in.

2. Check all dimensions on site to determine if any amendments to the designs are necessary. Note the required final height of the structure relative to the original ground level. The responsible engineer must be consulted before any changes are made to dimensions.

3. Excavation must be carried out to the final levels. Soil must be placed in areas best suited for re-use, for example, when building an earthen diversion embankment, the soil excavated should be used immediately in building up the embankment (on condition the excavated soil is of suitable quality). The excavated soil should alternatively be stockpiled immediately upstream of the site of the proposed wall. The topsoil must be stockpiled separately from the subsoil.

4. Where soil is to be the foundation for non-soil structures (for example, gabions and rafted weirs), all sand deposits must be removed and the floor well compacted while the soil is at optimum moisture content.

5. In instances where the addition of Gypsum (CaSO4) has been specified for the amelioration of a dispersive soil, mixing must be carried out off site, after which it must be transported to the construction site.

6. When the final level of the soil construction has been reached the previously stockpiled topsoil must be added as an extra height and planted to suitable vegetation (unless other provision for protection of the structure has been specified).

7. When backfilling soil against concrete or gabion work, extra care must be taken to ensure that a waterproof join with the structure is, as far as possible, achieved. Compaction must be carried out in layers as specified by the engineer. Material containing organic matter must not be used for this backfilling purpose.

8. Ensure that the correct steel reinforcing, as specified, has been delivered to site. Ensure that the minimum cover, as specified by the engineer, is achieved at all times. All welded steel mesh joins must have an overlap of at least 200mm and must be securely tied with 2mm building wire. At least three rings at 150mm spacing are required. Where reinforcing bars are used, bars at joins must be overlapped as per the distance specified

on the drawings. Particular attention must be paid to ensure the correct placing of steel reinforcing (particularly steel mesh with different bar sizes).

9. Before placing concrete on a rock foundation, carefully chip away any loose surface layers and wash away all debris. New surfaces must be painted with a cement slurry prior to the placing of the concrete.

10. Ensure that all shuttering is strong and well supported. It is recommended that the concrete be placed in layers no greater than one metre per day. The shuttering must be well oiled on the inside to prevent the concrete from sticking. Spacers between shuttering must be placed every one metre, both vertically and horizontally, with a minimum of two in both directions.

11. Note that when mixing concrete it is preferable to use a full pocket of cement with each mix. The specified cement water ratio must be maintained at all times.

12. The poured concrete must be "rodded" to ensure proper compaction. Never add more than one metre height of concrete in any one day, and attempt to lay the concrete in even, horizontal layers throughout the length of any section. Check the specifications for any requirement of expansion joints. The shuttering should be left for at least two days before stripping. Wetting the concrete while it is curing will make for a strong construction. Backfilling of soil against the completed structure may only be done after a period of at least seven days.

13. The use of "plums" in concrete: in some instances it may be feasible and economic to reduce the amount of concrete in mass gravity structures, by replacing up to 33% of the volume of concrete by the judicious use of suitable hand sized quarried rock. Where this is specified the rocks (purchased as handstone) must be so placed that there is always a minimum cover of 50mm between the rock and the shuttering, as well as between any two adjacent rocks. This should only be done where it is stated on the drawings that is permissible.

14. The standard procedures for the opening up and wiring together of gabion baskets and mattresses are well documented, and supplied with every delivery of the products. They must be strictly adhered to in all respects. Ensure that the lids of the final (top) baskets are always folded down and wired in a downstream direction.

15. Where rock-filled gabion baskets are used for the construction of keywalls, the trenches must be dug wide enough so that sufficient access is available to properly backfill and compact all the way around them. Making the trench only wide enough to receive the baskets is not acceptable, as water will eventually find its way around the structures and cause problems.

16. Where structures are to be built in dispersive soils, the following should be noted:

    - Impermeable cut off wall (at least 500mm deep) to be constructed under spillway section of the structure
    - Key walls to be impermeable

- Impermeable barriers to be constructed between key walls and spillway section of structures

17. Sloping and vegetating gully banks where specified:

    Where the gully is no more than approximately 1.0 metre deep, and the catchment area small (say ten hectares), the topsoil of the site immediately adjoining the channel is removed and stockpiled in a safe place nearby. The subsoil thus laid bare is excavated at a slope not less than 1:3 (V:H) and deposited in the gully. This deposit is carefully compacted while in a moist state. The topsoil is now returned to the sloped area, and spread as evenly as possible over it. Vegetation suitable to the site is planted. The additional advantage to this idea is that, as the channel cross section is made shallower and wider and established to vegetation, so the chances of floodwaters overflowing into the adjacent flood area will be that much greater. Note that the base of the modified channel should be planted to strong, hydrophitic plants while the outer edges will require plants more suited to drier regimes. It must be emphasised that the stockpiling of the topsoil and its replacement is vital, especially where very erodible subsoil is present. Failure to do this will be tantamount to a waste of money and effort.

18. The orientation of all wetlands and interventions is to be taken facing downstream i.e. left bank and right bank are to be identified **facing downstream**.

19. The Bill of Quantities for the various rehabilitation interventions only included revegetation in those instances where the engineer considered the re-vegetation of the denuded area as important due to the size of the area affected or due to the risk associated with scouring and erosion.

APPENDIX C
INTERVENTION BOOKLET

Intervention Number	Description	Type	Reference Document	Design Revision
B82G-01-201-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-202-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-203-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-204-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-205-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-206-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-207-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-208-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-209-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-210-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-211-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-212-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-01-213-00	Stone Masonry	New	Soutini-Baleni Rehabilitation Plan 2019	Rev B
B82G-02-201-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-02-202-00	Silt Fences	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-02-203-00	Rock/ Gravel Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-02-204-00	Earth Works	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-02-205-00	Fencing	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-03-201-00	Eco Logs	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-03-202-00	Eco Logs	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-04-201-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A

B82G-04-202-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-04-203-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-04-204-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-04-205-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-04-206-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-04-207-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-04-208-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A
B82G-04-209-00	Brush Pack	New	Soutini-Baleni Rehabilitation Plan 2019	Rev A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 15.5
Longitude (D°M'S")	E30 54 32.3

Location Photograph: B82G-01-201-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	1.20

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

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• Should any artefact or suspected artefact (e.g. ash deposits, animal/human bone concentrations, ceramic fragments/ pot shards and formal stone concentrations), or any site of cultural significance be encountered during construction:
o The Contractor must immediately stop work within a 50m radius of the site and immediately alert the relevant authorities.
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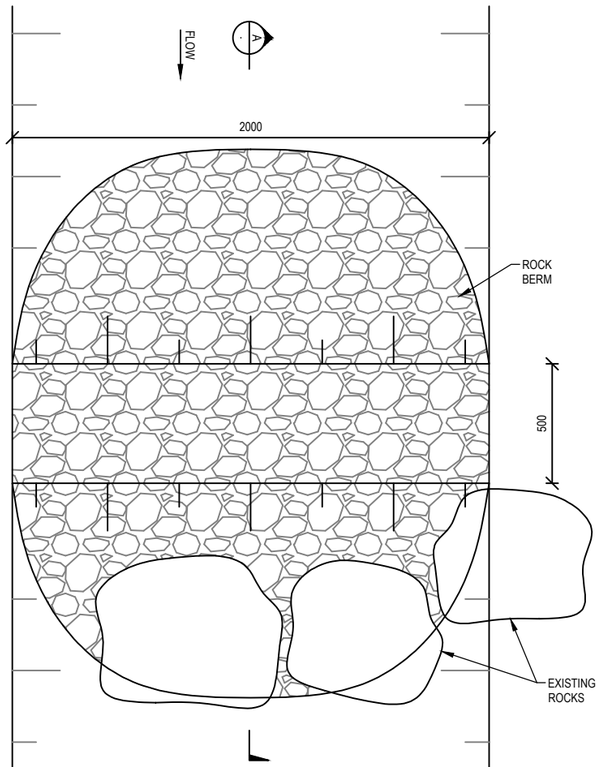
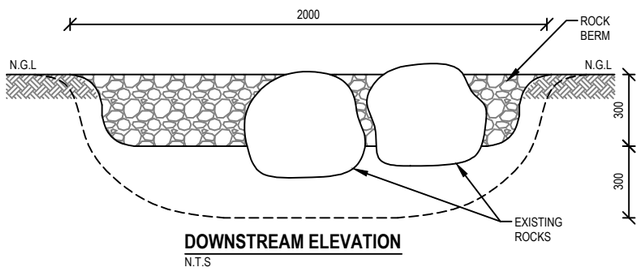
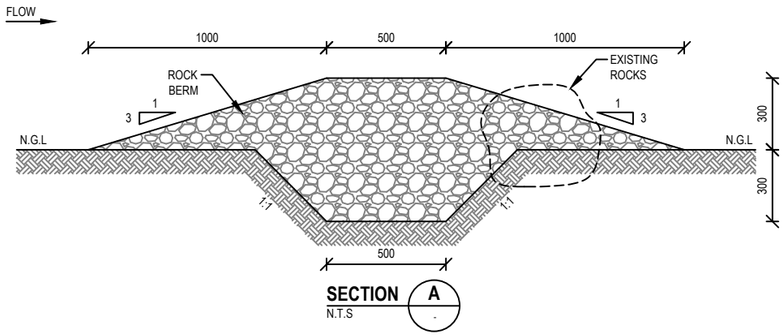
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities



PLAN VIEW
N.T.S



DOWNSTREAM ELEVATION
N.T.S



SECTION A
N.T.S

NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. LIMITED GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON-STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
2. AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED AGAINST ANY ASSOCIATED DAMAGES AND ACCEPT NO LIABILITY ASSOCIATED WITH THE CONSTRUCTION AND IMPLEMENTATION OF ENGINEERING INTERVENTIONS DUE TO THE ENGINEERS HAVING LIMITED CONTACT WITH THE IMPLEMENTER DURING THE CONSTRUCTION PHASE RESULTING IN OUR INABILITY TO DILIGENTLY SUPERVISE AND ASSESS ANY PROGRESS.

ACRONYMS AND ABBREVIATIONS:

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2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

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1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

ROCK BERM:

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
REGISTRATION No. 201170106
DATE 04/02/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM

DRAWING No. B82G - 01 - 201-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 15.7
Longitude (D°M'S")	E30 54 32.5

Location Photograph: B82G-01-202-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	1.20

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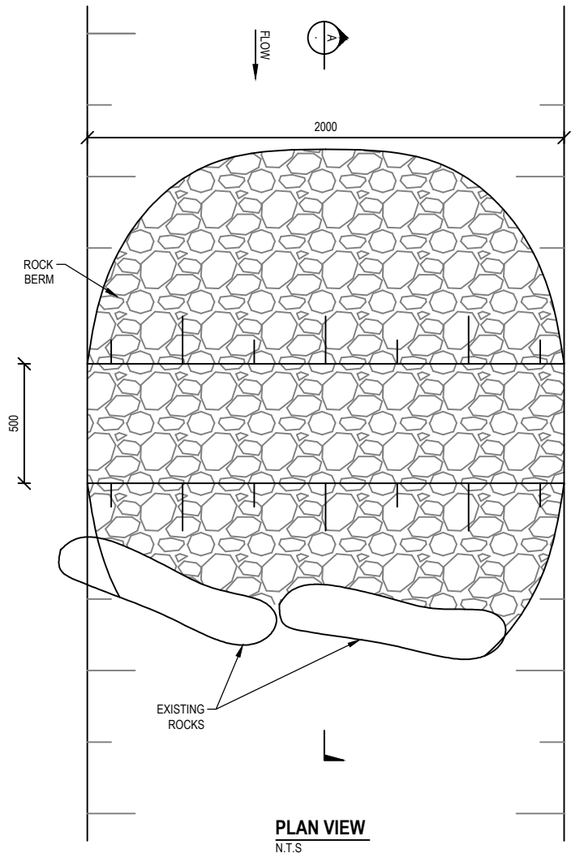
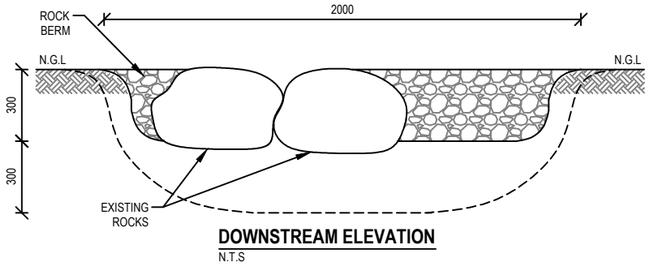


PLAN VIEW
N.T.S



DOWNSTREAM ELEVATION
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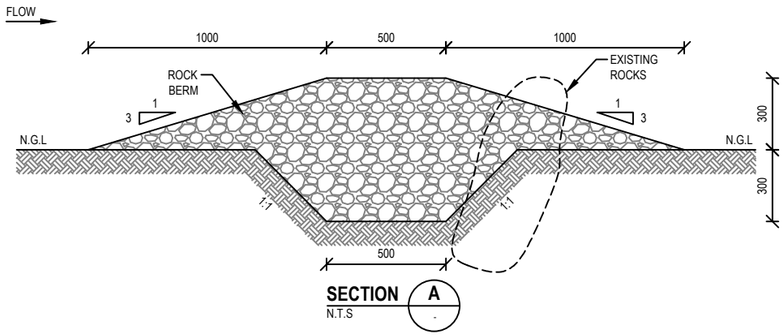

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REV	DATE	REVISION DETAILS	APPROVED
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SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM

DRAWING No.: QUATERNARY No. B82G - WETLAND No. 01 - INTERVENTION No. 202-00 - PAGE NUMBER 01 OF 01 - REV A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 15.8
Longitude (D°M'S")	E30 54 32.7

Location Photograph: B82G-01-203-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	2.90

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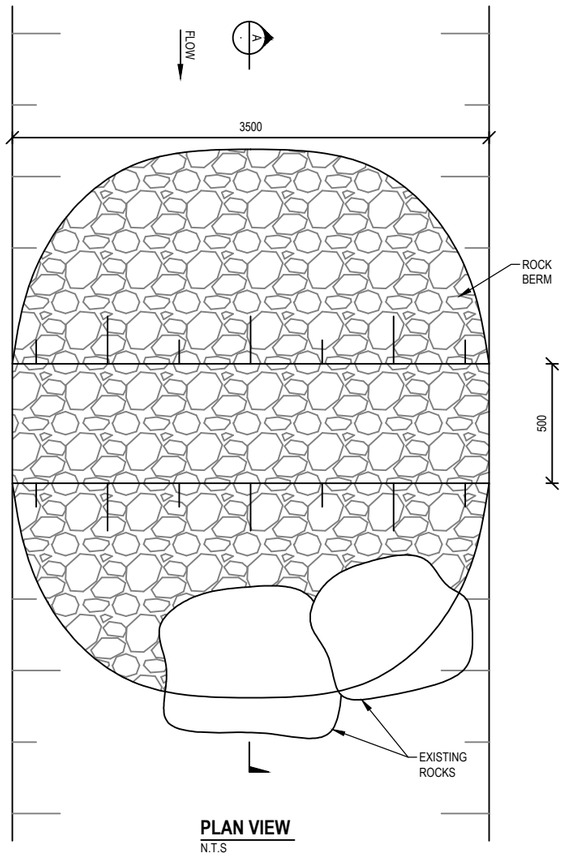
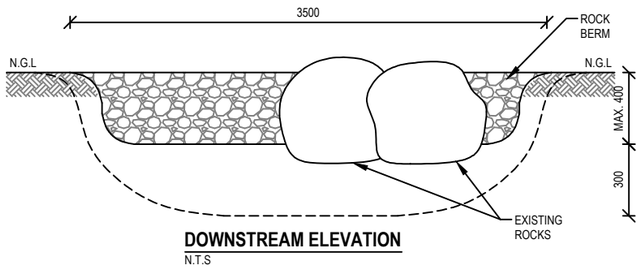
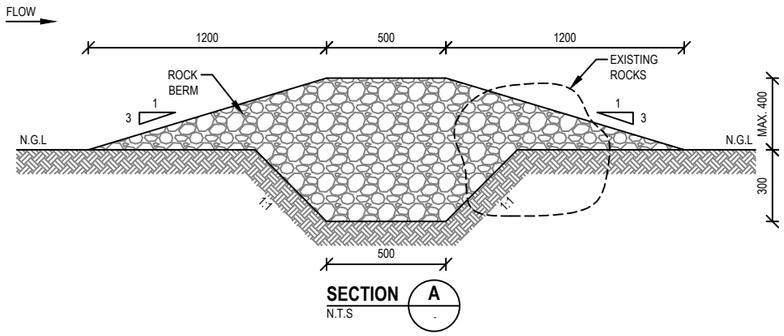


PLAN VIEW
N.T.S



DOWNSTREAM ELEVATION
N.T.S



SECTION A
N.T.S

NOTES

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ACRONYMS AND ABBREVIATIONS:

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2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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ROCK BERM:

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM

DRAWING No.: QUATERNARY No. B82G - WETLAND No. 01 - INTERVENTION No. 203-00 - PAGE NUMBER 01 OF 01 - REV A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 16.1
Longitude (D°M'S")	E30 54 33.0

Location Photograph: B82G-01-204-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	1.80

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

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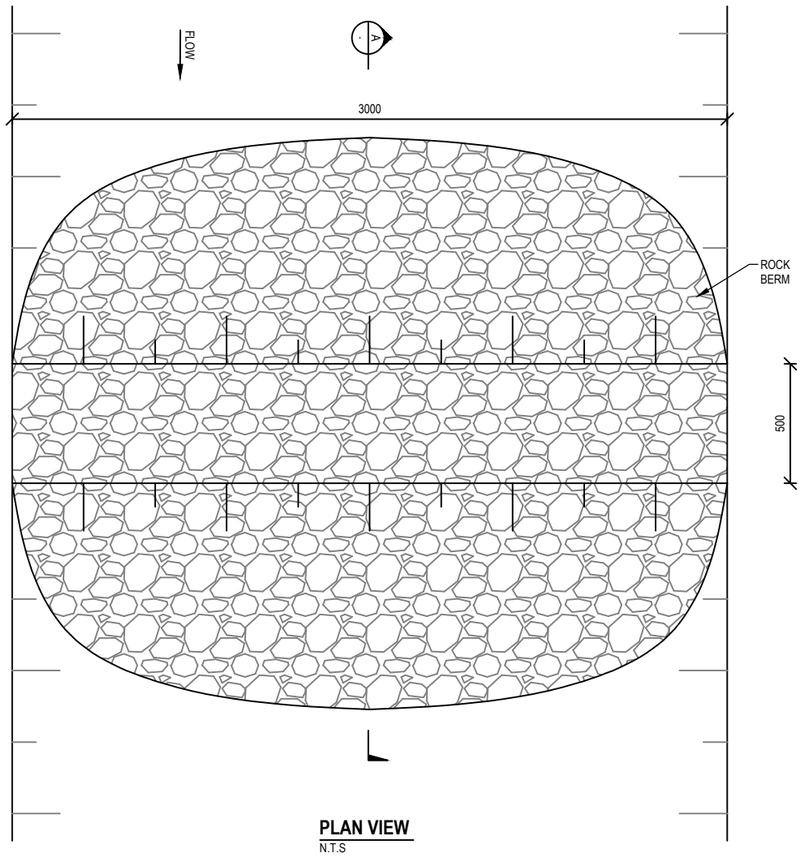
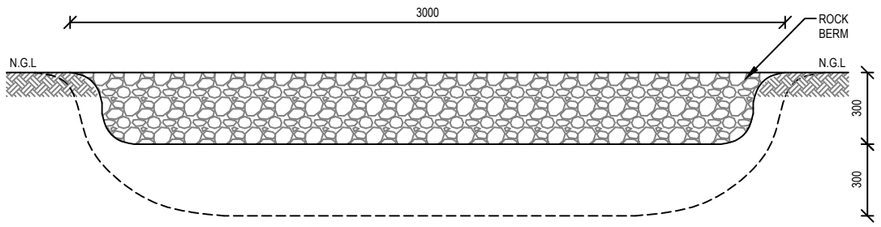
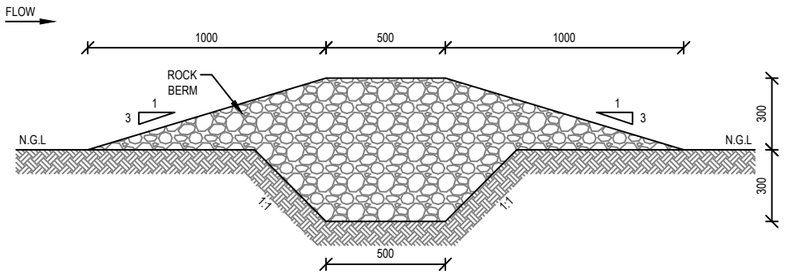


PLAN VIEW
N.T.S



DOWNSTREAM ELEVATION
N.T.S



SECTION A
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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM

DRAWING No.: B82G - 01 - 204-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 17.1
Longitude (D°M'S")	E30 54 31.8

Location Photograph: B82G-01-205-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	0.90

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

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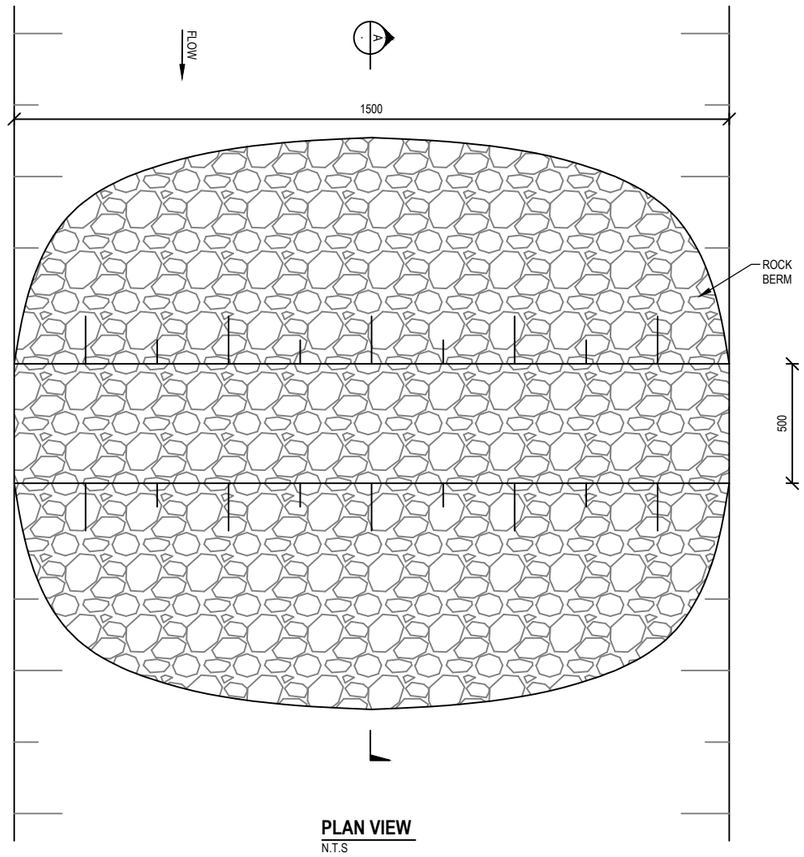
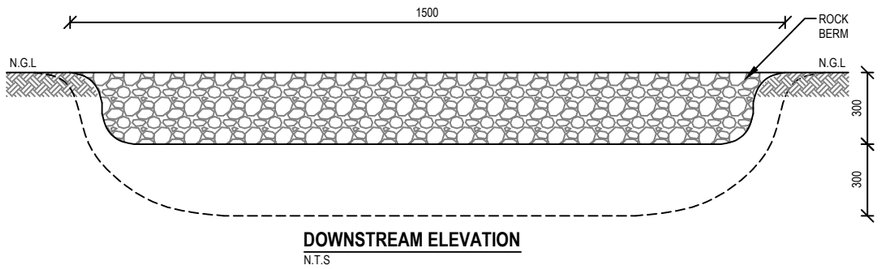
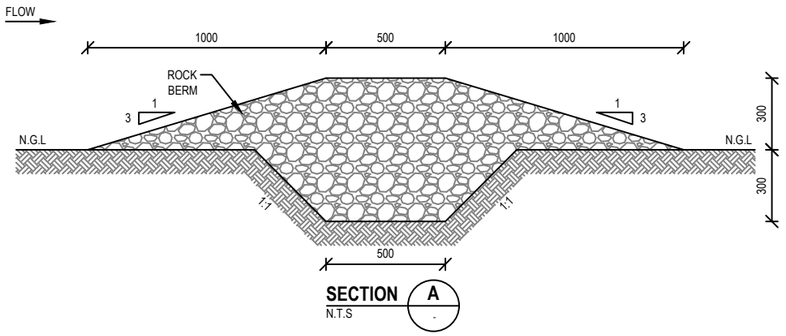


PLAN VIEW
N.T.S



DOWNSTREAM ELEVATION
N.T.S



SECTION A
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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM

DRAWING No. B82G - 01 - 205-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 17.0
Longitude (D°M'S")	E30 54 31.9

Location Photograph: B82G-01-206-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	1.66
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	6.00

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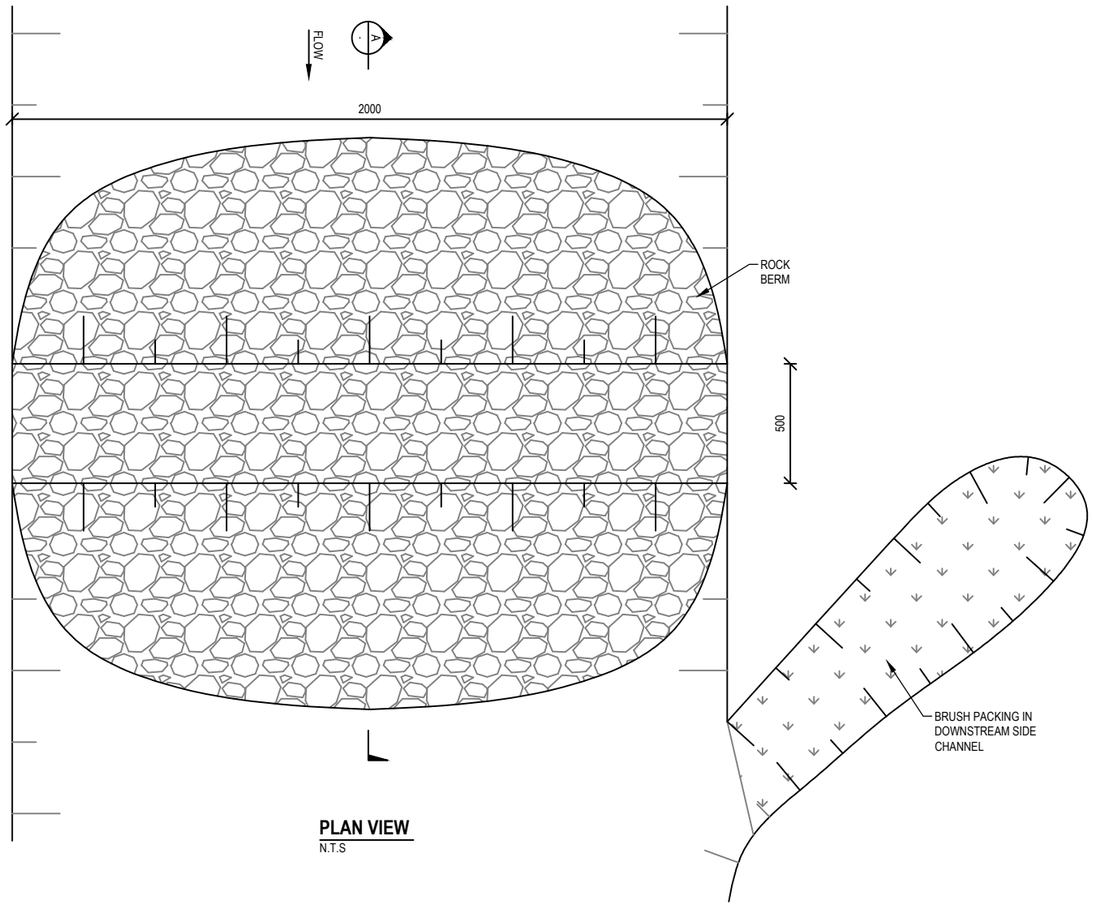
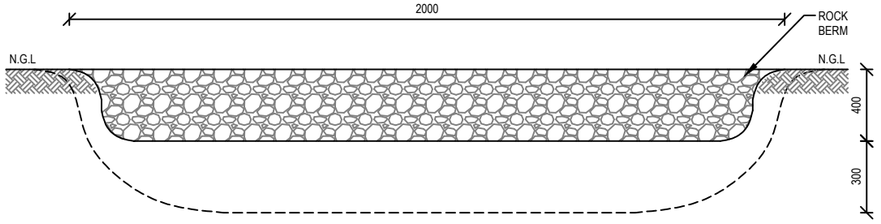
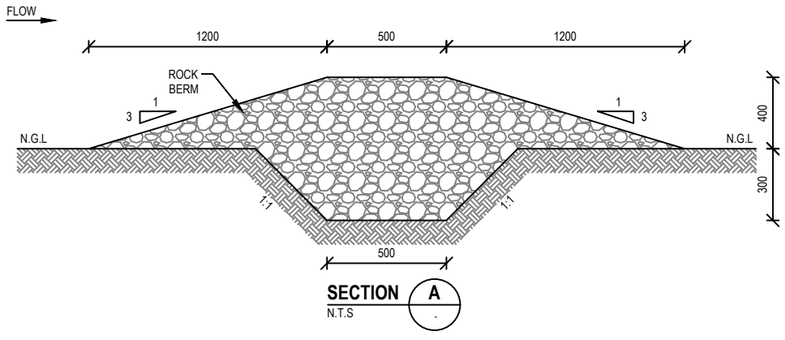


PLAN VIEW
N.T.S



DOWNSTREAM ELEVATION
N.T.S



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A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM

DRAWING No. B82G - 01 - 206-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 16.7
Longitude (D°M'S")	E30 54 32.2

Location Photograph: B82G-01-207-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	1.20

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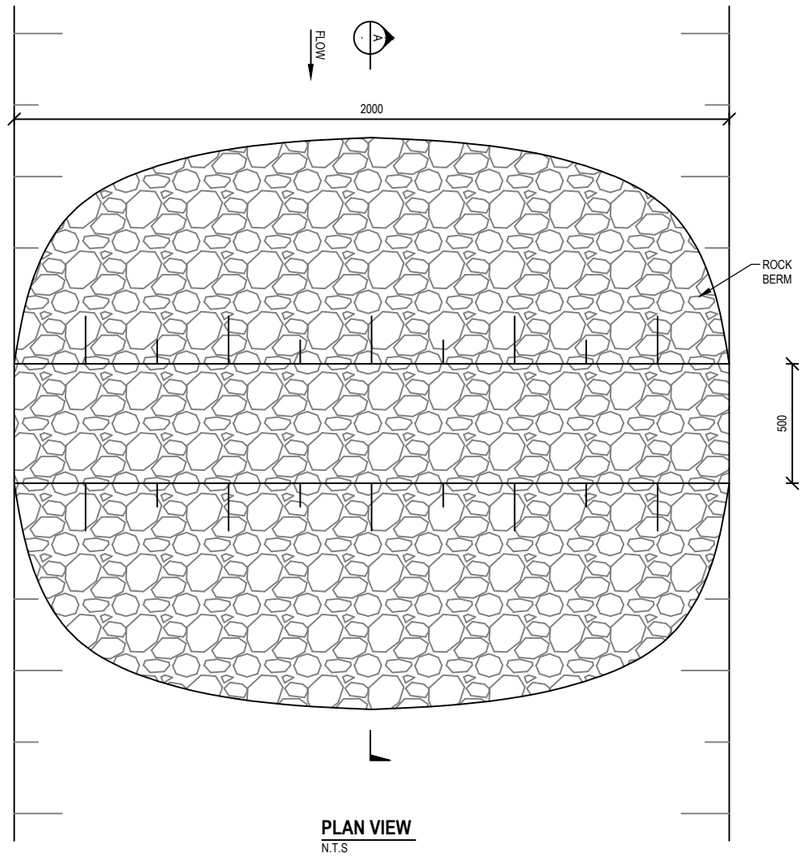
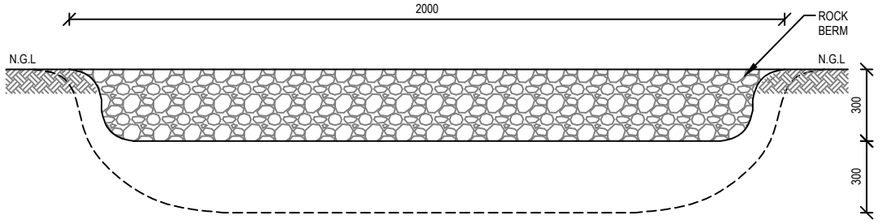
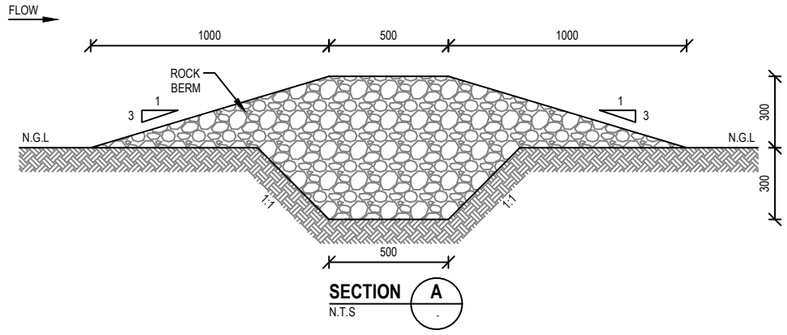


PLAN VIEW
N.T.S



DOWNSTREAM ELEVATION
N.T.S



SECTION A
N.T.S

NOTES

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ACRONYMS AND ABBREVIATIONS:

1. N.G.L - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

ROCK BERM:

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM

DRAWING No. B82G - 01 - 207-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 16.6
Longitude (D°M'S")	E30 54 32.6

Location Photograph: B82G-01-208-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	0.90

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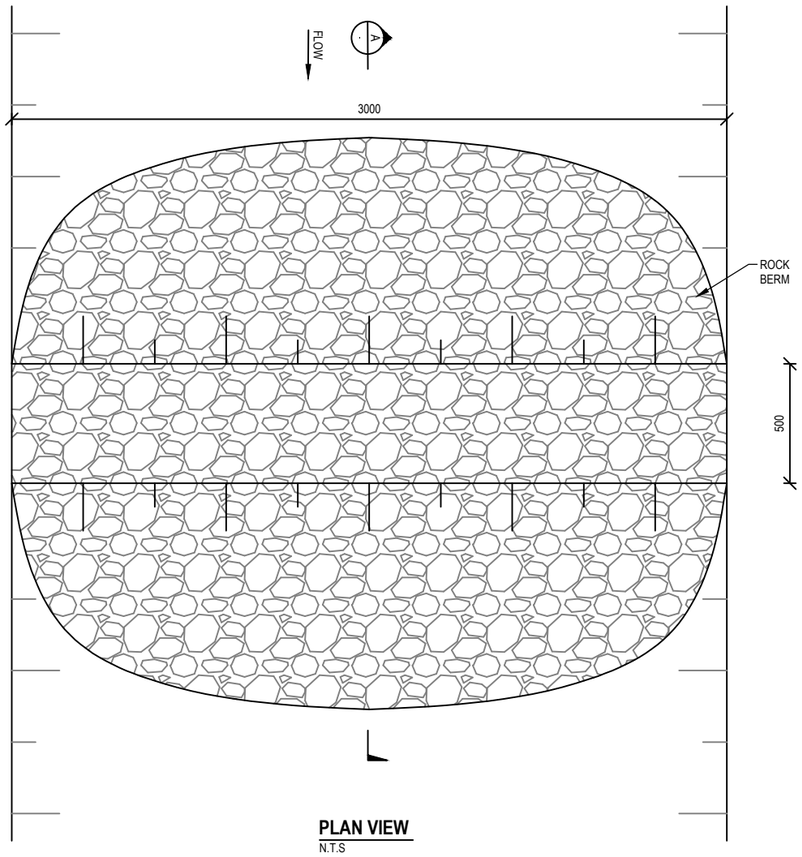
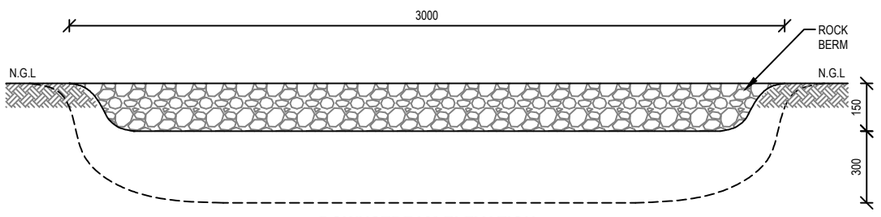
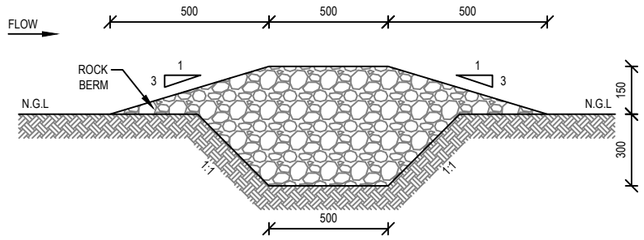


PLAN VIEW
N.T.S



DOWNSTREAM ELEVATION
N.T.S



SECTION A
N.T.S

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Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-01-208-0002018_2_REHAB\1 DWG\B82G-01-208-00_REVA.DWG
Office:
Plot Date: 4/2/2019 10:56:35 AM

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.: 201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM

DRAWING No.: QUATERNARY No. B82G - WETLAND No. 01 - INTERVENTION No. 208-00 - PAGE NUMBER 01 OF 01 - REV A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 17.4
Longitude (D°M'S")	E30 54 32.6

Location Photograph: B82G-01-209-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	0.90
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	50.00

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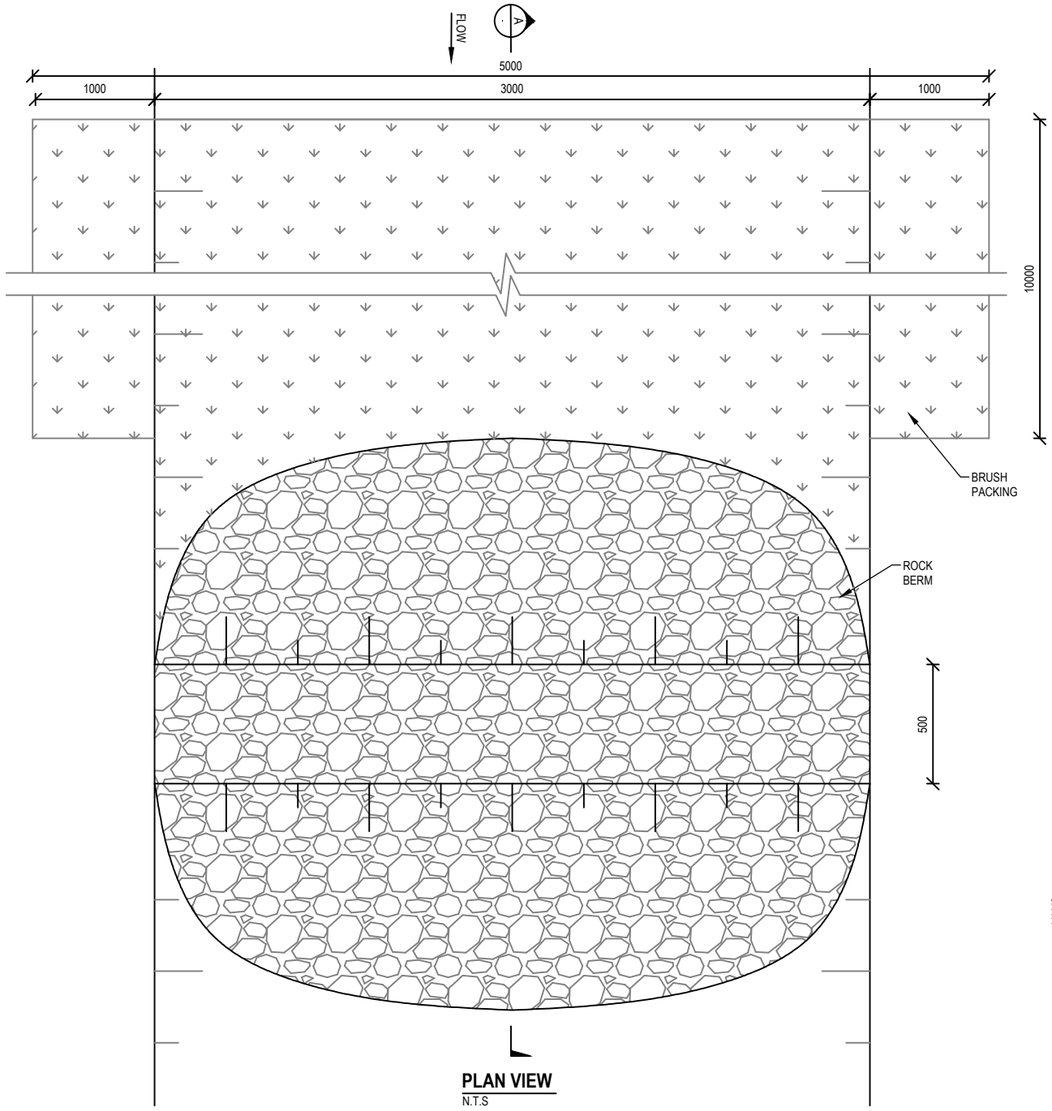
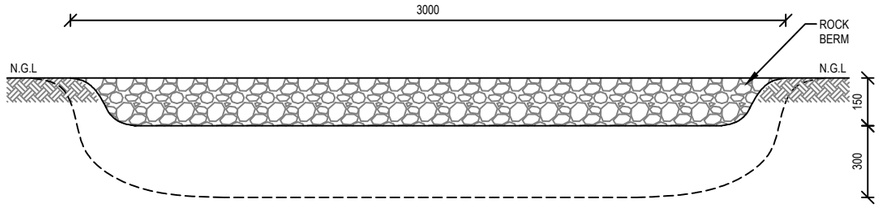
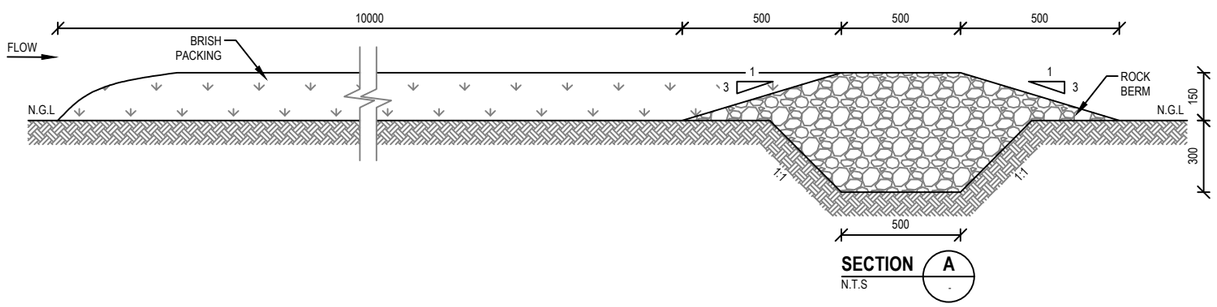


PLAN VIEW
N.T.S



DOWNSTREAM ELEVATION
N.T.S



SECTION A
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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	AS SHOWN
SIZE	A3
DRAWN	J.MORRISON
DESIGNED	P.C.BLAAUW
CHECKED	P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE
04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM

DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
	B82G	01	209-00	01 OF 01	A

Plot Date: 4/2/2019 11:26:53 AM Office: Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-01-209-00\2018_2_REHAB\1 DWG\B82G-01-209-00_REVA.DWG

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabile disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent further erosion.
Latitude (D°M'S")	S23 25 16.3
Longitude (D°M'S")	E30 54 33.8

Location Photograph: B82G-01-210-00

Bill of Quantities

Item	Descriptin	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	4.55
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	45.00

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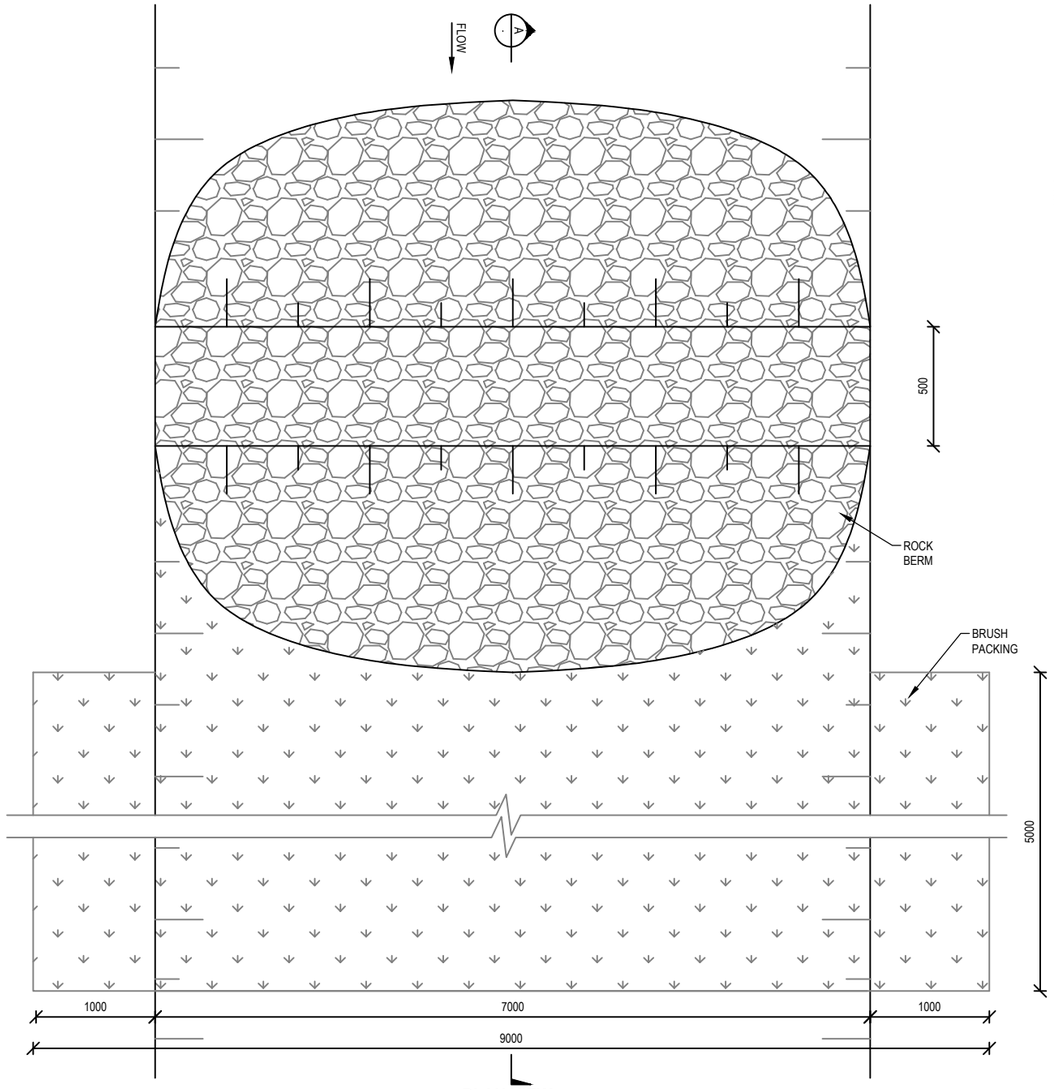
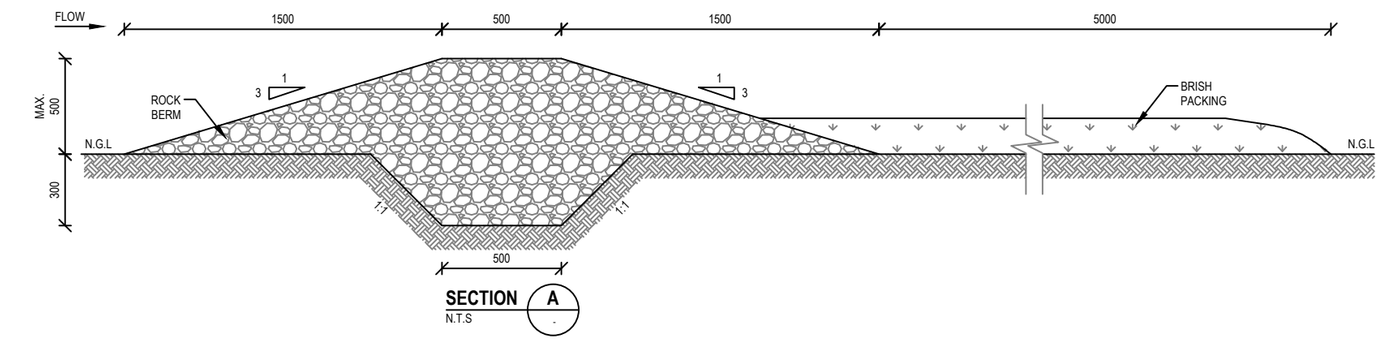
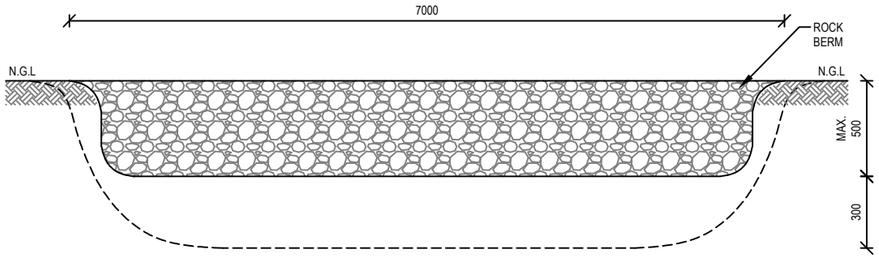


PLAN VIEW
N.T.S



SECTION A - A
N.T.S



DOWNSTREAM ELEVATION
N.T.S

NOTES

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Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-01-210-0002018_2_REHAB\1 DWG\B82G-01-210-00_REVA.DWG
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Plot Date: 4/2/2019 12:16:11 PM

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Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERM
DRAWING No.	QUATERNARY No. B82G - WETLAND No. 01 - INTERVENTION No. 210-00 - PAGE NUMBER 01 OF 01 - REV A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabilise disturbed environment. • Prevent any potential head-cuts and erosion. • Prevent further sediment deposition downstream. • Create environment for indigenous vegetation to re-establish.
Latitude (D°M'S")	S23 25 14.56
Longitude (D°M'S")	E30 54 44.72

Location Photograph: B82G-01-211-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	3.80

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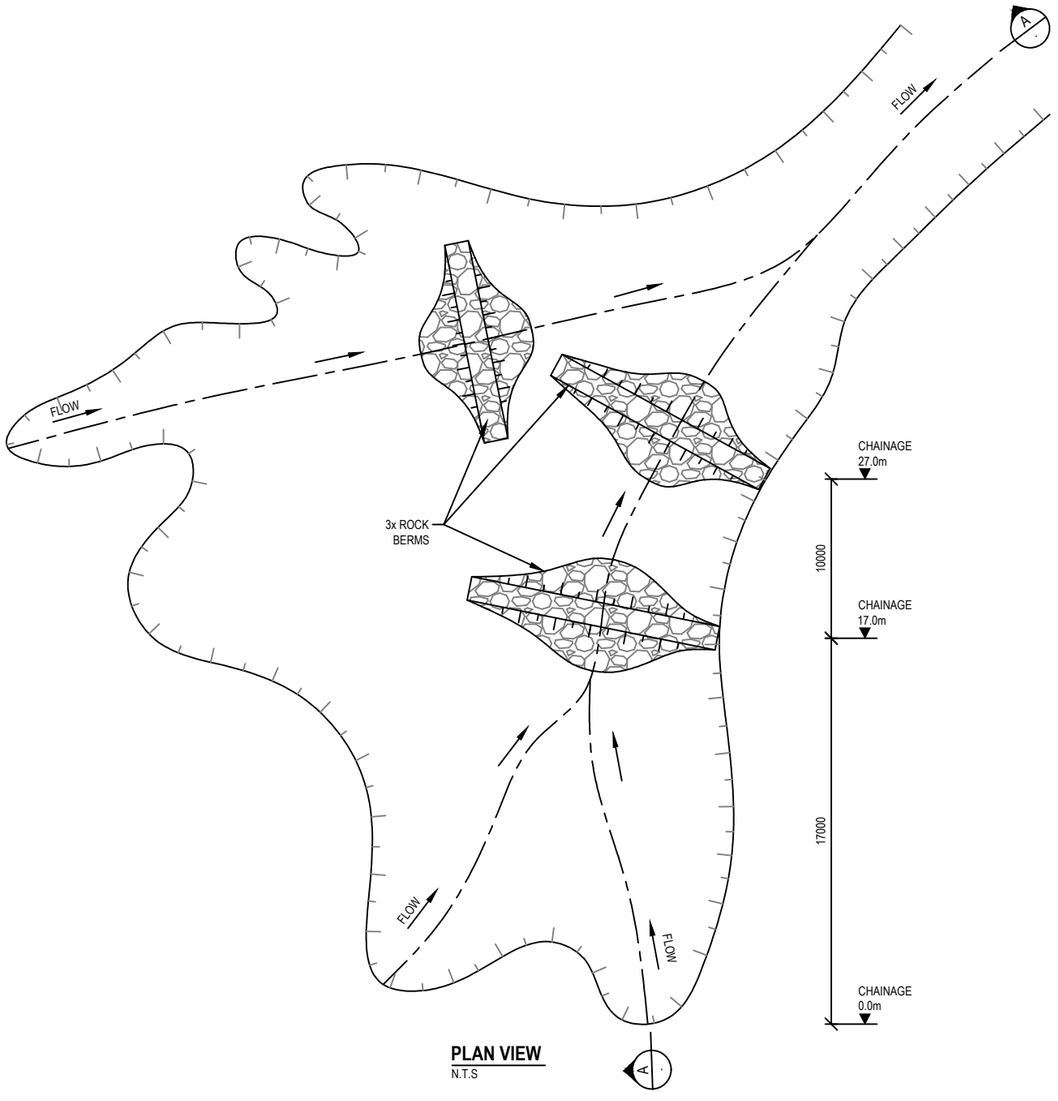
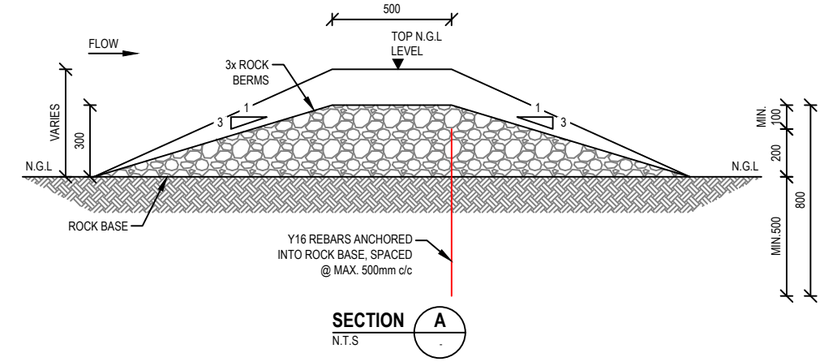
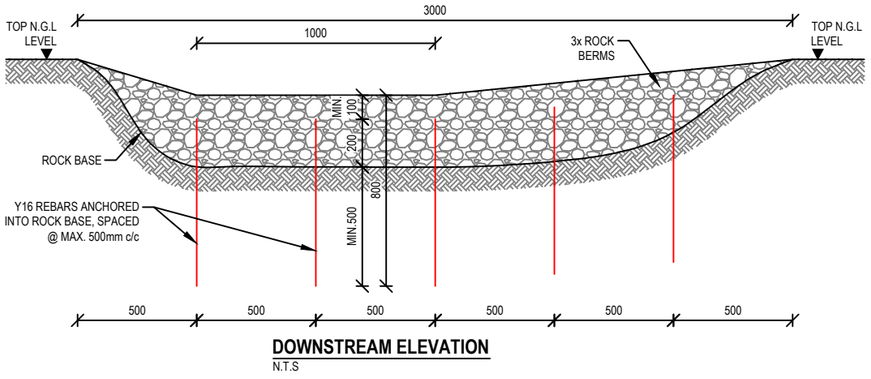
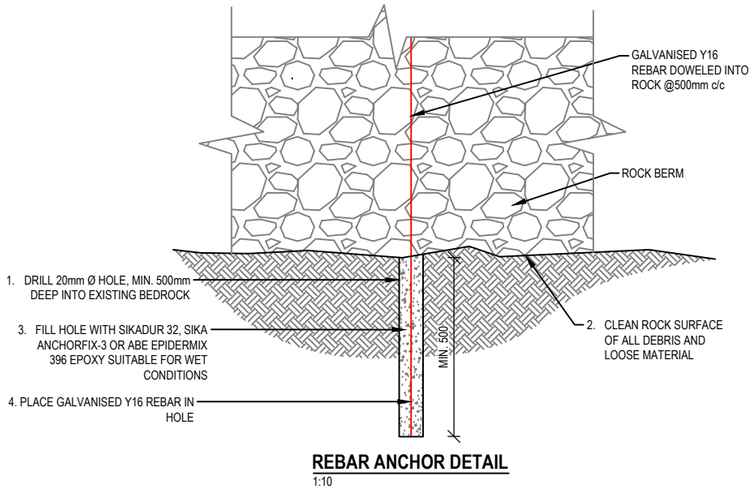
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities



PLAN VIEW
N.T.S







REBAR ANCHOR DETAIL
1:10

NOTES

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ACRONYMS AND ABBREVIATIONS:

1. N.G.L - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

ROCK BERM:

1. 100mm - 200mm STONE TO BE USED IN ROCK PACKS.
2. STONE MUST BE NON-FRIABLE AND INSOLUBLE, e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.

Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CAD\DRAWINGS\LIMPOPO\BALENI\B82G-01-211-0002018_2_REHAB\1 DWG\B82G-01-211-00_REVA.DWG
Office:
Plot Date: 5/2/2019 12:38:06 PM

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Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3
DRAWN	J.MORRISON
DESIGNED	P.C.BLAAUW
CHECKED	P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED	
ENGINEER	DATE
REGISTRATION No. 201170106	04/02/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERMS

DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
	B82G	01	211-00	01 OF 01	A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Provide control over water flow. • Prevent directional flows in artificial drain. • Restore disturbed environment. • Revegetate for stability. • Prevent future degradation.
Latitude (D°M'S")	S23 25 15.0
Longitude (D°M'S")	E30 54 45.7

Location Photograph: B82G-01-212-00

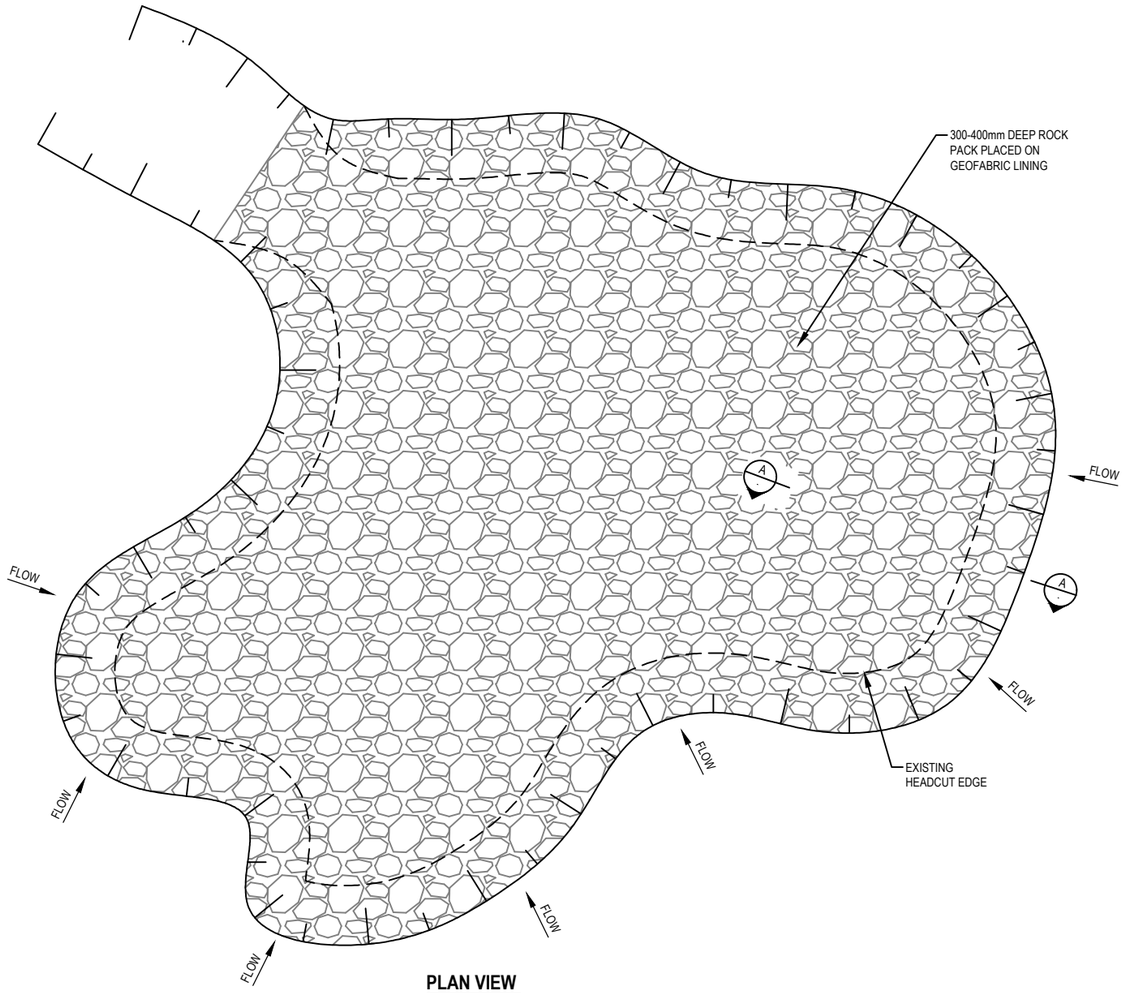
Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	100.00
Earth Works	Cut, slope, fill (into GeoCells) & removal of soil for excavations and replacing topsoil	m3	55.00

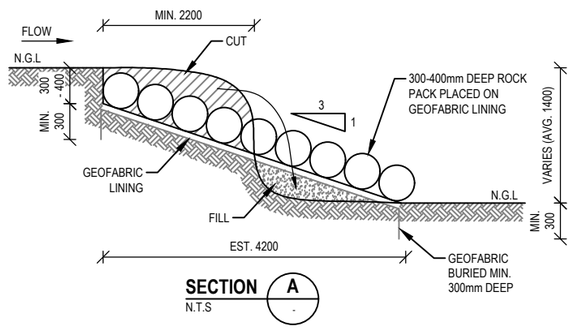
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

• All site staff shall be informed of the possibility of the occurrence of subsurface heritage resources and the procedures to be undertaken should such finds occur.
• Should any artefact or suspected artefact (e.g. ash deposits, animal/human bone concentrations, ceramic fragments/ pot shards and formal stone concentrations), or any site of cultural significance be encountered during construction:
o The Contractor must immediately stop work within a 50m radius of the site and immediately alert the relevant authorities.
o The area around the discovery (with a 50m radius buffer) shall be cordoned off until such time that work is authorised to proceed. Public access to the site must be limited.
o Should human remains be discovered, the South Africa Police Services (SAPS) and the provincial heritage authority shall be notified immediately.
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities



PLAN VIEW
N.T.S



SECTION A
N.T.S

NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. LIMITED GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON-STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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EARTHWORKS/ EARTH STRUCTURES:

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2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

DISPERSIVE SOILS:
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2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

ROCK PACK LINING:

1. SHAPE TO REQUIRED SLOPE. NOTE THAT A CUT TO FILL BALANCE OF HEAD-CUT SLOPE IS REQUIRED TO MINIMIZE IMPORT OF SOIL MATERIAL.
2. 100mm -200mm STONE TO BE USED IN ROCK PACKS.
3. STONE MUST BE NON-FRIABLE AND INSOLUBLE, e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.
4. GEOFABRIC TO BE GRADE A4, NOT LESS THAN 1.8mm THICK.
5. ALL GEOFABRIC TO HAVE 200mm OVERLAPS BETWEEN SHEETS AND STITCHED WITH EITHER POLYESTER OR GALVANISED WIRE @ 300mm C/C.

Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-01-212-00\2018_2_REHAB\1 DWG\B82G-01-212-00_REVA.DWG

Office:

Plot Date: 4/2/2019 3:47:49 PM

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REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER | DATE
04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK PACK

DRAWING No. B82G - 01 - 212-00 - 01 OF 01 - A
(QUATERNARY No. | WETLAND No. | INTERVENTION No. | PAGE NUMBER | REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	17/1/2019
Type	New
Description	Stone Masonry
Rehabilitation Objectives	• Stabilise high-energy environment. • Control water flow. • Prevent further incision and erosion of the channel. • Lift water table and hydrate upstream and adjacent area. • Rehydrate wetland soils. • Take control of water through gabion. • Release water in a controlled manner.
Latitude (D°M'S")	S23 25 08.8
Longitude (D°M'S")	E30 54 51.2

Location Photograph: B82G-01-213-00

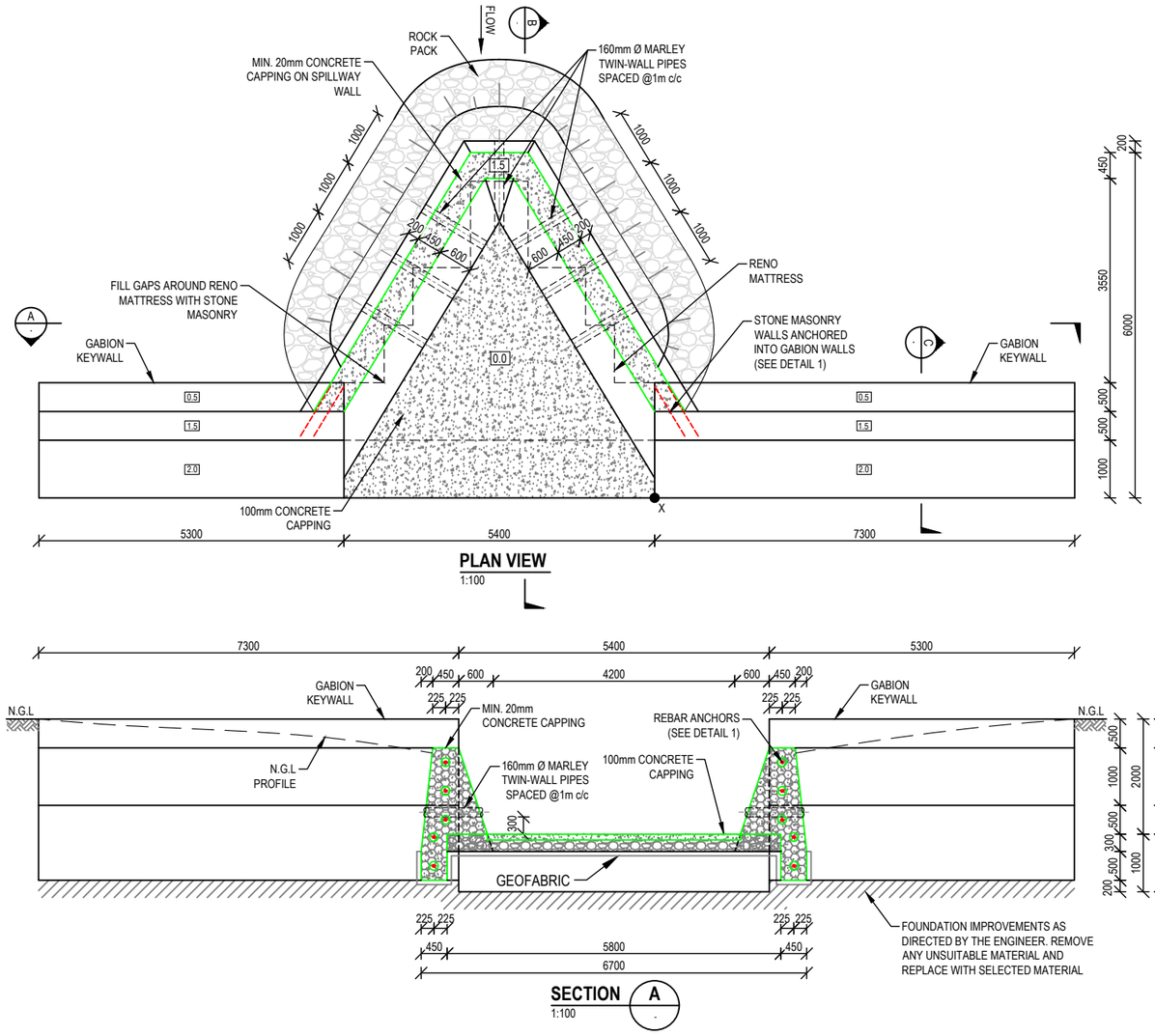
Bill of Quantities

Item	Description	Units	Quantity
Stone Masonry	Combination of large rocks & concrete, constructed as linings or mass gravity type structures/ conventional bricks & mortar	m3	30.00
Gabions	Rock filled gabions and/ or renos	m3	72.40
Earth Works	Cut, slope, fill (into GeoCells) & removal of soil for excavations and replacing topsoil	m3	225.00
Concrete (Low strength)	Concrete for gabion capping, cladding, road strips, filling GeoCells etc.	m3	1.92
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	71.00

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

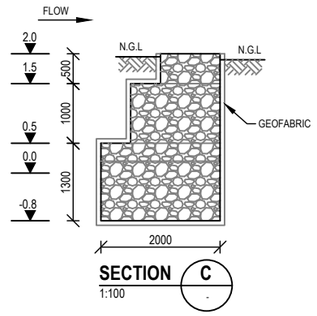
The following site specific mitigation measures shall be implemented:

• Undertake an archaeological excavation at site 23°25'13" S 30°54'52" E (under a permit issued by SAHRA) prior to the commencement of implementing intervention B82G-01-2013-00.
• All site staff shall be informed of the possibility of the occurrence of subsurface heritage resources and the procedures to be undertaken should such finds occur.
• Should any artefact or suspected artefact (e.g. ash deposits, animal/human bone concentrations, ceramic fragments/ pot shards and formal stone concentrations), or any site of cultural significance be encountered during construction:
o The Contractor must immediately stop work within a 50m radius of the site and immediately alert the relevant authorities.
o The area around the discovery (with a 50m radius buffer) shall be cordoned off until such time that work is authorised to proceed. Public access to the site must be limited.
o Should human remains be discovered, the South Africa Police Services (SAPS) and the provincial heritage authority shall be notified immediately.
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been



PLAN VIEW
1:100

SECTION A
1:100



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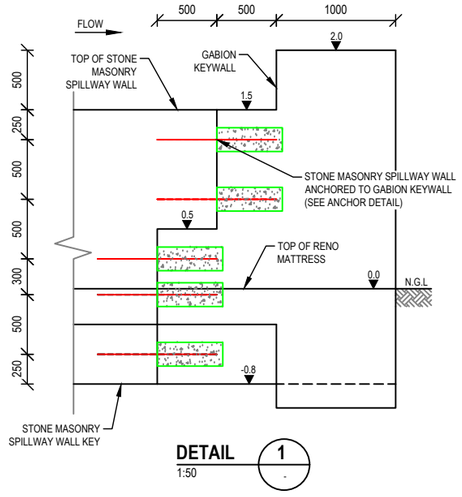

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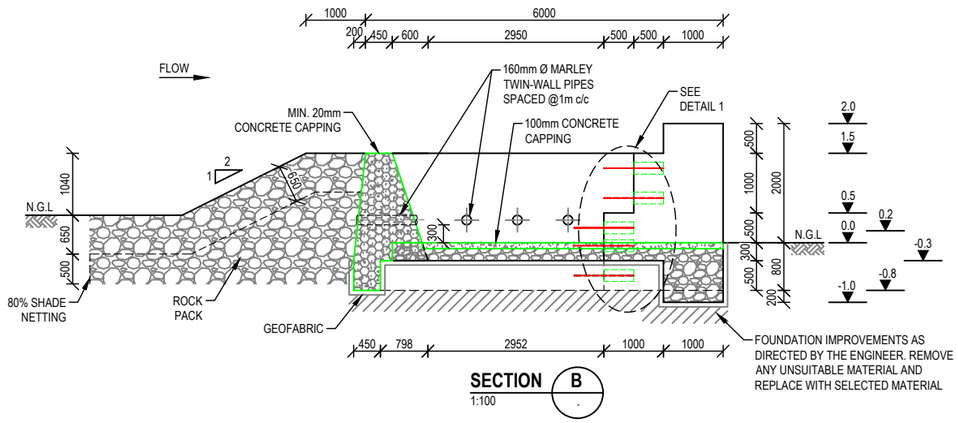

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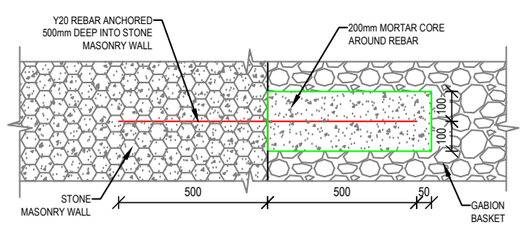

ANCHOR DETAIL
1:20

NOTES

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3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT

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2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

STONE MASONRY:

1. STONE TO BE PACKED AND MORTARED IN PLACE USING CONCRETE.
2. ALL CONCRETE TO BE MINIMUM 15MPa & MIX:
   1 BAG CEMENT
   130L SAND
   80L STONE
   29L WATER
3. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 9-13mm.
4. 100mm - 200mm STONE TO BE USED IN ALL STONE MASONRY, GABIONS AND RENO MATTRESSES. STONE FILL MUST BE NON-FRIABLE & INSOLUBLE e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.
5. GABION BASKETS AND RENO MATTRESSES TO BE CONSTRUCTED OF DOUBLE TWISTED, HEXAGONAL, GALFAN, GALVANISED WIRE MESH OF NOMINAL DIAMETER 80mm MESH, WITH 3.4mm o/d FRAME WIRE AND 2.7mm o/d MESH WIRE WITH PARTITIONS AT 1m CENTRES.
6. ALL GABIONS AND RENO MATTRESSES TO COMPLY WITH SANS-1200-DK.
7. ALL GEOFABRIC TO BE GRADE A4, NOT LESS THAN 1.8mm THICK.
8. GEOFABRIC TO BE INSERTED AT ALL SOIL/MESH INTERFACES UNLESS OTHERWISE SPECIFIED.
9. ALL LEVELS & DIMENSIONS REFER TO STONE MASONRY WALLS AND GABION BASKETS PRIOR TO CAPPING.
10. ALL GEOFABRIC TO HAVE 200mm OVERLAPS BETWEEN SHEETS AND STITCHED WITH EITHER POLYESTER OR GALVANISED WIRE @ 300mm C/C.
11. FOUNDATION IMPROVEMENT AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
B	17/01/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW
A	10/12/2018	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	AS SHOWN
SIZE	A3
DRAWN	J.MORRISON
DESIGNED	P.C.BLAAUW
CHECKED	P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED	
ENGINEER	DATE
REGISTRATION No. 201170106	17/01/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	STONE MASONRY DROP-INLET WEIR

DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
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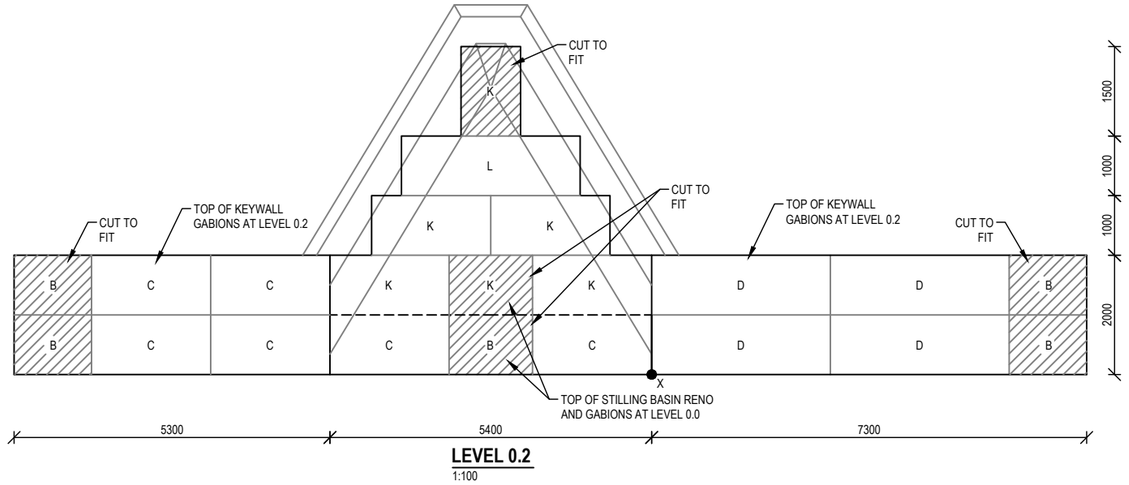

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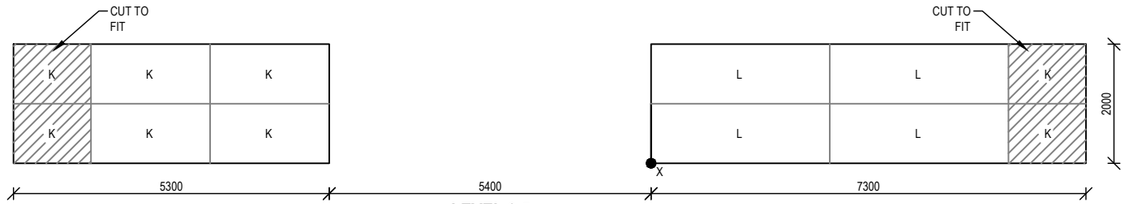

LEVEL 0.5
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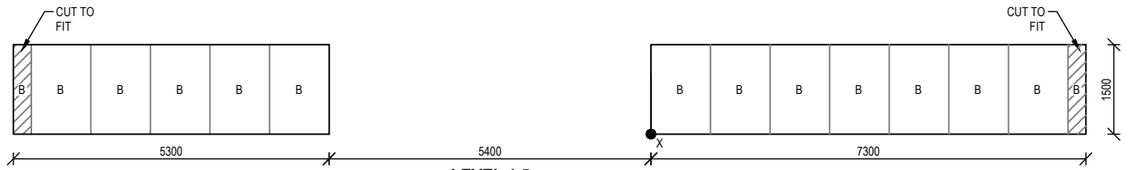

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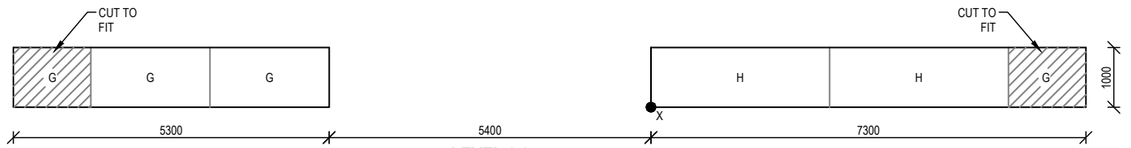

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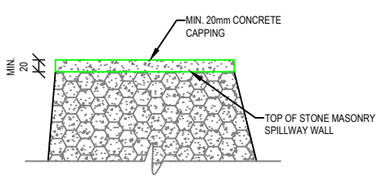
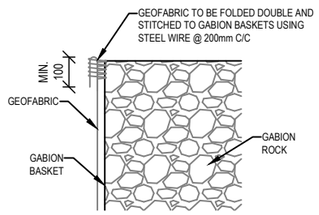
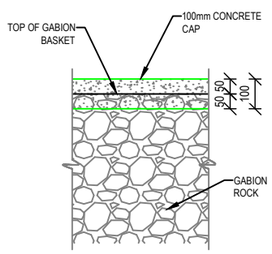


STONE MASONRY WALL CONCRETE CAPPING DETAIL
N.T.S



GEOFABRIC STITCHING DETAIL
1:20



CONCRETE CAPPING DETAIL
1:20

GABION & RENO MATTRESS SIZES		
CODE	SIZE	No.BASKETS
A	1.0 x 1.0 x 1.0m	-
B	1.5 x 1.0 x 1.0m	19
C	2.0 x 1.0 x 1.0m	6
D	3.0 x 1.0 x 1.0m	4
E	4.0 x 1.0 x 1.0m	-
F	2.0 x 0.5 x 0.5m	-
G	2.0 x 1.0 x 0.5m	4
H	3.0 x 1.0 x 0.5m	2
J	4.0 x 1.0 x 0.5m	-
K	2.0 x 1.0 x 0.3m	14
L	3.0 x 1.0 x 0.3m	5
M	6.0 x 2.0 x 0.17m	-
N	6.0 x 2.0 x 0.23m	-
P	6.0 x 2.0 x 0.3m	-

BILL OF QUANTITIES			
ITEM NO.	DESCRIPTION	UNIT	QTY
1	STONE MASONRY VOLUME	m³	30.0
2	GABION ROCK VOLUME	m³	72.4
3	EST. EARTHWORKS	m³	225.0
4	CONCRETE CAPPING VOLUME	m³	1.92
5	ROCK PACKING	m³	71.0

NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. LIMITED GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON-STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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ACRONYMS AND ABBREVIATIONS:

1. N.G.L - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

STONE MASONRY:

1. STONE TO BE PACKED AND MORTARED IN PLACE USING CONCRETE.
2. ALL CONCRETE TO BE MINIMUM 15MPa & MIX:
   1 BAG CEMENT
   130L SAND
   80L STONE
   29L WATER
3. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 9-13mm.
4. 100mm - 200mm STONE TO BE USED IN ALL STONE MASONRY, GABIONS AND RENO MATTRESSES. STONE FILL MUST BE NON-FRIABLE & INSOLUBLE e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.
5. GABION BASKETS AND RENO MATTRESSES TO BE CONSTRUCTED OF DOUBLE TWISTED, HEXAGONAL, GALFAN, GALVANISED WIRE MESH OF NOMINAL DIAMETER 80mm MESH, WITH 3.4mm o/d FRAME WIRE AND 2.7mm o/d MESH WIRE WITH PARTITIONS AT 1m CENTRES.
6. ALL GABIONS AND RENO MATTRESSES TO COMPLY WITH SANS-1200-DK.
7. ALL GEOFABRIC TO BE GRADE A4, NOT LESS THAN 1.8mm THICK.
8. GEOFABRIC TO BE INSERTED AT ALL SOIL/MESH INTERFACES UNLESS OTHERWISE SPECIFIED.
9. ALL LEVELS & DIMENSIONS REFER TO STONE MASONRY WALLS AND GABION BASKETS PRIOR TO CAPPING.
10. ALL GEOFABRIC TO HAVE 200mm OVERLAPS BETWEEN SHEETS AND STITCHED WITH EITHER POLYESTER OR GALVANISED WIRE @ 300mm C/C.
11. FOUNDATION IMPROVEMENT AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
B	17/01/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW
A	10/12/2018	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	AS SHOWN
SIZE	A3
DRAWN	J.MORRISON
DESIGNED	P.C.BLAAUW
CHECKED	P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION
APPROVED
ENGINEER
DATE 17/01/2019
REGISTRATION No. 201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	STONE MASONRY DROP-INLET WEIR

DRAWING No. B82G - 01 - 213-00 - 02 OF 02 - B
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabilise disturbed environment. • Prevent any potential head-cuts and erosion. • Prevent further sediment deposition downstream. • Create environment for indigenous vegetation to re-establish.
Latitude (D°M'S")	S23 25 06.3
Longitude (D°M'S")	E30 54 53.8

Location Photograph: B82G-01-213-00

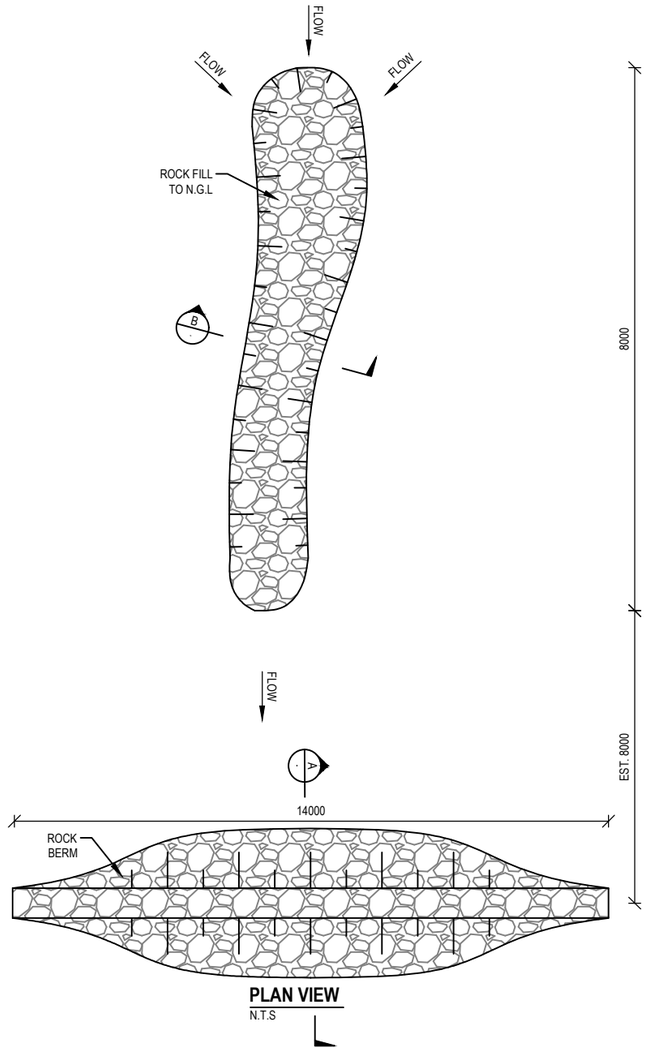
Bill of Quantities

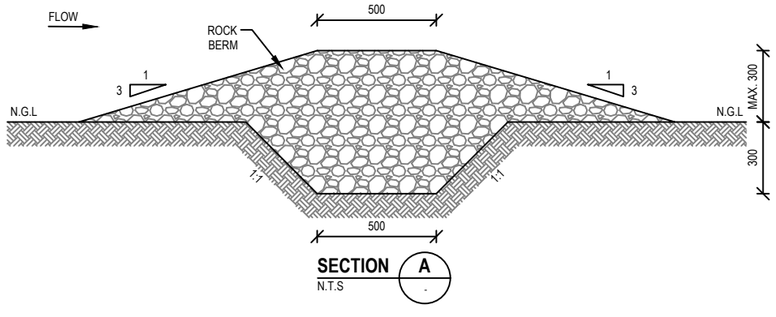
Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	10.38

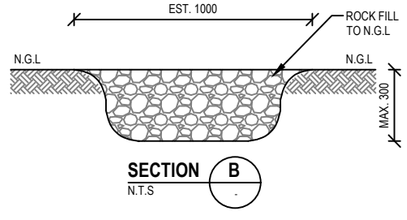
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

• All site staff shall be informed of the possibility of the occurrence of subsurface heritage resources and the procedures to be undertaken should such finds occur.
• Should any artefact or suspected artefact (e.g. ash deposits, animal/human bone concentrations, ceramic fragments/ pot shards and formal stone concentrations), or any site of cultural significance be encountered during construction:
o The Contractor must immediately stop work within a 50m radius of the site and immediately alert the relevant authorities.
o The area around the discovery (with a 50m radius buffer) shall be cordoned off until such time that work is authorised to proceed. Public access to the site must be limited.
o Should human remains be discovered, the South Africa Police Services (SAPS) and the provincial heritage authority shall be notified immediately.
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities







NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. LIMITED GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON-STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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ACRONYMS AND ABBREVIATIONS:

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2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

ROCK BERM AND ROCK PACK:

1. 100mm - 200mm STONE TO BE USED IN ROCK PACKS.
2. STONE MUST BE NON-FRIABLE AND INSOLUBLE, e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK PACKING
DRAWING No.	QUATERNARY No. B82G - WETLAND No. 02 - INTERVENTION No. 201-00 - PAGE NUMBER 01 OF 01 - REV A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	13/12/2018
Type	New
Description	Silt Fences
Rehabilitation Objectives	• Construct silt fencing. • Break water energy flows and create low energy environments to promote the sediment deposition. • Create environment for vegetation to establish. • Provide cover for disturbed areas, with brush packs. • Create a favourable environment for vegetation to re-establish.
Latitude (D°M'S")	S23 25 05.3
Longitude (D°M'S")	E30 54 50.8

Location Photograph: B82G-02-202-00

Bill of Quantities

Item	Description	Units	Quantity
Silt Fences	Shade netting weir like structures constructed by stranding wire along steel or wooden poles	m	80.00
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	3.60

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

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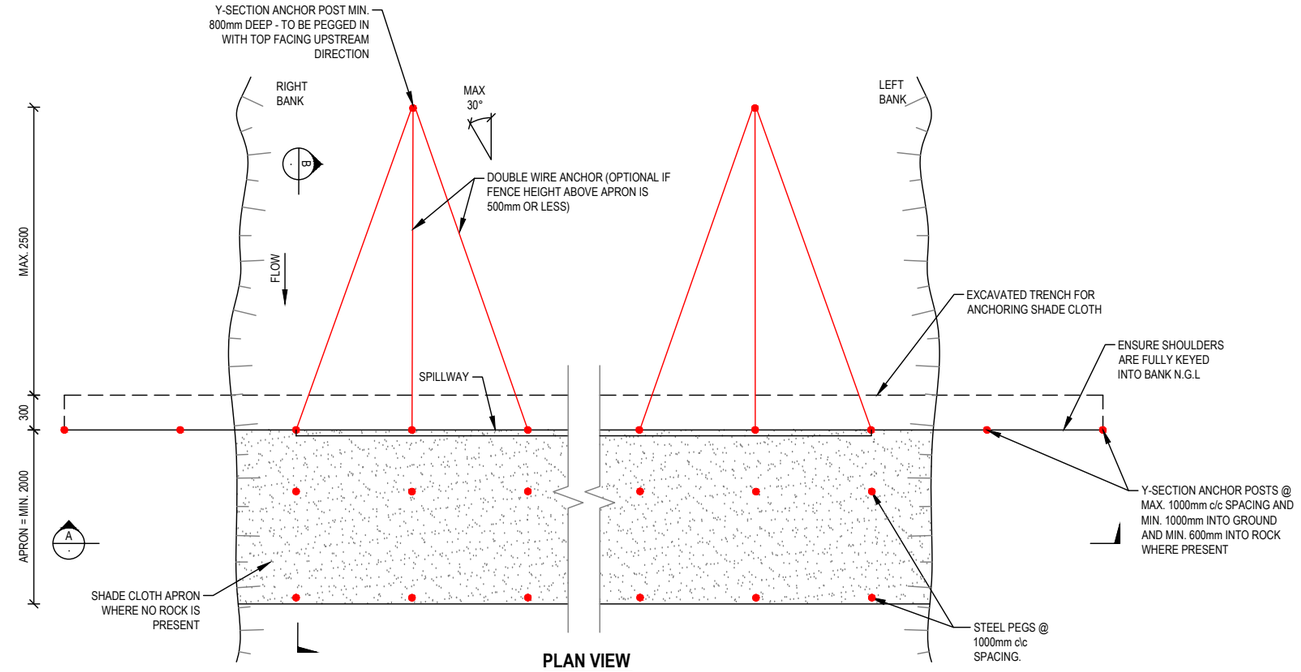
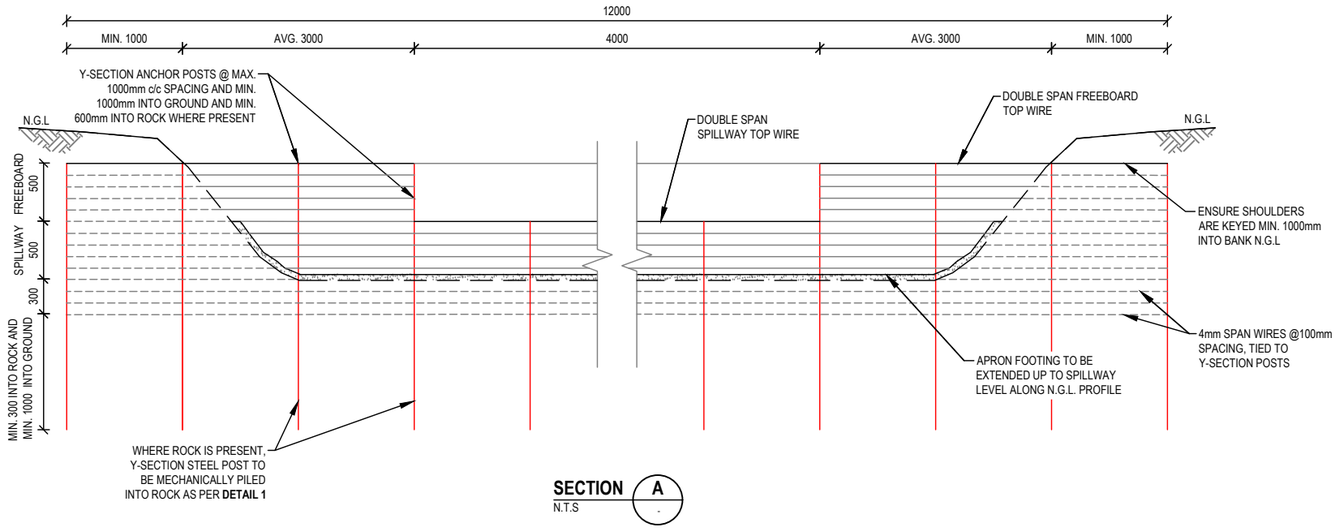
o Should human remains be discovered, the South Africa Police Services (SAPS) and the provincial heritage authority shall be notified immediately.
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities

NOTE:
- POSITION AND SPACING TO BE DETERMINED BY ENGINEER ON SITE.



PLAN VIEW
N.T.S



SECTION A
N.T.S

NOTES

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2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
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SILT FENCES:

1. SHADE CLOTH REFERS TO ALNET EXTRA BLOCK UV-TREATED SHADE CLOTH OR SIMILAR MATERIAL.
2. SUPPORT NETTING REFERS TO KAYTECH'S FLOWNET OR SIMILAR MATERIAL.
3. ANCHOR AND SPAN WIRE REFERS TO 4mm Ø SANS APPROVED GALVINISED STEEL WIRE.
4. WHERE ROCK IS PRESENT, SHADE CLOTH IS TO BE BOLT ANCHORED ONTO ROCK BASE.
5. WHERE ROCK IS PRESENT, NO SHADE CLOTH APRON, ROCK PACK AND ANCHOR TRENCH IS NECESSARY.
6. WHERE ROCK IS PRESENT, Y-SECTION POSTS ARE TO BE ANCHORED MIN. 600mm DEEP INTO ROCK, AS PER DETAIL 1.

Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-02-202-00\2018_2_REHAB\1 DWG\B82G-02-202-00_REVA.DWG

Office:

Plot Date: 11/1/2019 3:09:55 PM

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	13/12/2018	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: X.HAYDRICKS
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

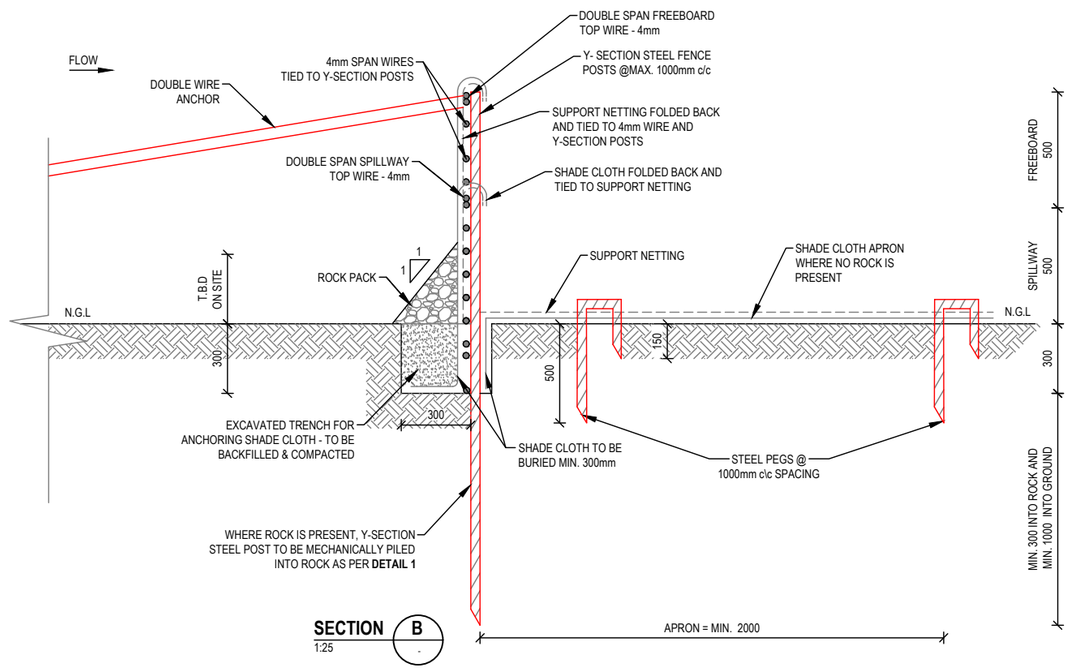
PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 13/12/2018
REGISTRATION No.: 201170106

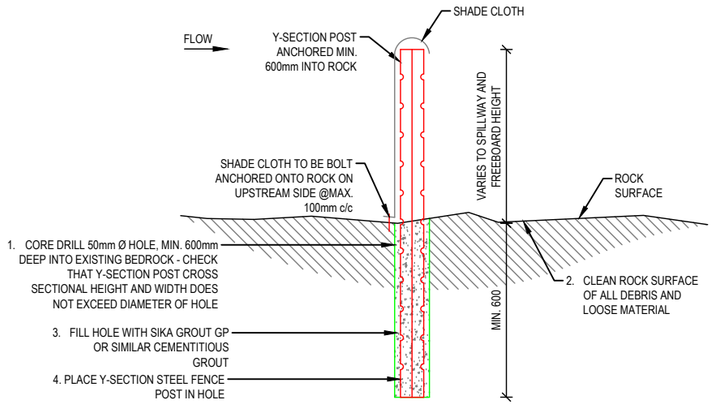
PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	SERIES OF SILT FENCES

DRAWING No.: QUATERNARY No. B82G - WETLAND No. 02 - INTERVENTION No. 202-00 - PAGE NUMBER 01 OF 02 - REV A

NOTE:
- POSITION AND SPACING TO BE DETERMINED BY ENGINEER ON SITE.



SECTION B
1:25



DETAIL 1 (Y-SECTION POST ANCHOR)
1:10

NOTES

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2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
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SILT FENCES:

1. SHADE CLOTH REFERS TO ALNET EXTRA BLOCK UV-TREATED SHADE CLOTH OR SIMILAR MATERIAL.
2. SUPPORT NETTING REFERS TO KAYTECH'S FLOWNET OR SIMILAR MATERIAL.
3. ANCHOR AND SPAN WIRE REFERS TO 4mm Ø SANS APPROVED GALVINISED STEEL WIRE.
4. WHERE ROCK IS PRESENT, SHADE CLOTH IS TO BE BOLT ANCHORED ONTO ROCK BASE.
5. WHERE ROCK IS PRESENT, NO SHADE CLOTH APRON, ROCK PACK AND ANCHOR TRENCH IS NECESSARY.
6. WHERE ROCK IS PRESENT, Y-SECTION POSTS ARE TO BE ANCHORED MIN. 600mm DEEP INTO ROCK, AS PER DETAIL 1.

Plot Date: 11/1/2019 3:09:58 PM Office: Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-02-202-00\2018_2_REHAB\1 DWG\B82G-02-202-00_REV.A.DWG

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	13/12/2018	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: X.HAYDRICKS
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION
APPROVED
ENGINEER
DATE: 13/12/2018
REGISTRATION No. 201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	SERIES OF SILT FENCE

DRAWING No.: QUATERNARY No. B82G - WETLAND No. 02 - INTERVENTION No. 202-00 - PAGE NUMBER 02 OF 02 - REV A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Rock/ Gravel Pack
Rehabilitation Objectives	• Stabilise disturbed environment. • Prevent any potential head-cuts and erosion. • Prevent further sediment deposition downstream. • Create environment for indigenous vegetation to re-establish.
Latitude (D°M'S")	S23 25 05.8
Longitude (D°M'S")	E30 54 51.4

Location Photograph: B82G-02-203-00

Bill of Quantities

Item	Description	Units	Quantity
Rock/ Gravel Pack	Placing a layer of gravel (stone)/ placing rocks either directly on NGL or over Geotextile	m3	5.56

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

• All site staff shall be informed of the possibility of the occurrence of subsurface heritage resources and the procedures to be undertaken should such finds occur.
• Should any artefact or suspected artefact (e.g. ash deposits, animal/human bone concentrations, ceramic fragments/ pot shards and formal stone concentrations), or any site of cultural significance be encountered during construction:
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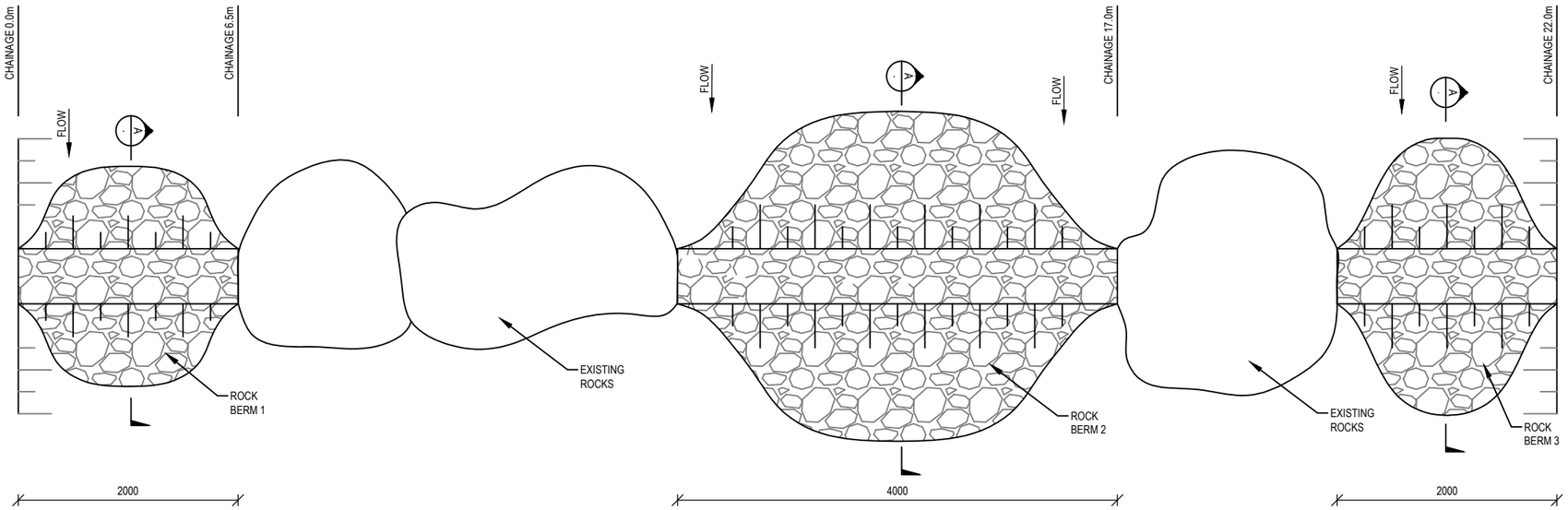
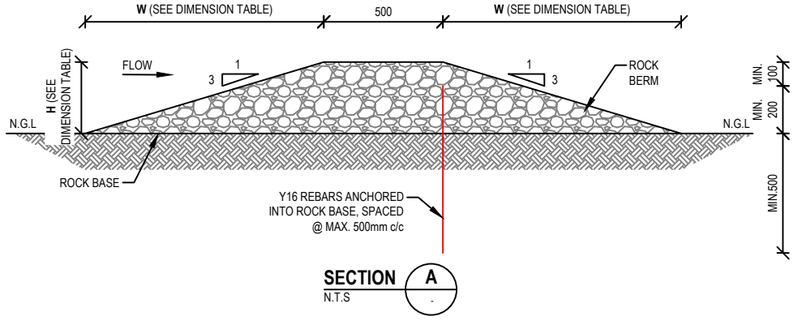
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities

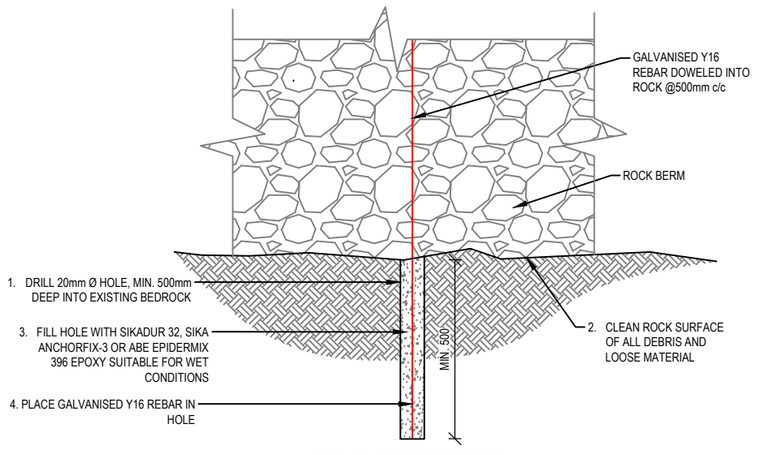


PLAN VIEW
N.T.S



SECTION A
N.T.S

ROCK PACK DIMENSION TABLE		
ROCK BERM NO.	H (mm)	W (mm)
1	500	1500
2	400	1200
3	300	1000



REBAR ANCHOR DETAIL
1:10

NOTES

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ACRONYMS AND ABBREVIATIONS:

1. N.G.L - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

ROCK BERM:

1. 100mm - 200mm STONE TO BE USED IN ROCK PACKS.
2. STONE MUST BE NON-FRIABLE AND INSOLUBLE, e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.

Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-02-203-0002018_2_REHAB\1 DWG\B82G-02-203-00_REVA.DWG

Office:

Plot Date: 5/2/2019 12:47:59 PM

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Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ROCK BERMS

DRAWING No.: QUATERNARY No. B82G - WETLAND No. 02 - INTERVENTION No. 203-00 - PAGE NUMBER 01 OF 01 - REV A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Earth Works
Rehabilitation Objectives	• Take control over water flow. • Restore disturbed environment. • Re-vegetate to stabilise. • Prevent future degradation.
Latitude (D°M'S")	S23 25 12.7
Longitude (D°M'S")	E30 54 37.3

Location Photograph: B82G-02-204-00

Bill of Quantities

Item	Description	Units	Quantity
Earth Works	Cut, slope, fill (into GeoCells) & removal of soil for excavations and replacing topsoil	m3	17.00
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	300.00

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• All site staff shall be informed of the possibility of the occurrence of subsurface heritage resources and the procedures to be undertaken should such finds occur.
• Should any artefact or suspected artefact (e.g. ash deposits, animal/human bone concentrations, ceramic fragments/ pot shards and formal stone concentrations), or any site of cultural significance be encountered during construction:
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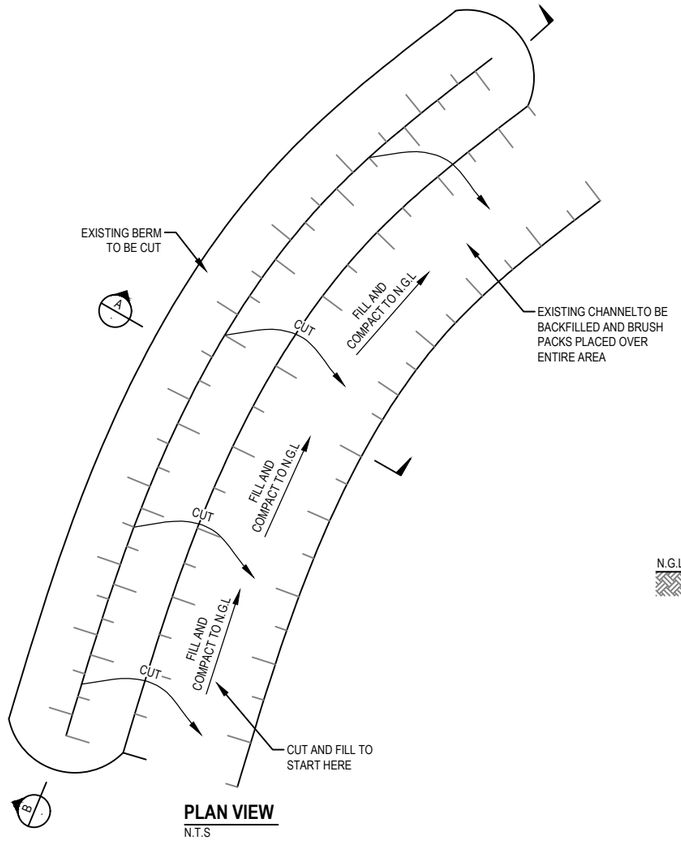
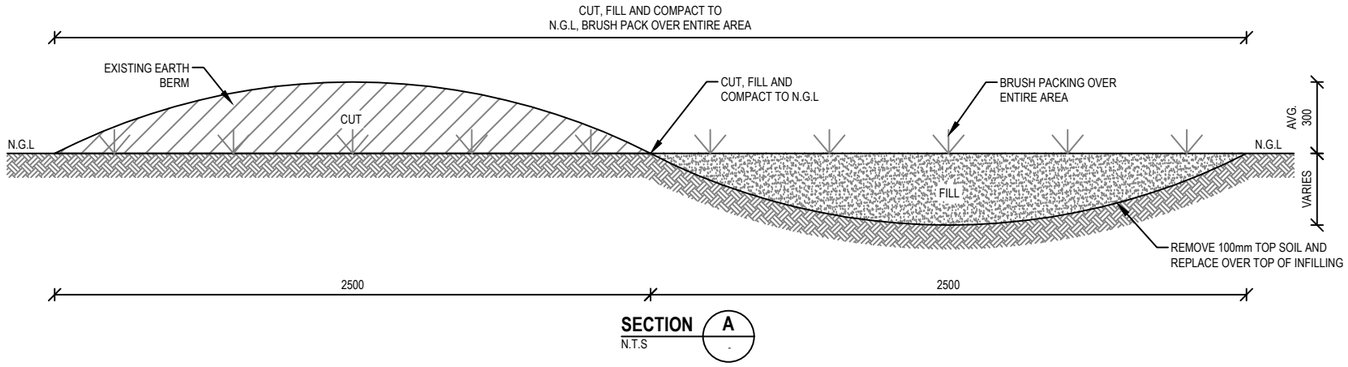
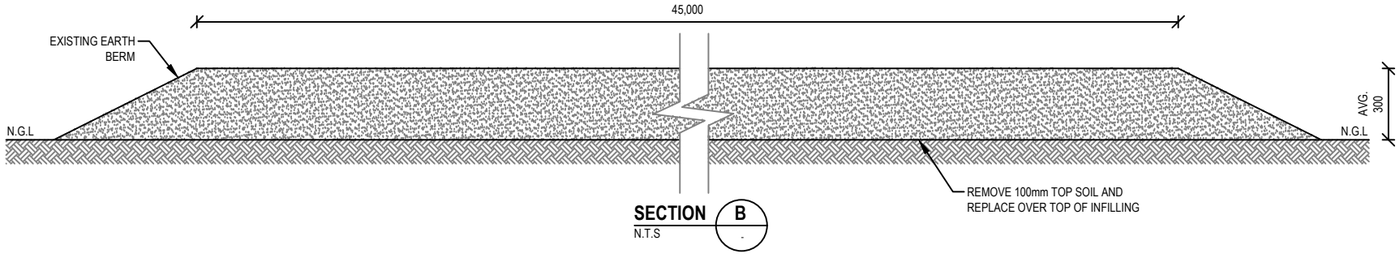
o Should human remains be discovered, the South Africa Police Services (SAPS) and the provincial heritage authority shall be notified immediately.
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities



PLAN VIEW
N.T.S



SECTION A
N.T.S



SECTION B
N.T.S

NOTE:
- ENGINEER TO CONFIRM VOLUMES DURING SETTING OUT.

BILL OF QUANTITIES

ITEM NO.	DESCRIPTION	UNIT	QTY
1	EST. EARTHWORKS (CUT)	m^3	17.0
2	EST. EARTHWORKS (FILL)	m^3	17.0
3	BRUSH PACKING	m^2	300.0

NOTES

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
REGISTRATION No. 201170106
DATE 04/02/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	EARTH WORKS (CUT AND FILL)

DRAWING No. B82G - 02 - 204-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	23/01/2019
Type	New
Description	Fencing
Rehabilitation Objectives	• Construct cattle fence, to control their movement. • Prevent trampling and destruction of sensitive 'eye' area.
Latitude (D°M'S")	S23 25 10.99
Longitude (D°M'S")	E30 54 42.07

Location Photograph: B82G-02-204-00

Bill of Quantities

Item	Description	Units	Quantity
Fencing	Fencing to specifications to include e.g. 4 or 5 strand live stock fence or game fences	m	353.00

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

Note that the location and specification of the pathway from the gate to the open waterbody must be approved by the aquatic specialist prior to the commencement of implementation.

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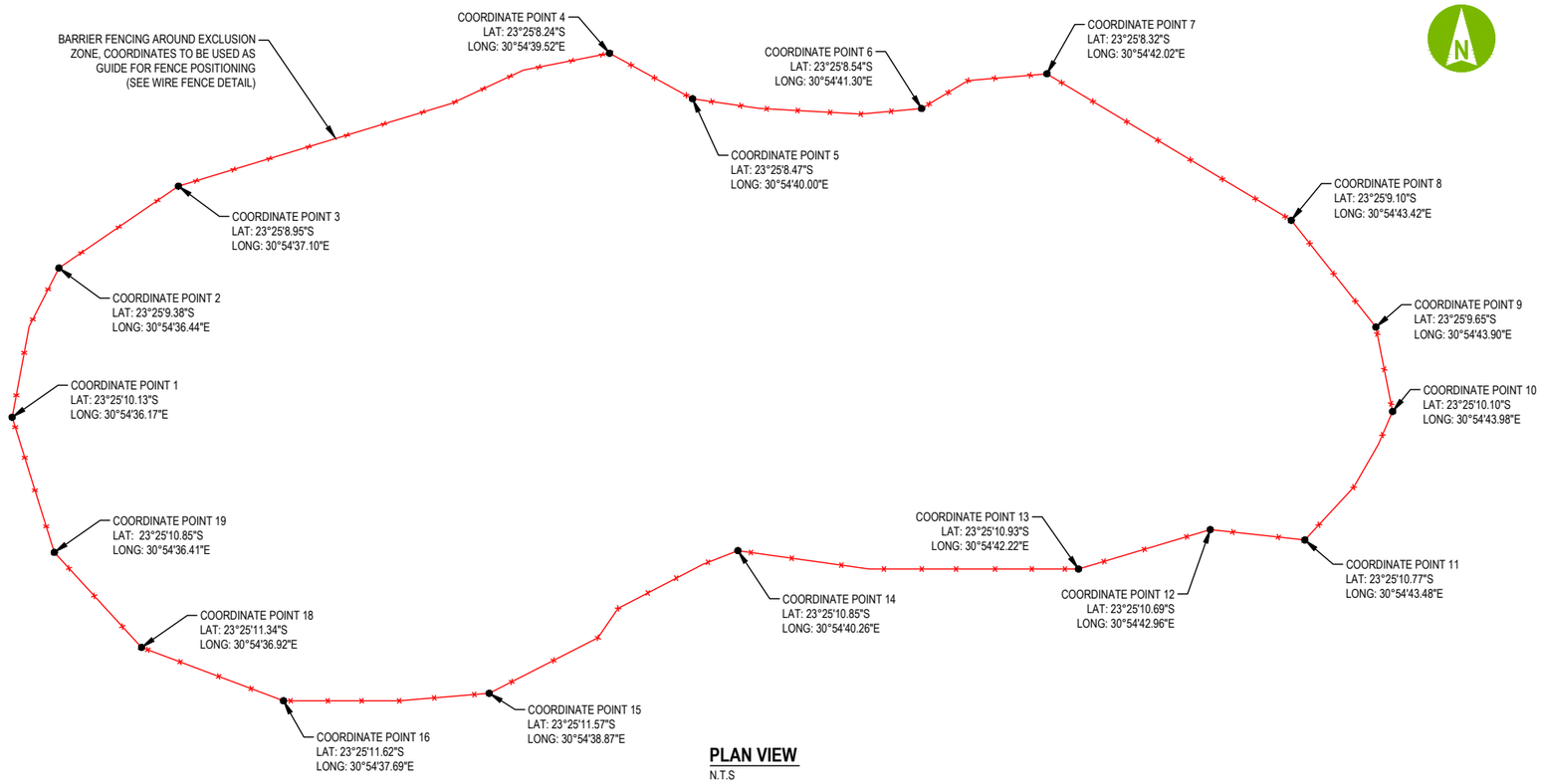

PLAN VIEW
N.T.S

FENCING SPECIFICATIONS:

CORNER, END, STRAINING AND GATE POSTS

- THESE ARE TO BE 108mm OUTSIDE DIAMETER STEEL TUBING WITH A WALL THICKNESS OF 3mm. 2.15m LONG AND FILLED WITH GROUT OR CAPPED AFTER ERECTION OF THE FENCE. ALTERNATIVELY 15 kg/m RAIL SECTIONS OR CREOSOTED TIMBER POSTS WITH A TOP DIAMETER OF AT LEAST 125mm MAY BE USED. TIMBER POSTS ARE TO COMPLY WITH SAGS 457 AND ARE NOT TO BE USED IN AREAS WHERE THE DANGER OF VELD FIRES ARE HIGH. ALL POSTS ARE TO BE BRACED AS SHOWN AND ARE TO BE PROVIDED WITH RESTRAINING BOLTS TO ACCOMMODATE WIRES AS DETERMINED BY THE CLASS OF FENCING. MAXIMUM SPACING OF STRAINING POSTS IS TO BE 500m. ALL POSTS TO BE HOT-DIP GALVANISED (CLASS A) ACCORDING TO SAGS 763.

STANDARDS

- THE STUDDED Y-SECTION FENCING POSTS OF MASS 2.5 kg/m. 1.85m LONG ARE RECOMMENDED AS THERE ARE NOTCHES AT 25mm INTERVALS. ALLOWING VERSATILITY OF SPACING WIRES. SPACING OF STANDARDS IS TO BE 12m AND THEY ARE TO BE TIED TO EACH WIRE. TO BE HOT-DIP GALVANISED (CLASS A) ACCORDING TO SASS 783.

DROPPERS

- RIDGEBACK T-SECTION MILD STEEL DROPPERS OF 1.35m LENGTH ARE TO BE SPACED AT 3m INTERVALS BETWEEN STANDARDS. AND TIED TO EACH WIRE. TO BE HOT-DIP GALVANISED (CLASS A) IN ACCORDANCE WITH SAGS 763.

FENCING WIRE

- ALL BARBED WIRE IS TO BE DOUBLE STRANDED GALVANISED MILD STEEL WIRE OF DIAMETER 2.5mm SPACED AS SHOWN ON THE RELEVANT DRAWINGS. BARB SPACING IS TO BE 125mm.
- CAUTION SHOULD BE EXERCISED TO ENSURE THAT WIRES ARE NOT OVER TENSIONED SINCE WHEN TEMPERATURES DROP AT NIGHT. TENSION WILL BUILD UP IN THE WIRES CAUSING DAMAGE TO THE GALVANISING AND/OR CORNER POSTS TO BE PULLED OVER.
- DIAMETER OF WIRE MESH SHALL BE 3.15mm AND APERTURE SIZE OF MESH NOT GREATER THAN 50mm. BARBED WIRE & WIRE MESH TO BE HOT-DIP GALVANISED (CLASS A) IN ACCORDANCE WITH SAGS 675.

GATES

- GATES ARE TO BE CONFORM TO THE STANDARDS OF THE SURROUNDING FENCE WITH RESPECT TO HEIGHT AND MESH.
- THE FRAMES SHALL BE FABRICATED FROM MILD STEEL TUBING HAVING CONTINUOUSLY WELDED SEAMS AND THIS TUBING SHALL HAVE A DIAMETER OF 50mm AND A WALL THICKNESS OF 2.5mm IN THE CASE OF MAIN FRAME MEMBERS AND 32mm AND 2mm RESPECTIVELY IN THE CASE OF BRACING MEMBERS. THE CLEAR OPENING OF ALL GATES IS TO BE 4.27m. TO BE HOT-DIP GALVANISED (CLASS A) IN ACCORDANCE WITH SAGS 763.

NOTES

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3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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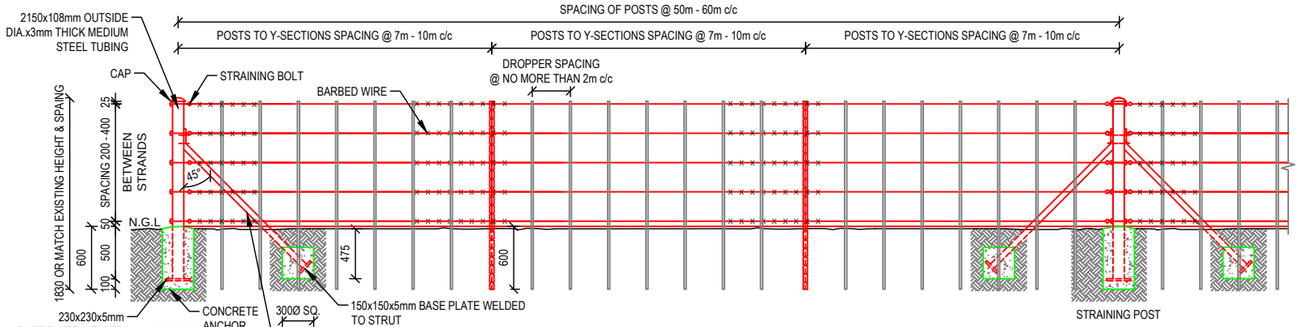
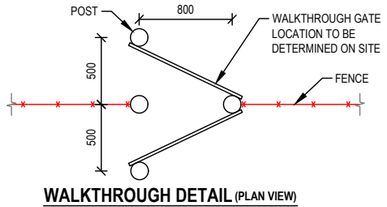
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

FENCING:

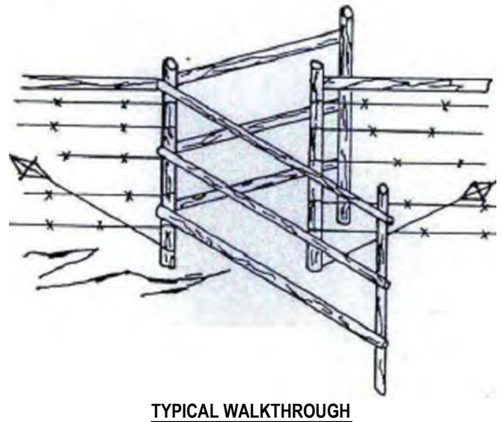
1. MAXIMUM SPACING OF STRAINING POSTS TO BE 500mm AT ANY POINT WHERE A CHANGE IN DIRECTION IS APPARENT A STRAINING POST SHOULD BE INSERTED.
2. FOR CORNER POSTS BRACE BOTH WAYS.
3. ALL ELEMENTS TO BE HOT-DIP GALVANISED (CLASS A) ACCORDING TO SANS 675 & SANS 121.
4. FENCING MATERIALS AND GATES TO BE ACCORDING PROJECT SPECIFICATIONS.
5. DRILLING, CUTTING AND WELDING MUST BE DONE BEFORE GALVANISING.
6. CONCRETE TO BE MINIMUM 15MPa & MIX:
   1 BAG CEMENT
   125L SAND
   120L STONE
   30L WATER
7. NOMINAL STONE SIZE OF 19mm-26mm FOR CONCRETE.



5 STRAND BARBED WIRE FENCE TYPE
N.T.S



WALKTHROUGH DETAIL (PLAN VIEW)
N.T.S



TYPICAL WALKTHROUGH
N.T.S

BILL OF QUANTITIES

ITEM No.	DESCRIPTION	UNIT	QTY
1	EST. FENCING	m	550.0

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Office:

Plot Date: 25/1/2019 2:19:57 PM

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	23/01/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

PRELIMINARY
NOT FOR CONSTRUCTION

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW
APPROVED
ENGINEER
DATE: 23/01/2019
REGISTRATION No.: 201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BARRIER FENCING

DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
	B82G	02	205-00	01 OF 01	A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	25/01/2019
Type	New
Description	Eco Logs
Rehabilitation Objectives	• Stabilise disturbed environment. • Discontinue directional flows. • Slow water down and prevent erosion. • Create environment for indigenous vegetation to re-establish.
Latitude (D°M'S")	S23 25 13.38
Longitude (D°M'S")	E30 54 53.58

Location Photograph: B82G-03-201-00

Bill of Quantities

Item	Description	Units	Quantity
Eco Logs	Supply and place Erosion Control eco logs as per design (incl. limited excavation where required)	m	6.00
Earth Works	Cut, slope, fill (into GeoCells) & removal of soil for excavations and replacing topsoil	m3	0.30
Re-vegetation	Planting or seeding vegetation into earth filled GeoCells & over earth works/ structures with topsoil	m2	2.00
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	31.50

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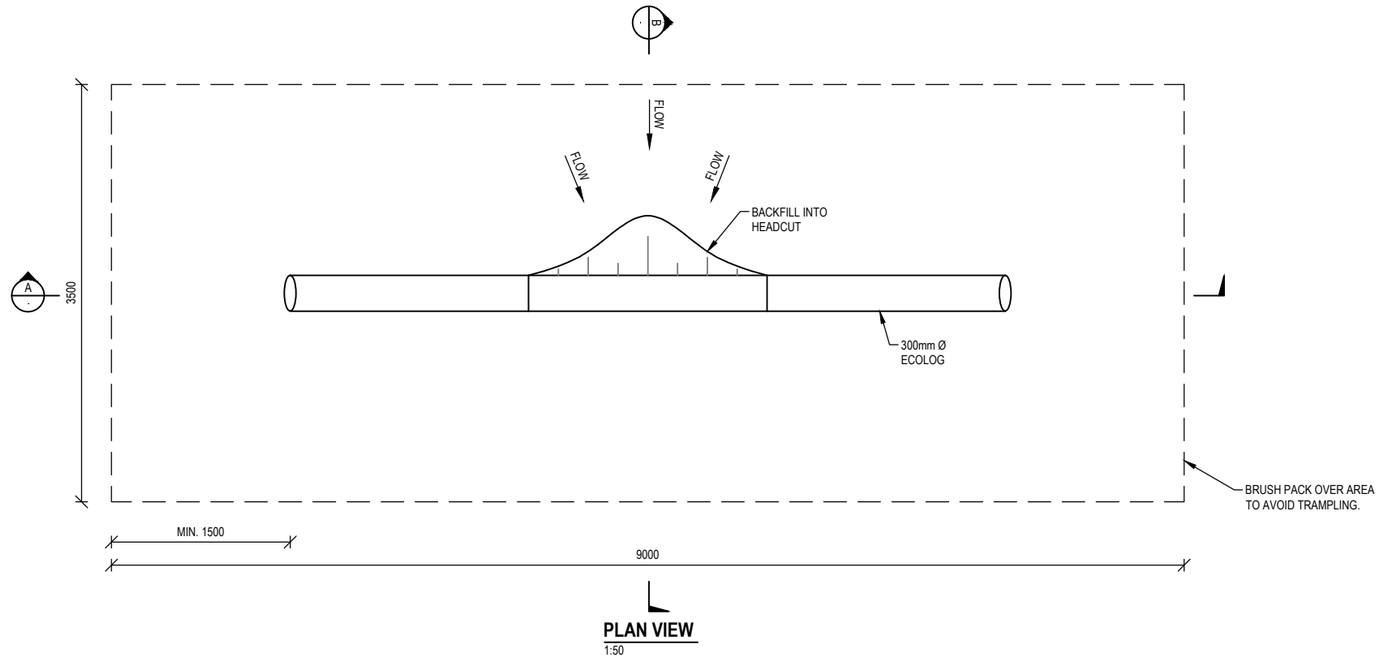
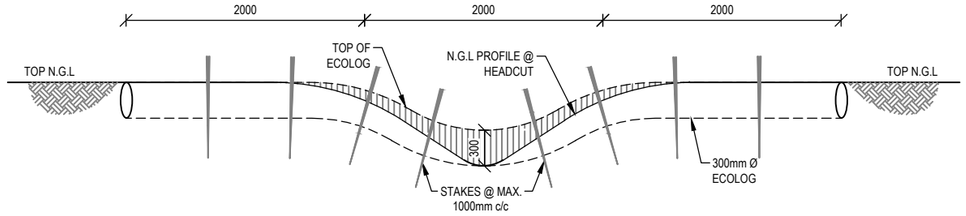
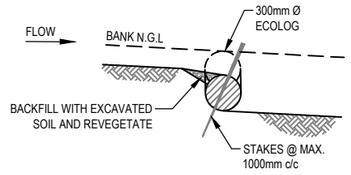
NOTE:
SETTING OUT TO BE DONE BY ENGINEER ON SITE.



PLAN VIEW
1:50



SECTION A
1:50



SECTION B
1:50

NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. LIMITED GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON-STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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ACRONYMS AND ABBREVIATIONS:

1. N.G.L - NATURAL GROUND LEVEL
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3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
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3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

ECOLOGS:

1. WOODEN PEGS USED TO ANCHOR ECOLOGS ARE TO BE NO LESS THAN 40mm Ø AND 1000mm IN LENGTH.
2. PEGS SHOULD PROTRUDE NO LESS THAN 600mm FROM THE SOIL @ 1000 c/c.
3. WHERE ECOLOGS ARE PLACED ACROSS A CHANNEL, ENSURE THAT THE CENTRE POINT OF THE ECOLOG IS LOWER THAN THE TOP OF THE CHANNEL BANKS AND THAT THE ECOLOG ENDS ARE KEYED INTO EACH BANK A MIN. OF 1000mm.

Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-03-201-0002018_2_REHAB\1 DWG\B82G-03-201-00_REVA.DWG
Office:
Plot Date: 30/1/2019 11:34:41 AM

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Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	25/01/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: X.HAYDRICKS
DESIGNED: P.C.BLAAUW
CHECKED: J.MORRISON

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	ECOLOG

DRAWING No. B82G - 03 - 201-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	25/01/2019
Type	New
Description	Eco Logs
Rehabilitation Objectives	• Stabilise disturbed environment. • Discontinue directional flows. • Slow water down and prevent erosion. • Create environment for indigenous vegetation to re-establish.
Latitude (D°M'S")	S23 25 8.17
Longitude (D°M'S")	E30 54 57.27

Location Photograph: B82G-03-202-00

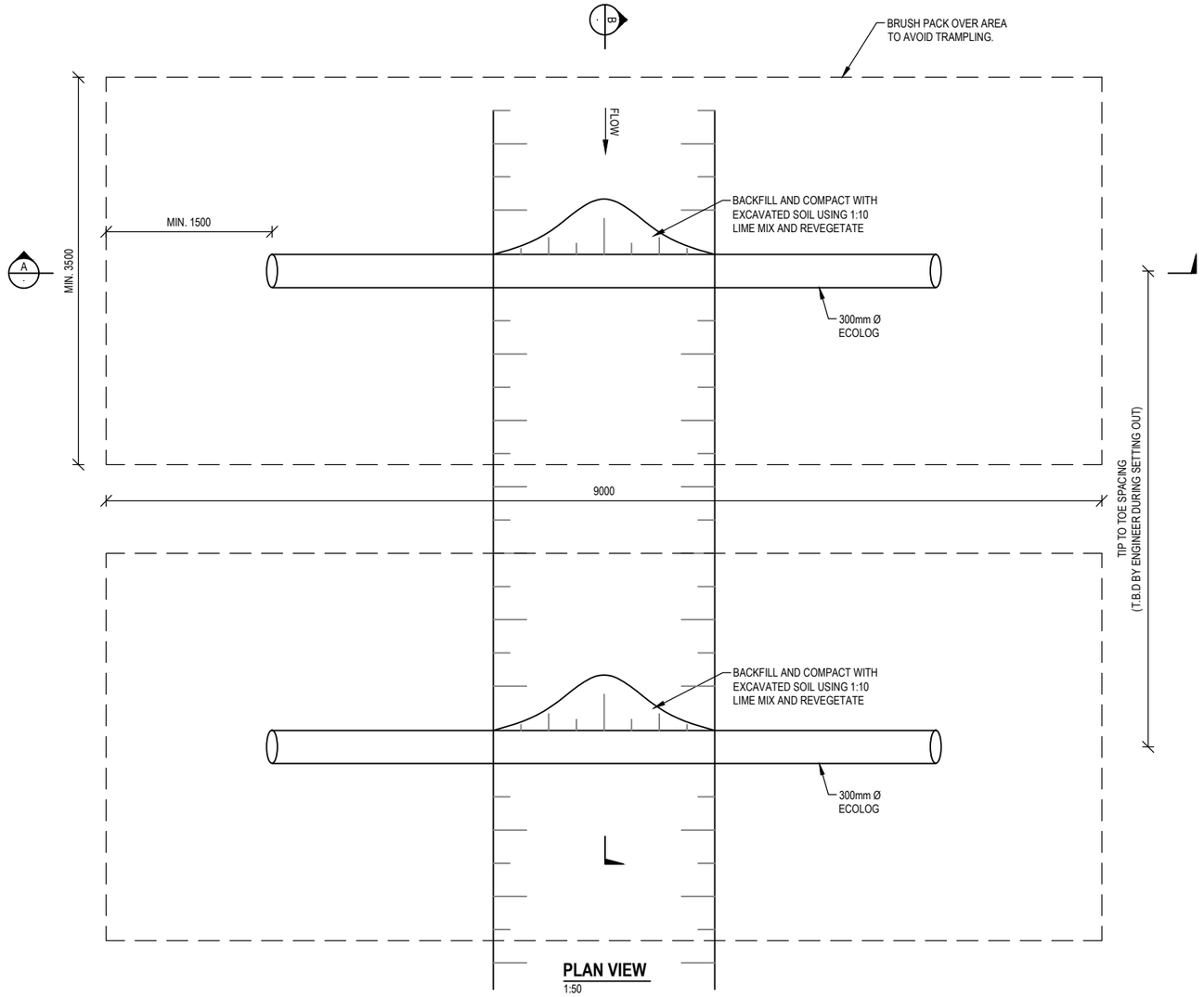
Bill of Quantities

Item	Description	Units	Quantity
Eco Logs	Supply and place Erosion Control eco logs as per design (incl. limited excavation where required)	m	36.00
Earth Structures	Construction of compacted berms or other components with or without lime, gypsum, cement (for soil crete) etc.	m3	0.85
Re-vegetation	Planting or seeding vegetation into earth filled GeoCells & over earth works/ structures with topsoil	m2	40.00
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	147.00

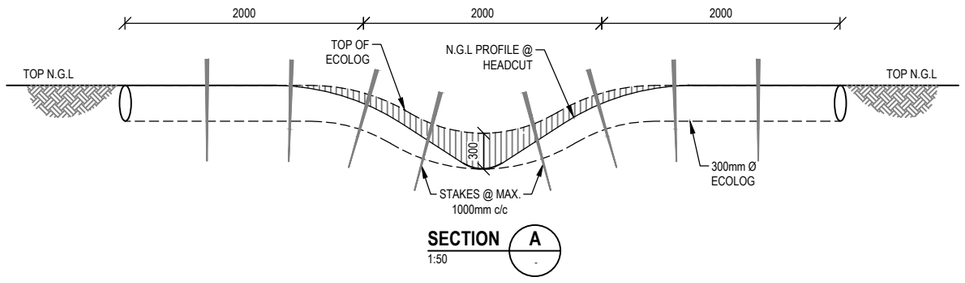
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

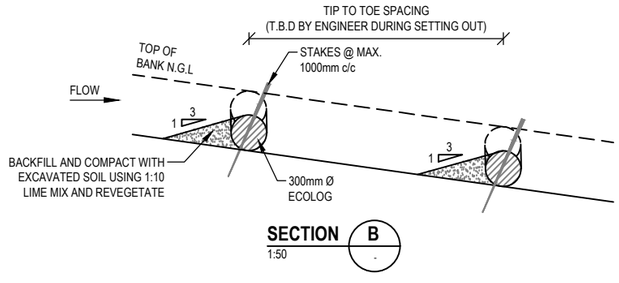
• All site staff shall be informed of the possibility of the occurrence of subsurface heritage resources and the procedures to be undertaken should such finds occur.
• Should any artefact or suspected artefact (e.g. ash deposits, animal/human bone concentrations, ceramic fragments/ pot shards and formal stone concentrations), or any site of cultural significance be encountered during construction:
o The Contractor must immediately stop work within a 50m radius of the site and immediately alert the relevant authorities.
o The area around the discovery (with a 50m radius buffer) shall be cordoned off until such time that work is authorised to proceed. Public access to the site must be limited.
o Should human remains be discovered, the South Africa Police Services (SAPS) and the provincial heritage authority shall be notified immediately.
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities.



PLAN VIEW
1:50



SECTION A
1:50



SECTION B
1:50

NOTE:
- INTERVENTION CONSISTS OF A SERIES OF ECOLOGS WITH POSITIONING AND SPACING TO BE DETERMINED BY THE ENGINEER ON SITE.

NOTES

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Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-03-202-00\2018_2_REHAB\1 DWG\B82G-03-202-00_REVA.DWG

Office:

Plot Date: 31/1/2019 10:56:33 AM

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	25/01/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	SERIES OF ECOLOGS

DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
	B82G	03	202-00	01 OF 01	A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.
Latitude (D°M'S")	S23 25 15.9
Longitude (D°M'S")	E30 54 54.54

Location Photograph: B82G-04-201-00

Bill of Quantities

Item	Description	Units	Quantity
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	240.00

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

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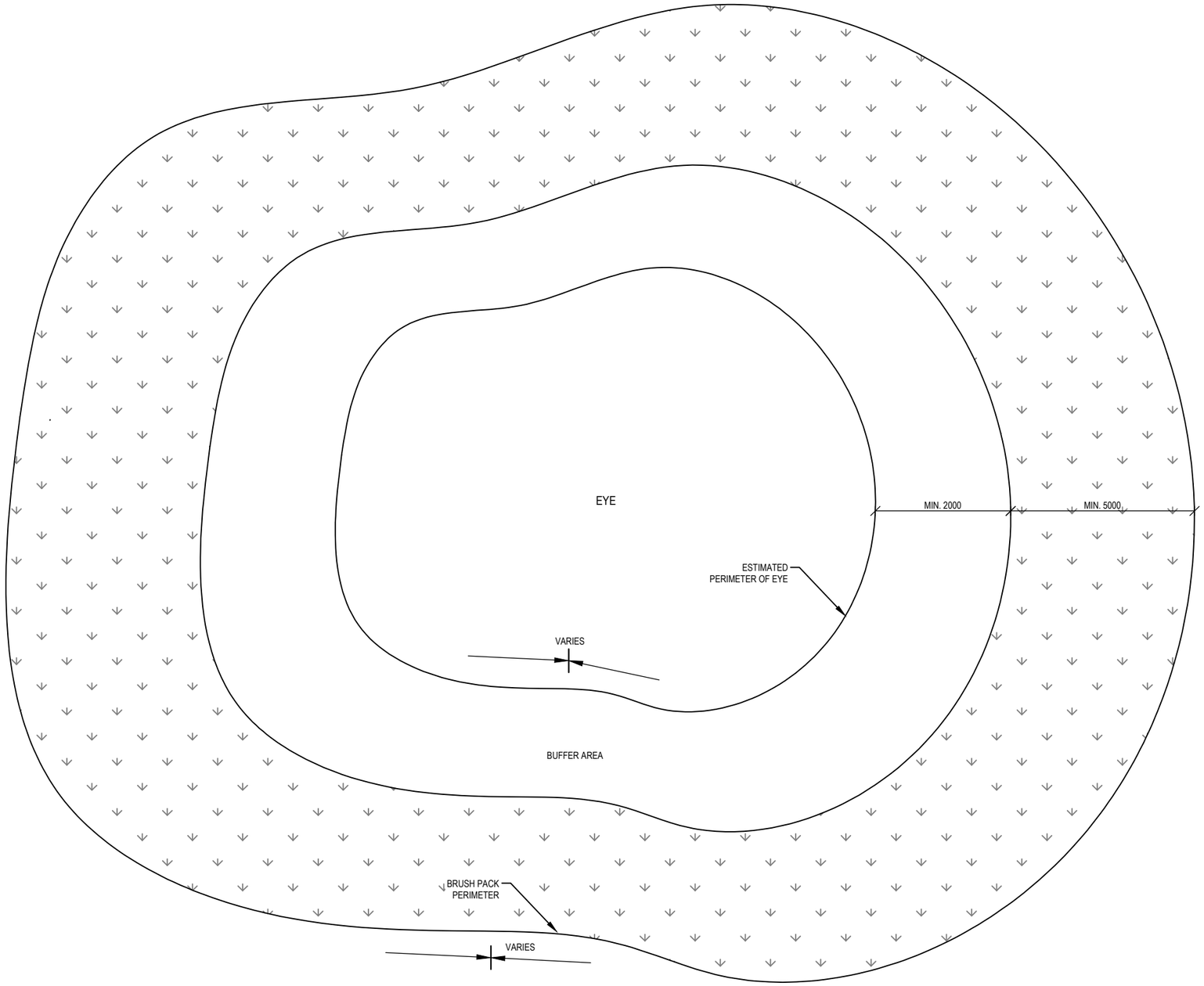

PLAN VIEW
N.T.S

NOTE:
- DRAWING OF PLACING OF BRUSH PACKS AROUND EYES.
- BOQ AND POSITIONING OF BRUSH PACK TO BE DETERMINED BY ENGINEER DURING SETTING OUT.

NOTES

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Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
REGISTRATION No. 201170106
DATE 04/02/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BRUSH PACKING

DRAWING No. B82G - 04 - 201-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.
Latitude (D°M'S")	S23 25 16.26
Longitude (D°M'S")	E30 54 55.02

Location Photograph: B82G-04-202-00

Bill of Quantities

Item	Description	Units	Quantity
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	240.00

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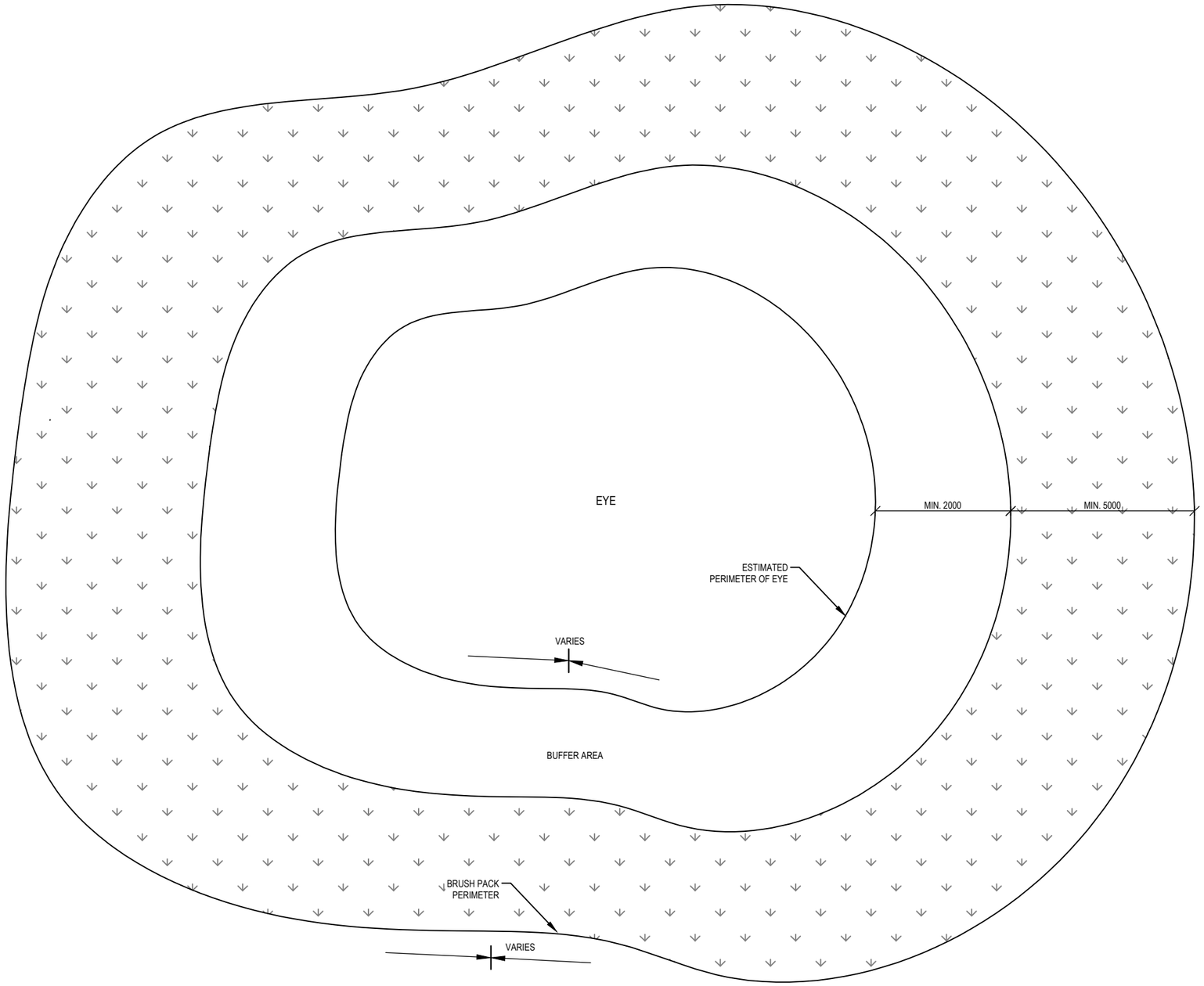

PLAN VIEW
N.T.S

NOTE:
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DISPERSIVE SOILS:
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Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-04-202-00\2018_2_REHAB\1 DWG\B82G-04-202-00_REVA.DWG
Office:
Plot Date: 5/2/2019 11:28:19 AM

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Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	AS SHOWN
SIZE	A3
DRAWN	J.MORRISON
DESIGNED	P.C.BLAAUW
CHECKED	P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE
04/02/2019
REGISTRATION No.
201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BRUSH PACKING

DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
	B82G	04	202-00	01 OF 01	A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.
Latitude (D°M'S")	S23 25 16.56
Longitude (D°M'S")	E30 54 54.66

Location Photograph: B82G-04-203-00

Bill of Quantities

Item	Description	Units	Quantity
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	240.00

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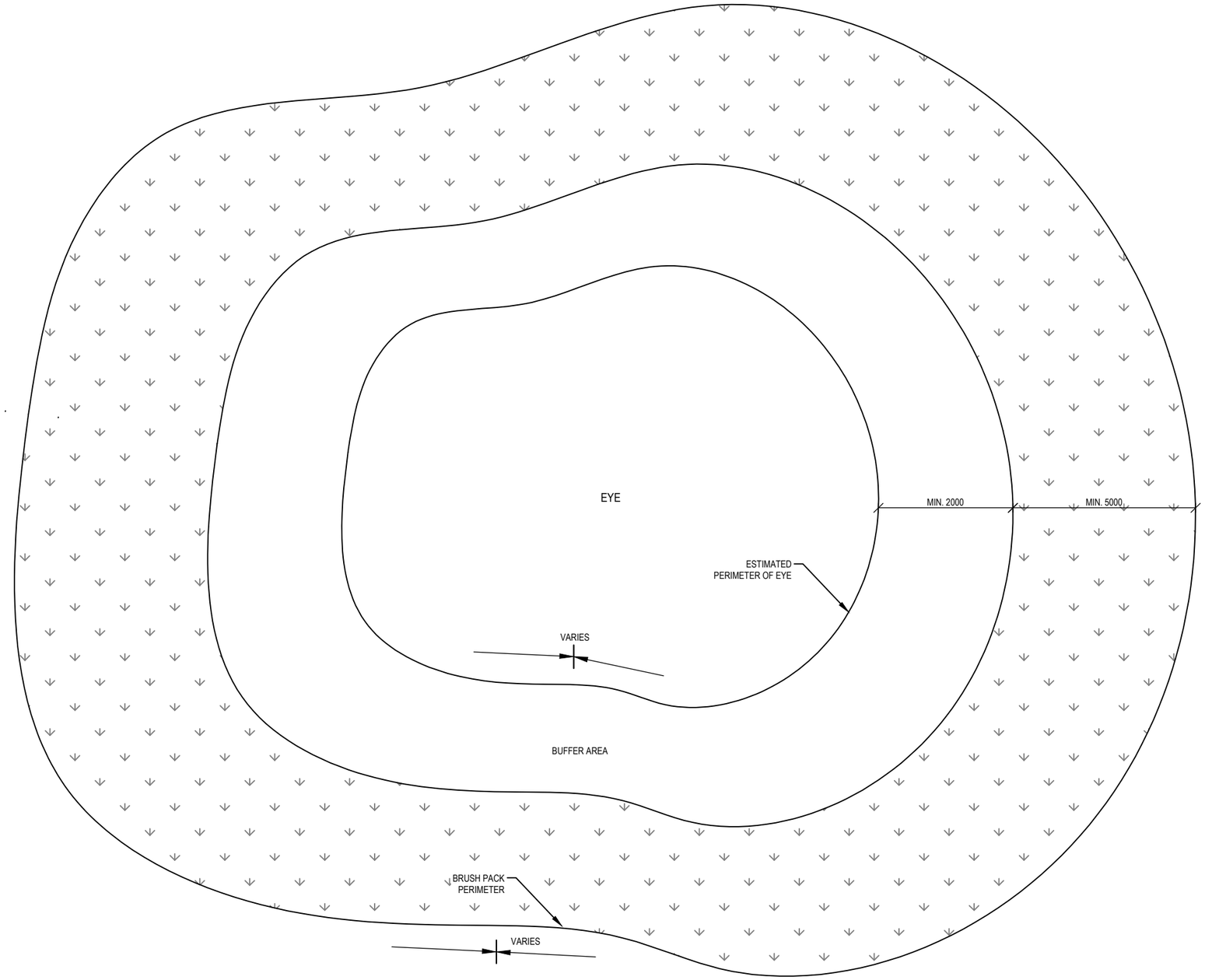
NOTE:

- DRAWING OF PLACING OF BRUSH PACKS AROUND EYES.
- BOQ AND POSITIONING OF BRUSH PACK TO BE DETERMINED BY ENGINEER DURING SETTING OUT.



PLAN VIEW
N.T.S

NOTES

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ACRONYMS AND ABBREVIATIONS:

1. N.G.L - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

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Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE: 04/02/2019
REGISTRATION No. 201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BRUSH PACKING

DRAWING No. B82G - 04 - 203-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.
Latitude (D°M'S")	S23 25 18.42
Longitude (D°M'S")	E30 54 55.14

Location Photograph: B82G-04-204-00

Bill of Quantities

Item	Description	Units	Quantity
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	240.00

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

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o Should human remains be discovered, the South Africa Police Services (SAPS) and the provincial heritage authority shall be notified immediately.
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities

NOTE:

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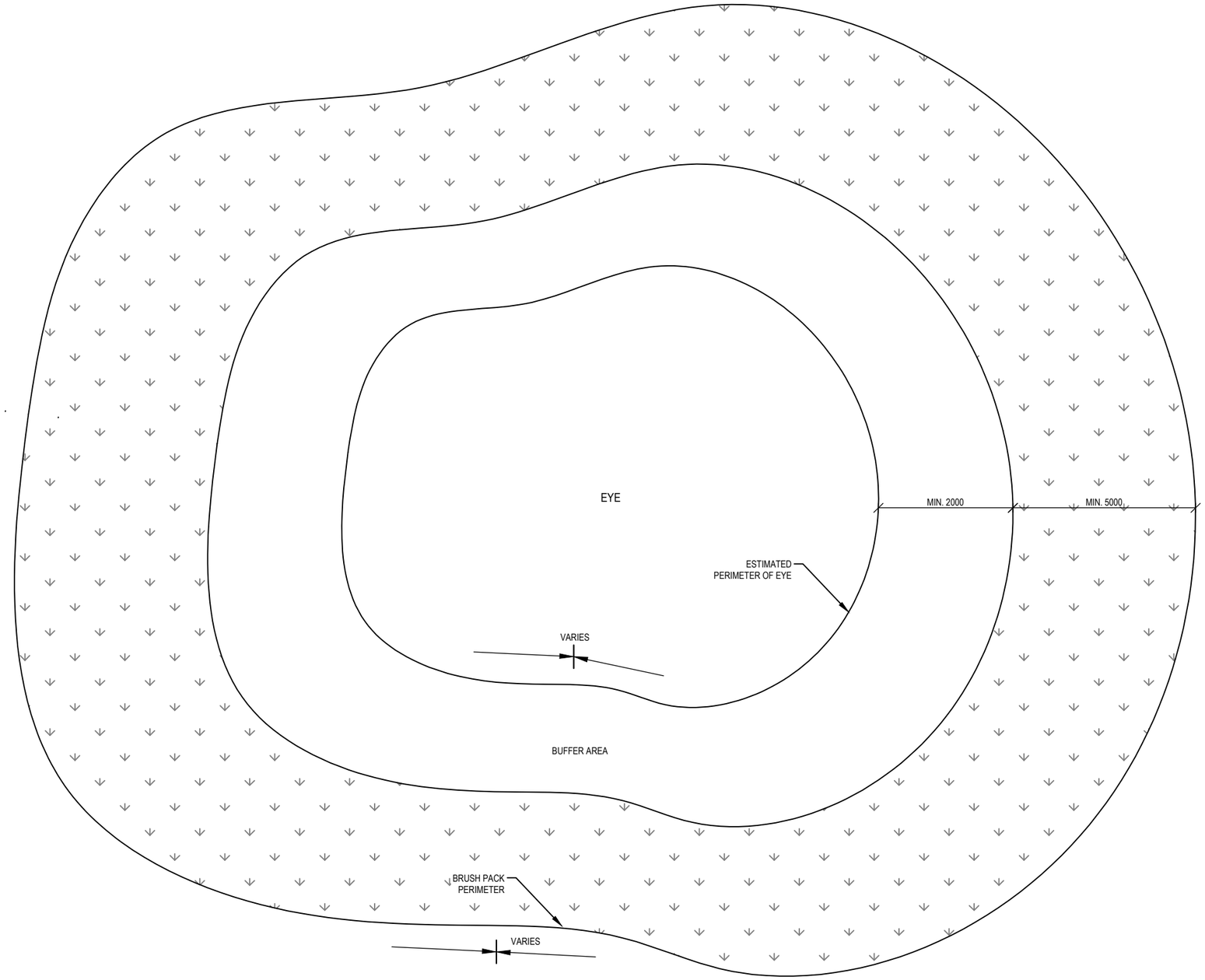
- BOQ AND POSITIONING OF BRUSH PACK TO BE DETERMINED BY ENGINEER DURING SETTING OUT.



PLAN VIEW
N.T.S

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	AS SHOWN
SIZE	A3
DRAWN	J.MORRISON
DESIGNED	P.C.BLAAUW
CHECKED	P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
DATE 04/02/2019
REGISTRATION No. 201170106

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BRUSH PACKING

DRAWING No. B82G - 04 - 204-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.
Latitude (D°M'S")	S23 25 15.16
Longitude (D°M'S")	E30 54 54.89

Location Photograph: B82G-04-205-00

Bill of Quantities

Item	Description	Units	Quantity
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	240.00

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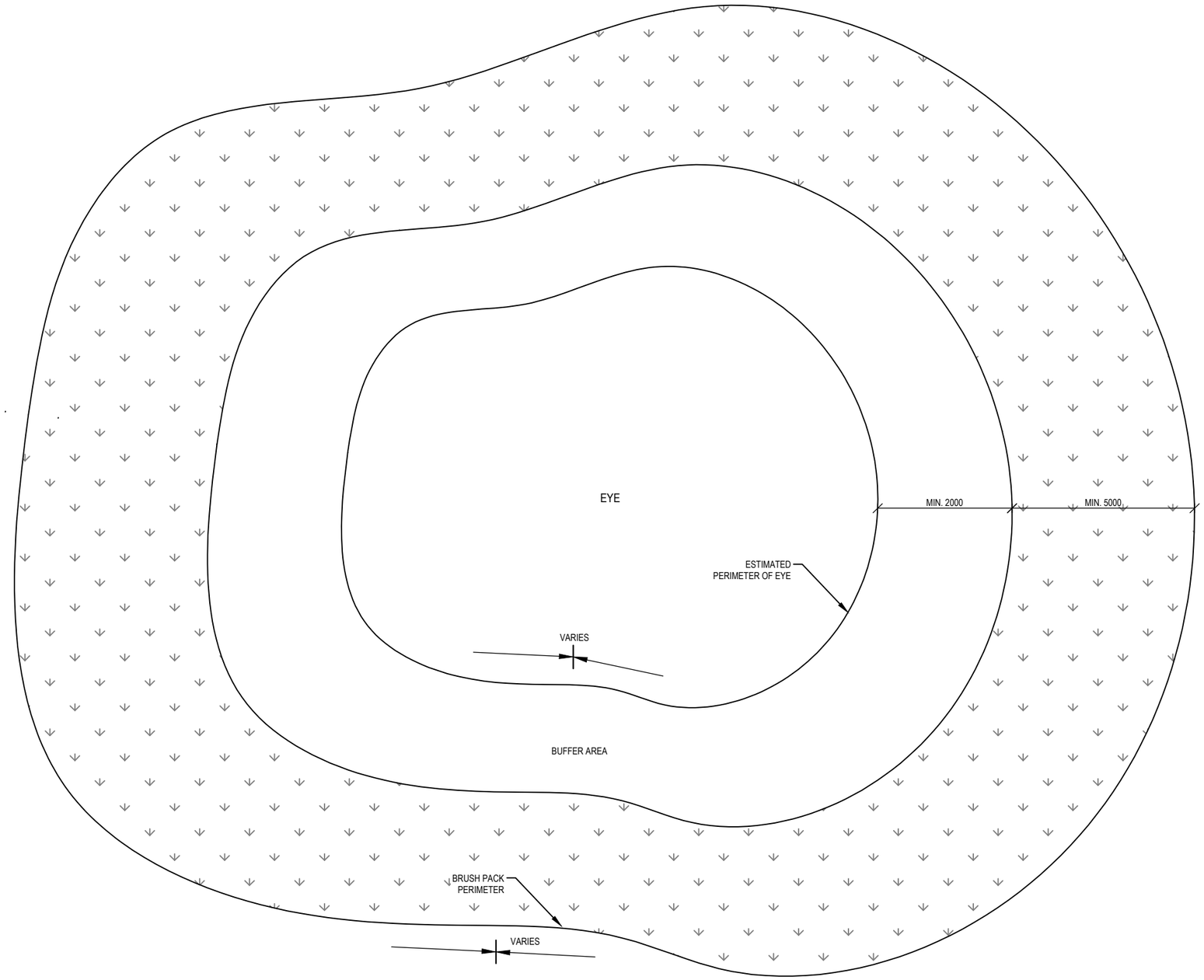

PLAN VIEW
N.T.S

NOTE:
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Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
REGISTRATION No. 201170106
DATE 04/02/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BRUSH PACKING

DRAWING No. B82G - 04 - 205-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.
Latitude (D°M'S")	S23 25 15.52
Longitude (D°M'S")	E30 54 58.89

Location Photograph: B82G-04-206-00

Bill of Quantities

Item	Description	Units	Quantity
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	240.00

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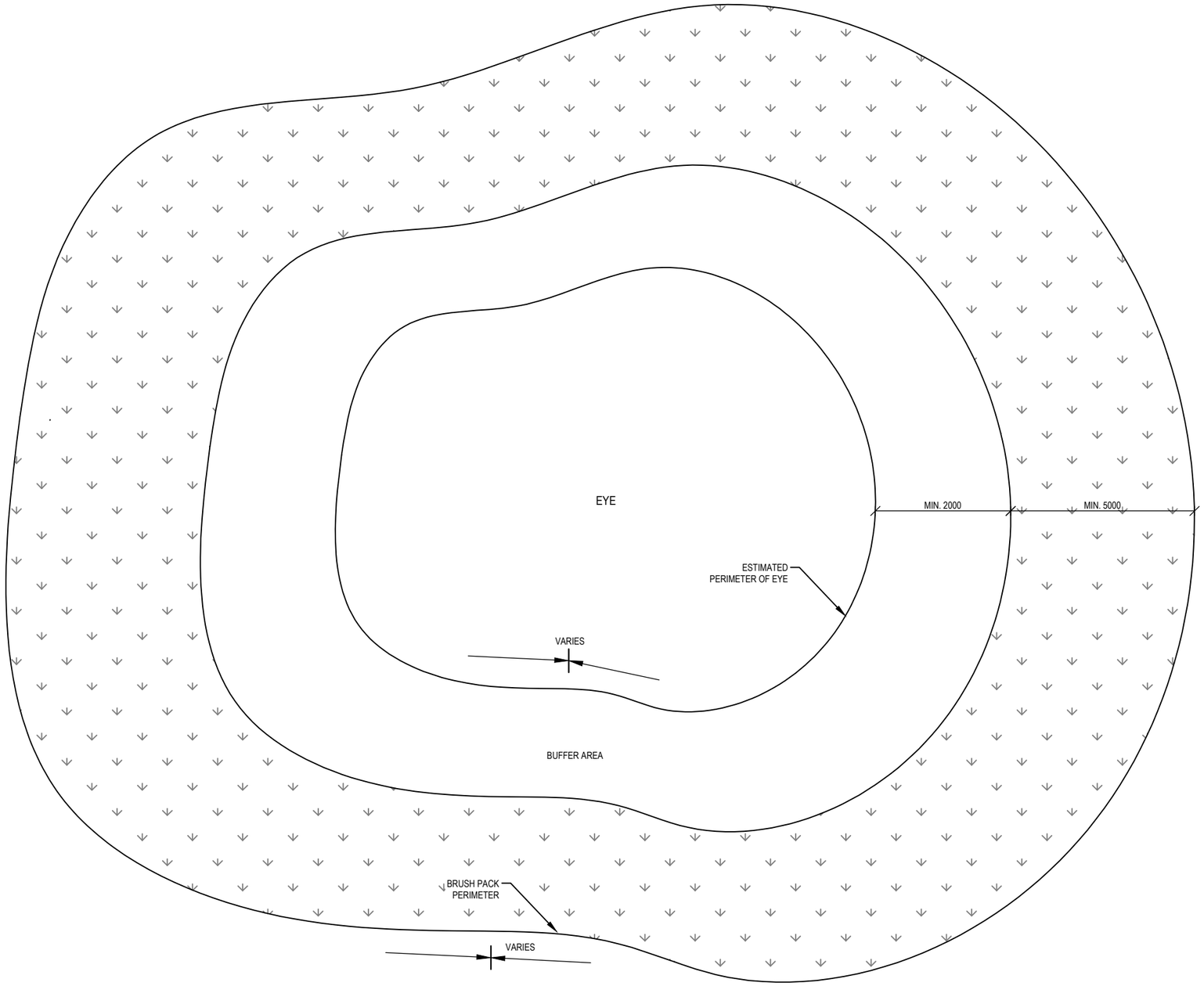

PLAN VIEW
N.T.S

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Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	AS SHOWN
SIZE	A3
DRAWN	J.MORRISON
DESIGNED	P.C.BLAAUW
CHECKED	P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED	
ENGINEER	DATE
REGISTRATION No. 201170106	04/02/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BRUSH PACKING

DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
	B82G	04	206-00	01 OF 01	A

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.
Latitude (D°M'S")	S23 25 19.27
Longitude (D°M'S")	E30 54 58.74

Location Photograph: B82G-04-207-00

Bill of Quantities

Item	Description	Units	Quantity
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	240.00

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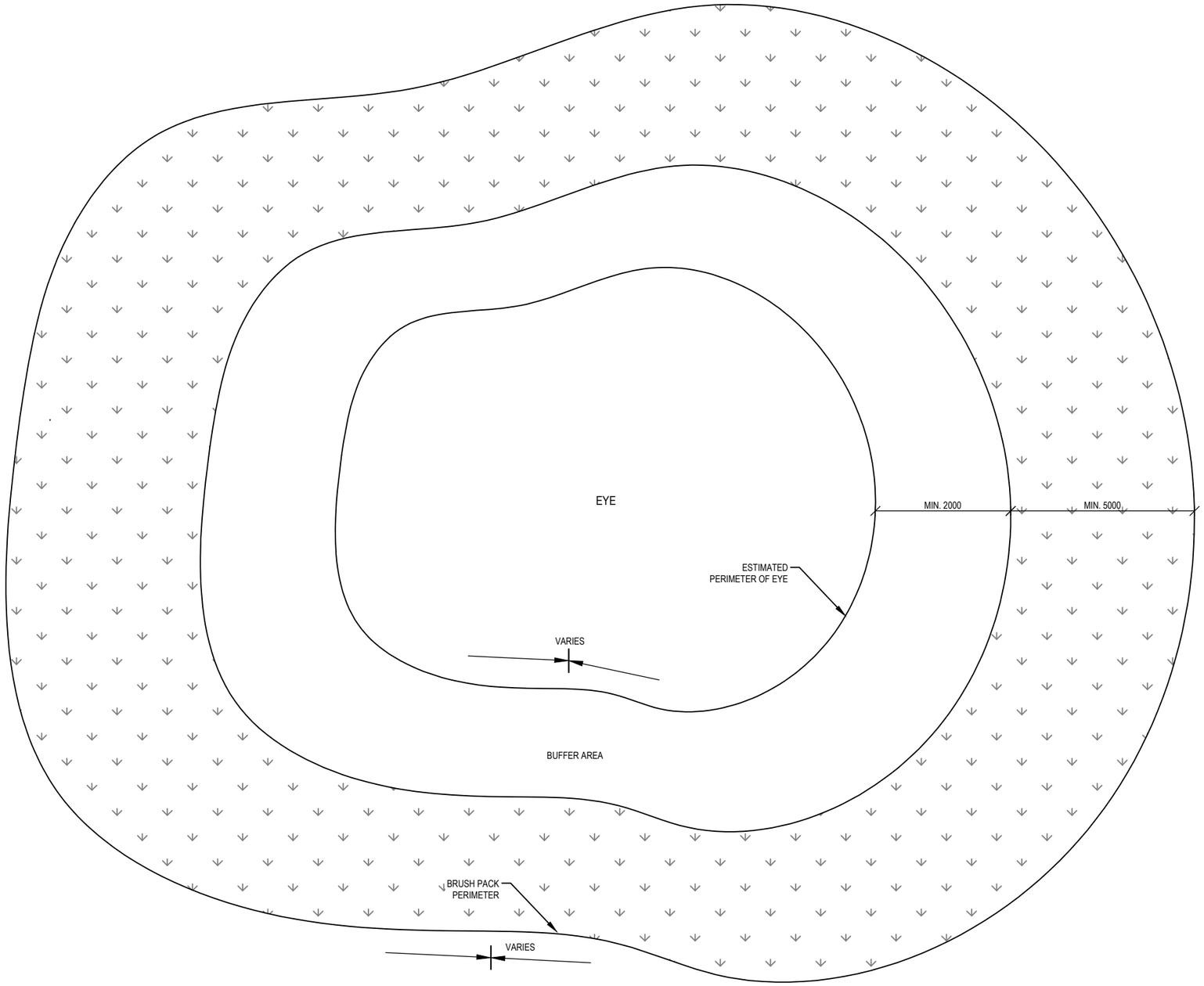

PLAN VIEW
N.T.S

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SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
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PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
ENGINEER
REGISTRATION No. 201170106
DATE 04/02/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BRUSH PACKING

DRAWING No. B82G - 04 - 207-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.
Latitude (D°M'S")	S23 25 20.86
Longitude (D°M'S")	E30 54 59.67

Location Photograph: B82G-04-208-00

Bill of Quantities

Item	Description	Units	Quantity
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	240.00

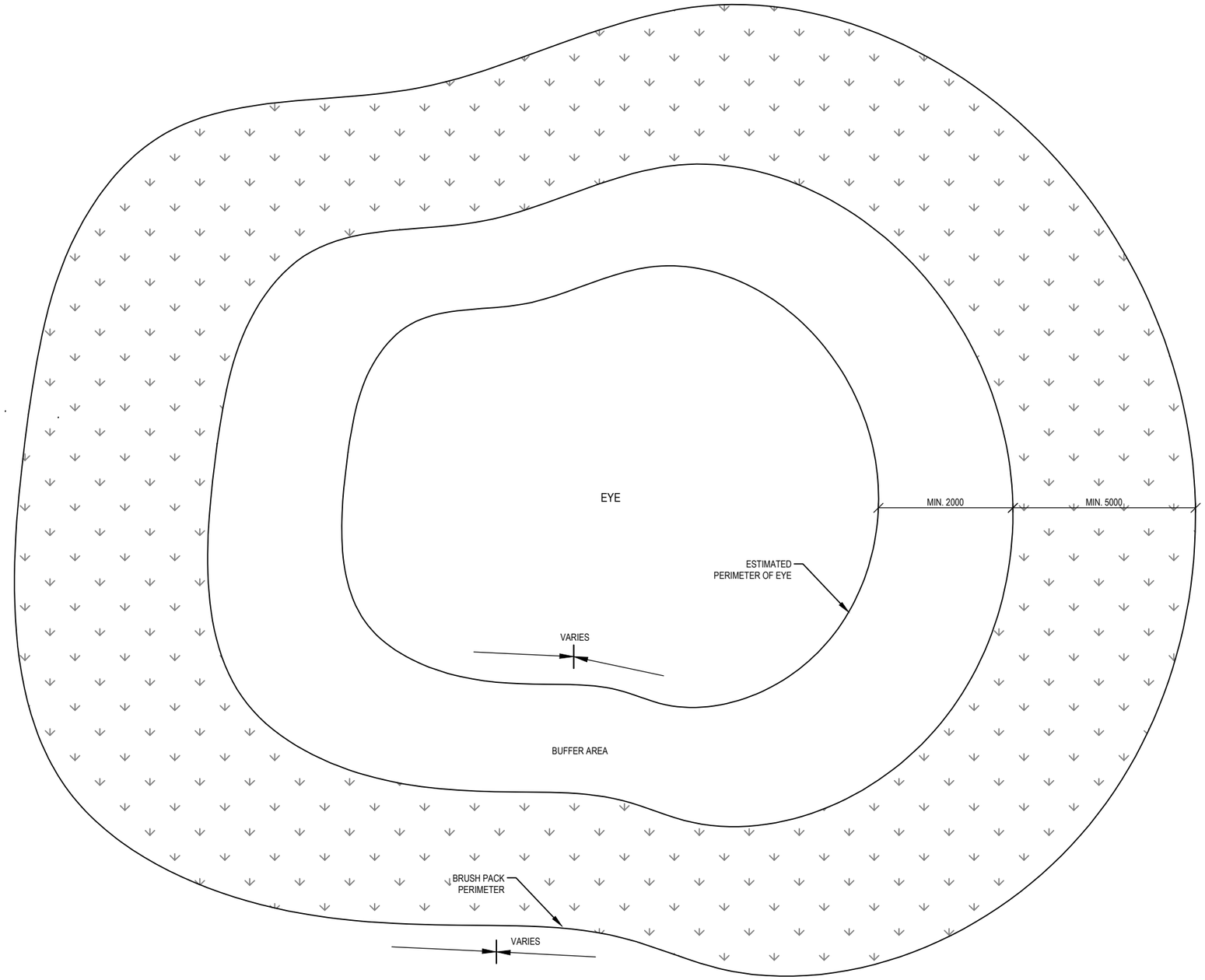
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

• All site staff shall be informed of the possibility of the occurrence of subsurface heritage resources and the procedures to be undertaken should such finds occur.
• Should any artefact or suspected artefact (e.g. ash deposits, animal/human bone concentrations, ceramic fragments/ pot shards and formal stone concentrations), or any site of cultural significance be encountered during construction:
o The Contractor must immediately stop work within a 50m radius of the site and immediately alert the relevant authorities.
o The area around the discovery (with a 50m radius buffer) shall be cordoned off until such time that work is authorised to proceed. Public access to the site must be limited.
o Should human remains be discovered, the South Africa Police Services (SAPS) and the provincial heritage authority shall be notified immediately.
o Excavated sites where artefacts have been discovered shall not be refilled without appropriate instructions have been received from the provincial heritage authority.
o Media statements shall only be released as agreed upon with the relevant authorities

NOTE:

- DRAWING OF PLACING OF BRUSH PACKS AROUND EYES.
- BOQ AND POSITIONING OF BRUSH PACK TO BE DETERMINED BY ENGINEER DURING SETTING OUT.



PLAN VIEW
N.T.S

NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. LIMITED GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON-STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
2. AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED AGAINST ANY ASSOCIATED DAMAGES AND ACCEPT NO LIABILITY ASSOCIATED WITH THE CONSTRUCTION AND IMPLEMENTATION OF ENGINEERING INTERVENTIONS DUE TO THE ENGINEERS HAVING LIMITED CONTACT WITH THE IMPLEMENTER DURING THE CONSTRUCTION PHASE RESULTING IN OUR INABILITY TO DILIGENTLY SUPERVISE AND ASSESS ANY PROGRESS.

ACRONYMS AND ABBREVIATIONS:

1. N.G.L - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE.
3. µm - MICRO METER
4. T.B.D - TO BE DETERMINED

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT, USING 1:10 LIME MIX.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

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GroundTruth
Water, Wetlands and Environmental Engineering

CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
A	04/02/2019	DRAFT FOR REHAB PLAN	P.C.BLAAUW

SCALE	SIZE
AS SHOWN	A3

DRAWN: J.MORRISON
DESIGNED: P.C.BLAAUW
CHECKED: P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED

ENGINEER	DATE
REGISTRATION No. 201170106	04/02/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BRUSH PACKING

DRAWING No. B82G - 04 - 208-00 - 01 OF 01 - A
(QUATERNARY No. - WETLAND No. - INTERVENTION No. - PAGE NUMBER - REV)

Details

Intervention	Baleni
Designer	Cilliers Blaauw
Design Date	02 April 2019
Type	New
Description	Brush Pack
Rehabilitation Objectives	• Stabilise disturbed environment and slopes. • Promote revegetation in upstream area. • Prevent current and future erosion.
Latitude (D°M'S")	S23 25 21.95
Longitude (D°M'S")	E30 55 01.40

Location Photograph: B82G-04-209-00

Bill of Quantities

Item	Description	Units	Quantity
Brush Pack	Packing brush/ tree branches over existing NGL or newly prepared area	m2	240.00

General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

• All site staff shall be informed of the possibility of the occurrence of subsurface heritage resources and the procedures to be undertaken should such finds occur.
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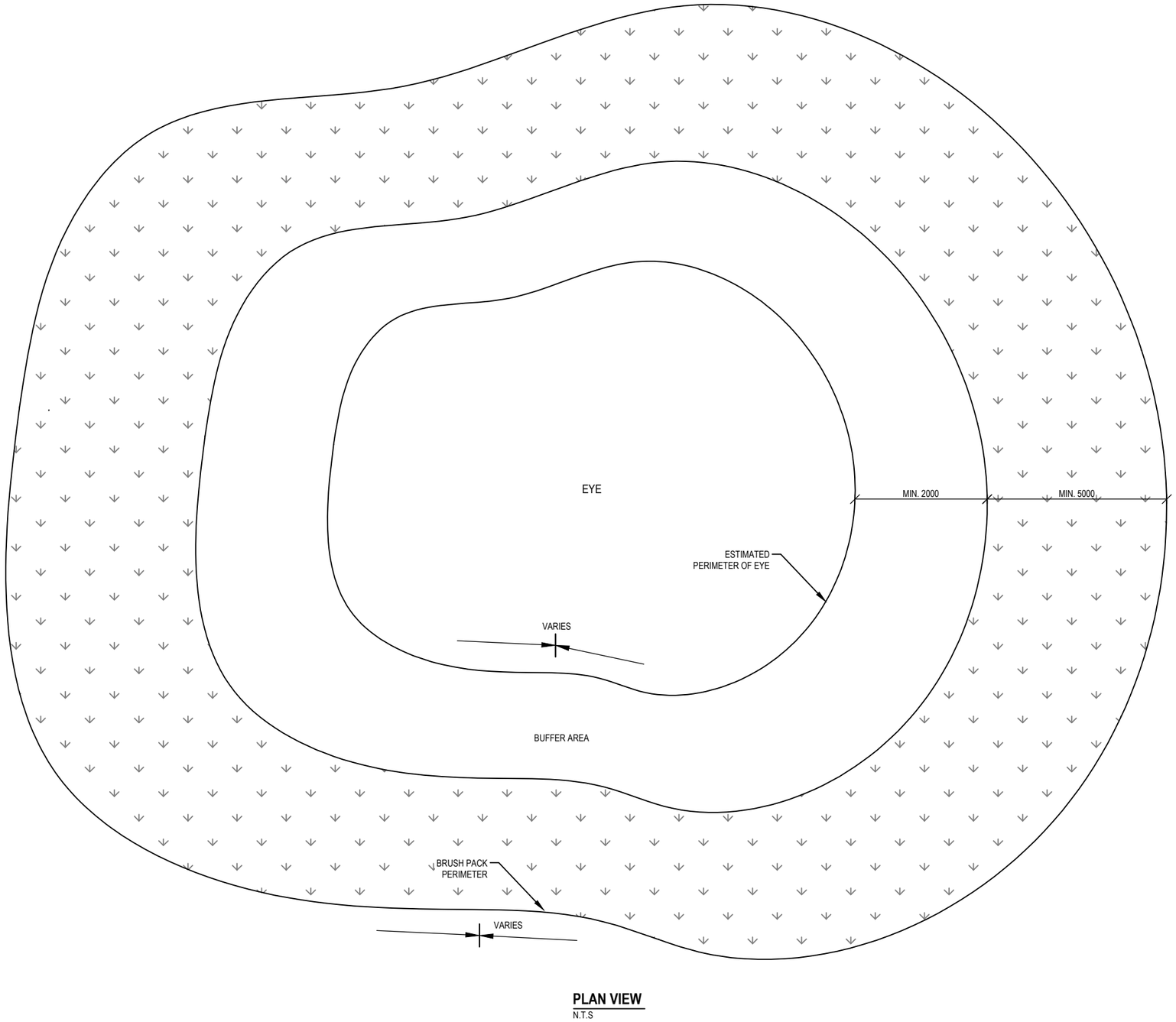

PLAN VIEW
N.T.S

NOTE:
- DRAWING OF PLACING OF BRUSH PACKS AROUND EYES.
- BOQ AND POSITIONING OF BRUSH PACK TO BE DETERMINED BY ENGINEER DURING SETTING OUT.

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Plot Date: 5/2/2019 11:34:29 AM Office: Filename: P:\PROJECTS\113223 PLAN & ENV COMP WORK FOR WETLANDS\ENGINEERING\5 DEL DES\503 CADD\DRAWINGS\LIMPOPO\BALENI\B82G-04-209-0002018_2_REHAB\1 DWG\B82G-04-209-00_REVA.DWG

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CLIENT: Working for Wetlands

REV	DATE	REVISION DETAILS	APPROVED
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SCALE	AS SHOWN
SIZE	A3
DRAWN	J.MORRISON
DESIGNED	P.C.BLAAUW
CHECKED	P.C.BLAAUW

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED	
ENGINEER	DATE
REGISTRATION No. 201170106	04/02/2019

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	LIMPOPO - BALENI
INTERVENTION DESCRIPTION	BRUSH PACKING

DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
	B82G	04	209-00	01 OF 01	A

Appendix D

ENVIRONMENTAL AUTHORISATION

A Basic Assessment Report has been submitted to the Department of Environmental Affairs for consideration with an application for Environmental Authorisation (EA). Should the Department issue a positive decision, the EA will be included in this section prior to the Rehabilitation Plan being implemented. No construction may occur without an EA.

Also included in this Appendix is the decision from the responsible heritage authority. All requirements included in this decision must be adhered to.

an agency of the
Department of Arts and Culture

T: +27 21 462 4502 | F: +27 21 462 4509 | E: info@sahra.org.za
South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

Enquiries: Nokukhanya Khumalo
Tel: 021 462 4502
Email: nkhumalo@sahra.org.za
CaseID: 13451

Final Comment

In terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999)

Attention: Dr Farai Tererai
Working for Wetlands Programme

Working for Wetlands (WfWetlands) is a government programme mandated to protect pristine wetlands, promote their wise-use and rehabilitate those that are damaged throughout South Africa, with an emphasis on complying with the principles of the Expanded Public Works Programme (EPWP) and using only local Small, Medium and Micro Enterprises (SMMEs).Due to the nature of the project, it is important to note that the very objectives of the WfWetlands Programme are to improve both environmental and social circumstances

Working for Wetlands is proposing to rehabilitate the wetland area within the Baleni nature reserve located in the Greater Giyane Local Municipality of the Limpopo Province. They plan on accomplishing this by constructing weirs/gabions that will create a barrier that will allow for sedimentation build-up to slow the water flow and re-wet the wetland area. There will be 28 intervention areas in the wetland including a 325m cattle fence.

Aurecon South Africa (Pty) Ltd is undertaking a Basic Assessment process on behalf of Working for Wetlands, in respect of listed activities in the Environmental Impact Assessment (EIA) Regulations 2014, as amended, that require an application for Environmental Authorisation, in terms of the National Environmental Management Act, 1998 (NEMA), as amended.

To meet the requirements of section 38(8) of the National Heritage Resources Act, no 25 of 1999, a Heritage Impact Assessment (HIA) Report by G&A Heritage Management Consultants (Pty) Ltd had been submitted to South African Heritage Resources Agency (SAHRA) for commenting on 11/02/2019. In an Interim Comment issued on 18/03/2019, SAHRA summarised the HIA report as follows:

Gaigher, S. December 2018. Phase 1 Heritage Impact Assessment Report for the Proposed Anti-Erosion Measures at the Baleni Salt Works Provincial Heritage Site, Limpopo Province.

The author undertook a field assessment of the proposed wetland area and identified two heritage sites that may be impacted by the proposed intervention areas. The first site, Site 1 in the HIA is the same site that was described in a Masters research paper as site BS04; it consists of hut floor remains, ash deposits, and

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potsherds of which some are diagnostic. This site will be partially impacted by trenching to install intervention measures to curb continued erosion. The author assessed the disturbance as beneficial to the long conservation of other archaeological sites downstream.

The second site, Site 2 is a single grave site located outside the proposed rehabilitation intervention areas. Both sites are of high heritage significance. As well as all other sites located within the entire wetland area is the Baleni Salt-works as it is a Provincial Heritage Site (PHS).

The author recommends:

No assessment of impacts on palaeontological resources because the study area is located in the grey zone in the SAHRA palaeo-map.

Site 1 must be mitigated by a qualified archaeologist in the area that will be disturbed by the installation of a gabions at Intervention B82G-01-213-00. In order to carry out the mitigations, a section 35 of the NHRA permit application must be applied for to SAHRA.

The cemetery must be protected by a 25 m buffer zone during construction.

The Chance Finds procedures provided in the report must be included in the EMPr for all intervention measures as well as the cattle fence construction.

SAHRA could not process the case to its conclusion until the accompanying environmental documents (BAR and appendices) were submitted to the case. The BAR has since been submitted and within section 7.1.4, it states that an archaeological excavation must be undertaken for site at 23°25'13" S 30°54'52" E (under a permit issued by SAHRA). The grave site at 23°25'13" S30°54'52" E will not be directly impacted but it may be impacted indirectly by construction activities. A buffer of 25 m radius must be applied to the grave site as a no-go area.

Final Comment

The South African Heritage Resources Agency (SAHRA) Archaeology, Palaeontology and Meteorites (APM) Unit accepts the recommendations provided in the HIA report however, the buffer zone around the grave must be increased to 30m.

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Tel: 021 462 4502
Email: nkhumalo@sahra.org.za
CaseID: 13451

The following additional recommendations must also be included as part of the EMPr for implementation during construction:

- An archaeologist must be appointed to undertake a weekly monitoring programme of all construction activities and develop a heritage training manual for the induction of the construction crew and ECO.
- All access points to the construction site, construction camps, laydown areas and stockpile areas must be assessed by an archaeologist prior to the construction phase. A report of the walk down assessment must be submitted to SAHRA.
- Once the design of the weir is finalised the potential extent of flooding must be determined and the potential impacts to the surrounding heritage sites must be assessed. This assessment must be included in the walk-down report.
- A CMP must be developed from the findings of this assessment, the CMP must also address any monitoring measures required for the long-term maintenance of the weirs.
- In the unlikely event that fossils are uncovered during construction then construction must cease within the immediate vicinity, a buffer of 30 m must be established, and a palaeontologist called in to inspect the finds. The palaeontologist must obtain a section 35(4) permit in terms of NHRA and Chapter IV NHRA Regulations, before any fossils are collected.
- If there are any new heritages resources are discovered during construction and operation phases of the proposed development, then a professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the findings at the expense of the developer.
- If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required at the expense of the developer. Mitigation will only be carried out after the archaeologist or palaeontologist obtains a permit in terms of section 35 of the NHRA (Act 25 of 1999). You may contact SAHRA APM Unit for further details: (Nokukhanya Khumalo/Phillip Hine 021 202 8654).
- If any unmarked human burials are uncovered and the archaeologist called in to inspect the finds and/or the police find them to be heritage graves, then mitigation may be necessary and the SAHRA Burial Grounds and Graves (BGG) Unit must be contacted for processes to follow (Thingahangwi Tshivase/Mimi Seetelo 072 802 1251).
- The Final BAR and its appendices must be uploaded to the case on SAHRIS.
- Once a decision on the EA application is reached, the record of decision must be uploaded to the case on SAHRIS.

Should you have any further queries, please contact the designated official using the case number quoted

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Department of Arts and Culture

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above in the case header.

Yours faithfully

Nokukhanya Khumalo
Heritage Officer
South African Heritage Resources Agency

Phillip Hine
Acting Manager: Archaeology, Palaeontology and Meteorites Unit
South African Heritage Resources Agency

ADMIN:
Direct URL to case: http://www.sahra.org.za/node/520847

Terms & Conditions:

1. This approval does not exonerate the applicant from obtaining local authority approval or any other necessary approval for proposed work.
2. If any heritage resources, including graves or human remains, are encountered they must be reported to SAHRA immediately.
3. SAHRA reserves the right to request additional information as required.

APPENDIX E

LANDOWNER AGREEMENTS

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Working for Wetlands

Working for Wetlands Programme

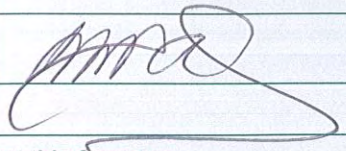
Wetlands Rehabilitation Activities Consent

Property Details	
Property Type:	Natural Heritage Site
Registration Division:	Registered with South African Heritage Site
Farm Number:	306
Portion Number:	306
Farm Name:	Soutini-Baleni
Surveyor-General Key:	N/A
Province:	Limpopo
Unique Wetland Number:	B81A

Owner Details							
Owner Name: (Full Names/Full Registered Name)	Mahumani Traditional Authority (His Majesty Hosi A K Mahumani)						
Person Type:		Company		Close corporation		Trust	Natural person
Registration/Identity Number:	5604115254082 Traditional Authority (Where applicable. For a trust, attach a copy of the latest letters of trusteeship issued by the Master of the High Court.)						
Owner's chosen address for delivery of notices and documents:	Postal Address: PO Box 2723 Giyani 0826		Physical Address: Nkomo 22B Village Giyani 0826				
	Telephone Number: 0797211313 0794963770		Email Address: amahumani@gmail.com				

Project Name:	Soutini Baleni

I/We hereby consent to the Working for Wetlands Programme and its appointed implementers undertaking the wetland rehabilitation activities listed in annexure "WFW 003A" attached hereto, for the project referred to above, subject to my/our approval of the relative Wetland Rehabilitation Plan, on the property described above of which I am the owner.

Name	Khavhareni Aarone Mahumani	**Position**	His Majesty Hosi
Signature		**Date**	08/09/2018

Please fax or post this form to:	**With a copy to:** The Planning, Monitoring and Evaluation Manager Working for Wetlands Programme, Private Bag X101, PRETORIA, 0001 Telefax (012) 8435165

Wetland rehabilitation activities to be carried out in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), as amended

[*Note: To be added to/amended as appropriate*]

Please note: The description of the project activities may not all occur, however they do provide some context for the possible interventions that may be implemented on your land.

Listed activity as described in GN 983, 984 & 985
***GN 983 (as amended): Activity 12**: the development of-* *i. dams or weirs, where the dam weir, including infrastructure and water surface area, exceeds 100 m²; or* *ii. infrastructure or structures with a physical footprint of 100 m² or more;* *where such developments occurs-* *(a) within a watercourse;* *(b) in front of development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;-* *excluding-* *(ee) where such development occurs within existing roads, road reserve or railway line reserves; or*
***GN R983 (as amended): Activity 19:** The infilling or depositing of material of more than 10 m³ into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 m³ from a watercourse;* *But excluding where such infilling, depositing, dredging, excavation, removal or moving-* *(a) will occur behind a development setback;* *(b) is for maintenances purposes undertaken in accordance with a maintenance management plan;*
***GN R983 (as amended): Activity 27:** The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for –* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*
***GN 983 (as amended): Activity 48:** The expansion of-* *(i) infrastructure or structures where the physical footprint is expanded by 100 m² or more; or* *(ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 m² or more;* *where such expansion occurs-* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding-* *(ee) where such expansion occurs within existing roads, road reserves or railway line reserves.*
***GN R984 (as amended): Activity 15:** The clearance of an area of 20 hectares or more, except where such clearance of indigenous vegetation is required for –* *ii. maintenance purposes undertaken in accordance with a maintenance management plan.*

GN R984 (as amended): Activity 24: *The extraction or removal of peat or peat soils, including the disturbance of vegetation or soils in anticipation of the extraction or removal of peat or peat soils, but excluding where such extraction or removal is for the rehabilitation of wetlands in accordance with a maintenance management plan.*

GN R985 (as amended): Activity 12 (e): *The clearance of an area of 300 m² or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.*

e. Limpopo

i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;

ii. Within critical biodiversity areas identified in bioregional plans; or

iii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.

GN 985 (as amended): Activity 14 (e): *The development of-*

(i) Dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 m²; or

(ii) Infrastructure or structures with a physical footprint of 10 m² or more;

Where such development occurs-

(a) Within a watercourse;

(b) In front of a development setback; or

(c) If no development setback has been adopted within 32 of a watercourse, measured from the edge of a watercourse;

excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.

e. Limpopo

i. Outside urban areas:

(aa) A protected area identified in terms of NEMPAA, excluding conservancies;

(bb) National Protected Area Expansion Strategy Focus areas;

(cc) World Heritage Sites;

(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;

(ee) Sites or areas identified in terms of an international convention;

(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;

(gg) Core areas in biosphere reserves; or

(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;

GN R985 (as amended): Activity 23 (e): *The expansion of-*

(i) dams or weirs where the dam or weir is expanded by 10 m² or more; or

(ii) infrastructure or structures where the physical footprint is expanded by 10 m² or more;

Alam

where such expansions occurs-

(a) within a watercourse;

(b) in front of a development setback adopted in the prescribed manner; or

(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;

excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.

e. *Limpopo*

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APPENDIX F

ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

WORKING FOR WETLANDS PROGRAMME

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PROGRAMME

Date: September 2017
Version: 5

Prepared by:
Aurecon South Africa (Pty) Ltd
PO Box 494
Cape Town
8000

Prepared for:
Working for Wetlands Programme
Department of Environmental Affairs:
Natural Resource Management
Private Bag X447
0001

REPORT CONTROL

Document control					
Report title	Working for Wetlands Programme: Construction Environmental Management Programme				
Prepared by	Aurecon South Africa (Pty) Ltd PO Box 494 Cape Town 8000				
On behalf of	Working for Wetlands Programme (WfWetlands) Department of Environmental Affairs: Natural Resource Management Private Bag X447 0001				
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TABLE OF CONTENTS

List of Annexures

Annexure A: Basic Code of Conduct / Implementation

Annexure B: Site Environmental File & Templates

Annexure C: Sensitive Areas

Annexure D: Minimum Standards for Construction and Maintenance

Annexure E: Curriculum Vitae of EAP

List of Figures

List of Tables

ACRONYMS

BAR	Basic Assessment Report
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EMPr	Construction Environmental Management Programme
EPWP	Expanded Public Works Programme
GPS	Global Positioning System
IE	Implementing Entity
NEMA	National Environmental Management Act (Act 107 of 1998)
NRM	Natural Resource Management
PC	Provincial Coordinator[1]
PDP	Professional Driving Permit
PIP	Project Implementation Plan
PPE	Personal Protective Equipment
PPR	Project Progress Report
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resources Agency
SEP	Site Environmental File
SETA	Sector Education and Training Authority

[1] Also referred to as Assistant Director: Wetlands Programme.

DEFINITIONS

Alien species[2]:

(a) a species that is not an indigenous species; or

(b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Approved: Means approved in terms of the applicable legal requirements (e.g. NEMA approval/ Environmental Authorisation) and/or has been approved by the WfWetlands Programme's Deputy Director: Planning, Monitoring and Evaluation and/or an authorised representative of the WfWetlands Programme.

Archaeological[3]:

(a) material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;

(b) rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;

(c) wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which the South African Heritage Resource Agency (SAHRA) considers to be worthy of conservation; and

Auditing[4]: A systematic, documented, periodic and objective evaluation which provides verifiable findings, in a structured and systematic manner, on:

(a) the level of performance against and compliance of an organisation or project with the provisions of the requisite environmental authorisation or Environmental Management Programme (EMPr) and, where applicable, the closure plan; and

(b) the ability of the measures contained in the EMPr, and where applicable the closure plan, to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity.

Authority*:* National, regional or local authority, that has a decision-making role or interest in the project.

Basic Assessment Report (BAR): A report as described in Regulation 19 of GN R982 (2014, as amended) of the National Environmental Management Act (No. 107 of 1998, as amended) (NEMA).

Best Management Practice (BMP): Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWetlands implementers.

[2] National Environmental Management: Biodiversity Act (No. 10 of 2004)
[3] National Heritage Resources Act (No. 25 of 1999)
[4] Regulation 34 of GN R982 (2014, as amended) of NEMA

Cement laden water: Means water (fresh or wash water) which has been in contact with partially cured concrete/mortar or raw cement product and which contains suspended and dissolved cement solids.

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Contaminated water: Means water contaminated by the Implementing Entity's activities such as with hazardous substances, hydrocarbons, paints, solvents and runoff from plant, workshop or personnel wash areas but excludes water containing cement/ concrete or silt.

Corrective (or remedial) action*:* Reactive response required to address an environmental problem that is in conflict with the requirements of the EMPr. The need for corrective action may be determined through monitoring, audits or management review.

Dam[5]: Any barrier dam and any other form of impoundment used for the storage of water, excluding reservoirs.

Dangerous goods: Goods containing any of the substances as contemplated in South African National Standard No. 10234, supplement 2008 1.00: designated "*List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)"* published by Standards South Africa, and where the presence of such goods, regardless of quantity, in a blend or mixture, causes such blend or mixture to have one or more of the characteristics listed in the Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards.

Decommissioning[6]: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned.

Dust[7]: Any material composed of particles small enough to pass through a 1 mm screen and large enough to settle by virtue of their weight into the sampling container from the ambient air.

Eco-log: A cylindrical sleeve made from, for example wire mesh, filled with organic material and/or soil used to prevent and/or repair minor erosion.

Ecosystem services or 'eco services': The services such as sediment trapping or water supply, supplied by an ecosystem (in this case a wetland ecosystem).

Endangered species: Means any indigenous species listed as an endangered species in terms of section 56 of the National Environmental Management Biodiversity Act ((No. 10 of 2004).

Endemic: An "endemic" is a species that grows in a particular area (i.e. it is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

[5] GN R983 (2014, as amended) of NEMA
[6] GN R983 (2014, as amended) of NEMA
[7] National Dust Regulations GN R827 (2013)

Environment[8]: Means the surroundings within which humans exist and that are made up of:

i. the land, water and atmosphere of the earth;

ii. micro-organisms, plant and animal life;

iii. any part or combination of i) and ii) and the interrelationships among and between them; and

iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Assessment Practitioner (EAP): The individual responsible for the planning, management and coordination of the environmental impact assessments, strategic environmental assessments, environmental management plans and/or other appropriate environmental instruments introduced through regulations of NEMA.

Environmental Impact Assessment (EIA): A study of the environmental consequences of a proposed course of action via the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental impact: An environmental change caused by some human act.

Environmental impact: Change in an environment resulting from the effect of an activity on the environment, whether positive or negative. Impacts may be the direct consequence of an individual's or organisation's activities or may be indirectly caused by them (DEAT, 1998).

Erosion: The loss of soil through the action of water, wind, ice or other agents, including the subsidence of soil.

Establishment of grass: Refers to all necessary procedures taken to produce an acceptable cover of specified live grass over an area.

Gabion: A structure made of wire mesh baskets filled with regularly sized stones, and used to prevent and/or repair erosion. They are flexible and permeable structures which allow water to filter through them. Vegetation and other biota can also establish in/around the habitat they create.

Hazard: Means a source of or exposure to danger.

Invasive alien species control:

(a) to combat or eradicate an alien or invasive species; or

(b) where such eradication is not possible, to prevent, as far as may be practicable, the recurrence, re-establishment, re-growth, multiplication, propagation, regeneration or spreading of an alien or invasive species.

Implementing Entity: The entity responsible for the construction of WfWetlands rehabilitation interventions by means of various contracted teams.

Indigenous vegetation[9]: Refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

[8] NEMA
[9] GN R983 (2014, as amended) of NEMA

Interested and Affected Parties (I&APs)[10]:

(a) all persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;

(b) all persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; c) all organs of state which have jurisdiction in respect of the activity to which the application relates.

Intervention: An engineered structure such as a concrete or gabion weir, earthworks or revegetation that that achieves identified objectives within a wetland e.g. raising of the water table within a drainage canal.

Invasive species[11]: Means any species whose establishment and spread outside of its natural distribution range-

(a) threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and

(b) may result in economic or environmental harm or harm to human health.

Listed invasive species: Any invasive species listed in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the National Environmental: Biodiversity Act (No. 10 of 2004).[12]

Maintenance period: The period after the Establishment Period (Practical Completion), up to and until the end of the Maintenance Period (i.e. a period of 12 months).

Maintenance[13]: Means actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint.

Mine:

(a) used as a noun-

any excavation in the earth, including any portion under the sea or under other water or in any residue deposit, as well as any borehole, whether being worked or not, made for the purpose of searching for or winning a mineral;

any other place where a mineral resource is being extracted, including the mining area and all buildings, structures, machinery, residue stockpiles, access roads or objects situated on such area and which are used or intended to be used in connection with such searching, winning or extraction or processing of such mineral resource; and

(b) used as a verb-

in the mining of any mineral, in or under the earth, water or any residue deposit, whether by underground or open working or otherwise and includes any operation or activity incidental thereto, in, on or under the relevant mining area.

Mitigation: Actions to reduce the impact of a particular activity.

[10] Regulation 42 GN R983 (2014, as amended) of NEMA
[11] National Environmental Management: Biodiversity Act (No. 10 of 2004)
[12] Also refer to GN 864 (2016): Alien and Invasive Species Lists
[13] GN R983 (2014, as amended) of NEMA

Mitigation[14]**:** Means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible;

Monitoring[15]**:** The repetitive and continued observation, measurement and evaluation of environmental criteria to follow changes over a period of time and to assess the efficiency of control measures.

Nursery conditions: This refers to the necessary conditions that must be in place for maintaining strong healthy growth in all container plant materials on site. This includes for the protection of all container plants against wind, frost, direct sunlight, pests, disease and drought. It also includes for the provision of adequate and suitable water supply, fertilisers and all other measures necessary to maintain strong and healthy plant growth.

Offensive odour: Any smell which is considered to be malodorous or a nuisance to a reasonable person.

Pollution[16]**:** Means any change in the environment caused by substances;

(ii) radioactive or other waves; or

(iii) noise, odours, dust or heat,

emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or wellbeing or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.

Post-construction: Refers to the period of 12 months after the completion of the construction works, the onset coinciding with the maintenance period.

Potentially hazardous substance: Any substance or mixture of substances, product or material declared to be a hazardous substance under section 2(1) of the Hazardous Substance Act (1973).

Pre-construction: Refers to the period leading up to the establishment on site by the Implementing Entity.

Project: A defined area for which an approved rehabilitation plan exists for the WfWetlands Programme.

Public Participation Process (PPP): A process of involving the public in order to identify issues and concerns, and obtain feedback on options and impacts associated with a proposed project, programme or development. Public Participation Process in terms of NEMA refers to a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to specific project matters.

Quaternary Catchment: A fourth order catchment in a hierarchal classification system in which a primary catchment is the major unit and that is also the "principal water management unit in South Africa"[17]

[14] GN R983 (2014, as amended) of NEMA
[15] DEAT, 1998
[16] National Environmental Management Act (No. 107 of 1998, as amended)
[17] DWS Groundwater Dictionary. Available online: http://www.dwaf.gov.za/Groundwater/Groundwater_Dictionary/index.html?introduction_quaternary_catchment.htm

Reasonable: Means, unless the context indicates otherwise, reasonable in the opinion of the relevant environmental authority.

Rehabilitation: Refers to re-instating the driving ecological forces (including hydrological, geomorphological and biological processes) that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers; and

Restoring processes and characteristics that are sympathetic to and not conflicting with the natural dynamic of an ecological or physical system[18].

Scarifying: Loosening the soil in areas which have become hard and compacted and which need to be loosened in order to facilitate revegetation.

Shaping: Finishing all slopes which do not form part of the permanent works so that they do not exceed the maximum gradient stipulated in the approved rehabilitation plan.

Significant impact: Means an impact that may have a notable effect on one or more aspects of the environment or may result in k with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence.

Silt laden water: Means water (mostly overland surface runoff) containing a substantial concentration of suspended solids with increased turbidity. Usually occurs as a result of exposed/cleared ground surfaces, concentration of runoff and/or erosion of excavated or imported materials.

Site: This is the area described in the approved/authorised rehabilitation plan for the implementation of the rehabilitation measures. Where the area is not demarcated, it will include all adjacent areas, which are reasonably required for the activities for the Implementing Entity, and approved for such use by the Environmental Control Officer (ECO).

Slope: The inclination of a surface expressed as 1 unit of rise or fall for so many horizontal units.

Subsoil: The soil horizons between the topsoil horizon and the underlying parent rock.

Topsoil: The upper soil profile irrespective of the fertility appearance, structure, agriculture potential, fertility and composition of the soil, usually containing organic material and which is colour specific. Also referred to as the "O" and "A" horizons.

Waste: Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 the National Environmental Management: Waste Act (No. 59 of 2008)[19]. Examples include construction debris, chemical waste, used oils and lubricants, batteries, metal and wood off-cuts, excess cement/ concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Watercourse:

(a) a river or spring;

(b) a natural channel in which water flows regularly or intermitted;

(c) a wetland, pan, lake or dam into which, or from which, water flows

[18] Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008
[19] National Environmental Management: Waste Act (No. 59 of 2008, as amended)

A reference to a watercourse includes, where relevant, its bed and banks

Weir: A dam-type structure placed across a watercourse to raise the water table of the surrounding ground and trap sediment on the upstream face without preventing water flow. Weirs are generally used to prevent erosion from progressing up exposed gullies.

Wetland: Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils[20] and,

Land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants living there[21].

[20] National Water Act (No. 36 of 1998, as amended)
[21] Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008

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1 INTRODUCTION

1.1 Project Overview

Working for Wetlands is a government programme managed by the Natural Resource Management (NRM) Programme of the Department of Environmental Affairs (DEA), and is a joint initiative with the Departments of Water and Sanitation (DWS), and Agriculture and Forestry and Fisheries (DAFF). In this way the programme is an expression of the overlapping wetland-related mandates of the three parent departments, and besides giving effect to a range of policy objectives, it also honours South Africa's commitments under several international agreements, especially the Ramsar Convention on Wetlands.

The programme is mandated to protect pristine wetlands, promote their wise-use and rehabilitate those that are damaged throughout South Africa, with an emphasis on complying with the principles of the Expanded Public Works Programme (EPWP) and using only local Small, Medium and Micro Enterprises (SMMEs). The EPWP seeks to draw significant numbers of unemployed people into the productive sector of the economy, gaining skills while they work and increasing their capacity to earn an income.

1.2 Purpose of the EMPr

An Environmental Management Programme (EMPr) is compiled as part of the requisite submissions contained in a Basic Assessment Report (BAR) or Environmental Impact Report (EIR) in order to obtain an Environmental Authorisation (EA) to proceed with a listed activity(ies) as defined in GN R982 (2014, as amended) of the National Environmental Management Act (No. 107 of 1998), as amended. Upon approval of the BAR or EIR and resultant issuing of the EA, the EMPr becomes a legally binding document of which compliance has to audited by an independent and appropriately qualified auditor as per Regulation 34 of GN R982 (2014, as amended).

The EMPr's main purpose is to document general and specific avoidance, mitigation and termination actions in order to address general and project specific impacts as identified by means of the EIA and/or Phase 2 planning process. Implementation of the actions specified in the EMPr can be contractually delegated to various parties involved in the project execution. However, legal compliance with the EA and EMPr remains with the EA holder and cannot be delegated or transferred. It is therefore of utmost importance that WfWetlands ensures that all parties involved are familiar with the contents and requirements of the EMPr as non-conformances can ultimately have legal and financial consequences to primarily the EA holder but also subsequently all other parties involved.

1.3 Auditing of compliance with the EA and EMPr

Compliance auditing has been transformed from a vague requirement under the 2006 and 2010 EIA regulations to a very specific set of actions and outcomes which are to be achieved under the 2014 EIA regulations. An audit report is now also subject to a specified structure and with specific content requirements (Appendix 7 of GN R982), as amended. According to GN R982 Appendix 7 (Section 2) the objectives of an audit report include *inter alia* the following:

a) to report on—

   i. the level of compliance with the conditions of the environmental authorisation and the EMPr, and where applicable, the closure plan; and

   ii. the extent to which the avoidance, management and mitigation measures provided for in the EMPr, and where applicable, the closure plan achieve the objectives and outcomes of the EMPr, and closure plan;

b) identify and assess any new impacts and risks as a result of undertaking the activity;

c) evaluate the effectiveness of the EMPr, and where applicable, the closure plan;

d) identify shortcomings in the EMPr, and where applicable, the closure plan; and

e) identify the need for any changes to the avoidance, management and mitigation measures provided for in the EMPr, and where applicable, the closure plan.

As per Regulation 34, sub-regulation 4 of GN R982, where the findings of the environmental audit report contemplated in sub- regulation (1) of GN R982 indicate:

(a) insufficient mitigation of environmental impacts associated with the undertaking of the activity; or

(b) insufficient levels of compliance with the environmental authorisation or EMPr and, where applicable the closure plan;

the holder must, when submitting the environmental audit report to the competent authority in terms of sub-regulation (1), submit recommendations to amend the EMPr or closure plan in order to rectify the shortcomings identified in the environmental audit report.

When submitting recommendations in terms of sub-regulation (4), such recommendations must have been subjected to a public participation process, which process has been agreed to by the competent authority and was appropriate to bring the proposed amendment of the EMPr and, where applicable the closure plan, to the attention of potential and registered interested and affected parties, including organs of state which have jurisdiction in respect of any aspect of the relevant activity and the competent authority, for approval by the competent authority.

Given the strict and onerous above-mentioned requirements in terms of compliance with the EA and EMPr as well as auditing thereof, it is therefore of utmost importance that the EMPr specifies realistic and auditable avoidance, mitigation and cessation actions which can be applied across a wide range of project in various geographical settings. The approach to the structure and content of this EMPr is discussed in more detail under Section 1.7 below.

1.4 Frequency of compliance auditing

The ECO and Implementing Entity is responsible for ensuring compliance with the EMPr. The ECO shall inspect the site prior to commencement of any construction activity, at least once per month during construction and on completion of construction to establish the level of compliance with this CEMP. At sensitive sites, bi-weekly inspections shall take place as a minimum.

Monthly site audits shall be undertaken by the ECO and a bimonthly Project Inspection Report submitted to the Working for Wetlands Deputy Director: Planning, Monitoring and Evaluation for review prior to the annual Compliance Audit taking place.

The annual Compliance Audit Report shall be submitted to the DEA collating the year's completed checklists. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified to the DEA.

1.5 Content of an EMPr

Environmental management programmes are intended to be documents which indicate how the mitigation and management measures proposed for a project can be implemented in practice. As such they should be practical, reasonable and feasible. They must also meet the requirements of the legislation (Table 1), in particular regulation 19 (4) of the 2014 EIA regulations (GN R982).

Table 1: Requirements of an EMPr as per Appendix 4 of the 2014 EIA regulations, GN R982 (2014, as amended)

Section	Description	Heading/ section in this EMPr
(a)	details of- (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Report control sheet Annexure E
(b)	a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Sections 1.1, 1.2 and 1.7
(c)	a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Chapter 6 Annexure C
(d)	a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including- (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities;	Chapters 3-5
(f)	a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraphs (d) will be achieved, and must, where applicable, including actions to - (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	Chapters 4-5
(g)	the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Chapters 4-5
(h)	the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Chapters 4-5
(i)	an indication of the persons who will be responsible for the implementation of the impact management actions;	Section 2.1; Chapters 4-5
(j)	the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 2.1

Section	Description	Heading/ section in this EMPr
(k)	the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Chapters 4-5
(l)	a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Sections 1.3 and 1.4
(m)	an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 3.3 and Chapter 6
(n)	any specific information that may be required by the competent authority.	NA

1.6 Relevant legislation, guidelines and other documents

This EMPr should be read in the context of the following documents:

- Constitution of the Republic of South Africa Act (No. 108 of 1996)
- National Environmental Management Act, (No. 107 of 1998, as amended)
- National Environmental Management: Waste Act (No. 59 of 2008)
- National Forest Act (No. 84 of 1998)
- National Water Act (No. 36 of 1998)
- National Heritage Resources Act (No. 25 of 1999)
- Municipal Systems Act (No. 32 of 2000)
- Occupational Health and Safety Act (No. 85 of 1993)

Note that the EMPr is not intended to replace any of the above, but rather augment them. Compliance with the EMPr does not exempt the EA holder, i.e. WfWetlands, from compliance with the legal or management requirements of any other licence or permit issued in terms of the project.

1.7 The EMPr in the context of the WfWetlands programme

As discussed under the previous sections, an EMPr and compliance with the EMPr (including compliance auditing) is specifically and strictly regulated under the 2014 EIA regulations, as amended. The implementation of a standard EMPr across a programme as diverse as WfWetlands does however pose various challenges as a result of the wide variety of interventions, site conditions, types of wetland systems, ecological integrity and complexity and so forth.

As a result the EMPr has been written with the abovementioned challenges in mind. It therefore focuses on the typical activities and impacts related to a WfWetlands project and generic avoidance, mitigation and termination actions. The EMPr is augmented by a site specific Rehabilitation Plan which includes more site specific mitigation measures and requirements where required. It is recommended that

compliance auditing takes into account the specific mitigation measures recommended in the accompanying Rehabilitation Plan for each individual project as well.

- Allowance will also be made throughout the document for minor deviations to allow for site specific scenarios but with the condition that each deviation be approved by the provincial Programme's Provincial Coordinator (PC) and in the case of major deviations by the DEA (also see Annexure B).

2 IMPLEMENTATION OF THE EMPr

The EMPr is ultimately intended to aid in the implementation of specific actions on site in order to ensure that the impacts of a project are avoided or mitigated during the various project implementation phases. A number of role-players are required to actively participate in the implementation of the EMPr with different roles and responsibilities typically assigned to each. The various roles and responsibilities are outlined below.

2.1 Role-players and their functions/responsibilities

2.1.1 DEA

Responsible Entity: DEA	
• DEA (specifically the Legal Authorisations and Compliance Inspectorate) holds the ultimate authority and mandate in terms of ensuring environmental legislation is adhered to.	
Responsibilities	**Duration**
• Investigate reported non-compliances with EAs and EMPrs either as a result of findings by an ECO/auditor, reporting by the EA holder or public complaints. • Enforce compliance and adherence to the EA, EMPr or any other environmental legislation through a number of administrative and legal procedures should it prove that a person or organisation is in contravention of an EA, EMPr or other environmental authorisation.	Project lifespan

2.1.2 The EA holder

Responsible Entity: WfWetlands		
• Holds sole legal liability in terms of ensuring compliance to the EA and EMPr. • Some responsibilities resulting from the EA or EMPr can be delegated or transferred contractually.		
Responsibilities		**Duration**
Contractual	• Ensure that the EA and EMPr is included in the contract documentation for a project in order to ensure that compliance with the EA and EMPr is contractually binding. • Ensure that current standards and specifications forming part of the standard contract documentation allow for or are aligned to the requirements of the EA and EMPr. • Ensure that all PCs and Implementing Entities are familiar with the requirements of the EA and EMPr.	Appointment; Project lifespan

Responsibilities		Duration
Approvals and licences	• Identify, obtain and comply with all other necessary approvals, permits, authorisations and requirements set by the relevant National and Provincial Departments and Local Authority for the construction of engineering interventions for the rehabilitation of wetlands before any site preparation activities are undertaken.	Pre-construction
Record keeping	• Ensure that a proper record keeping system is in place to keep track of proof that copies of the EA and EMPr were issued to the PCs and Implementing Entities.	Pre-construction; Project lifespan

2.1.3 The PC

Responsible Entity: PC		
• The PC shall be responsible for his/her specific province to ensure compliance with the EMPr.		
Responsibilities		**Duration**
Approvals and licences	• Be fully aware of and understand all the requirements of the EA(s) and EMPr(s) issued for projects in his/her province. • Ensure compliance with the EA and implementation of the EMPr. • Ensure that each Implementing Entity receives a copy of the EA and EMPr for distribution to each contractor, with proof of receipt (e.g. a transmittal note or similar). • Ensure that each Implementing Entity fully understands the contents and requirements of the EA and EMPr and the legal and financial consequences of non-compliance.	Pre-construction; Project lifespan
Communication	• Communicate environmental issues associated with the site to the Implementing Entity, including having adequate environmental knowledge in the field of wetland rehabilitation to understand the detailed environmental issues associated with the project.	Pre-construction; Project lifespan
Site management	• Assist with developing a site environmental file and ensuring all documentation is filed correctly. • Assist with site or project specific challenges or problems which might result in a non-conformance with the EA and EMPr. • Provide guidance to Implementing Entities on practical solutions in achieving the outcomes and requirements of the EA and EMPr.	Pre-construction; Project lifespan

Responsibilities		Duration
Environmental training	• Confirm that Environmental Awareness training has been undertaken on all sites prior to construction commencing.	Pre-construction

2.1.4 The ECO

Responsible Entity: ECO		
• The PC shall perform the duties of the ECO via monthly inspections in order to minimise adverse environmental impacts and effects. • Any changes to any environmental management documentation must be reviewed and understood by the ECO. • The ECO has access to the construction site at all times. • Remain appointed until the site has been rehabilitated as specified in the EMPr.		
Responsibilities		**Duration**
Approvals and licences	• Ensure compliance with the EA, EMPr, permits issued and all the environmental legislation. • Be fully knowledgeable with the contents and the conditions of the EA and all amendments. • Be fully knowledgeable with the contents of the latest revision of the EMPr. • Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with them.	Pre-construction
Communication	• Ensure that the contents of the EMPr are communicated to the Implementing Entity. • Escalate serious or repeat non-conformances to the relevant competent authority (i.e. DEA, DWS, SAHRA, etc.).	Pre-construction; Project lifespan
Site management	• Approve the site layout plan (showing environmental sensitive/ no-go areas). • Ensure that all relevant activities being undertaken on site are within the scope of the EA and within the boundaries of the approved layout plan.	Project lifespan
Environmental training	• Confirm that Environmental Awareness training has been undertaken on all sites prior to construction commencing.	Pre-construction
Method statements	• Ensure that all method statements required are submitted and approved prior to site establishment.	Pre-construction

Responsibilities		Duration
Record keeping	• Keep and maintain a schedule of current site activities including the monitoring of such activities. • Keep copies of all reports submitted to DEA. • Obtain and keep record of all documentation including: environmental authorisation from DEA, EMPr, basic assessment, site layout plan, method statements, all communication detailing changes that may have environmental implications, site inspection checklist, Environmental awareness training attendance register, Environmental incident report, environmental performance certificates (once a project has been completed) photographic records (before, during and after development), records of non-compliance and corrective action taken to remediate, permits, licenses, and authorisations such as waste disposal certificates, hazardous waste landfill site licenses etc. which are required by this facility.	Project lifespan
Audits	• Compile an audit checklist which complies with the requirements of GN R982 Appendix 7 and is able to measure compliance against the EA, EMPr, other relevant permits and contract environmental specifications (where applicable). • Escalate serious or repeat non-conformances to the relevant competent authority (i.e. DEA, DWS, SAHRA, etc.). • Work with the Implementing Entity and relevant stakeholders to resolve any areas of non-compliance with appropriate corrective action. • Assist the Implementing Entity in finding environmentally responsible solutions to problems. • Giving a report back on the environmental issues at the monthly site meetings and other meetings that may be called regarding environmental matters. • Submit final audit report to DEA upon project closure in accordance with the requirements of the EA and EMPr.	Project lifespan; Project closure

2.1.5 The Implementing Entity

Responsible Entity: Implementing Entity
• The Implementing Entity will be acting as the Project Manager and is responsible for complying with the EMPr during the construction phase of the development on a day-to-day basis. • The Implementing Entity will be responsible for any non-compliance with the EMPr and will pay for any remedial work that may result from non-compliance resulting directly from his/her negligence. Failure to comply with the EMPr is addressed in Section 2.2.3.

Responsibilities		Duration
Approvals and licences	• Ensure that a copy of the EMPr, EA and any other applicable permit/licence are available on site.	Pre-construction; Project lifespan
Communication	• Submit all required documentation (e.g. proof of training, method statements, layout plans, and requests for deviations) to the ECO on a timely basis. • Communicate any issues or concerns of the surrounding community regarding the development to the ECO or other responsible party and visa-versa. • Ensure that all materials and equipment required for daily environmental compliance is ordered through the correct channels if such is not available.	Pre-construction; Project lifespan
Site management	• Ensure that appointed contractors, participants and sub-contractors are familiar with the EMPr and that they abide by it. • Monitor and verify on a daily basis that the EMPr and specifications (if applicable) is adhered to at all times and taking the necessary action to ensure compliance is achieved where it is lacking. • Ensure that site demarcation and no-go areas are maintained. • Monitor and verify that environmental impacts as a result of construction activities are kept to a minimum. • Ensure that all materials and equipment required for daily environmental compliance are available on site and ensure that the aforementioned is ordered through the correct channels if such is not available. • Inspect the site and surrounding areas regularly with regard to compliance with the EMPr. • Keep a photographic record of progress on site from an environmental perspective.	Project lifespan
Environmental training	• Provide environmental awareness training for all new personnel coming onto site and filing proof of such training in the Environmental File on site.	Pre-construction
Method Statements	• Ensure compliance with approved Method Statements.	Pre-construction; Project lifespan

Responsibilities		Duration
Record keeping	• Submit all required documentation (e.g. proof of training, method statements, layout plans, and requests for deviations) to the ECO on a timely basis. • File proof of environmental awareness training in the Environmental File kept on site. • Keep and maintain a detailed incident (including spillage of fuels, chemicals, or any other material) and complaints register on site indicating how these issues were addressed, what rehabilitation measures were taken and what preventative measures were implemented to avoid re-occurrence of incidents/complaints. • Ensure that all relevant documentation illustrating or proving environmental compliance are filed on site in the Environmental File for inspection by the ECO or Competent Authority. • Keep a photographic record of progress on site from an environmental perspective.	Project lifespan
Audits	• Complete start-up and site closure checklists on a weekly or monthly basis or as otherwise specified.	Project lifespan

2.2 Record keeping (site related activities)

The development of an EMPr for a project is an important and necessary task that is aimed at assigning responsibilities and mitigation options to a variety of activities. However, it can be an ineffective tool in the absence of auditing or monitoring activities. Auditing or monitoring activities involve the structured observation, measurement, and evaluation of environmental data over a period of time.

2.2.1 Site Environmental File

The Site Environmental File (SEF) is a critical part of compliance record keeping, specifically in terms of proof of activities undertaken on a regular basis on site to ensure compliance with the EA and EMPr. The SEF is further a key component to demonstrate compliance to the ECO or relevant Competent Authority official during a compliance audit. The typical SEF contents should include *inter alia* the following:

1. **Rehabilitation Plan and EMP**

2. **Approvals and licences**
   2.1. EA
   2.2. Section 21(c) and (i) General Authorisation
   2.3. Waste licence (if applicable)
   2.4. Mining permit/licence (e.g. for proof of quarry legitimacy)

3. **Communication**
   3.1. Important correspondence e.g. notice to Competent Authority of commencement of construction
   3.2. Copy of public complaints register

4. **Site management**
   4.1. Approved layout
   4.2. Site instructions (or copies thereof)

5. **Environmental Training**
   5.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)

6. **Method statements**
   6.1. Approved method statements

7. **Records**
   7.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)
   7.2. Proof of legal/safe waste disposal
   7.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)
   7.4. Record of water usage (if applicable)
   7.5. Log of topsoil samples (if applicable)

8. **Audits**
   8.1. ECO audit reports
   8.2. Internal audits/check conducted by the Implementing Entity
   8.3. Incident and non-conformance reports

Typical examples of checklists and other types of record keeping are included in Annexure B.

2.2.2 Progress / Site Meetings

Environmental issues shall be put on the agenda as a discussion point during these meetings. The Implementer, or a designated person involved with environmental issues on the project, shall attend the progress and/or site meetings on a regular basis to provide feedback on any outstanding or contentious environmental matter.

2.2.3 Failure to comply with the EA and EMPr

The WfWetlands Programme, as the holder of the Environmental Authorisation, is responsible for ensuring compliance with the conditions by any person acting on their behalf including Implementing Entities. The EA holder must notify the DEA in writing within the period specific in the EA if any condition in the Environmental Authorisation is or cannot be complied with. Upon receiving such notification the DEA (Compliance Directorate) will assess the reported non-conformance and inform the EA holder of further actions and submissions required.

In addition to the above, the ECO may order the Implementing Entity to suspend part or all of the works if, based on the ECO's reasoned opinion, the Implementing Entity has, is in the process of or will cause significant environmental damage and/or cause a non-conformance to the EA and/or EMPr. The ECO shall report this instruction to the WfWetlands' *Deputy Director: Programme Implementation* **within 24 hours** of the instruction being issued. Should the aforementioned suspension of work be as a result of negligence or actions by the Implementing Entity, no extension of time will be granted for such delays and all costs will be borne by the Implementing Entity. Apart from direct non-compliance with the EA or EMPr, the following will be regarded as indirect non-compliance:

- Failure to comply with corrective or other instructions issued by the Implementing Entities, ECO or Competent Authority within a specified time.
- Failure to produce the supporting documentation proving compliance with the EA or EMPr.
- Failure to ensure that sub-contractors appointed by the Implementing Entity comply with the EA and EMPr.

3 PRECONSTRUCTION/PLANNING PHASE

3.1 Compliance with environmental legislation

Ensure relevant approvals from regulatory authorities are obtained, in particular in terms of:

- National Environmental Management Act (No. 107 of 1998) (NEMA), as amended;
- National Water Act (No. 36 of 1998);
- National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004);
- National Forests Act (No. 84 of 1998);
- National Heritage Resources Act (No. 25 of 1999); and
- Other provincial and local environmental legislation.

3.2 Submission of method statements

- Method Statements must be compiled by the Implementing Entity.
- All Method Statements must be submitted and approved prior to site establishment commencing.
- The content and required actions of the Method Statements must be communicated to site staff through a compulsory environmental induction.
- Approved Method Statements will be dated and signed by all relevant parties (Implementing Entity, ECO, DEA, Engineer).
- Should a Method Statement need to be revised, a formal revision will be issued, signed and dated. The updated Method Statement will be filed in the SEF.
- The submitted Method Statements (see Annexure B) will include but not be limited to:
    - Site division, demarcation and no-go areas (incl. site camp establishment, access, construction working widths).
    - Site clearance and topsoil management.
    - Stockpiling and laydown areas.
    - Solid waste management (general and hazardous, incl. disposal).
    - Hazardous substances storage and management.
    - Contaminated water management and disposal.
    - Cement storage and handling as well as concrete batching.
    - Fuel storage and management.
    - Ablution facilities and eating areas.
    - Dust and noise/nuisance control.
    - Protection of flora, fauna and natural features.
    - Stormwater management and erosion.

- Site de-establishment and rehabilitation.

- The submission of a site layout plan (see Annexure B) by the IE to the ECO for approval is compulsory. The layout plan must indicate all areas of relevance including *inter alia*:
  - The location of the site camp as well as the site camp layout indicating the location of materials storage (general and hazardous), fuel storage, the site office, ablution facilities, vehicle/machinery parking areas.
  - Access to the site camp and intervention sites.
  - Any required stormwater management measures such as diversion berms, cut-off drains, silt fences etc.
  - Stockpiling and laydown areas.
  - Concrete/mortar mixing/batching areas.
  - No-go or sensitive areas.
  - Limit(s) of the construction footprint.

The layout plan must take into consideration the buffer distances and restrictions as specified in the EMPr. Where applicable[22] the IE must make use of multiple layout plans to indicate the location of the abovementioned areas.

3.3 Environmental induction/training

Training and induction forms an integral part of ensuring and maintaining compliance with the EA and EMPr. Every person on site needs to understand the importance of compliance with the EA and EMPr and their specific role(s) in achieving this. Environmental induction and/or training must be specific or relevant to the level of responsibility of the person receiving the training. Environmental training and/or induction shall comply with the following requirements:

- The Implementing Entity and any other staff with management responsibilities (e.g. HSE officer and the foreman) will undergo environmental compliance training prior to construction commencing. The induction/training shall include project specific requirements for compliance with the EA and EMPr and responsibilities assigned to each party.
- Once the Method Statement is approved, a copy of the Method Statement must be circulated and communicated to the responsible parties (see Section 3.2).
- General staff will receive a simplified environmental induction and/or training before the commencement of construction (i.e. site establishment). The induction/training shall address, but not be limited to, basic environmental awareness, basic health and safety awareness, prevention of water, soil, and air pollution, prevention of soil erosion and sedimentation, basic principles of materials handling and storage, fire risks, protection of fauna and flora, removal of invasive alien species (if relevant), emergencies and incident responses, spill response provisions, social responsibility, and administrative and reporting procedures.
- All project personnel shall further be trained in basic wetland awareness, including a basic understanding of the components of wetlands, how wetlands function, the benefits they provide,

[22] Where the “site” covers an extensive area or where a large number of interventions are to be constructed.

why they need to be conserved and used sustainably, and the importance of rehabilitation in contributing to wetland conservation and sustainable use.

- Where work takes place in areas containing dangerous game, especially nature reserves and national parks, participants shall receive training in basic animal behaviour. A person trained in dangerous animal behaviour shall be present and suitably equipped to deal with such threats at all times. Before work commences each day, the site shall be checked for dangerous animals by the trained person. First aid training shall include current treatments for snakebites.
- Provision must be made for quarterly refresher environmental training to be undertaken during the course of the contract. The Implementing Entity shall ensure that all attendees sign an attendance register, and shall provide the Implementer with a copy of the attendance register the day after each course.
- Daily/weekly *Toolbox Talks* should include an environmental topic/issue in addition to a Health and Safety topic/issue.
- Proof (training material, attendance registers, photos) of training and attendance to be filed in SEF.
- Include environmental considerations as an item on the agenda of the monthly site meetings.

4 CONSTRUCTION PHASE

4.1 Compliance with the EA and successful implementation of EMPr, environmental specifications and other permits/licences

Identified impacts: The EA, EMPr and other relevant permits and licences are only of value if the conditions/requirements contained in them are adhered to. As these documents are legal documents, non-conformance in terms of adherence/implementation may constitute an offence and be subject to suspension of the authorisation/permit/licence and possible penalties or fines.

Objective of improved management:

- Continued and consistent compliance with the EA and EMPr as well as environmental specifications and other permits/licences

Specifications:

- The ECO shall be responsible for the implementation of this EMPr for the duration of the construction phase and until rehabilitation is completed.
- The ECO shall have full access to the site at all times.
- Audits[23] undertaken by the ECO shall comply with the requirements of GN R982 (2014, as amended).
- Although the EA/licence/permit holder can transpose contractual liabilities to the Implementing Entity in terms of compliance with the EA, EMPr, Environmental Specification and any other relevant permits/licenses, the EA/licence/permit holder will remain legally liable in terms of compliance.

Table 2: Compliance with the EA and successful implementation of EMPr, environmental specifications and other permits/licences

Management Measure	Detailed Description	Responsibility
Avoidance	• A copy of the EA, EMPr, Environmental Specifications and any other relevant permits/licenses will be kept in the SEF on site. • The Implementing Entity will familiarise himself/herself with the contents and requirements of the EA, EMPr, Environmental Specifications and any other relevant permits/licenses.	Implementing Entity, EA holder, ECO

[23] The ECO is responsible for providing an independent evaluation of compliance with the EMPr and not for enforcement of the conditions of the EMPr. The responsibility of enforcement of the conditions of the EMPr lies with the EA holder.

Management Measure	Detailed Description	Responsibility
	• The Implementing Entity and/or EA holder will not knowingly proceed with any action which might compromise compliance with the EA, EMPr, Environmental Specifications or any other relevant permits/licenses.	
Mitigation	• Should a situation arise where compliance with the EA, EMPr, Environmental Specifications or any other relevant permits/licenses is likely to be compromised/deviated from due to exceptional circumstances or a change in scope of work, the Implementing Entity will notify the ECO immediately. The ECO will assess the type of deviation and its significance and will advise the Implementing Entity whether the deviation requires an amendment to the EA, EMPr, Environmental Specifications or any other relevant permits/licenses.	Implementing Entity, EA holder, ECO
Stop work	• Should a situation arise where there is accidental or intentional non-conformance with the EA, EMPr, Environmental Specification and any other relevant permits/licenses, the ECO may order all work to stop until such non-conformance has been assessed, reported to the relevant authority (if necessary) and appropriately mitigated • A non-conformance will be recorded in writing by the ECO with a description (and photographic evidence where applicable) of the incident/non-conformance. A non-conformance report will contain detailed actions and action dates for each responsible party and will be signed off by the ECO and IE once completed/closed out.	Implementing Entity, EA holder, ECO
Monitoring method and frequency	• Daily/weekly monitoring by Implementing Entity. • Formal monthly audits by ECO.	Implementing Entity, EA holder, ECO
Management outcomes	• Full and continued compliance with the EA, EMPr, Environmental Specifications and any other relevant permits/licenses. • Identification of possible deviations in advance to avoid non-conformances. • Independent and impartial monitoring of compliance by the ECO.	Implementing Entity, EA holder, ECO

4.2 Site establishment

Identified impacts: Site establishment can often have a significant environmental impact in terms of vegetation clearance and/or the construction footprint and therefore needs to be carefully managed. It is also usually during site establishment that the site camp and laydown areas are identified and demarcated. If the aforementioned is not properly planned, it could have several secondary impacts such as water pollution, soil contamination, erosion and excessive dust.

Objective of improved management:

- To avoid excessive disturbance in terms of vegetation clearance and the construction footprint.
- Ensure that activities/facilities/site structures with pollution potential are located outside buffer zones and no-go areas, preferably in already disturbed or transformed areas. Examples include the site camp, material laydown areas, concrete batching plant, ablution facilities etc.
- Ensure that all activities remain within the approved construction footprint.

Specifications:

- Site establishment will not commence until such time that the EA appeal period has passed and will further be subject to the approval of the required method statements by the ECO.
- The wetland boundary shall be demarcated on the site plan and on site.
- Demarcation will be by means of brightly painted/white pegs/poles at least 1.5m in height and placed at regular (10m for linear of on every corner for non-linear) intervals on both sides of the approved construction footprint. **Demarcation shall be maintained for the duration of construction.**
- Danger tape and/or snow/barrier netting shall only be used for health and safety requirements along excavations or high risk areas.
- All areas outside approved and demarcated footprint are to be treated as no-go areas.

Table 3: Specific avoidance, mitigation and cessation management measures related to impacts identified with site establishment

Management Measure	Detailed Description	Responsibility
Avoidance	• The Implementing Entity must prioritise the use of disturbed areas for site camp establishment, laydown areas and stockpile areas. • The site camp shall be clearly demarcated and fenced subsequent to approval of the ECO.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• The site camp, laydown and stockpile areas may not be established within any environmentally sensitive area. Refer to Annexure C for sensitivity and wetland boundary map. • Should an extension/amendment to the construction footprint be required, the Implementing Entity must submit such a request to the ECO for approval prior to extending the construction footprint. • All work will be executed within the approved working area. • Temporary laydown areas will not be used for a period exceeding four (4) weeks and must be approved by the ECO prior to being used. • Temporary laydown areas must be demarcated should it fall outside the approved construction footprint. • The Implementing Entity is to ensure that all staff (e.g. plant operators, general workers) are informed of no-go areas as part of the induction/environmental awareness training.	
Mitigation	• Should the Implementing Entity disturb an area outside the approved footprint, then the Implementing Entity will be held liable to reinstate the impacted area to its original condition. • All temporary footprint areas must be reinstated/rehabilitated at the end of construction.	Implementing Entity
Stop work	• Should the Implementing Entity fail to remain within the approved construction footprint or intentionally/negligently cause damage to a natural feature in a no-go area, the ECO reserves the right to suspend or partially suspend construction via written instruction in order to allow for the assessment, reporting and rectification of the impact. • The aforementioned will be determined by the type and significance of the non-conformance and the risk of it reoccurring should construction proceed.	ECO, Engineer
Monitoring method and frequency	• Daily and weekly monitoring/inspections by the Implementing Entity. • Formal monthly audits by the ECO.	ECO, Implementing Entity

Management Measure	Detailed Description	Responsibility
Management outcomes	• Method Statements are submitted at least 14 days prior to the commencement of site establishment. • Site establishment only commences after approval of the Method Statements. • Already disturbed areas are prioritised for site camp, laydown and stockpile areas. • Construction footprint and vegetation clearance is controlled and kept to a minimum. • Activities are restricted to within the approved construction footprint. • Demarcation remains visible and in place for the duration of construction.	Implementing Entity, EA holder, ECO

4.3 Channels of communication for public complaints

Identified impacts: The construction activities could lead to nuisance impacts and impacts on the adjacent properties. This may result in complaints from the public and/or adjacent landowners

Objectives of improved management:

- To record and address (within a reasonable timeframe) any complaints by the public arising from the construction activities and the impacts thereof.

Specifications: None

Table 4: Specific avoidance, mitigation and cessation management measures related to impacts identified with public complaints

Management Measure	Detailed Description	Responsibility
Avoidance	• The IE must contact the landowner and/or occupier of the land where the construction is to take place at last 10 working days prior to moving onto site. • The IE must confirm the procedure to be followed for access including gates which must remain locked or open. • The Implementing Entity must ensure that the site remains neat and that no littering occurs. • Ensure that the public and adjacent landowners are informed well in advance of any construction activities to take place in the vicinity of their properties. • Where the site is located in a nature reserve/park, the Implementing Entity must familiarise him/herself with the rules and regulations of the reserve/park and where necessary include such information in the environmental induction and training. • Where the site is frequently visited by tourists, the Implementing Entity must ensure that his/her site does not cause a visual or noise disturbance. • Also refer to the Code of Conduct attached under Annexure A.	Implementing Entity
Mitigation	• Provide a contact number of person responsible for the site on the site signage. • Maintain a complaints register on site to allow public complaints to be recorded.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• Verbal complaints must be recorded within 24 hours of being received with a copy provided to the complainant. • Actions to address the complaints must be recorded in writing with sign-off by the ECO once the actions have been completed. • Address all complaints within a reasonable timeframe (24 hours for initial contact and 5 working days to resolve minor issues or complaints). • Ensure that actions are recorded in the SEF and the actions are implemented to avoid the future complaints regarding the same issue.	
Stop work	• Should a complaint relate to an action by the Implementing Entity which can cause/has caused a serious health and safety or environmental impact, the ECO may suspend or partially suspend work via instruction from the Engineer in order to assess the impact/complaint and identify any remedial actions required.	ECO
Monitoring method and frequency	• Reporting of serious complaints within 24 hrs to the ECO. • Address all complaints within a reasonable timeframe (24 hours for initial contact and 5 working days to resolve minor issues or complaints). • Ensure that all complaints are recorded in the complaints registered and that remedial actions are recorded, implemented and maintained. • Daily and weekly monitoring/inspections by the Implementing Entity. • Formal monthly audits by the ECO.	Implementing Entity, ECO
Management outcomes	• The public is timeously informed of construction activities which might impact them. • Contact details of the Implementing Entity is visible on site signage at the site camp. • A register is available at the site camp to record any community/public complaints.	Implementing Entity, ECO

Management Measure	Detailed Description	Responsibility
	• All public complaints are recorded and closed out within a reasonable timeframe (24 hours for initial contact and 5 working days to resolve minor issues or complaints). • Repeat complaints regarding the same matter/issue are avoided.	

4.4 Vegetation clearance

Identified impacts: Various activities that take place during the construction phase require the removal of vegetation, including clearing of the construction footprint for construction activities, site camp establishment, laydown and stockpile areas and access roads.

Objective of improved management:

- To retain natural vegetation in terrestrially sensitive areas.
- To minimise the extent of disturbance of vegetation/habitats on-site.
- Avoid the loss of species of conservation concern.

Specifications:

- Vegetation clearance must be restricted to the approved construction footprint.
- Removal of vegetation must occur at increments and must only be done up to two weeks ahead of actual construction commencing in an area.
- No burning of vegetation will be allowed.
- Where vegetation consists of grasses, bulbs and shrubs, it will be cleared (i.e. complete removal of the vegetation with its root system) as part of the removal of topsoil (i.e. to a maximum depth of 30cm) in order to maximise organic content and the available seedbank in the topsoil.
- Where vegetation consists predominately of reeds, the reeds will be slashed/cut to 30cm in height, measured from ground level, with the remainder of the plant and its root/rhizome system removed with the topsoil layer (i.e. at a maximum depth of 30cm).
- Vegetation/ plant material is not allowed to be disposed of as waste at a landfill site and should be stored for mulching purposes upon completion of the construction works.

Table 5: Specific avoidance, mitigation and cessation management measures related to impacts identified with vegetation clearance

Management Measure	Detailed Description	Responsibility
Avoidance	• Limit vegetation clearance in “sensitive areas” as identified in the BAR and as indicated on the maps under Annexure C. • Prioritise the use of already disturbed and degraded areas for site camps, laydown and stockpiling areas.	Implementing Entity, ECO

Management Measure	Detailed Description	Responsibility
	• Do not remove/clear vegetation outside the approved construction footprint. • Ensure that site demarcation is maintained throughout the construction phase. • Clearly mark shrubs and trees which should not be disturbed/damaged during construction. • Remove/relocate species of conservation concern where possible and practical.	
Mitigation	• Ensure that all temporary footprint areas are rehabilitated at the completion of construction in a specific area. • Ensure that topsoil is removed and conserved in order to ensure successful revegetation/rehabilitation (also see Section 4.5). • Any area disturbed outside the approved construction footprint must be reinstated at the Implementing Entity's cost to the satisfaction of the ECO. • Ensure that sufficient funds are allocated in the BoQ for rehabilitation of temporary footprints.	Implementing Entity, ECO, Engineer
Stop work	• Should the Implementing Entity fail to remain within the approved construction footprint or intentionally/negligently cause damage to a natural feature/vegetation in a no-go area, the ECO reserves the right to suspend or partially suspend construction via instruction from the EA holder in order to allow for the assessment, reporting and rectification of the impact. • The aforementioned will be determined by the type and significance of the non-conformance and the risk of it reoccurring should construction proceed.	ECO, Engineer
Monitoring method and frequency	• Daily and weekly monitoring/inspections by the Implementing Entity. • Formal monthly audits by the ECO.	Implementing Entity, ECO
Management outcomes	• Work is contained to the approved construction footprint. • Site demarcation is maintained for the duration of construction.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• Vegetation clearance is limited in sensitive areas. • No site camps, laydown or stockpile areas in sensitive areas. • Plants of conservation concern are relocated where possible and feasible (with the necessary permits/licences/approvals in place). • Temporary footprint areas are rehabilitated once work in an area has been completed. • Topsoil is removed and managed properly (see Section 4.5 below) to aid in successful rehabilitation.	

4.5 Topsoil management

Identified impacts: Topsoil is an essential component to achieve successful rehabilitation/revegetation of a disturbed area. Poor topsoil management practices such as double handling, compaction, contamination, erosion and failing to control weeds/alien invasive species on stockpiles all contribute to the degradation and loss of topsoil. This in turn compromises the success of rehabilitation or results in additional costs to improve or import topsoil.

Objective of improved management:

- To ensure that topsoil is properly removed and managed during construction in order to enable successful rehabilitation at the completion of construction.

Specifications:

- Topsoil must be removed to a maximum depth of 30cm.
- Where the topsoil layer is shallow or alternating in depth, it must be removed to the maximum depth possible.
- Topsoil removal must occur at increments and will only be done up to two weeks ahead of actual construction commencing in an area.
- Topsoil will be removed with the appropriate equipment i.e. pointed or flat tip shovel/spade and a wheelbarrow.
- Topsoil stockpiles must be stored on level areas to a maximum height of 1.5m. The stockpile areas will be properly planned and will be approved as part of the site demarcation process and will be indicated on the site layout plan.
- Stockpiles will not block access routes or endanger any person or animal.
- The stockpiles must be protected from erosion and contamination by subsoil or imported materials.
- Topsoil will not be driven over or compacted and stockpiles will not be reworked or moved unnecessarily.
- Topsoil stockpiles must be kept free of weeds for the duration of construction until reapplied during rehabilitation.
- Topsoil will only be reapplied after all civil work has been completed in order to avoid compaction.

Working in peat wetlands:

Some of the wetlands identified for priority rehabilitation may occur in soils with a high organic composition, known as peat. These soils hold huge importance globally due to their nature to hold high levels of carbon (known as carbon sequestration). The following considerations should be made for site clearance in peatlands:

- Work shall only be done in periods with low rainfall (Winter rainfall areas - November to March and Summer rainfall areas - May to September).
- No material will be removed from the peatland for construction purposes e.g. boulders, rocks, sand.
- All access to the intervention site in the peatland will be by foot, no vehicles will be allowed in the peatland.
- Where materials need to be transported into the peatland, it will be done by means of wheelbarrows on demarcated walkways lined by wooden planks, geotextile or similar material.
- The Implementing Entity will use only one access path/point per Intervention Point and will not create multiple access paths or points.
- No foreign vegetable matter (e.g. mulch) may be brought into the wetland area (especially from alien species).
- Topsoil shall be removed specifically in the form of sods (20 to 20cm (length) x 20cm (width) x 20cm (depth)):
    - The first sod shall include the roots/rhizome layer (i.e. the rootstalks and their associated nodes/tubers)
    - The sods shall be stored in a wet area, on site, in their original orientation and order.
    - Vegetation can be cut short if it will make it easier to handle the sods.
    - Soil shall be stockpiled according to the different soil layers (i.e. in separate stockpiles) as per the soil profile. Where possible, soils shall be stockpiled as high as possible to retain moisture, but not higher than 0.5m.
    - Stockpiles will be located in a saturated area with shallow surface water immediately adjacent to the Intervention Point. Sods will be placed on the existing vegetation. Where vegetation height exceeds 30cm, the vegetation can be cut and used as mulch/cover layer.
    - The stockpile area will be indicated by means of painted pegs at each corner.
    - Stockpiles shall only be handled twice i.e. during removal and during placement for rehabilitation.
    - Stockpiles shall be covered with 10cm mulch or cloth (geotextile with <0.5cm aperture) to ensure that the moisture content is maintained by restricted evaporation and evapotranspiration.

Table 6: Specific avoidance, mitigation and cessation management measures related to impacts identified regarding topsoil management

Management Measure	Detailed Description	Responsibility
Avoidance	• Ensure topsoil is stockpiled in areas on site where opportunity for compaction and contamination due to other construction activities are limited. • Avoid moving/handling the topsoil more than twice (i.e. restricted to initial stripping and final reapplication). • Ensure weeds and alien invasive species are removed from the stockpiles prior to reaching seed formation stage. • Do not move topsoil between different areas on site i.e. it should be reapplied in the same area that it was removed from.	Implementing Entity
Mitigation	• Remove more than 15cm of topsoil where possible to compensate for areas of shallow/no topsoil as well as topsoil loss due to mismanagement. • Apply mulch to the topsoil if the topsoil quality has been impacted significantly and will compromise the success of revegetation (based on the reasoned opinion of the ECO or wetland specialist). • Enforce a stricter and more frequent weeding/alien invasive removal regime where there was failure to remove weeds/alien invasive species from topsoil stockpiles prior to seed formation stage.	Implementing Entity, ECO, Engineer
Stop work	N/A	
Monitoring method and frequency	• Use of approved site layout to confirm correct location of topsoil stockpiles. • Continuous monitoring during initial topsoil removal/stripping. • Weekly to bi-weekly monitoring of stockpiles for signs of erosion and weeds. • Monthly audits for general topsoil management practices.	Implementing Entity, ECO
Management outcomes	• Topsoil is removed to a minimum depth of 15cm. • Topsoil is not contaminated by other materials.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• There is no compaction of topsoil. • Topsoil is not eroded or washed away. • Handling of topsoil is restricted to initial removal and final reapplication. • The topsoil applied during rehabilitation matches the quality and thickness of topsoil removed during site clearance. • Weeds and alien invasive species on topsoil stockpiles are removed on a regular basis prior to the plants reaching seed formation stage.	

4.6 Materials management (non-hazardous)

Identified impacts:

- Material delivered to areas not approved by the ECO and Engineer e.g. outside the approved construction footprint, on steeply sloped areas, etc.
- Imported materials introduce new alien invasive species to site.
- Materials spilling from vehicles causing a safety or pollution risk.
- Materials are eroded and washed into wetland systems as a result of being stockpiled in areas with concentrated stormwater runoff or on sloped areas.
- Materials are mixed with the underlying natural ground surface causing contamination of soil, excessive quantities of material remaining on site after construction, localised plant die-off, increase in sedimentation etc.
- Wetland systems are impacted and/or polluted due to an insufficient buffer width between site camps, laydown and stockpile areas and water resource.
- Materials susceptible to wind erosion results in a dust nuisance and contamination of surrounding areas.
- Materials are stored on site for extended periods leading to the need for increased storage area due to materials not being used.

Objectives of improved management:

- Ensure material delivery and storage takes place in such a manner that it does not cause pollution or degradation of the surrounding environment.
- Plan material use and delivery in order to ensure that material storage on site does not take place for extended periods of time (i.e. > 4 weeks).
- Minimise the use of intact/undisturbed areas for material stockpiling/storage.
- Minimise exposure of materials to wind and water erosion.
- Ensure that materials are stored on site for the shortest possible period to limit the extent of areas required for storage and stockpiling.

Specifications: None

Table 7: Specific avoidance, mitigation and cessation management measures related to impacts identified with materials management (non-hazardous)

Management Measure	Detailed Description	Responsibility
Avoidance	• It will be the Implementing Entity's responsibility to ensure that delivery drivers/suppliers are aware of the relevant EMPr requirements. • The Implementing Entity shall ensure that materials are sourced from legal and approved sources. If unsure the Implementing Entity will obtain permission from the ECO prior to using a certain material resource. • Imported materials shall be free of weeds, litter and contaminants. • Materials shall be appropriately secured to ensure safe passage between destinations. Loads including, but not limited to, sand, stone chip, fine vegetation, refuse, paper and cement, shall have appropriate cover to prevent them spilling from the vehicle during transit. The Implementing Entity shall be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials. • The Implementing Entity will identify appropriate storage and laydown areas prior to delivery to site. The areas will be approved by the ECO either as part of the required Method Statement or on an *ad hoc* basis. • Open, disturbed areas will be prioritised for stockpiling and laydown areas. • Bulk stockpile areas will be outside the wetland boundary and any other areas prone to seasonal flooding unless otherwise approved by the ECO. • The Implementing Entity will schedule the delivery of materials in such a manner that it does not require excessive periods (>4 weeks) of on-site storage unless otherwise approved by the ECO e.g. where delivery/source distances are excessive. • Minor stockpiles (not covering an area exceeding 4m^2 unless otherwise approved by the ECO) will be allowed next to an Intervention Point for specific use at the Intervention Point. • Minor stockpiles next to intervention sites will be utilised within 2 weeks of the material being stockpiled i.e. it will not be left adjacent to a planned or completed Intervention Point for an excessive period of time.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• Laydown and storage areas where such occurs on vegetation, topsoil or in a wetland shall be on hessian, PVC sheeting or a similar material in order to separate the imported material from the vegetation/topsoil and to ensure easy and proper removal of excess material. • Stockpile heights will be limited to 1.5m where the material is fine (i.e. susceptible to wind erosion) or in areas known to regularly (weekly to fortnightly basis) experience wind speeds exceeding 20km/h. Alternatively, material which can be windblown will be covered with shade cloth, PVC sheeting, hessian or similar suitable material. • Stockpile areas will be flat and not subject to concentrated stormwater runoff or surface water flow. • Materials such as precast pipes and culverts, gabions baskets, MacMat-R, hessian etc. can be placed directly on vegetated areas to avoid the disturbance and clearance of vegetation and topsoil. This will be at the discretion of the ECO based on the merits of avoiding vegetation and topsoil removal.	
Mitigation	• Should material be washed or blown into the surrounding environment, the Implementing Entity will be responsible for the removal/recovery of such material. Whether removal/recovery is required will be determined by the ECO based on the type of material, volume of material and whether the material can be recovered/removed without causing substantial additional degradation of the surrounding environment. • Materials not used at a specific Intervention Point will be removed once the activity requiring the material has been completed e.g. stones for gabions. • Where sand/fill material is legally sourced from a dam, existing borrow pit or similar with clear presence of invasive alien species, the Implementing Entity will allow for a weeding programme at the on-site stockpile area and Intervention Point. The weeding programme will span a winter and summer period consecutively to ensure that introduced invasive alien and weed species are removed prior to seed formation stage. • All remaining/waste material will be removed off-site before or by the end of construction.	Implementing Entity
Stop work	N/A	

Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	• Daily and weekly monitoring/inspections by the Implementing Entity. • Formal monthly audits by the ECO.	Implementing Entity, ECO
Management outcomes	• Imported materials are stored/stockpiled on already disturbed areas within the approved construction footprint. • Material delivery and storage takes place as in such a manner that it does not cause pollution or degradation of the surrounding environment. • Materials are not eroded and/or deposited in the surrounding environment. • Materials are used within four weeks of delivery. • No new or additional alien invasive species are introduced via imported material. Where such are imported, the Implementing Entity implemented a weeding programme spanning at least one winter and one summer i.e. a year. • All imported material is removed from site at the completion of construction.	

4.7 Hazardous chemicals and potential hazardous substances

Identified impacts:

- Includes, but are not limited to: drums of fuel, grease, oil, brake fluid, hydraulic fluid, paint, batteries and herbicides (for alien plant clearing), etc.
- Spills resulting in pollution of nearby aquatic systems and water resources.
- Spills resulting in soil contamination and degradation.
- Fauna and/or (indigenous) flora fatalities/die-off.
- Illegal/improper disposal of materials contaminated with hazardous product/spill.

Objectives of improved management:

- Ensure the controlled and documented management of hazardous chemicals and substances.
- Avoid and minimise spillages through proper storage and dispensing practices.
- Ensure that the appropriate mitigation measures are in place in the event of a spill.
- Ensure that hazardous materials are stored in designated/approved areas away from sensitive receptors/environments.

Specifications:

- The Implementing Entity must supply the ECO with a list of all hazardous materials that would be present on site during the construction period.

Table 8: Specific avoidance, mitigation and cessation management measures related to impacts identified with hazardous materials management

Management Measure	Detailed Description	Responsibility
Avoidance	• All hazardous materials and products must be stored in containers marked as per SANS 10234 requirements i.e. in its original container. • All containers will have lids and stored in a covered and bunded area or in a flammables/hazardous store with a metal drip tray able to contain 110% of the volume of the largest container.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• A register of hazardous materials and products will be kept at the site officer or flammables/hazardous store together with up to date Material Safety Data Sheet (MSDS). • Containers with a volume of more than 20ℓ will have proper dispensing equipment. • Dispensing of hazardous materials into smaller containers or equipment will only occur at the site camp on a lined or impermeable surface. • Hazardous materials and products will only be stored at the site camp.	
Mitigation	• The Implementing Entity must ensure that there is an emergency procedure in place to deal with accidents and incidents (e.g. spills) arising from hazardous substances. • The Implementing Entity must ensure that all personnel on site are properly trained concerning the proper use, handling and disposal of hazardous substances. • The Implementing Entity must report major incidents to the ECO immediately. Any spill incidents must be cleaned up immediately and in according with the emergency procedure	Implementing Entity
Stop work	• Should the Implementing Entity through negligent or wilful action/behaviour cause a significant/major spill or dispose of hazardous materials illegally, the ECO reserves the right to suspend or partially suspend construction via instruction from the EA Holder in order to allow for the assessment, reporting and rectification of the impact. • Depending on the severity of the non-conformance, the ECO will also inform the relevant competent authority to confirm the Implementing Entity's liability to be prosecuted and/or fined.	ECO, EA Holder
Monitoring method and frequency	• Visual inspection. • Immediate response to spillage. • Completion of an incident form for major spillages (>5ℓ). • Reporting of major spills within 24 hrs to the ECO.	Implementing Entity, ECO

Management Measure	Detailed Description	Responsibility
	• Daily and weekly monitoring/inspections by the Implementing Entity. • Formal monthly audits by the ECO.	
Management outcomes	• Hazardous materials are properly managed including recording keeping, storage, dispensing and disposal. • Spillages are avoided and minimised through proper storage and dispensing practices. • All personnel on site are properly trained concerning the proper use, handling and disposal of hazardous substances. • The Implementing Entity has a designated and trained individual on-site to respond to spills on site. • Spillages are removed/cleaned/treated immediately after occurring. • Ensure that the appropriate mitigation measures are in place and implemented in the event of a spill. • Hazardous materials are stored in designated/approved areas away from sensitive receptors/environments. • Spills are reported to the ECO within 24hrs of occurring. • Spilled hazardous product and materials used for clean-up are stored and disposed of as hazardous waste or collected by a registered service provider.	Implementing Entity, ECO

4.8 Contamination of soils and water

Identified impacts: Soil and water can be contaminated or polluted by construction activities via several pathways. In terms of soil contamination, pollution can result in the soil being unsuitable for certain land uses and it can also indirectly contribute to sustained pollution of both surface and groundwater resources. The pollution of water resources can lead to numerous direct and indirect impacts including the following:

- Water becoming unsuitable for certain uses such as human consumption and certain agricultural activities due to a decline in water quality.
- A loss of aquatic biodiversity through a change in species composition and diversity and/or species die-off in reaction to a decline in water quality.
- An increase in alien invasive fauna and flora species as a result of higher tolerance capacity in terms of water quality changes/deterioration.
- Increased costs of treating contaminated water for human consumption.

Objective of improved management:

- To conduct/manage construction activities in such a manner that the contamination of soil and water resources is avoided and/or minimised.

Specifications: None

Table 9: Specific avoidance, mitigation and cessation management measures related to impacts identified regarding contamination of soil and water

Management Measure	Detailed Description	Responsibility
Avoidance	• Ensure that all equipment, machinery and vehicles are in good working order. • No maintenance will take place on site and broken equipment, machinery and vehicles must be removed off-site within 24 hours of the breakdown. • Use drip trays for all stationary or parked equipment, machinery and vehicles showing signs of leakage. • Ensure that substances that pose a risk of water/soil contamination are appropriately stored and disposed of (also refer to Section 4.7). • Site camps are not allowed in a wetland. • Hazardous materials storage areas are not allowed within 100m of watercourses.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• Concrete mixers may only operate on a stable, level site. • Concrete shall be mixed on trays or other suitable lining material to prevent contamination of the soil and/ or waterbodies. • Ensure that minor mixing of concrete and mortar is done on impermeable surfaces or in wheel barrows. • Store chemicals in clearly marked, sealable containers in bunded areas as approved by the ECO. Inspect the containers at regular intervals for any leaks. • Use proper dispensing equipment on containers for hazardous products and store the dispensing equipment in weatherproof containers when not in use. • Ensure that equipment and plant is in proper working condition and do not leak fuel or oil, especially during work in or near watercourses. • Ensure designated staff are trained in the prevention and mitigation of spills. • The construction camp and any major stockpiling or storage areas should be outside any watercourse unless otherwise approved by the ECO. • Stormwater runoff must be diverted around the site camp and stockpile areas (material susceptible to erosion) by means of cut-off berms or trenches to avoid contamination of clean overland runoff. • Stockpiles (topsoil, subsoil and imported materials such as sand and fill material) must be on flat surfaces in areas which are not susceptible to concentrated stormwater runoff or flow. • Ablution facilities must be located outside the boundary of any watercourse unless otherwise approved by the ECO. Workers should not be allowed to urinate or defecate near or in bushes or rivers/streams.	
Mitigation	• All spills to be contained and adequately cleaned-up or treated *in situ.* • Conduct activities with high pollution potential in the low rainfall months.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• Use designated washing areas for all equipment used for concrete work with the necessary mechanisms in place to retain contaminated runoff and allow for the necessary treatment/filtering of polluted water.	
Stop work	• Should a major spill occur (as per Section 4.7), the ECO reserves the right to suspend or partially suspend construction via instruction from the EA Holder in order to allow for the assessment, reporting and rectification of the impact. • Depending on the severity of the non-conformance and degree of negligence on the Implementing Entity's part, the ECO will also inform the relevant competent authority to confirm the Implementing Entity's liability to be prosecuted and/or fined.	ECO, EA Holder
Monitoring method and frequency	• Daily visual inspection of equipment, vehicles and machinery for signs of leaks. • Immediate response to spillage of product or material with pollution potential. • Completion of an incident form for major spillages (>5ℓ). • Reporting of major spills within 24 hrs to the ECO. • Daily and weekly monitoring/inspections by the Implementing Entity. • Formal monthly audits by the ECO.	Implementing Entity, ECO
Management outcomes	• All activities and materials with a notable pollution potential or located away from any watercourse unless otherwise approved by the ECO. • All the necessary pollution prevention measures are in place. • Plant is in good and working condition with leaks repaired immediately or the plant removed from site where more extensive repairs are required. • All hazardous products/materials are handled/managed correctly as per Section 4.7. • All hazardous liquid product spills are cleaned/treated/removed immediately as per procedure under Section 4.7.	Implementing Entity

4.9 Concrete mixing and cement handling

Identified impacts: Concrete batching/mixing operations can have several impacts, most notably soil and water pollution (increase in pH, TSS, TDS and minor levels of Aluminium, Iron and Magnesium oxides) as a result of cement laden runoff not being properly contained or purposeful discharge of cement laden runoff. Poor cement handling, storage and disposal practices can also contribute to the aforementioned impacts. Hardened concrete is however stable and inert as a waste.

Objective of improved management:

- Ensure proper cement handling, storage and disposal, avoiding discharge or disposal into the environment.
- Ensure that cement laden water/runoff from concrete/mortar mixing and application activities is collected and retained on site to allow for reuse in construction activities, avoiding discharge into the environment.

Specifications:

- A concrete batching plant/portable mixer will not be allowed to operate until a temporary washwater and runoff containment system has been constructed/established.

Table 10: Specific avoidance, mitigation and cessation management measures related to impacts identified in terms of concrete batching and cement handling

Management Measure	Detailed Description	Responsibility
Avoidance	• Where concrete is mixed in bulk (i.e. portable concrete mixer), the following will apply: o The mixer will be placed on a level, surfaced/lined area. o Bulk mixing will not occur in the wetland unless the distance from the wetland boundary to the Intervention Point necessitates *in situ* mixing. This must be approved in all instance by the PC/ECO prior to the commencement of bulk mixing concrete. • Cement storage will be in a closed container. • Waste or contaminated cement powder will be stored in a marked container with a lid until disposal or reuse. • Cement bags must be emptied properly and stored in a weatherproof container until disposal.	Implementing Entity, ECO

Management Measure	Detailed Description	Responsibility
	• Minor concrete and mortar mixing will be done on an impermeable surface such as a wooden board, wheelbarrow, metal tray etc.	
Mitigation	• Equipment and containers used for minor concrete/mortar work and mixing will be washed in a designated container and the contents disposed of in the settling system at the concrete batching plant. Washwater can alternatively be reused in concrete/mortar mixing or application, but may not be disposed of onto the ground surface or into a water resource. • Concrete (not cement) spills will be allowed to harden and removed within 2 days for reuse or disposal as a Type 4 waste to a Class D landfill.	Implementing Entity
Stop work	• Mismanagement of waste concrete and/or cement laden runoff can result in the suspension of bulk concrete mixing activities via instruction from the ECO until non-conformances have been rectified to the ECO's satisfaction.	Implementing Entity, ECO, Engineer
Monitoring method and frequency	• Daily visual inspection of areas where concrete/mortar work is taking place (Foreman). • Weekly inspection of settling system at batching plant (Foreman). • Reporting of major spills within 24 hrs to the ECO. • Formal monthly audits by the ECO.	Implementing Entity, ECO
Management outcomes	• Cement laden runoff is contained to site in an appropriately sized settling system. • Cement product is properly handled and stored and does not result in pollution of soil or water resources. • No equipment or plant used for concrete/mortar mixing or application is washed in a watercourse. • The settling system at the batching plant/portable mixer is maintained and does not overflow. • Waste concrete is removed within 2 days and reused or disposed of as inert waste.	Implementing Entity

4.10 Stormwater management, erosion and sedimentation

Identified impacts: The clearance of vegetation and earthworks associated with construction usually results in an increase in stormwater runoff volume and velocity. This in turn results in an increase in erosion and sedimentation, impacting both terrestrial and aquatic systems. Temporary structures, stockpiles and access roads can also further contribute to a concentration of runoff and resultant increase in erosion and sedimentation on site.

Objective of improved management:

- To avoid and mitigate the increase in stormwater volumes and velocity, thereby reducing erosion and sedimentation on site.

Specifications: None

Table 11: Specific avoidance, mitigation and cessation management measures related to impacts identified in terms of stormwater management, erosion and sedimentation

Management Measure	Detailed Description	Responsibility
Avoidance	• Vegetation and topsoil clearance will occur at increments and will only be done up to two weeks ahead of actual construction (i.e. excavation) commencing in an area. • Material (excavated and imported) stockpiles will not be located in areas of concentrated runoff/flow.	Implementing Entity
Mitigation	• Stormwater generated on the cleared construction footprint will be allowed to discharge into the surrounding vegetation at regular intervals and will not be allowed to collect and concentrate in large volumes or discharge at high velocities. • Disturbed areas must be rehabilitated as soon as possible after construction has been completed in order to stabilise exposed surfaces which are susceptible to erosion. • Implement temporary stormwater management and erosion prevention measures in areas with high erosion potential (in consultation with the ECO).	Implementing Entity
Stop work	N/A	

Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	• *Ad hoc* visual inspections of site by the Implementing Entity after rainfall exceeding 15mm per day. • Formal monthly audits by the ECO.	Implementing Entity, ECO
Management outcomes	• Exposed ground surfaces are limited and rehabilitated immediately after completion of construction activities in an area. • Stormwater runoff is dissipated and allowed to discharge at regular intervals. • Erodible stockpiles are located outside areas of stormwater concentration. • The construction site does not contribute notably to erosion on-site and in the immediate vicinity of the site. • Erosion is detected/identified and addressed/mitigated within 14 days of occurring. • Temporary stormwater management and erosion prevention measures are implemented in areas with high erosion potential of signs of extensive erosion occurring.	Implementing Entity, ECO

4.11 Dust nuisance

Identified impacts: Construction activities will typically lead to dust generation and general exhaust emissions from vehicles and construction plant. Given the limited extent of vegetation clearance and low number of vehicles and construction plant used on a typical WfWetlands site, dust generation is expected to generally be minimal and restricted to mostly a nuisance impact.

Objective of improved management:

- To limit the generation of dust and where needed mitigate dust nuisance.

Specifications:

- Watering for dust suppression purposes is only recommended in instances where dust will create a significant health and/or safety hazard.

Table 12: Specific avoidance, mitigation and cessation management measures related to impacts identified regarding dust nuisance

Management Measure	Detailed Description	Responsibility
Avoidance	• As far as possible stockpile materials which are prone to become airborne away from areas where dust will be a nuisance or a hazard. • Limit the height of stockpiles which could cause a dust nuisance to 1m. • Where the abovementioned cannot be achieved, cover stockpiles consisting mostly of fine material with shade cloth, hessian or a similar acceptable cover. • Limit earthworks in during windy conditions (i.e. winds above 40 km/h). • Limit vehicle travelling speeds on unsurfaced roads to 40 km/h.	Implementing Entity
Mitigation	• Where dust poses a notable health and/or safety hazard, implement a watering schedule to address the particular area of concern. • Ensure that a watering schedule is maintained over weekends and holidays where a dust nuisance could pose a health and/or safety hazard to the public using the road. • Record and address any public/community complaints regarding dust generation in the Complaints Register.	Implementing Entity

Management Measure	Detailed Description	Responsibility
Stop work	• Work causing excessive dust will be halted at wind speeds exceeding 40km/h. • Where dust generation leads to/results in a complaint by the public or landowner, the ECO reserves the right to suspend or partially suspend work on site until the source of dust is identified and mitigation measures implemented.	Implementing Entity, ECO
Monitoring method and frequency	• Daily visual monitoring. • Recording of public complaints regarding dust generation in Complaints Register.	Implementing Entity
Management outcomes	• The dustfall rate as specified under regulation 3 of GN R827 (National Environmental Management: Air Quality Act (No. 39 of 2004) - National Dust Control Regulations, 2013) is not exceeded. • Stockpiles which could cause a dust nuisance are limited to 1m in height or covered with a suitable material. • No public complaints are received regarding dust nuisance and/or health and safety hazard. • Where required, a watering schedule is implemented where required i.e. where dust causes a health and/or safety hazard. • Alternative dust binding products are used where long-term watering (> 4 weeks) over an extensive area (>1ha) is required. • Vehicle travelling speed is limited to 40km/h on unsurfaced roads.	Implementing Entity, ECO

4.12 Noise nuisance

Identified impacts: Typical construction activities can lead to excessive noise which could cause a disturbance or nuisance to neighbouring land uses/receptors. Typical construction related noise which would usually be regarded as permissible in urban areas might also be regarded as a disturbance in areas such as nature reserves or on farms.

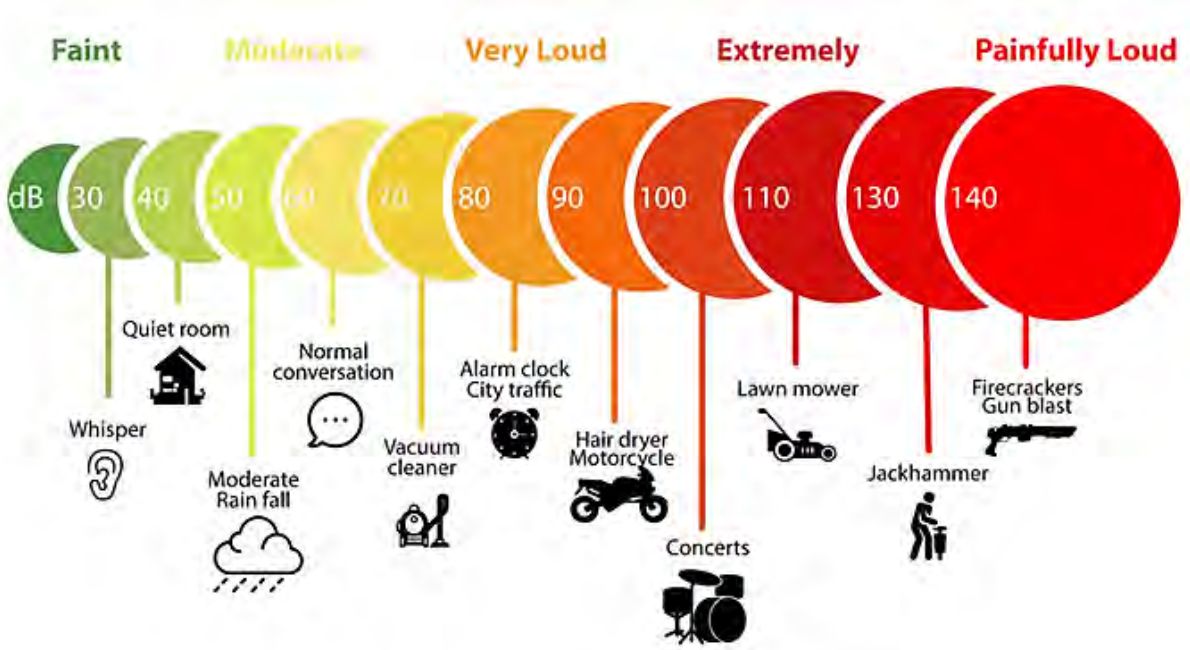

Figure 1: Example of typical everyday noises and related dB values[24]

Objective of improved management:

- Manage the level and duration of excessive noise generated as a result of construction activities and avoid resultant public complaints. Also ensure that sensitive receptors are notified in advance where excessive noise cannot be avoided for a certain period of time or activity.

Specifications: None

[24] http://ototronixdiagnostics.com/images/decibelthermometer-horizontal.jpg

Table 13: Specific avoidance, mitigation and cessation management measures related to impacts identified regarding noise nuisance

Management Measure	Detailed Description	Responsibility
Avoidance	• Fit silencers to equipment as required. • Ensure equipment and vehicles are properly maintained and in working order. • The Implementing Entity shall limit noise levels (e.g. install and maintain silencers on machinery). The provisions of SANS 1200A Sub-clause 4.1 regarding "built-up areas" shall apply to all areas within audible distance of residents whether in urban, peri-urban or rural areas. • Appropriate directional and intensity settings are to be maintained on all hooters and sirens.	Implementing Entity
Mitigation	• Limit working hours with noisy equipment to weekdays between 07H00 and 18H00. • Inform sensitive receptors in advance of construction activities. • Construction activities generating output levels of 50dB (A) or more, in peri-urban areas, shall be confined to the hour's 08h00 to 17h00 Mondays to Saturdays. • Record and address any public/community complaints regarding noise generation in the Complaints Register. • Request formal approval of extension of working hours by the ECO prior to implementing extended hours or working over weekends.	Implementing Entity, ECO
Stop work	N/A	
Monitoring method and frequency	• Daily monitoring (by means of a dB meter application on a cell phone) should any laud activities take place. • Recording of public complaints regarding noise generation in Complaints Register.	Implementing Entity

Management Measure	Detailed Description	Responsibility
Management outcomes	• Compliance with the Environment Conservation Act (No. 73 of 1989): Regulations in terms of Section 25 - Noise Control (GN R154, 1992)[25]. • No public complaints are received regarding noise generation and/or health and safety hazard.	Implementing Entity, ECO

[25] Please note: These regulations have been repealed in Gauteng by Gen N 5479 / PG 75 / 19990820; in the Free State by Gen N 24 / PG 35 / 19980424 and in the Western Cape by RN 627 / PG 5309 / 19981120. Proposed Noise Control Regulations have been published for Eastern Cape under Gen N 181 / PG 824 / 20011210. Please also note that various municipalities have their own By-Laws regarding noise control.

4.13 Ablution

Identified impacts: A lack of proper and well placed ablution facilities can result in poor working conditions, health risks as well as environmental pollution.

Objective of improved management:

- To provide sanitary working conditions and avoid heath risks and environmental pollution as a result of a lack of ablution facilities.

Specifications: None

Table 14: Specific avoidance, mitigation and cessation management measures related to impacts identified in terms of ablution

Management Measure	Detailed Description	Responsibility
Avoidance	• Prior to construction commencing the Implementing Entity must provide sanitation for Contractors at a ratio of one (1) toilet for every 15 workers. • Toilets should preferably be located outside the wetland boundary and must be approved by the ECO. • Toilets shall be placed on level surfaces and secured to the ground outside areas susceptible to potential flooding. • The Implementing Entity shall supply toilet paper at all toilets at all times. The Implementing Entity shall ensure that the workers make use of the toilets provided. • The Implementing Entity shall be responsible for the cleaning, maintenance and servicing of the toilets. • The Implementing Entity shall ensure that the toilets are protected from vandals. No litter or general waste shall be placed in the toilets. • Upon completion of the contract, the pit latrines shall be filled in and all structures shall be removed from site. • Washing areas with soap and sufficient clean water shall be provided for hand washing after use of ablutions.	Implementing Entity
Mitigation	N/A	
Stop work	N/A	

Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	• Daily inspection (by the Implementing Entity) to allow for timely removal/servicing of the ablution facilities. • Monthly compliance audits (including checking of disposal slips where relevant) by the ECO.	Implementing Entity, ECO
Management outcomes	• A sufficient number of ablution facilities is provided at locations approved by the ECO. • Toilets are placed on level areas and secured to the ground. • Toilets are provided at a ratio of one (1) toilet for every 15 workers.	Implementing Entity

4.14 Waste management

Identified impacts: The construction phase will produce typical construction waste such as general waste, waste containers, cement bags, off-cuts etc. The volumes of waste to be generated on a typical WfWetlands site are expected to be low.

Objective of improved management:

- To prevent general littering and to ensure that waste is correctly stored on-site and disposed of off-site. Licenced waste disposal facilities (landfill, transfer, recycling) can be found using the search function at the following link http://sawic.environment.gov.za/?menu=88.

Specifications: None

Table 15: Specific avoidance, mitigation and cessation management measures related to impacts identified in terms of waste management

Management Measure	Detailed Description	Responsibility
Avoidance	• Waste will not be buried or burned on site. • The quantity of materials and product brought to site will not be in notable excess of what is required for construction. • Waste from other construction sites where the Implementing Entity is working will not be brought onto site or stored on site. • Waste storage facilities will outside the wetland boundary or other sensitive areas. • Waste storage facilities and containers will be weather and scavenger proof with sufficient capacity to avoid waste accumulating outside of the facility or containers. • The Implementing Entity shall ensure that general and inert waste does not become contaminated by hazardous waste thereby generating larger volumes of hazardous waste requiring disposal at a Class A landfill.	Implementing Entity
Mitigation	• The Implementing Entity shall, in conjunction with the ECO, designate restricted areas for eating. The feeding, or leaving of food, for stray or other animals in the area is strictly prohibited.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• Waste generated on site will be collected and transported to the waste storage area at the site camp on a daily basis. • Each foreman will do a daily inspection/walkthrough of his area and ensure that it is litter free. • Waste storage areas will be restricted to the site camp. • Hazardous and general waste will be separated and designated and marked bins/containers provided for each. • In the case of skippy bins being used, the bins will be covered with secured shade cloth or other cover approved by the ECO. Skippy bins are only allowed for storage of inert waste such as wood off-cuts, hardened concrete etc. • Waste transport will be by means of an appropriate vehicle with containers and/or bags secured and covered to prevent waste being blown from the vehicle during transport. • Used oil will be collected and taken to or collected by a registered oil recycling company. • Other hazardous waste as per Schedule 3 of NEM:WA and Annexure 1 of GN R634 (2013) will be disposed of at a Class A landfill or collected by an approved service provider. Proof of safe transfer/disposal will be filed in the SEF. • Waste disposal restrictions as per GN R636 (2013) shall apply. Of specific relevance is: o Lead acid batteries, corrosive or oxidizing products. o Waste which is flammable with a flash point lower than 61°C. o Waste compressed gases. o Re-usable, recoverable or recyclable used lubricating mineral oils, as well as oil filters, but excluding other oil containing wastes. o Re-usable, recoverable or recyclable used or spent solvents.	

Management Measure	Detailed Description	Responsibility
	o Lamps. o Tyres (whole or quartered). o Liquid waste or waste with a moisture content of >40%.	
Stop work	N/A	
Monitoring method and frequency	• Daily inspection of working area for any litter/waste. • Weekly checking of waste storage area to ensure timeous removal of waste off-site prior to storage areas becoming overfull. • Proof of safe disposal filed in Environmental File and audited monthly by ECO.	Implementing Entity, ECO
Management outcomes	• No waste disposed of or burned on site. • No visible littering. • Waste transport does not result in waste being blown from the vehicle along the route. • Appropriate and separate storage of different types of waste in approved locations. • Proper record keeping of hazardous waste generated and safe and legal disposal thereof.	Implementing Entity

4.15 Removal of alien invasive species

Identified impacts: The WfWetlands programme often involves the removal of alien invasive species as part of an intervention(s) to improve wetland functioning. The method for removal is usually specified in the aforementioned situation. A construction site, due to its inherent disruptive nature, does however also lead to conditions ideal for the establishment of weeds/pioneer species and alien invasive species (hereafter collectively referred to as "weeds") which could compromise the habitat integrity and ecological functioning of the wetland system as well as downstream systems. It is therefore important to implement strict control measures to ensure that alien invasive species are not introduced into a system or/and are not allowed to dominate an area post-construction.

Objective of improved management:

- No new alien invasive/pioneer species are introduced into the wetland system and catchment.
- Emerging weeds are removed prior to seed formation stage.

Specifications:

- Where project activities include the eradication of invasive alien plants, Working for Water guidelines and policies shall be adhered to.
- Weeds will be removed prior to reaching seed formation stage.
- Prior to construction, the Implementing Entity shall ensure that invasive alien vegetation is cleared from the entire site in accordance to the applicable Working for Water guidelines and policies. Follow up clearing may be necessary if the species re-establish following the initial clearing.
- Species that are declared invasive species (according to NEMBA's Alien and Invasive Species Regulations, 2014 (GN R598)) must be recorded and polygons of the affected area must be submitted to the Working for Water national alien invasive plant database.
- The Alien and Invasive Species Lists 2016 (GN 864) will apply when identifying species which require removal/eradication.
- No trees within the environmentally sensitive areas may be removed, whether alien species or not, unless permitted by the ECO.
- Other alien species (non-listed) occurring on site may not be used in the landscaping and should be removed from site where possible.
- Where an individual or group of an invasive alien specimens/plants has potential cultural or heritage value e.g. a blue gum lane, tree at a grave site, the landowner and/or community will be consulted prior to the removal of the specimen(s). The aforementioned might also be protected under the NHRA, in which case removal might not be allowed.

Table 16: Specific avoidance, mitigation and cessation management measures related to the removal of Alien Invasive/pioneer species

Management Measure	Detailed Description	Responsibility
Avoidance	• Imported material shall be free of weeds. • Stockpiles (topsoil and subsoil) will be checked for emerging weeds on a fortnightly basis. • Topsoil sourced from areas with notable weeds infestation will not be used in other areas for rehabilitation or fill purposes.	Implementing Entity
Mitigation	• Where sand/fill material is legally sourced from a dam, existing borrow pit or similar with clear presence of invasive alien species, the Implementing Entity will allow for a weeding programme at the on-site stockpile area and Intervention Point.	Implementing Entity
Stop work	N/A	
Monitoring method and frequency	• Fortnightly inspections of disturbed/cleared areas and stockpiles for signs of emerging weeds. • Monthly audit/visual inspection by ECO.	ECO
Management outcomes	• Construction activities are restricted to the approved construction footprint. • The Implementing Entity's activities does not lead to the negligent or wilful damage to a natural feature.	Implementing Entity

4.16 Impact on fauna

Identified impacts: Typical construction activities could lead to fatalities of small fauna e.g. birds, reptiles, rodents through direct impact and the destruction of habitat. The proposed project will however be limited to the road reserve which is already completely transformed and subject to daily traffic. The upgrade/replacement of culverts and bridges might result in the destruction of a number bird nests attached to the structures.

Objective of improved management:

- Protect fauna in the study area, preserve the ecological functioning along the development footprint as much as is possible.

Specifications: None

Table 17: Specific avoidance, mitigation and cessation management measures related to impacts on fauna

Management Measure	Detailed Description	Responsibility
Avoidance	• Do a site walkthrough prior to construction commencing to remove any slow moving animals and to identify nesting sites, burrows etc. • Demarcate nesting sites which should be avoided as no-go areas by means of painted pegs. • Avoid disturbance of burrows, nests etc. where possible. • Create awareness of conservation of fauna during environmental induction and toolbox talks. • Fauna may not be captured, poisoned, trapped or killed. • Do not feed wildlife. • Where working in a nature reserve with potentially dangerous animals present, ensure that the team is accompanied by a suitably qualified game ranger at all times. • A speed limit of 20 km/h in nature reserves will apply unless otherwise indicated by the reserve road signage. • Inspect excavations for trapped animals prior to work commencing each day. • Do not use pesticides on site.	Implementing Entity

Management Measure	Detailed Description	Responsibility
	• Do not burn vegetation. • Store waste in weather and scavenger proof bins to avoid ingestion of waste by wildlife.	
Mitigation	• Limit the construction footprint. • Reinstate temporary footprints after construction has been completed. • Report any animal fatalities of significance to the ECO and relevant reserve management (where applicable) and identify measures to avoid reoccurrence.	Implementing Entity, ECO
Stop work	N/A	
Monitoring method and frequency	• Daily inspections of trenches and excavations prior to construction commencing. • Weekly inspections of demarcated no-go areas. • Recording of incidents and near misses (e.g. vehicle-antelope collision) in the site diary and at site meetings. • Disciplinary action against any construction staff guilty of purposefully capturing, poisoning, trapping or killing wildlife.	Implementing Entity
Management outcomes	• No unnecessary fauna fatalities. • Limited habitat disturbance and reinstatement of temporary construction footprints.	Implementing Entity

4.17 Protection of natural features

Identified impacts: Construction activities could result in damage to natural features such as rock outcrops and exposed rock faces/cliffs. The project is not located in an area associated with rock paintings, caves, waterfalls, trees of historical or cultural significance etc. and the risk of damage to natural features is generally considered low.

Objective of improved management:

- No damage to natural features due to negligent or purposeful action during construction.

Specifications:

- Demarcation will be by means of brightly painted/white pegs/poles at least 1.5m in height and placed at regular (10m for linear of on every corner for non-linear) intervals on both sides of the approved construction footprint.
- Danger tape and/or snow/barrier netting shall only be used for health and safety requirements along excavations or high risk areas.
- All temporary barriers and signage must be removed and the site restored on completion of the project.

Table 18: Specific avoidance, mitigation and cessation management measures related to impacts on natural features

Management Measure	Detailed Description	Responsibility
Avoidance	• Construction activities shall be restricted to the approved construction footprint. • Sensitive or no-go areas in close proximity (<100m) to the construction site will be demarcated with painted pegs and marked as no-go areas. • The Implementing Entity shall not deface, paint, damage or mark any natural features (e.g. trees or rock formations) situated in or around the site for survey or other purposes unless agreed beforehand with the ECO and Engineer.	Implementing Entity
Mitigation	• Any features affected by the Implementing Entity as a result of negligence or wilful conduct shall be restored/ rehabilitated to the satisfaction of the ECO and/or relevant competent authority.	Implementing Entity
Stop work	N/A	

Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	• Monthly audit/visual inspection by ECO.	ECO
Management outcomes	• Construction activities are restricted to the approved construction footprint. • The Implementing Entity's activities does not lead to the negligent or wilful damage to a natural feature.	Implementing Entity

4.18 Protection of heritage resources (including palaeontological objects)

Identified impacts: The nature and location of typical WfWetlands interventions seldom have the potential to cause the destruction or lead to the discovery of palaeontological objects such as fossils. An exception is peat wetlands which can contain fossils at usually substantial depth. Heritage resources are identified during the EIA phase and indicated as no-go areas. There is however still the opportunity for the discovery or damage to new objects during the construction phase.

Objective of improved management:

- To avoid damage to known heritage objects and to ensure a protocol is in place in the case of discovery of an unknown heritage or palaeontological object.

Specifications: None

Table 19: Specific avoidance, mitigation and cessation management measures related to impacts on heritage resources (including palaeontological objects)

Management Measure	Detailed Description	Responsibility
Avoidance	• The Implementing Entity shall avoid all “no-go” areas as identified during the EIA. • General staff awareness training in terms of the protection and conservation of heritage resources during the environmental induction and toolbox talks.	Implementing Entity
Mitigation	• Should any cultural, archaeological or palaeontological artefacts/objects or evidence be discovered at any stage during construction, the Implementing Entity will cease work in the vicinity of the artefact/object and inform the ECO who will in turn inform the relevant specialists and authorities. • Site staff is not allowed to collect or keep on artefact or object of cultural, archaeological or palaeontological significance.	Implementing Entity, ECO, Specialist
Stop work	• Should any cultural, archaeological or palaeontological artefacts/objects or evidence be discovered, partial suspension of construction activities in the immediate vicinity of the object might need to be required until the object can be evaluated and/or removed.	Implementing Entity, ECO, Specialist

Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	• Continuous during construction. • Monthly audit by ECO in terms of no-go areas being maintained.	Implementing Entity
Management outcomes	• No-go areas (i.e. all areas outside the approved construction footprint) are treated as no-go areas with no disturbance of heritage/cultural objects on private land adjacent to the construction site. • Proper procedure followed should any object or artefact be discovered during construction.	Implementing Entity

4.19 Visual impact

Identified impacts: The nature of a typical WfWetlands project is seldom such that it causes significant visual disturbance, with the visual impact of the operational outcome usually being positive. Construction activities can however lead to temporary and permanent landscape scarring and impacts, which can be excessive if not controlled and mitigated properly.

Objective of improved management: Ensure that visual impacts caused by landscape scarring are minimised through proper planning and mitigated through successful rehabilitation.

Specifications: None

Table 20: Specific avoidance, mitigation and cessation management measures related to visual impacts

Management Measure	Detailed Description	Responsibility
Avoidance	• Avoid excessive vegetation clearance. • Ensure construction remains within the approved construction footprint. • Do not paint or deface any natural feature.	EAP, ECO, Implementing Entity
Mitigation	• Ensure that materials used for construction limits visual impacts e.g. use natural colours where possible. • Ensure that the site remains neat and tidy with no littering etc. • Use shade cloth or construction cordon in areas specifically sensitive to visual disturbances e.g. areas frequented by tourists or the public. • Record and address community complaints as per procedure specified under Section 4.3. • Ensure rehabilitation is successful as specified under Section **5**.	Implementing Entity
Stop work	N/A	
Monitoring method and frequency	As specified for rehabilitation under Section **5**.	ECO

Management Measure	Detailed Description	Responsibility
Management outcomes	• Visual impacts are minimised and managed. • The extent of disturbance is minimised and limited to the approved construction footprint. • The extent of intervention infrastructure remaining bare i.e. no vegetated is limited as best as possible. • Rehabilitation meets the requirements and targets as per Section **5**.	Implementing Entity, ECO

5 REHABILITATION PHASE

Identified impacts: Poor rehabilitation can often lead to secondary impacts such as erosion, an increase in alien invasive species, decreased biodiversity, decreased habitat connectivity, poor ecological integrity and functioning and so forth. Given the core focus of the WfWetlands programme, successful rehabilitation is also a key factor, but should entail more than the functioning of an intervention with focus on ensuring that the permanent footprint of the construction site and actual structure is minimal.

Objective of improved management:

- To ensure that construction footprints are rehabilitated and that site rehabilitation is undertaken in such a manner that the permanent footprint of the construction site of the Intervention Point is minimal.

Specifications:

- All working areas shall be rehabilitated once work has been completed and before the team leaves the site. This includes closure and rehabilitation of temporary access routes.
- All foreign material not utilised in the rehabilitation activities shall be removed from the site.
- Re-vegetation of all exposed soils, and measures to address any potential erosion risk shall be done before the team leaves the site.
- Where project activities include the eradication of invasive alien plants, Working for Water guidelines and policies shall be adhered to.
- All rehabilitated areas shall be considered “no-go” areas upon completion and the Implementing Entity shall ensure that none of his staff or equipment enters these areas.
- Specific Site Rehabilitation measures have been included in the project specific Rehabilitation Plans and shall be referred to for site closure. Due notice of the conditions of Environmental Authorisation and requirements of the General Authorisation for water uses (Annexure B) must be complied with.
- Specifically, on the completion of the construction activities:
    - All disturbed areas must be re-vegetated with local indigenous vegetation suitable to the area.
    - An active campaign for controlling new exotic and alien vegetation must be implemented within the disturbed areas.
    - Structures must be inspected after a major rain event (i.e. more than 50mm rainfall) or annually for the accumulation of debris, blockages, instabilities and erosion with concomitant remedial and maintenance actions.

Table 21: Specific avoidance, mitigation measures related to rehabilitation of the project footprint

Management Measure	Detailed Description	Responsibility
Avoidance	• Manage site demarcation and vegetation clearance as per Sections 4.2, 4.4 and 4.5 respectively. • Ensure that sufficient topsoil is available through proper removal, stockpiling and maintenance procedures as specified under Section 4.5.	Implementing Entity
Mitigation	**General:** • All waste will be collected and removed (also look beyond immediate working area for any waste which might have been blown into the surrounding area). • All spoil and excess material must be removed material. • All spills and waste concrete must be removed. • All temporary markings and site demarcation must be removed. • All temporary construction signage must be removed. • Where temporary access roads cut across contours, diversion berms will be constructed at 30m intervals to avoid erosion and concentration of runoff prior to vegetation establishing. Mulching shall be applied to the decommissioned temporary access road. **Shaping and revegetation:** • Material will be backfilled in the order on which it was removed. • Compacted soil shall be scarified prior to topsoil and seed application. • Topsoil shall be applied at a minimum depth of 75mm. • Where the Implementing Entity failed to manage topsoil properly, the Implementing Entity shall be held responsible to source topsoil of similar quality from a commercial source OR to remediate compromised topsoil by means of compost, fertiliser and seeding as agreed by the ECO.	Implementing Entity, ECO, Engineer

Management Measure	Detailed Description	Responsibility
	• Topsoil shall match the type and quality of topsoil removed from that area. • Special care shall be taken where rehabilitation occurs across several wetland zones and or crossing between wetland and dryland habitats to match the soil removed to the area where it is reapplied. • Seeding/re-seeding should, where possible, be timed to take advantage of the rainy season. • All reinstated slopes will be at a gradient of 1:3 to 1:4. • Slopes of 1:2 and 1:1 shall be stabilised by means of suitable geotextiles, hard structures or any other means as approved by the ECO. • Slopes of 1:2 and 1:1 will be revegetated by means of sods and/or plugs of an approved indigenous grass specie. No Kikuyu shall be used for revegetation purposes. • Local indigenous plants shall be used in the landscaping of the site. Plants that are proclaimed as problem plants or noxious weeds (see Section 4.15) are to be excluded from the landscaping plan and must be removed immediately, should they occur on site. • Plants introduced into the project sites must be guided by ecological rather than horticultural principles. For example ecological communities of indigenous plants provide more biodiversity and habitat opportunities and would blend with natural vegetation. • Where sods are sources from the surrounding environment, the sods must be 30x30cm, sourced in a checkered pattern in a flat area (i.e. not on slopes). The sods must be sourced 1m in radius apart and will be planted within 24 hours of removal unless otherwise approved by the ECO. • Should the reshaping of watercourse banks be required it will match the natural preconstruction geomorphology and slope structure. Extensive reshaping of watercourse banks (and beds if applicable) will be done under close supervision of the ECO or relevant specialist.	

Management Measure	Detailed Description	Responsibility
	• Areas where sods, plugs or seeds have been used as part of slope stabilisation measures will be watered at least every third day for a minimum period of 6 weeks unless the area is in a permanently wet zone of a wetland i.e. no watering required. **Rehabilitation of peatlands**: • Upon rehabilitation, the removed sods and soil stockpiles shall be placed back into the system in the original order/layers (i.e. deeper layers shall be placed first with the rhizosphere layer at ground level), and orientation (according to the natural slope). Should the moisture content of the sods be less than 90% moisture, the Implementing Entity shall be required to peg them with wooden stakes. • The site shall be mulched (alternatively cloth/geotextile may be used) and livestock shall be fenced out for at least two seasons. Alternatively brush packs can be used to keep livestock and/or game away from the site. • If compaction took place, the Implementing Entity shall loosen the soil with a fork on flat surfaces, and create small contour berms on paths with slopes.	
Stop work	N/A	
Monitoring method and frequency	• The Implementing Entity shall notify the ECO once rehabilitation in an area has been completed. The ECO shall be responsible for the technical, not contractual, sign-off of the rehabilitated sections. Only once the rehabilitation has been approved by the ECO, may the contractual sign-off be effected. • The ECO shall conduct monthly inspections of rehabilitated areas for the first three months and then continue with inspections on a quarterly basis until the end of the contract period. • The ECO should audit the site at the end of the Implementing Entity's retention period to establish whether rehabilitation has been successfully carried out. If not, the retention money could be used to implement additional rehabilitation measures.	Implementing Entity, ECO, Engineer
Management outcomes	• Vegetation clearance is limited to the approved construction footprint. • All sloped areas are stable with no sign of slope failure or erosion.	Implementing Entity, ECO, Engineer

6 EMERGENCY REPORTING AND PROCEDURES

The Implementing Entity must ensure that all emergency procedures are in place prior to commencing work. The nearest emergency service provider shall be identified and the up-to-date contact details of this emergency centre, as well as the police and ambulance services shall be displayed on a notice board and shall be made available to staff on-site. Emergency equipment including fire-fighting equipment shall be positioned at accessible locations near to areas where such emergencies may arise.

6.1 Emergency Awareness

The Implementing Entity shall ensure that site staff are aware of the procedure to be followed for dealing with emergencies, which shall include notifying the Implementer and relevant authorities of the event. All site staff shall be briefed regarding the requirements for dealing with potential emergencies including fires, accidental leaks and spillage of pollutants (also see Section 4.7 and 4.8), as well as Health and Safety incidents. Education of site staff shall focus on both preventative and remedial actions in the case of an emergency.

6.2 Incident Recording

The Implementing Entity shall complete an Incident Report (refer to template under Annexure B) in the case of any environmental emergencies, accidents or incidents (including near misses). The ECO shall monitor that the necessary procedures and responses are followed to close out any entries in the Environmental Incident Report. The aforementioned report will be filed in the SEF.

6.3 Fire

The Implementing Entity must take all reasonable measures to ensure that fires are not started as a result of construction activities on site, and shall also ensure that their operations comply with the Occupational Health and Safety Act (Act No. 85 of 1993). Where possible, all work done in the dry season shall be organised in liaison with the landowners so that it fits into their firebreak/ fire protection programme. No large open fires are permitted on site. Smoking on site shall only be permitted in designated areas and in the presence of a fire extinguisher.

Basic functional fire-fighting equipment (one back pack and at least five beaters) shall be made available at each work site at all times. In forestry areas there must also be two rake hoes per team. The Implementing Entity shall appoint a member of his staff to be responsible for the installation and inspection of this equipment. Where work will take place in a peatland or wetland with a high organic soil content, a Method Statement shall be prepared for the ECO's approval, detailing all the actions that will take place should a fire occur, as well as the relevant emergency contacts.

Where fuels and machines are used on site, the prescribed fire extinguishers in working condition must be made available by the Implementing Entity.

Sparks generated during welding, cutting of metal or gas cutting can result in fires. Every possible precaution shall therefore be taken when working with this equipment near potential sources of combustion. Such precautions include having an approved fire extinguisher immediately available at the site of any such activities.

The Implementing Entity is to ensure that he/ she has the contact details of the nearest fire station in case of an emergency.

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Annexure A: Basic Code of Conduct / Implementation

- Private property access is only permitted on previous agreement with the affected landowner, or will be considered trespassing. Trespassing on adjacent properties shall be subject to disciplinary and legal action.
- Ensure that closed gates are kept closed. When in doubt, the landowner should be consulted.
- Teams working outside of the active site, or requiring access to private properties are to carry identification on their persons that includes their name, position, company of employ, and reference to the Working for Wetlands Project. Similarly, such information shall be displayed on vehicle dashboards/exteriors.
- All work shall be based on an approved rehabilitation plan.
- Any deviations from the planned specification need to be approved by the PC and the relevant Engineer.
- A construction supervisor shall be appointed. The appointment letter shall be made available on site.
- Work sites shall be properly planned and marked out, preferably in collaboration with the Implementing Entity. Areas shall be demarcated for vehicle access and parking, off-loading, mixing etc. (refer to Section 4.2).
- No unauthorised person may enter the work site.
- The location and position of all rehabilitation interventions shall be precisely demarcated by the Engineer and the Implementer, according to the rehabilitation plan.
- Dimensions of rehabilitation interventions shall also be marked out where appropriate (e.g. depth of an excavation).
- Implementation of all interventions will be done with a focus on cost-effectiveness and efficiency, while maintaining quality and appropriateness.

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Annexure B: Site Environmental File & Templates

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity **Agreements**	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	**Yes**
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	**Yes**
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	**Yes**
7.2. Additional method statements	**Yes**
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	**Yes**
9. Audits	
9.1. Baseline Audit	**Yes**
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	**Yes**
9.4. Incident and non-conformance reports	**Yes**
9.5. Site closure	**Yes**

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Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	**Yes**
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

2 Implementing Entity Agreements

2.1 Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements

PROJECT NAME:	……
IMPLEMENTING ENTITY:	……
DATE:	……

I, _____ (name), ID number _____ hereby confirm the following:

1. I have received a copy of the Environmental Authorisation (EA), Environmental Management Programme (EMPr) and Rehabilitation Plan for this project.
2. I have familiarised myself with the contents of aforementioned documents and understand what is required from me as the Implementing Entity.
3. I understand that I will be audited against the EA, EMPr, Rehabilitation Plan and approved Method Statements.
4. I understand that the EA is legally binding and that a contravention of an EA condition can lead to the suspension of the EA and thus construction.
5. I understand that I am responsible for the actions of my employees and will ensure that all staff on site are aware of the requirements and restrictions as per the EA, EMPr, Rehabilitation Plan and Method Statements.

_____	_____	_____
Signed	Designation	Dated

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	**Yes**
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

4 Communication

4.2 Copy of public complaints register

COMPLAINTS REGISTER

PROJECT NAME:	……
IMPLEMENTING ENTITY:	……
DATE:	……
REVISION:	……

Id.	Date	Time	Complainant Name	Address	Contact Details	Path for complaint (Phone, Discussion, email)	Description of complaint	Detail of investigation	Result of investigation	Corrective action	Response to complaint
1											
2											
3											
4											
5											
6											
7											
8											

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	**Yes**
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

7 Method Statements

The Implementing Entity is to complete this section, taking cognisance of the relevant EA, EMP, environmental specifications and SANS.

7.1 Combined method statements

PROJECT NAME:	……
IMPLEMENTING ENTITY:	……
DATE:	……
REVISION:	……

ACRONYMS

ECO	Environmental Control Officer
EMPr	Environmental Management Programme
NEMA	National Environmental Management Act (Act 107 of 1998)
SHE	Safety Health Environment

DEFINITIONS

Alien species[1]:

(a) a species that is not an indigenous species; or

(b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Approved: Means approved in terms of the applicable legal requirements (e.g. NEMA approval/ Environmental Authorisation) and/or has been approved by the WfWetlands Programme's Deputy Director: Planning, Monitoring and Evaluation and/or an authorised representative of the WfWetlands Programme.

Archaeological[2]:

(a) material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;

(b) rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;

(c) wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the

[1] National Environmental Management: Biodiversity Act (No. 10 of 2004)
[2] National Heritage Resources Act (No. 25 of 1999)

Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which the South African Heritage Resource Agency (SAHRA) considers to be worthy of conservation; and

Auditing[3]**:** A systematic, documented, periodic and objective evaluation which provides verifiable findings, in a structured and systematic manner, on:

(a) the level of performance against and compliance of an organisation or project with the provisions of the requisite environmental authorisation or Environmental Management Programme (EMPr) and, where applicable, the closure plan; and

(b) the ability of the measures contained in the EMPr, and where applicable the closure plan, to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity.

Authority*:* National, regional or local authority, that has a decision-making role or interest in the project.

Best Management Practice (BMP): Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWetlands implementers.

Cement laden water: Means water (fresh or wash water) which has been in contact with partially cured concrete/mortar or raw cement product and which contains suspended and dissolved cement solids.

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Contaminated water: Means water contaminated by the Implementing Entity's activities such as with hazardous substances, hydrocarbons, paints, solvents and runoff from plant, workshop or personnel wash areas but excludes water containing cement/ concrete or silt.

Corrective (or remedial) action*:* Reactive response required to address an environmental problem that is in conflict with the requirements of the EMPr. The need for corrective action may be determined through monitoring, audits or management review.

Dam[4]**:** Any barrier dam and any other form of impoundment used for the storage of water, excluding reservoirs.

Dangerous goods: Goods containing any of the substances as contemplated in South African National Standard No. 10234, supplement 2008 1.00: designated "*List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)"* published by Standards South Africa, and where the presence of such goods, regardless of quantity, in a blend or mixture, causes such blend or mixture to have one or more of the characteristics listed in the Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards.

Decommissioning[5]**:** To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned.

[3] Regulation 34 of GN R982 (2014, as amended) of NEMA
[4] GN R983 (2014, as amended) of NEMA
[5] GN R983 (2014, as amended) of NEMA

Dust[6]: Any material composed of particles small enough to pass through a 1 mm screen and large enough to settle by virtue of their weight into the sampling container from the ambient air.

Eco-log: A cylindrical sleeve made from, for example wire mesh, filled with organic material and/or soil used to prevent and/or repair minor erosion.

Endangered species: Means any indigenous species listed as an endangered species in terms of section 56 of the National Environmental Management Biodiversity Act ((No. 10 of 2004).

Endemic: An "endemic" is a species that grows in a particular area (i.e. it is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment[7]: Means the surroundings within which humans exist and that are made up of:

i. the land, water and atmosphere of the earth;

ii. micro-organisms, plant and animal life;

iii. any part or combination of i) and ii) and the interrelationships among and between them; and

iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An environmental change caused by some human act.

Environmental impact: Change in an environment resulting from the effect of an activity on the environment, whether positive or negative. Impacts may be the direct consequence of an individual's or organisation's activities or may be indirectly caused by them (DEAT, 1998).

Erosion: The loss of soil through the action of water, wind, ice or other agents, including the subsidence of soil.

Gabion: A structure made of wire mesh baskets filled with regularly sized stones, and used to prevent and/or repair erosion. They are flexible and permeable structures which allow water to filter through them. Vegetation and other biota can also establish in/around the habitat they create.

Hazard: Means a source of or exposure to danger.

Invasive alien species control:

(a) to combat or eradicate an alien or invasive species; or

(b) where such eradication is not possible, to prevent, as far as may be practicable, the recurrence, re-establishment, re-growth, multiplication, propagation, regeneration or spreading of an alien or invasive species.

Implementing Entity: The entity responsible for the construction of WfWetlands rehabilitation interventions by means of various contracted teams.

Indigenous vegetation[8]: Refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

[6] National Dust Regulations GN R827 (2013)
[7] NEMA
[8] GN R983 (2014, as amended) of NEMA

Interested and Affected Parties (I&APs)[9]:

(a) all persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;

(b) all persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; c) all organs of state which have jurisdiction in respect of the activity to which the application relates.

Intervention: An engineered structure such as a concrete or gabion weir, earthworks or revegetation that that achieves identified objectives within a wetland e.g. raising of the water table within a drainage canal.

Invasive species[10]: Means any species whose establishment and spread outside of its natural distribution range-

(a) threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and

(b) may result in economic or environmental harm or harm to human health.

Listed invasive species: Any invasive species listed in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the National Environmental: Biodiversity Act (No. 10 of 2004).[11]

Maintenance period: The period after the Establishment Period (Practical Completion), up to and until the end of the Maintenance Period (i.e. a period of 12 months).

Maintenance[12]: Means actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint.

Mine:

(a) used as a noun-

any excavation in the earth, including any portion under the sea or under other water or in any residue deposit, as well as any borehole, whether being worked or not, made for the purpose of searching for or winning a mineral;

any other place where a mineral resource is being extracted, including the mining area and all buildings, structures, machinery, residue stockpiles, access roads or objects situated on such area and which are used or intended to be used in connection with such searching, winning or extraction or processing of such mineral resource; and

(b) used as a verb-

in the mining of any mineral, in or under the earth, water or any residue deposit, whether by underground or open working or otherwise and includes any operation or activity incidental thereto, in, on or under the relevant mining area.

Mitigation: Actions to reduce the impact of a particular activity.

Mitigation[13]: Means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible;

[9] Regulation 42 GN R983 (2014, as amended) of NEMA
[10] National Environmental Management: Biodiversity Act (No. 10 of 2004)
[11] Also refer to GN 864 (2016): Alien and Invasive Species Lists
[12] GN R983 (2014, as amended) of NEMA
[13] GN R983 (2014, as amended) of NEMA

Monitoring[14]**:** The repetitive and continued observation, measurement and evaluation of environmental criteria to follow changes over a period of time and to assess the efficiency of control measures.

Nursery conditions: This refers to the necessary conditions that must be in place for maintaining strong healthy growth in all container plant materials on site. This includes for the protection of all container plants against wind, frost, direct sunlight, pests, disease and drought. It also includes for the provision of adequate and suitable water supply, fertilisers and all other measures necessary to maintain strong and healthy plant growth.

Offensive odour: Any smell which is considered to be malodorous or a nuisance to a reasonable person.

Pollution[15]**:** Means any change in the environment caused by substances;

(ii) radioactive or other waves; or

(iii) noise, odours, dust or heat,

emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or wellbeing or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.

Post-construction: Refers to the period of 12 months after the completion of the construction works, the onset coinciding with the maintenance period..

Potentially hazardous substance: Any substance or mixture of substances, product or material declared to be a hazardous substance under section 2(1) of the Hazardous Substance Act (1973).

Pre-construction: Refers to the period leading up to the establishment on site by the Implementing Entity.

Project: A defined area for which an approved rehabilitation plan exists for the WfWetlands Programme.

Quaternary Catchment: A fourth order catchment in a hierarchal classification system in which a primary catchment is the major unit and that is also the "principal water management unit in South Africa"[16]

Reasonable: Means, unless the context indicates otherwise, reasonable in the opinion of the relevant environmental authority.

Rehabilitation: Refers to re-instating the driving ecological forces (including hydrological, geomorphological and biological processes) that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers; and

Restoring processes and characteristics that are sympathetic to and not conflicting with the natural dynamic of an ecological or physical system[17].

Significant impact: Means an impact that may have a notable effect on one or more aspects of the environment or may result in k with accepted environmental quality standards, thresholds or targets

[14] DEAT, 1998
[15] National Environmental Management Act (No. 107 of 1998, as amended)
[16] DWS Groundwater Dictionary. Available online: http://www.dwaf.gov.za/Groundwater/Groundwater_Dictionary/index.html?introduction_quaternary_catchment.htm
[17] Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008

and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence.

Silt laden water: Means water (mostly overland surface runoff) containing a substantial concentration of suspended solids with increased turbidity. Usually occurs as a result of exposed/cleared ground surfaces, concentration of runoff and/or erosion of excavated or imported materials.

Site: This is the area described in the approved/authorised rehabilitation plan for the implementation of the rehabilitation measures. Where the area is not demarcated, it will include all adjacent areas, which are reasonably required for the activities for the Implementing Entity, and approved for such use by the Environmental Control Officer (ECO).

Slope: The inclination of a surface expressed as 1 unit of rise or fall for so many horizontal units.

Subsoil: The soil horizons between the topsoil horizon and the underlying parent rock.

Topsoil: The upper soil profile irrespective of the fertility appearance, structure, agriculture potential, fertility and composition of the soil, usually containing organic material and which is colour specific. Also referred to as the "O" and "A" horizons.

Waste: Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 the National Environmental Management: Waste Act (No. 59 of 2008)[18]. Examples include construction debris, chemical waste, used oils and lubricants, batteries, metal and wood off-cuts, excess cement/ concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Watercourse:

(a) a river or spring;

(b) a natural channel in which water flows regularly or intermitted;

(c) a wetland, pan, lake or dam into which, or from which, water flows

A reference to a watercourse includes, where relevant, its bed and banks

Weir: A dam-type structure placed across a watercourse to raise the water table of the surrounding ground and trap sediment on the upstream face without preventing water flow. Weirs are generally used to prevent erosion from progressing up exposed gullies.

Wetland: Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils[19] and,

Land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants living there[20].

[18] National Environmental Management: Waste Act (No. 59 of 2008, as amended)
[19] National Water Act (No. 36 of 1998, as amended)
[20] Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008

SECTION 1: SITE ESTABLISHMENT

Briefly describe where the site camp will be located. Also provide a layout on the next page.
Coordinates:
How will you demarcate the site camp (note no danger tape allowed)
What will the size of the site camp be?
Are there any sensitive areas, trees, shrubs or landscape features (e.g. a heritage site) that must be avoided to prevent disturbances and/or damage? How will disturbances or damage be prevented?

Is the site camp on a flat area (i.e. slope not exceeding 1:3)?	**Y**	**N**
Is the site camp located away from areas of stormwater concentration and areas prone to flooding?	**Y**	**N**
Are there any recently disturbed areas close to the site which can be used as a site camp?	**Y**	**N**
Is there sufficient space available at the identified site to accommodate all site camp components i.e. ablution facilities, eating areas, laydown areas, stockpile areas, vehicle parking area, concrete wash water settling area?	**Y**	**N**
Can the site camp remain at one location? I.e. it does not need to be moved on a regular basis (i.e. every two to four weeks) due to intervention sites being far apart?	**Y**	**N**

If, "No", attach the approved for request for deviation form to the back of this document.

Indicate the following (ignore if not relevant): Ablution facilities, waste storage area (general and hazardous), eating area, laydown area, stockpile area, concrete/mortar mixing/batching area, concrete wash water settling system, site office, access, vehicle parking area, any stormwater diversion measures required, the wetland boundary and sensitive features that must be avoided.

Site camp layout (please use multiple layout plans if required).

SECTION 2: SITE DEMARCATION

Indicate the working area required for each intervention site.

Intervention No	Type of intervention	Area required (incl. temporary laydown and stockpile areas, topsoil stockpiling, equipment etc.)

How will you demarcate the working area required for each intervention?

SECTION 3: ACCESS ROUTES/HAUL ROADS

Length of new access road required for each intervention site.

Intervention No	Existing access (Y/N)?	Length of access road required

Describe how access roads will be made and demarcated (i.e. avoiding unnecessary access roads and the creation of multiple access roads).

**Include a simple layout indicating the proposed access routes as an addendum to this document.*

SECTION 4: MATERIALS HANDLING, USE AND STORAGE

Briefly list the materials (**including volumes**) to be used during construction (e.g. bidim, gabion baskets, stones, gravel, shuttering oil, cement, sand, MacMat-R, geotextile):		
Where will the materials be off-loaded?		
Where are you sourcing the material from?		
If it is not a commercial source, have you written obtained permission from the ECO and any other relevant party e.g. the landowner, provincial roads, Department of Mineral Resources? Please attached a copy of the written permission/consent to the end of this **METHOD STATEMENT**.	**Y**	**N**

Are the areas you've identified for stockpiling of bulk material outside of the wetland? If "No", consult with the ECO.	**Y**	**N**
Are the areas you've identified for stockpiling level (i.e. not steeper than 1:30)? If no, explain the measures which will be implemented to prevent materials washing away during rainfall.	**Y**	**N**
Have you planned how to get the materials from the stockpile/laydown area to the intervention working area? Please provide details on the proposed methodology below. Differentiate between the various materials where required.	**Y**	**N**
Do you have sufficient covered storage space for products such as cement, and shuttering oil? Please provide details of the storage areas to be used and the type of cover e.g. roofed, shade cloth, storage container.	**Y**	**N**
Do you need to stockpile bulk materials e.g. rock, sand next to an intervention? If "Yes", please provide details on the duration of stockpiling, the volume and the measures to be taken to avoid erosion of material and contamination of topsoil.	**Y**	**N**
Have you worked out a delivery schedule to avoid materials being stored on site for longer than 4 weeks?	**Y**	**N**
Is there any material which will be prone to become windblown e.g. sand? If yes, describe how you will contain the material.	**Y**	**N**

SECTION 5: SOLID WASTE MANAGEMENT AND DISPOSAL

What types of waste is expected to be generated during the construction period?		
List any wastes that are potentially hazardous[21] (e.g. empty sealant containers, materials from spill kit used to clean spillages, batteries, contents from portable toilets, herbicide containers):		
How will waste be stored on site (i.e. where and in what)?		
General:		
Hazardous:		
How often, how and where will waste be disposed of?		
General:		
Hazardous:		
Is a substantial quantity of vegetation clearance required?	**Y**	**N**

[21] Refer to National Environmental Management: Waste Amendment Act 26 of 2014 and SANS 10234

If “yes” indicate how vegetation material not removed as part of topsoil stripping will be dealt with e.g. chipping, brush packing, donate to local community.

** Please remember to clearly indicate waste storage areas on the layout plan.*

SECTION 6: HAZARDOUS CHEMICALS AND POTENTIAL HAZARDOUS SUBSTANCES

List potentially hazardous substances to be used on the project. *(Hazardous being defined in terms of Hazardous Substances Act (No.187 of 1993) and associated regulations as well as SANS 10234. Examples include, but are not limited to: drums of fuel, grease, oil, brake fluid, hydraulic fluid, paint, batteries and herbicides (for alien plant clearing)).*

How and where will these substances be stored?

How will these substances be applied or dispensed?

How will spills be prevented?

In the event of a spill, how will it be mitigated?

Procedure:
Materials:
Person responsible and contact details:

**Attach the relevant Material Safety Data Sheet (MSDS) of hazardous materials to be stored on site as an addendum to this document.*

SECTION 7: FUEL

What is the volume of fuel planned to be stored on site?

How and where will fuel be stored?

How will fuel be dispensed?

What precautions will be taken to prevent accidental spills or fires?

In the event of a spill, how will it be mitigated (i.e. cleaned up)?

Procedures:
Materials:
Person responsible and contact details:

How will hydrocarbon contaminated materials be managed and disposed of? Note hydrocarbon contaminated soil is only allowed to go to a Class A landfill (previously H:H landfill site).

SECTION 8: WATER USE

What source will be used to obtain water for construction purposes?

What source will be used to obtain water for drinking and sanitation purposes?

SECTION 9: CONCRETE BATCHING AND CEMENT HANDLING

List activities where concrete or mortar will be used:

If ready mix is not used, where and how will concrete be mixed and how will it be transported to the intervention location?

How will cement laden runoff be managed? Specify for the concrete mixing area as well as washing of equipment.

Where and how will cement be stored?

How and where will cement bags be stored until taken off site?

How will excess concrete and concrete remains be disposed of?

SECTION 10: ABLUTION FACILITIES

How many people will be on site?

How many toilets will be required at a ratio of 1 toilet for every 15 people?

What type of toilet will be used (e.g. chemical or pit latrine) and where will it be located?

If chemical toilets are used, specify how and when they'll be serviced.

SECTION 11: EATING AREAS

Where will the eating area be located?

How will you prevent littering around the eating area?

** Also clearly indicate the designated eating area(s) on the layout plan.*

SECTION 12: VEHICLES AND EQUIPMENT

Describe the number and type of vehicles to be used on site.

Where will vehicles be parked or equipment stored overnight, during weekends and during holidays?

Describe the procedure to be implemented for dealing with vehicles or equipment leaking oil or fuel:

Describe emergency equipment maintenance procedures:

Procedure:
Materials:
Person responsible:

SECTION 13: NOISE

Are there any houses nearby? Do you need inform the landowners of any noisy activities that will take place? How will this be done?

Describe the measures to be implemented to prevent excessive noise disturbance during construction:

SECTION 14: DUST

What is the distance to the closest occupied building and what type of building is it (e.g. house, school, clinic, etc.)

List activities and material that might lead to the generation of dust:

If closer than 100m from a sensitive receptor e.g. occupied building, road, orchard, describe the activities to be implemented to limit and mitigate the generation of dust:

SECTION 15: IMPLEMENTING ENTITY'S SAFETY HEALTH ENVIROMENT (SHE) OFFICER

Who will be responsible to ensure that Health and Safety and Environmental Requirements are implemented on site? Describe responsibilities of the relevant person:

Name:
Responsibilities:
Reporting to:

SECTION 16: ENVIRONMENTAL AWARENESS TRAINING

Describe how environmental awareness and training for senior staff will be addressed:

Describe how environmental awareness and training for general labour will be addressed:

** Please include a copy of the training material and attendance register in the environmental folder.*

SECTION 17: FIRE CONTROL

List activities on site with a fire risk e.g. smoking areas, generators.

How will fires be prevented?

Describe the procedure to be followed in case of a fire on site:

Process:
Materials:

Responsible person:

SECTION 18: COMMUNITY RELATIONS

Who is/are the landowner(s) of the property/properties where work will be conducted?

Has the landowner been contacted and notified of construction commencing and are there any specific concerns or requests which need to be taken into account?

Describe how good community relationships will be ensured (e.g. complaints register, contact details of Implementing Entity on site):

SECTION 19: PROTECTION OF FAUNA AND FLORA

Are you working in a conservancy, nature reserve or biosphere? If, yes, what are the precautions to be taken to avoid the accidental or intentional killing and/or trapping of animals?

Are you aware of any nesting or breeding sites close to any of the interventions?

Describe the procedure to be followed pre-construction to check for slow moving animals in the vicinity of the construction area.

Describe the procedure to be followed to check excavations of 0.5m and deeper for trapped animals.

If you are working in an area with potentially dangerous animals, describe the measures to be taken to ensure the safety of staff.

Are there any trees or shrubs that may not be disturbed or damaged? Have these been clearly marked to prevent disturbances and potential damage?

SECTION 20: STORMWATER MANAGEMENT

Is the site located in floodplain or valley? If “Yes”, have you verified the typical rainfall patterns in the area and when increased flow/flooding can be expected?

Are you aware of any major dams or impoundments upstream of the site? If yes, do you have the contact details of the entity/responsible person in control of releases from the dam or impoundment and have you notified them of work being undertaken downstream?

Are you doing work in the "seasonal" or "permanent zone" of the wetland i.e. an area that is seasonally or permanently wet? If "Yes", describe the dewatering procedures to be followed (i.e. will pumping be required, where will the pumped water be discharged, how will you reduce sediment loads in pumped water, how will you prevent scouring at the pipe outlet?)

Do you need to divert flow to enable construction/work being undertaken? If "Yes", provide details on the type and duration of the diversion.

SECTION 21: EROSION AND SEDIMENTATION CONTROL

How will you prevent the erosion of access roads?

Will there be significant exposed areas (areas exceeding $10m^2$) during the rainfall season? If "Yes", how will you protect bare soil surfaces exposed for a month or longer (e.g. stormwater diversion, temporary revegetation, geotextile)?

Do you need to work on steep (1:4) slopes? If "Yes", describe the measures to be implemented to avoid the erosion of exposed ground surfaces, excavated material and construction material.

Are there any known stormwater structures discharging towards the site e.g. culverts, stormwater outlets. If "Yes", is the diversion of the stormwater required to protect the site from erosion and how will it be done?

SECTION 22: PROTECTION OF ARCHAEOLOGICAL AND PALAEONTOLOGICAL SITES

Are you aware of any known heritage artefacts (e.g. old buildings, Stone Age sites, shell middens, caves, historic grave sites, monuments) close to the site? If "Yes", describe how you will protect the site.

Describe the procedure to be followed in the event that an object of heritage, archaeological or paleontological is discovered:

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	**Yes**
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

7 Method Statements

7.2 Additional method statements

INFORMATION ON METHOD STATEMENTS

Method Statements are to be completed by the person undertaking the work (i.e. the Implementing Entity). The Method Statement will enable the potential negative environmental impacts associated with the proposed activity to be assessed.

The Method Statement can only be implemented once approved by the PC in consultation with the ECO.

The Implementing Entity (and, where relevant, any sub-contractors) must also sign the Method Statement, thereby indicating that the works will be carried out according to the methodology contained in the approved Method Statement.

The PC and/or ECO will use the Method Statement to audit compliance by the Implementing Entity with the requirements of the approved Method Statement.

Changes to the way the works are to be carried out must be reflected by amendments to the original approved Method Statement; amendments require the signature of the PC, denoting that the changed methodology or works are necessary for the successful completion of the works, and where applicable the PC will consult with the ECO regarding to environmental concerns. The Implementing Entity will also be required to sign the amended Method Statement thereby committing him/herself to the amended Method Statement.

This Method Statement MUST contain sufficient information and detail to enable the PC (and ECO were applicable) to apply his/her mind to the potential impacts of the works on the environment. The Implementing Entity will also need to thoroughly understand what is required of him/her in order to undertake the works.

THE TIME TAKEN TO PROVIDE A THOROUGH, DETAILED METHOD STATEMENT IS TIME WELL SPENT. INSUFFICIENT DETAIL WILL RESULT IN DELAYS TO THE WORKS WHILE THE METHOD STATEMENT IS REWRITTEN TO THE ASD's SATISFACTION

METHOD STATEMENT

PROJECT NAME: ……

IMPLEMENTING ENTITY: ……

DATE: ……

PROPOSED ACTIVITY *(give title of method statement):*

E.g. construction of diversion structure, temporary damming of stream, deviation from standard rehabilitation procedures

Scope	
Potential Impacts	E.g. litter, spills, damage to flora, contamination of water
Start Date:	
End Date:	
Description (i.e. how will the Method Statement be implemented?):	
Location:	
Person(s) responsible for implementing (Name and designation):	

DECLARATIONS

1) Environmental Consultant/Environmental Control Officer

The work described in this Method Statement, if carried out according to the methodology described, is satisfactorily mitigated to prevent avoidable environmental harm:

_____	_____	_____
Signed	Print name	Dated

2) Implementing Entity

I understand the contents of this Method Statement and the scope of the works required of me. I further understand that this Method Statement may be amended on application to other signatories and that the PC/ECO will audit my compliance with the contents of this Method Statement

_____	_____	_____
Signed	Print name	Dated

3) Engineer/Engineer's Representative

The works described in this Method Statement are approved.

_____	_____	_____
Signed	Print name	Dated

4) Approving authority: PC

_____	_____	_____
Signed	Print name	Designation

Dated: _____

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	**Yes**
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

8 Records

8.5 Request for deviations from standard EMPr or Rehabilitation Plan requirement

PROJECT NAME:	……
IMPLEMENTING ENTITY:	……
DATE:	……

DEVIATION 1 *(Implementing Entity to complete)*

Description of deviation	*E.g. mixing of concrete in wetland*
Reason for deviation	*E.g. major wetland system resulting in excessive transport distances*
Start Date:	
End Date:	
Relevant section in EMPr	
Potential impacts associated with deviation	*E.g. concrete spills in wetland, additional vegetation clearance, water pollution*
Mitigation measures identified	*E.g. mixing boards, dedicated wash bins, no cement storage in wetland next to mixing area, regular clean-up*

DEVIATION 2 *(Implementing Entity to complete)*

Description of deviation	
Reason for deviation	
Start Date:	
End Date:	
Relevant section in EMPr	
Potential impacts associated with deviation	
Mitigation measures identified	

PC CHECKLIST

Does the deviation carry a high risk e.g. pollution, structure failure	Yes	No	Unsure	If “yes” or “unsure” consult with Engineer
Does the proposed deviation trigger a new listed activity	Yes	No	Unsure	If “yes” or “unsure” consult with EAP
Does the deviation involve a change in design of the IP	Yes	No	Unsure	If “yes” or “unsure” consult with Engineer and Wetlander
Is the deviation outside the approved wetland system?	Yes	No	Unsure	If “yes” or “unsure” consult with EAP

DECLARATIONS

1) Environmental Consultant/Environmental Control Officer

The work described in this request for deviation does not trigger any additional listed activities and will not result in excessive environmental damage:

_____	_____	_____
Signed	Print name	Dated

2) Person undertaking the works/Implementing Entity

I understand the scope of deviation requested and will implement the mitigation measures as indicated.

_____	_____	_____
Signed	Print name	Dated

3) Engineer/Engineer's Representative

The works described in this Method Statement are approved.

_____	_____	_____
Signed	Print name	Dated

4) Approving authority

_____	_____	_____
Signed	Print name	Designation

Dated _____

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	**Yes**
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

9 Audits

9.1 Baseline audit/ inspection prior to commencement of construction

PROJECT NAME:	……
IMPLEMENTING ENTITY:	……
DATE:	……

SECTION 1: WETLAND ZONE IN WHICH WORK WILL BE UNDERTAKEN:

Permanent	Seasonal	Temporary	Outside wetland boundary

SECTION 2: CONDITION OF VEGETATION

Coverage:	Poor	Moderate	Good
Species diversity:	Poor	Moderate	Good
Grazing in wetland:	Yes	No	
Harvesting of vegetation in wetland:	Yes	No	
Level of alien invasive species infestation:	Low	Moderate	High

Insert photos:

SECTION 3: SOIL

Topsoil depth:	≥10cm	≥30cm	≥ 50cm
Peat know to be present?	Yes	No	
Evidence of erosion	Yes	No	
Type of erosion	Dryland	Gullies/donga	In-stream (undercutting, lateral, scouring)
	Stormwater outlets	Dispersed overland flow	Tunnelling (dispersive soils)

SECTION 4: IS THERE ANY EXISTING WASTE OR SPOIL ON SITE?

Yes	No

If yes, specify the type and estimated quantity

Insert photos:

SECTION 5: ARE THERE EXISTING ALIEN INVASIVE SPECIES ON THE SITE?

Yes	No

If yes, list the species

Are any of the species Category 1a or b species? (Alien and Invasive Species Regulations, 2014 - GN R598/2014)

Yes	No

If yes, list the species and number/density of plants.

Insert photos:

SECTION 6: ARE THERE EXISTING ACCESS ROADS TO THE SITE?

Yes	No

If yes, what is the condition of the road(s)?

Good	Moderate	Poor

SECTION 7: ARE THERE OTHER IMPACTED OR DISTURBED AREAS

Cleared area	Mining area	Kraal	Previous site camps	Ploughed agricultural land
Roads	Settlements	Other:		

SECTION 8: EXISTING WATER QUALITY ISSUES

High sediment loads (murky/cloudy water)	Eutrophication (excess algal growth)	High TDS (salt deposits)	Low pH (orange coloured water)	*E. coli* (leaking sewer lines, concentration of animals)

SECTION 9: IS THERE EXISTING FENCING ON THE PROPERTY WHERE THE WORK WILL BE CONDUCTED?

Yes	No

If yes, what type of fencing and what is the condition of the fencing?

Insert photos:

SECTION 10: ARE THERE ANY KNOW PROTECTED PLANT SPECIES ON SITE?

Yes	No

If yes, list the species

Insert photos:

SECTION 11: ARE THERE ANY SIGNIFICANT TREES OR CLUMPS OF TREES WHICH NEED TO BE CONSERVED?

Yes	No

If yes, specify the species and location.

Insert photos:

SECTION 12: ARE THERE ANY KNOWN OR VISIBLE HERITAGE OBJECTS (E.G. OLD KRAAL, OLD FURROW, CORNER POSTS, OLD BUILDINGS)?

Yes	No

If yes, specify the type of object and location.

Insert photos:

SECTION 13: ARE THERE ANY EXISTING ANIMAL (DOMESTIC OR WILD) CROSSINGS ON OR CLOSE TO THE SITE?

Yes	No

If, yes, will the planned work impact on the crossings and movement of the animals?

Yes	No

SECTION 14: ARE THERE ANY EXISTING SERVICES ON OR NEAR THE SITE (E.G. POWER LINES, SUB-STATIONS, PIPELINES, TELEPHONE LINES)?

Yes	No

If yes, specify the type of infrastructure and whether it will be impacted by the activities on site

Insert photos:

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	**Yes**
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

9 Audits

9.3 Internal audits/check conducted by the Implementing Entity

PROJECT NAME:	……
IMPLEMENTING ENTITY:	……
DATE:	……
WEEK:	*E.g. Week 1 / Week 2*……

SECTION 1: SITE CONDITIONS

SECTION 2: LAYDOWN AREAS & SITE OFFICES

		EVALUATION		
ITEM	**DESCRIPTION**	**Not to Standard**	**To Standard**	**NOTES**
2.1	Litter control			
2.2	Dust suppression			
2.3	Erosion control			
2.4	Storm water / Runoff control			
2.5	Toilets			
2.6	Fuel & oil storage & dispensing			
2.7	Material handling or Storage			
2.8	Waste management			
2.8.1	*Domestic Waste*			
2.8.2	*Hazardous Waste*			
2.9	Noise control			

SECTION 3: CONSTRUCTION SITES

		EVALUATION		
ITEM	**DESCRIPTION**	**Not to Standard**	**To Standard**	**NOTES**
3.1	Litter control/Recycle			

3.2	Dust suppression			
3.3	Erosion control			
3.4	Toilets			
3.5	Eating areas			
3.6	Material handling and Storage			
3.7	No go areas, natural features and trees have not been damaged			
3.8	Drip trays			
3.9	Waste management			
3.9.1	*Domestic Waste*			
3.9.2	*Hazardous Waste*			
3.10	Noise control			
3.11	Environmental Awareness Training			

SECTION 4: COMPLAINCE WITH THE EA CONDITIONS AND EMP AND/OR ENVIRONMENTAL INCIDENTS

SECTION 5: GENERAL NOTES

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	**Yes**
9.5. Site closure	Yes

9 Audits

9.4 Incident and non-conformance reports

9.4.1 Environmental Incident Report

PROJECT NAME:	……
IMPLEMENTING ENTITY:	……
DATE:	……
REVISION:	……

SECTION 1: DESCRIPTION OF INCIDENT

SECTION 2: REMEDIAL ACTION REQUIRED

Remedial Action Due Date:	

SECTION 3: RELEVANT DOCUMENTATION

SECTION 4: SIGNATURES

ECO:		**Implementing Entity:**	
Name:		**Name:**	
Date:		**Date:**	

SECTION 5: REMEDIAL ACTION COMPLETED

Implementer to sign when remedial action has been completed and return original to ECO:	
Name:	
Date:	

SECTION 6: REMEDIAL ACTION VERIFIED

ECO:		**Implementing Entity:**	
Name:		**Name:**	
Date:		**Date:**	

SECTION 7: DRAWING/SKETCH

9.4.2 Environmental Non-Conformance Notice

PROJECT NAME:	……
IMPLEMENTING ENTITY:	……
DATE:	……
REVISION:	……

SECTION 1: INCIDENT SEVERITY

High	Medium	Low
Number of previous similar non-conformances on same contract:		

SECTION 2: DESCRIPTION OF INCIDENT

SECTION 3: DRAWING/SKETCH

SECTION 4: REMEDIAL ACTION REQUIRED

Remedial Action Due Date:	

SECTION 5: DRAWING/SKETCH

SECTION 6: RELEVANT DOCUMENTATION

SECTION 7: SIGNATURES

ECO:		**Implementing Entity:**	
Name:		**Name:**	
Date:		**Date:**	

SECTION 8: REMEDIAL ACTION COMPLETED

Implementer to sign when remedial action has been completed and return original to ECO:	
Name:	
Date:	

SECTION 9: REMEDIAL ACTION VERIFIED

ECO:		**Implementing Entity:**	
Name:		**Name:**	
Date:		**Date:**	

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	**Yes**

9 Audits

9.5 Site closure

PROJECT NAME:	……
IMPLEMENTING ENTITY:	……
DATE:	……

SECTION 1: SITE CLOSURE INSPECTION SHEET

Slope:	
Alien invasives:	
Topsoil:	
Anti-erosion:	
Waste:	
Other:	
Timeframe for completion:	

PC signature	Implementing Entity signature
Date	Date

SECTION 2: POST SITE CLOSURE INSPECTION COMMENTS

Slope:	
Alien invasives:	
Topsoil:	
Anti-erosion:	
Waste:	
Other:	

Outstanding items:

1._____

2._____

3._____

Completion date: _____

PC signature	Implementing Entity signature
Date	Date

Annexure C: Sensitive Areas

Sensitive areas (incl. delineated wetland boundary)

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Annexure D: Minimum Standards for Construction and Maintenance

Note that maintenance information of structures (position, numbering and BoQ) will be determined as part of the planning process (by the PC and/or the Engineer) and will be included in the Rehabilitation Plan together with new wetlands. This information will be available on WetIS for inclusion in the PIPs. It is the Implementing Entity's responsibility to make provision for maintenance activities in the PIP as discussed and agreed with the PC.

Concrete Batching

- Concrete shall be mixed according to the correct MPa and mix information as specified in the construction notes of the respective design drawings.
- All material used in the mixing of concrete are to be of good quality, clean and clear of any organic material.
- Manufacturer's directions for mixing, consistency and treatment after pouring shall be complied with.
- Cement shall be stored in dry conditions for no longer than six weeks after delivery.
- When cement is stored temporarily infield it shall be kept on a dry waterproof base with a waterproof cover.
- The batching of concrete shall be done on a smooth impermeable surface (e.g. shutter ply-wood sheets). The batching area shall be prepared by cutting (not removing) the existing vegetation and covering the natural ground level (NGL) with Geotextile lining (minimum A4 grade). A sand retaining berm is to be constructed on top of the geotextile on the downstream end to contain any run-off. A 250µm plastic lining is to cover the geotextile and sand berm while secured to the NGL. The prepared area should be of sufficient size to prevent overspill of any material of substance. All wastewater resulting from batching of concrete shall be disposed of via a contaminated water management system and shall not be discharged into the environment.
- Contaminated water storage areas shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented.
- A demarcated site at least 20m away from water/ wetland edge shall be used for cement mixing. No batching activities shall occur directly on unprotected ground.
- Empty cement bags shall be stored in weather proof containers to prevent windblown cement dust and water contamination. Empty cement bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose. Unused cement bags shall be stored so as not to be affected by rain or runoff events. In this regard, closed steel containers shall be used for the storage of cement powder and any additives.
- The Implementing Entity shall ensure that sand, aggregate, cement or additives used during the mixing process are contained and covered to prevent contamination of the surrounding environment.
- The Implementing Entity shall take all reasonable measures to prevent the spillage of cement/ concrete during batching and construction operations. During pouring, the soil surface shall be protected using plastic and all visible remains of concrete shall be physically removed on completion of the cement/ concrete pour and appropriately disposed of. All spoiled and excess

aggregate/ cement/ concrete shall be removed and disposed of via the solid waste management system.

- Construction using shuttering shall take into consideration the structure design dimensions and safe working heights to prevent over extension of shuttering. Steel shuttering panel sizes shall be used to match the dimensions of the final concrete section as close as possible.
- Concrete will be mixed and used on the same day. Time from mixing to final compaction should not exceed 45 minutes.
- The maximum haul distance of mixed concrete by means of wheel barrows should be limited to ensure the maximum time from mixing to final compaction does not exceed 45 minutes.
- Where sand, stone and cement are transported by wheelbarrow to their point of mixing the distance travelled should be limited to 150m.
- Where applicable, the location of the batching site (including the location of cement stores, sand and aggregate stockpiles) shall be as approved by the PC. The concrete batching plant shall be kept neat and clean at all times.
- Water used for mixing purposes will be of suitable non-potable quality and may not be obtained from natural water resources.

Concrete Structures:

- Concrete mix to follow the design specification.
- Participants shall be trained in concrete mixing and placing by an accredited organisation prior to performing construction of concrete structures.
- Concrete to be placed in 300mm layers and vibrated using a concrete vibrator.
- Minimum 50mm cover required on all concrete reinforcing and mesh unless otherwise specified.
- 250µm plastic sheets to be placed under structure.
- All concrete walls to be fully supported until they are backfilled to the designed level.
- All mesh reinforcing to have 500mm overlaps between sheets.
- Buttresses and walls to be cast monolithically with footing.
- Construction joints to be used wherever new concrete is cast against previously cast concrete.
- If rebar or mesh crosses a construction joint, it should be continuous through the joint and extend 600mm into each side.
- Foundation improvement to be constructed from 70kg sandbags made of BIDIM A4 and filled with sand or well graded gravel, where indicated.

Gabion Structures:

- Gabion work shall be done according to design specifications.
- Participants shall be trained in gabion construction by an accredited organisation prior to performing placing or construction of gabion structures.
- Gabion baskets and Reno mattresses to be constructed of minimum double twisted, hexagonal galfan galvanised wire mesh of nominal diameter and 80mm mesh. Frame wire to be 3.4mm outside diameter (o/d) and mesh wire to be 2.7mm o/d with partitions at 1m centres.

- Support and binding wire shall be a minimum 2.2mm. Lacing shall be done according to specification.
- Support wires (bracing) shall be in place according to manufacturer's specifications.
- All adjoining baskets shall be laced together according to manufacturer's specifications.
- Geotextile shall line all faces of the gabion baskets that are exposed to earth and certain water exposed sides with a minimum of 200mm overlap in all directions and stitched with either polyester of galvanised wire at 300mm c/c.
- Water corrosivity shall be determined at each site; if necessary PVC coated gabion gabion wire shall be used as specified.
- Soil dispersivity shall be determined at each site. If dispersive soils are detected, the ECO / Engineer shall be contacted.
- Density of fill material shall satisfy the gabion design. Clay bricks, weathered rock and sandstone and shale shall not be used as fill material. Any unconventional fill material shall be approved by the ECO / Engineer.
- Fill material shall not be smaller than mesh size.
- Where fill material is hauled to its point of placement by means of wheelbarrows, the haul distance shall not be greater than 150m.

Stone Masonry Structures:

- Stone to be packed and mortared in place using concrete with specified strength.
- Concrete mix to follow the design specification
- 100mm - 200mm stone to be used in all stone masonry, gabions and Reno mattresses. Stone fill must be non-friable & insoluble e.g. Granite, basalt, limestone or sandstone.

Geo Cells:

- Geo cells shall not be used in conditions that exceed their design specifications.
- Geo cell material shall be UV resistant.
- Geo cells shall be anchored in by the "trench" method and in such a way that prevents undermining of the cells.
- Fill material shall conform to the design specifications. The following general rules shall be applied: If soil is used to fill the cells, it shall be re-vegetated immediately with optimum prepared soil conditions.
- If concrete is used to fill the cells, some degree of permeability of the structure shall be permitted. If concrete is used as fill, concrete baffles should be inserted or as per specified design. Rock is not suitable for this purpose.

Earth Works

- Excavations may not exceed 1.5m depth without stepping, shoring and/or reinforcement.
- All excavated material temporarily stored shall be placed on Geotextile sheets covering the NGL. If stockpiled for extended periods, it will be done so at predetermined positions approved by the ECO.
- Excavation and compaction must comply with design specifications.

- The ECO / Engineer must be consulted for work undertaken in dispersive, unstable and organic soils.
- Backfilling in trenches must be done in layers of thickness not exceeding 100mm before compaction. Each layer shall be compacted using hand compactors or mechanical rammers at optimum moisture content.
- Where excavation material is hauled by means of wheelbarrows, the haul distance shall not be greater than 150m.

All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities, particularly with regards to erosion and dust generation. No equipment associated with earthworks shall be allowed outside of the Site and defined access routes unless expressly permitted by the ECO / Engineer.

Rock Packing:

- Stone must be non-friable and insoluble, e.g. granite, basalt, limestone or sandstone
- Rock packs placed across a stream to be tied min 1m into each bank.
- The ECO must approve the source of rocks if not supplied by suitable rock supplier.
- The haul distance may not be greater than 150m where rocks are transported to their point of placement by means of wheel barrows
- The size of rocks must comply with the specifications shown on the drawings and must be handled in a safe manner particularly during offloading/placing. Heavy duty gloves to be worn when handling rocks.

Ecologs:

- Wooden pegs used to anchor EcoLogs are to be no less than 40mm diameter and 1000mm in length.
- Pegs should protrude no less than 600mm from the soil @ 1000 c/c.

MacMat / MacMat-R

- MacMat / MacMat-R to be installed to manufacturers specifications.

Working with Wire (Ecologs, fencing, silt traps)

- Wire used must comply with the engineer's specifications.
- The appropriate tools are to be used for safe handling of wire.
- Heavy duty gloves must be worn when handling wire.
- No loose wire/sharp edges are to remain on completed interventions.
- All excess wire must be removed from the site.
- Stakes used for pegging should not present a tripping/piercing risk (as far as practically possible).

Annexure E: Curriculum Vitae of EAP

Franci Gresse

Qualifications

BSc (Hons) Conservation Ecology

Member, International Association of Impact Assessment (IAIA)

Specialisation

Environmental Impact Assessment Practitioner

Years in industry

8.08

Franci is a senior environmental practitioner in Aurecon's Cape Town office. She has been involved in various environmental investigations, including environmental impact assessments (EIA's), environmental management plans (EMP's), environmental management programmes (EMP's), rehabilitation plans maintenance management plans (MMP's) and fatal flaw analysis.

Franci has been involved with the Working for Wetlands rehabilitation programme for the past five years, of which she has been acting as the Team Leader for the environmental assessment practitioners (EAP's) for the last three years. The Working for Wetlands project won the 2012 Aurecon Chairman's Award for its positive contribution to the natural and social environmental. In addition, Franci has also been involved with a number of projects in the renewable energy sector.

Franci served on the committee of the South African affiliate of the International Association for Impact Assessment (IAIA) for the Western Cape Branch from 2009 to 2011, and remains a member. She completed a Bachelor of Science and an Honours Degree in Conservation Ecology at the University of Stellenbosch (South Africa).

Experience

Working for Wetlands plan 2016 - 2018, Regional South Africa, Department of Environmental Affairs: Natural Resource Management Directorate, 06/2016 - Date, Project Leader

The Natural Resource Management Directorate of the Department of Environmental Affairs appointed Aurecon to provide environmental and engineering services for the Working for Wetlands Programme which is a national wetland rehabilitation programme. Responsibilities include the management and coordination of the overall project, management of the environmental authorisation component of the project, as well as the compilation of basic assessment reports (BAR) for the country. Other responsibilities include the compilation of wetland rehabilitation plans for the Western Cape, Northern Cape and Limpopo Provinces, liaison with authorities and the public (public participation process) and management of wetland specialists.

Integrated Environmental Impact Assessment (EIA) for the proposed extension of the Ash Dam facility at Kriel power station, Mpumalanga Province, South Africa, Eskom Holdings, 06/2016 - date, Project Leader

Appointed by Eskom to conduct an integrated environmental impact assessment (EIA) for the proposed construction of a fourth ash dam facility at the Kriel power station. Responsible for the general project management and finances, authority liaison and the compilation and review of the EIA documentation.

Amended Environmental and Socio-Economic Impact Assessment for a concentrated solar plant facility near Arandis in the Erongo Region, 02/2016 – 10/2016, Project Leader

Aurecon was appointed by the NamPower to amend the Environmental Clearance Certificate (ECC) issued for the Erongo Coal-fired Power Station at Arandis, to a Concentrated Solar Plant. Responsibilities included project management (programme, finances and client expectations), liaison with authorities and relevant stakeholders, review of specialist reports and the compilation and review of the Amendment Report.

Franci Gresse Senior Environmental Impact Assessment Practitioner

Table Mountain Group (TMG) Aquifer feasibility study and pilot project, Western Cape Province, South Africa, City of Cape Town, 2015 - date, Environmental Consultant

The TMG Aquifer Feasibility Study and Pilot Project was initiated in 2002 and is a long term planning initiative to investigate the groundwater potential of the TMG Aquifer as a water source to augment Cape Town's water supply. Given the recommendations in the Exploratory Phase report, and the fact that the TMG Aquifer has since been utilised as a water resource in areas such as Hermanus and Oudtshoorn, the City of Cape Town decided to omit the Pilot Phase and rather proceed with an extended Exploratory Phase, which would include limited pump testing. Aurecon was appointed n to undertake the extended Exploratory Phase work. Responsibilities include the compilation of Environmental Management Plans for the additional test sites, liaison with the relevant authorities and landowners and management of the Environmental Control Officers on the project.

Implementation of the Hoekplaas environmental authorisation (EA), Northern Cape Province, South Africa, Mulilo Renewable Energy, 11/2013 - 05/2015, Project Leader

Aurecon assisted the holder of the environmental authorisation (EA) for the 100 MW photovoltaic (PV) facility in De Aar with the implementation of the environmental conditions to ensure compliance to all relevant environmental legislation. Responsible for the management of tasks and review of all documentation. Also assisting client with questions on the environmental impact assessment (EIA) process.

Environmental impact assessment and compilation of an environmental management plan (EMP) for the Swakopmund-Mile 7 Water Supply, Phase 2, Swakopmund, Namibia, NamWater, 11/2013 - 10/2015, Project Leader

NamWater appointed Aurecon to assist with the environmental impact assessment process for the proposed construction of a new bulk water pipeline between Swakopmund and Mile 7. Responsible for the management and review of the environmental impact assessment (EIA) reports and processes, as well as the project's finances.

Working for Wetlands plan 2014 - 2016, Regional South Africa, South African National Biodiversity Institute (SANBI), 06/2013 – 05/2016, Task Leader

The South African National Biodiversity Institute (SANBI) appointed Aurecon to provide environmental and engineering services for the Working for Wetlands Programme which is a national wetland rehabilitation programme. Responsible for the management of the environmental authorisation component of the project, as well as the compilation of basic assessment reports (BAR) for the country. Other responsibilities include the compilation of wetland rehabilitation plans for the Western Cape, Northern Cape, North West and Limpopo Provinces, liaison with authorities and the public (public participation process) and management of wetland specialists.

Franci Gresse Senior Environmental Impact Assessment Practitioner

Maintenance management plans (MMP's) for flood damaged road infrastructure, Western Cape Province, South Africa, Western Cape Provincial Government Department of Transport and Public Works, 06/2013 - Date, Project Staff

The project entails the compilation of maintenance management plans (MMP's) for two local municipal areas (Laingsburg and Worcester), as well as obtaining the necessary permits/ water use authorisations. Personally involved during the project commencement with regards to strategy development, meetings with the relevant authorities and assistance with the development of the MMP's.

Environmental impact assessment (EIA) for the expansion of approved solar energy facilities located near Prieska and De Aar, Northern Cape Province, South Africa, Mulilo Renewable Energy, 03/2013 - 09/2015, Phase Leader

Mulilo Renewable Energy decided to expand the approved solar energy facilities on the farms Hoekplaas and Klipgats in Prieska, as well as on the farms Badenhorst Dam and Du Plessis Dam in De Aar. The expasion of Hoekplaas farm in Prieska includes ten additional 75 MW photovoltaic (PV) facilities and six additional PV units at Klipgats Pan farm. The expansion at Badenhorst Dam farm includes four additional 75 MW PV facilities and three additional PV units at Du Plessis Dam farm. Responsible for the management and review of the environmental impact assessment (EIA) reports and processes, as well as the project's finances.

Fatal flaw study for two potential Wind Energy Facility (WEF) sites, Northern and Western Cape Provinces, South Africa, Juwi Renewable Energies (Pty) Ltd, 03/2013 - 04/2013, Environmental Practitioner

The study entailed a fatal flaw analysis of two potential wind energy facility (WEF) sites in the Northern and Western Cape Provinces. Responsible for the assessment of the sites and compilation of the fatal flaw report.

Richtersveld wind energy facility (WEF), Northern Cape Province, South Africa, TRE Tozzi Renewable Energy S.p.A and Guma Group, 07/2012 - 09/2013, Environmental Practitioner

The project entailed a due diligence of the proposed wind energy facility (WEF) to review compliance with the requirements of the Department of Energy's independent power producer (IPP) process. Responsible for the review of the environmental reports and compilation of the due diligence report.

Three photovoltaic (PV) energy facilities near Copperton, Northern Cape Province, South Africa, Mulilo Renewable Energy (MRE), 09/2011 - 05/2015, Environmental Practitioner

The project entailed three environmental impact assessments (EIA's) for three photovoltaic (PV) energy facilities comprising 75 MW to 150 MW, located near Copperton. Responsible for the management the EIA process and project specialists, compilation of scoping and EIA reports and liaison with authorities.

Fatal flaw study for four potential wind energy facility (WEF) sites, Northern and Western Cape Provinces, South Africa, Mainstream Renewable Power South Africa, 11/2011 - 05/2012, Environmental Practitioner

The study entailed a fatal flaw analysis of four potential wind energy facility (WEF) sites across the Northern and Western Cape Provinces. Responsible for the management of specialists, review of reports, assessment of the sites and compilation of the fatal flaw report.

Franci Gresse Senior Environmental Impact Assessment Practitioner

Implementation of the Klipgats Pan environmental authorisation (EA), Northern Cape Province, South Africa, Mulilo Renewable Energy, 09/2011 - 05/2015, Project Leader

Aurecon was appointed to undertake three environmental impact assessments (EIA's) for three proposed phtovoltaic (PV) solar energy plants near Copperton. The first PV solar energy plant will generate around 100 MW (preferred alternative) or 150 MW (alternative) on the Hoekplaas Farm (Farm 146/RE). The proposed PV plant will cover approximately 300 ha (preferred alternative) or 450 ha (alternative). The second includes a PV solar energy plant to generate roughly 100 MW on the farm Klipgats Pan (Farm 117/4) near Copperton in the Northern Cape. The proposed PV plant will cover an estimated 300 ha. An alternative site for a 100 MW PV plant with a 300 ha footprint is also being considered. The third comprises a PV solar energy plant to generate about 100 MW (preferred alternative) or 300 MW (alternative) on the farm Struisbult (Farm 104, portion 1) which will cover 300 ha to 900 ha. Responsible for managing tasks and reviewing all documentation for updating the environmental management plan (EMP) and implementing the environmental authorisation (EA). Also assisted client with questions on the EIA process.

Proposed rehabilitation of Wetlands as part of the Working for Wetlands, Regional, South Africa, South African National Biodiversity Institute (SANBI), 08/2011 - 09/2013, Environmental Practitioner

Appointed by the South African National Biodiversity Institute (SANBI) to conduct environmental impact assessments (EIA's) for the rehabilitation of specific wetlands in all provinces of South Africa over a five year period. Responsible for the compilation of basic assessment reports (BAR) and Wetland Rehabilitation Plans for the Western Cape, Northern Cape, Gauteng and Limpopo Provinces. Other responsibilities included liaison with authorities, public participation process, management of specialists and general project management of the environmental component of the project.

Repair of flood damage to road structures in the Eden District Municipality, Western Cape Province, South Africa, Western Cape Provincial Department of Transport and Public Works, 01/2011 - Date, Environmental Practitioner

The project entails the compilation of maintenance management plans (MMP) for seven areas with the Eden District Management Area to repair. Responsible for compilation of MMP's, review of reports and liaison with stakeholders and authorities.

Environmental impact assessment (EIA) for the proposed extension of the Ash Dam facility at Kriel power station, Mpumalanga Province, South Africa, Eskom Holdings, 11/2009 - 12/2015, Environmental Practitioner

Appointed by Eskom to conduct an environmental impact assessment (EIA) for the proposed construction of a fourth ash dam facility at the Kriel power station. Responsible for the general project management and finances, screening process, compilation of the scoping and EIA reports, public participation and the compilation of a waste management licence application.

Franci Gresse Senior Environmental Impact Assessment Practitioner

Environmental impact assessment (EIA) for proposed relocation of solar energy facility, Onder Rietvlei Farm, Aurora, Western Cape Province, South Africa, Solaire Direct Southern Africa, 2010 - 2011, Project Leader

Appointed by Solaire Direct to undertake a basic environmental impact assessment (EIA) process for the proposed relocation of an approved, but not yet constructed 10 MW solar energy facility. Responsible for the management and review of the EIA process and finances.

Environmental impact assessment (EIA) for proposed solar energy facility, Onder Rietvlei Farm, Western Cape Province, South Africa, Solaire Direct Southern Africa, 07/2010 - 02/2012, Environmental Practitioner

Appointed by Solaire Direct to undertake a basic environmental impact assessment process for the proposed construction of a 10 MW solar energy facility. Responsible for the compilation of the draft and final reports, public participation process, management of specialists and general project management.

Proposed Paarl Mountain and Ysterbrug pumping main upgrades, Western Cape Province, South Africa, Drakenstein Municipality, 06/2010 – 12/2015, Environmental Advisor

The Drakenstein Municipality appointed Aurecon's engineers to investigate and plan the proposed upgrade of the Paarl Mountain and Ysterbrug Pumping Scheme. The upgrading of the pipelines feeding the Meulwater Water Treatment Works from the Bethel and Nantes dams, also part of this scheme, was also investigated. Responsible for providing advice on environmental processes required. Other responsibilities included the management of the independent environmental assessment practitioner and the review of all environmental impact assessment (EIA) documentation.

Environmental sensitivity study (ESS) for a proposed solar energy facility on a farm Near Aurora, Western Cape Province, South Africa, Solaire Direct Southern Africa, 2010, Environmental Practitioner

Appointed to provide and environmental sensitivity study (ESS) which inter alia highlights the potential constraints ('red flags') and opportunities presented by the site from an environmental perspective. Responsible for the compilation of the ESS.

Proposed remediation, rehabilitation and restoration of the Spruit, Krom, Leeu and Palmiet Rivers, Western Cape Province, South Africa, Drakenstein Municipality, 2009 - 2010, Environmental Practitioner

Appointed by the Drakenstein Municipality to undertake the requisite environmental impact assessment (EIA) process for the rehabilitation, remediation and stabilisation of four rivers in Paarl and Wellington. Responsible for the EIA and public participation processes.

Proposed construction of a new pipeline from Bovlei Winer to Withoogte Dam, Wellington, Western Cape Province, South Africa, Drakenstein Municipality, 2009 - 2010, Environmental Practitioner

The Drakenstein Municipality proposed to replace a section of the existing pipeline extending from the Withoogte Dam to the Welvanpas Reservoir near Wellington as part of the municipality's water master plan in order to improve the overall water supply. Responsible for the compilation of the environmental impact assessment (EIA) report, management of specialists and the public participation process.

Franci Gresse Senior Environmental Impact Assessment Practitioner

Proposed erection of Eskom communication sirens and public anouncement (PA) systems, Blaauwberg, Western Cape Province, South Africa, Eskom, 2009 - 2010, Environmental Practitioner

The project entailed three environmental impact assessment (EIA) processes for the (a) erection of 10 new sirens in the Parklands area, (b) the relocation of one siren in Bloubergstrand, and (c) the upgrade of five sirens on farms near Melkbosstrand. Responsible for compiling environmental impact assessment (EIA) reports, and the public participation process.

Overberg District Municipality integrated transport plan (ITP) strategic environmental informants, Western Cape Province, South Africa, Overberg District Municipality, 2009, Environmental Practitioner

Aurecon's Transportation Unit was appointed to revise the integrated transport plan (ITP). The Environmental Unit was subcontracted to provide environmental input. Responsible for identifying and describing the relevant informants.

Annandale Commercial: development of petrol filling station on portion of Erf 5561, Kuils River, Western Cape Province, South Africa, Communicate, 2009, Environmental Practitioner

Appointed to compile a construction environmental management plan (CEMP) for the construction of a filling station on the corner of Gladioli Street and Amandel Drive, Kuils River. Responsible for the compilation of the project specification document as part of the CEMP.

Environmental impact assessment (EIA) for the proposed Langezandt Quays development in Struisbaai Harbour, Western Cape Province, South Africa, Golden Falls (Pty) Ltd, 2008 - Date, Environmental Practitioner

Aurecon was appointed to undertake an environmental impact assessment (EIA) process for the proposed development of a four storey development on Erf 848 within the Struisbaai harbour precinct. Responsible for drafting responses to the Department of Environmental Affairs' independent review report on the proposed development.

Pre-feasibility and feasibility studies for augmenting the Western Cape water supply system, South Africa, Department of Water Affairs (DWA), 2008 - 2013, Project Staff

The Department of Water Affairs commissioned pre-feasibility and feasibility studies for the augmentation of the Western Cape water supply system through the further development of the surface water resources. Surface water schemes to be investigated were identified by the Western Cape water supply system reconciliation strategy study. Responsible for the public participation process, managing environmental specialists, and compiling a socio-economic overview of the study area.

Proposed redevelopment of the Blaauwberg Conservation Area: Eerstesteen Node, Western Cape Province, South Africa, City of Cape Town, 2008 - 2010, Environmental Practitioner

The project entailed an environmental impact assessment (EIA) process for redeveloping the Eerstesteen Conservation Area on the West Coast. Responsible for compiling the EIA report, as well as managing specialists and the public participation process.

Franci Gresse Senior Environmental Impact Assessment Practitioner

Table Mountain Group aquifer feasibility study and pilot project, Western Cape Province, South Africa, City of Cape Town, 2008 - 2010, Environmental Control Officer

The City of Cape Town initiated a study into the Table Mountain Group Aquifer as a potential water source to augment the city's supply. The feasibility and pilot project phase record of decision (RoD) required completion for site-specific environmental management plans (EMP's) for drilling sites that were assessed to be environmentally sensitive. Site-specific EMP's were designed for sensitive sites to ensure minimal environmental impact during the drilling phase. Responsible for monitoring compliance with the RoD and EMP during the drilling phase.

Water reconciliation strategy for the Algoa water supply area, Eastern Cape Province, South Africa, 2008 - 2009, Environmental Practitioner

This project provided an assessment of the environmental opportunities and constraints for a suite of water schemes in the Algoa water supply area. This was undertaken as part of a broader study in the area.

Application for rectification in terms of Section 24G of the National Environmental Management Act (NEMA) for the unlawful commencement of a fruit processing factory on Op de Tradouw Farm, Number 69, Barrydale, Western Cape Province, South Africa, Schoonies Family Trust, 2008 - 2009, Environmental Practitioner

The project consisted of an application for rectification in terms of Section 24G of NEMA. Responsible for compiling an environmental impact report and an environmental management plan (EMP) for the application, as well as managing the public participation process.

Proposed development of apple and pear orchards on Soetmelksvlei Farm, Western Cape Province, South Africa, BETCO, 2008 - 2009, Project Staff

This Agri-development project involved the development of 50 ha of apple and pear orchards in the Riviersonderend region. Responsible for compiling the basic assessment report, environmental management plan (EMP), and managing the specialists and public participation process.

C.A.P.E. Olifants-Doring Catchment Management Agency project: Development of a catchment management strategy water resource protection sub-strategy for the Olifants-Doring Catchment, South Africa, CapeNature, 2008 - 2009, Environmental Practitioner

Appointed by CapeNature to compile a catchment management strategy water resource protection sub-strategy for the Olifants-Doorn catchment. Responsible for compiling a database that lists all institutions and their respective mandates in terms of water resource protection and biodiversity conservation decision making for the Olifants-Doring Catchment, workshop arrangements, and general project related work.

Environmental sensitivity study for the proposed Dasdrif poultry farm in Moorreesburg, Western Cape Province, South Africa, Eikenhoff Poultry Farms (Pty) Ltd, 2008, Project Staff

The project consisted of an environmental sensitivity study (ESS) which, inter alia, highlighted the potential constraints ('red flags') and opportunities presented by the site from an environmental perspective. Responsible for compiling the ESS.

Qualifications

MSc Geography

BSc (Geography and Environmental Management)

BSc Geography (Hons)

Environmental Assessment Practitioner, Interim Certification Board of Environmental Assessment Practitioners of South Africa

Candidate Natural Scientist, South African Council for Natural Scientific Professions (SACNASP)

Member, International Association for Impact Assessment (IAIAsa), South Africa

Member, Institute of Waste Management of Southern Africa (IWMSA)

Specialisation

Environmental Specialist

Years in industry

7

Languages

Afrikaans

English

Margaret Lowies

Senior Environmental Scientist

Margaret is a senior environmental scientist currently based in Aurecon's Port Elizabeth office. She has over seven years of experience in environmental impact assessment (EIA) processes, water use licence applications, waste licence applications, environmental compliance auditing, mining permit applications, wetland assessments, due diligence assessments and water quality assessments. Most of these projects have been focussed at a municipal level within the various municipalities of the Eastern Cape, and her roles include both the technical work and overall project management. Her role as an environmental control officer (ECO) has also given her a very practical understanding of how projects of various scales are implemented.

She obtained a BSc degree in Geography and Environmental Management, a BSc in Geography (Hons) as well as an MSc degree in Geography from the University of Johannesburg, South Africa in 2008, 2010 and 2014 respectively. She is registered as an environmental assessment practitioner with the Environmental Assessment Practitioners Association of South Africa (EAPSA) and is a registered candidate natural scientist with the South African Council for Natural Scientific Professions (SACNASP). She is also member of the Institute of Waste Management of South Africa (IWMSA) and the South African affiliate of the International Association of Impact Assessment (IAIAsa).

Experience

Training & Capacity Building

Working for Wetlands ECO training, South Africa,

Having worked on the planning cycles of the Working for Wetlands Programme for many years, Margaret provided training on the importance of implementing the appropriate mitigation measures during wetland rehabilitation. This was guided by her experience as an Environmental Control Officer.

Environmental Control Officer

Construction of Zone 7 municipal infrastructure to service the TNPA Tank Farm, Eastern Cape Province, South Africa, Coega Development Corporation (CDC), 10/2007 - 12/2025, Environmental Control Officer

The project involved the construction of roads, a stormwater detention pond and the installation of various services. Responsible for ensuring compliance with environmental assessment and CDC standard environmental specifications.

Dordrecht water and sanitation services upgrade, Eastern Cape Province, South Africa, Chris Hani District Municipality, 10/2015 - 12/2017, Environmental Control Officer

This project is divided into four future projects, which includes the construction of new sewage treatment facilities; the construction of new reticulation in Dordrecht; immediate water supply upgrades and long-term bulk water supply upgrades. Responsible for report review.

Northern outfall sewers, Mthatha, Eastern Cape Province, South Africa, Amatola Water - Amanzi, 06/2013 - 12/2017, Environmental Control Officer

The project entailed consulting engineering, social facilitation and environmental services for the construction of the outfall sewers along the banks of the Mthatha River. This involved the installation of 1 200 mm diameter sewer pipes, crossing the river above ground and below the river bed level. The sewage will discharge into a 17 m-deep pump station, from where it will be pumped into the head of the existing wastewater treatment works (WWTW).The project also entailed the application for a water use licence application (WULA). Responsible for management of environmental site officer, report writing and WULA report/application review.

Construction of Graaff-Reinet solid waste site, Eastern Cape Province, South Africa, Camdeboo Local Municipality, 12/2010 - 12/2016, Environmental Control Officer

The project comprised the construction of a new solid waste site outside Graaff-Reinet. Responsible for monitoring compliance with the environmental management plan (EMP) and record of decision (ROD).

Construction environmental management plan (EMP) for Ugie particle board plant, Eastern Cape Province, South Africa, PG Bison, 08/2006 - 08/2016, Environmental Control Officer

The project entailed a construction environmental management plan (EMP), operation environmental management plan (OEMP), atmospheric emissions license (AEL) reviews and ongoing monitoring for the Ugie particle board plant. Responsible for operational compliance auditing.

Sidwadweni Bulk Regional Water Supply Scheme, Eastern Cape Province, South Africa, Amatola Water - Amanzi, 09/2012 - 07/2016, Environmental Control Officer

The project included the construction of river abstraction, raw water reservoir, water treatment works (WTW), clear water pump station and bulk supply mains for the Sidwadweni Bulk Regional Water Supply Scheme. Responsible for report review.

Idutywa East Water Supply Scheme (WSS), Eastern Cape Province, South Africa, Amathole District Municipality (ADM), 05/2006 - 12/2015, Environmental Control Officer

Aurecon undertook the design and construction of the Idutywa East Water Supply Scheme (WSS) in the Eastern Cape Province. Responsible for ensuring environmental compliance and report review.

Khayamnandi housing development project, Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 02/2011 - 01/2015, Environmental Control Officer

The project entailed environmental services for the development of Khayamnandi extension on erven 114, 609, 590 and 24337, Bethelsdorp, including the construction of 7 960 residential stands, business stands and community facilities and supporting infrastructure. Responsible for overall environmental monitoring and inputs as well as compilation/review of monthly audit reports.

Cookhouse Wind Farm project, Eastern Cape Province, African Clean Energy Developments (ACED), 12/2012 - 12/2014, Environmental Control Officer

Aurecon was appointed as owner's engineer for the construction of a 140 MW wind farm in the Eastern Cape Province of South Africa. The scope of services included design review, site supervision, environmental monitoring, health and safety monitoring and witnessing of commissioning and testing. The Cookhouse Wind Farm Stage 1 comprise 66 x Suzlon S88 2.1 MW wind turbines, associated roads and foundations, electrical reticulation, substation, supervisory control and data acquisitioning (SCADA) system as well as a 132 kV overhead line (OHL) to the Poseidon substation. The scope of owner's engineer services has been structured to align with the role and obligations of the owner's engineer defined in the draft engineering, procurement and construction (EPC) agreement for the project. Responsible for overseeing environmental compliance of the project including updating of the environmental management plan (EMP), approval of method statements, environmental authorisation and layout amendments, bi-weekly audits with a monthly environmental assessment (EA) and EMP compliance report.

Advisory

Reconciliation strategy for Algoa Water Supply System (WSS), Eastern Cape Province, South Africa, Department of Water and Sanitation, 04/2016 - 03/2019, Environmental Specialist - Advisory

The project objectives are to put arrangements and resources in place for the ongoing implementation of the recommendations and maintenance of the Algoa Reconciliation Strategy; to evaluate the efficiency of the Orange-Fish-River Project and to remove potential operating system constraints for the sustainable delivery of the Orange River bulk water supply to the Lower Sundays River Government Water Scheme (LSRGWS) and to Nelson Mandela Bay Municipality (NMBM) for water requirements up to 2040. In order to evaluate the efficiency of the Orange River Project Aurecon will estimate water use efficiency; determine catchment yields of the Fish and Sundays catchments; give recommendations for the phasing-out of current gratis allocations; identify potential water savings and provide options for re-allocation as well as confirm an official allocation from the Teebus Tunnel to the Orange-Fish System (OFS) in the Eastern Cape. While the focus is on providing additional balancing storage in addition to the Scheepersvlakte Balancing Dam, the provision of storage at other potential locations in the bulk transfer infrastructure must also be considered. Responsible for ad hoc advisory relating to environmental legislation compliance and general environmental matters.

Public Servant Association Social and Labour Plan (SLP), Eastern Cape Province, South Africa, Public Servant Association, 12/2010 - 02/2011, Environmental Assessment Practitioner

The Social and Labour Plan (SLP) was done in order to obtain a mining right conversion for the Department of Mineral Resources (DMR) for the Gonubie Sand Mine. Responsible for compilation of SLP and communication with DMR.

Margaret Lowies Senior Environmental Scientist

Integrated Environmental Permitting (EIAs, EMPs and MMPs)

Working for Wetlands Programme, Department of Environmental Affairs, 06/2011 - 04/2018, Environmental Assessment Practitioner - Coordinator of the Mpumalanga and Eastern Cape Provincial teams

Aurecon was appointed in 2011, 2013 and then again in 2016 for a three-year cycle for the design, planning, environmental, project and risk management of the Working for Wetlands programme. The programme's objective is to rehabilitate damaged wetlands throughout South Africa, with an emphasis on complying with the principles of the Expanded Public Works Programme (EPWP) through employing only local small, medium and micro enterprises (SMMEs). Involvement included site work, a rehabilitation plan and basic assessment report to enable the rehabilitation of various wetlands within the Mpumalanga and Eastern Cape provinces. Responsible for coordination of provincial team (wetland specialist, engineer and DEA Assistant Director) and report writing.

Motherwell North Bulk Sewer, Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 12/2015 - 10/2017, Project Leader/Environmental Assessment Practitioner

Aurecon was appointed to undertake environmental authorisations for the Motherwell North Bulk Sewer project. This included environmental impact assessment (EIA), heritage, water use licenses (WUL) and specialist studies for the 1.5 m diameter collector sewer of 10 km. Responsible for project management and review of report.

Misgund augmentation bulk water supply, Eastern Cape Province, South Africa, Amatola Water - Amanzi, 01/2014 - 06/2017, Environmental Assessment Practitioner/Specialist

The project entailed a study to determine the technical feasibility of bulk water supply in Misgund as per the Department of Water Affairs (DWA) guidelines for Regional Bulk Infrastructure Grant (RBIG) projects. Responsible for environmental impact assessment (EIA) process, water use licence application (WULA) and wetland assessment.

Upgrading and permitting of the Klipplaat landfill site, Eastern Cape Province, South Africa, Ikwezi Local Municipality, 10/2011 - 06/2016, Environmental Assessment Practitioner

The project involved the upgrading and permitting of the existing Klipplaat landfill site. This includes a scoping-environmental impact assessment (EIA) process as well as waste licence application process. Responsible for managing the EIA process, including public participation and report writing and review.

Bende water supply scheme, Eastern Cape Province, South Africa, Amathole District Municipality, 05/2014 - 02/2015, Environmental Assessment Practitioner

Aurecon was appointed for the environmental management for the proposed implementation of two rural water supply schemes at Bende and Shixini in the Eastern Cape Province. Responsible for report review, appointment of specialists and management of environmental impact assessment (EIA) process.

Upgrading of National Route 61 Section 6 (R61/6) from All Saints (Km 68.5) to Section 7 - Baziya (Km 12), between Baziya and Queenstown, Eastern Cape Province, South Africa, South African National Roads Agency Limited

(SANRAL), 04/2012 - 12/2014, Environmental Assessment Practitioner/Environmental Specialist

Aurecon was appointed by Jeffares & Green (J&G), on behalf of the South African National Roads Agency Limited (SANRAL), to undertake an all environmental authorisation and public participation process (PPP) for the proposed road upgrade of National Route R61. The project involved the upgrading of a 36 km stretch of road as well as replacing five bridges. Responsible for project management, report writing and water quality specialist report.

Social impact assessment (SIA) for augmentation of the Driftsands collector sewer, Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 08/2011 - 10/2011, Environmental Assessment Practitioner

The project involved a survey of households in the Walmer Township that are impacted by the augmentation of the Driftsands sewer collector. Responsible for coordination of survey, capturing of data and report writing.

Other Environmental Permitting/ Management Projects

- Churchill water treatment works (WTW), Eastern Cape Province, 03/2007 – 12/2020, Environmental Assessment Practitioner
- Upgrade of Brickfields pre-treatment works in Nelson Mandela Bay Metropolitan Municipality, 12/2010 – 07/2020, Environmental Assessment Practitioner
- Sewer maintenance backlog study for the Nelson Mandela Bay Metropolitan Municipality, Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 10/2004 - 07/2020, Environmental Assessment Practitioner
- Environmental impact assessment for pipe upgrade of Eastbury Drive Sewer, KwaZulu-Natal Province, South Africa, eThekwini Municipality, 06/2016 - 05/2019, Environmental Assessment Practitioner
- Environmental services for upgrading of R75, Eastern Cape Province, South Africa, South African National Roads Agency Limited (SANRAL), 02/2015 - 02/2018, Project Leader/Environmental Assessment Practitioner
- Woodchem water use licence, Mpumalanga Province, South Africa, KAP Diversified Industrial (Pty) Ltd, 04/2016 - 07/2017, Environmental Specialist
- Environmental impact assessment (EIA) for Coega wastewater treatment works (WWTW), Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 12/2014 - 05/2017, Project Leader/Environmental Assessment Practitioner
- Water use licence application (WULA) and wetland assessment for Grassridge to Melkhout 132 kV line, Eastern Cape Province, South Africa, Eskom SOC Ltd, 11/2014 - 12/2015, Environmental Specialist/Project Leader
- Proposed construction of the Ingquza Hill Museum - basic assessment, Eastern Cape Province, South Africa, National Department of Arts and Culture, 08/2013 - 10/2013, Environmental Assessment Practitioner

APPENDIX G

STAKEHOLDER DATABASE

Stakeholder Database

Stakeholder	Contact	Organisation
National Stakeholders	Mr Mark Anderson	Birdlife South Africa
	Ms Mpume Ntlokwana	Department of Agriculture Forestry & Fisheries
	Ms Serah Muobeleni	Department of Agriculture Forestry & Fisheries: Land Use and Soil Management
	Ms Wilma Lutsch	Department of Environmental Affairs: Biodiversity Conservation
	Mr Danie Smit	Department of Environmental Affairs: Sensitive Environments
	Ms Naomi Fourie	Department of Water and Sanitation
	Dr Paul Meulenbeld	Department of Water and Sanitation
	Ms Jackie Jay	Department of Water and Sanitation
	Ms Barbara Weston	Department of Water and Sanitation
	Mr Kelvin Legge	Department of Water and Sanitation
	Mr Bongani Madikizela	Water Research Commission
	Ms Olga Jacobs	SANParks: Biodiversity and Social Projects
	Mr Steven Segang	Endangered Wildlife Trust
	Mr Ahmend Khan	Department of Environmental Affairs
	Mr Louwrens Ferreira	Department of Environmental Affairs
	Mr Wemer Roux	Department of Environmental Affairs
	Ms Kerryn Morrison	Endangered Wildlife Trust
	Ms Tanya Smith	Endangered Wildlife Trust
	Morgan Griffiths	WESSA
	Mr Dumisani Mabona	Department of Environmental Affairs: Sensitive Environments
	Mr Umesh Bahadur	Department of Environmental Affairs: Working for Wetlands
	Mr Farai Tererai	DEA: Working for Wetlands: Manager: Planning, Monitoring and Evaluation
	Dr Piet-Louis Grundling	Department of Environmental Affairs: Working for Wetlands

Stakeholder	Contact	Organisation
	Mr Seoka Lekota	DEA: Biodiversity Conservation
	Khosa Tsunduka	Department of Water and Sanitation
	Malaudzi Nkumbudzeni	Department of Water and Sanitation
	Lumka Kuse	Department of Water and Sanitation
	Xolani Hadebe	Department of Water and Sanitation
Provincial Stakeholders: State Authorities	Mr Thingahangwi Malotsha	Limpopo Department of Economic Development, Environment and Tourism
	Mr Chris S Nghenabo	Limpopo Department of Economic Development, Environment and Tourism
	Mr Vincent Egan	Limpopo Department of Economic Development, Environment and Tourism
	Mr Meshack Masindi	Limpopo Department of Economic Development, Environment and Tourism
	Mr Donald Lithole	Limpopo Heritage Resource Authority
	Mr Nimrod Mathivha	Department of Agriculture
	Mr David Nethengwe	Department of Water and Sanitation
	Mr Foletgi Mahlakoane	Department of Agriculture, Forestry & Fisheries
	Mr Sam Makhubele	Limpopo Department of Economic Development, Environment and Tourism
	Mr Solly Kgopong	Limpopo Department of Economic Development, Environment and Tourism
	Mr Vusi E Makhubele	Limpopo Department of Economic Development, Environment and Tourism
	Ms Magdeline Msimanga	Department of Water and Sanitation
	Mr Love Hlekane	Department of Water and Sanitation
	Mr Anton Van Wetten	Limpopo Department of Economic Development, Environment and Tourism
Landowner	Mr Nditsheni Seth Nethengwe	Thengwe Tribal Authority
	Mr Reuben Mabunda	Mahumani Tribal Authority
	Hosi Mahumani	Mahumani Tribal Authority
	Mr Madi Simon	Thulamela Local Municipality

Stakeholder	Contact	Organisation
Municipal Stakeholders	Mr C Mapholi	Vhembe District Municipality
	Mr Godfrey Mawela	Vhembe District Municipality
	HE Maluleke	Thulamela Local Municipality
	Mrs J Selapyane	Bela-Bela Local Municipality
	Cllr Thoma Tuaani	Thulamela Local Municipality
	Cllr TS Pandelane	Thulamela Local Municipality
	Mr Ombali Phineas Sebola	Modimolle/Mookgophong Local Municipality
	Ms Marlene Van Staden	Modimolle/Mookgophong Local Municipality
	Mr Robert Mokgalabone	Limpopo Tribunal
	Cllr M.J Aphiri	Limpopo Executive Council
	Cllr R.R Molapo	Limpopo Executive Council
	Mr Republic Monakedi	Mopani District Municipality
	Mr Dumisani Shitlhangu	Mopani District Municipality
	Ms Faith Maboya	Mopani District Municipality
	Cllr Nkakareng Rakgoale	Mopani District Municipality
	Maxwell Chauke	Greater Giyani Local Municipality
General I&APs	Mrs Kelly Abram	Waterberg Biosphere
	Mr Mick Angliss	LEDET
	J.A Bierman	Marievale Farms
	Mr Michael Breetzke	Southern Mapping
	Ms Terry Calmeyer	ILISO Consulting Environmental
	Mr Mahlomola Ernest Daemane	SANParks
	Mr Samuel Davidson-Phillips	Welgevonden Game Reserve
	Mr C.S Deetlefs	Smithvlei
	Ms Natasha Du Plessis	Nylsvley Nature Reserve
	Ms Marion Dunkeld-Mengell	Friends of Nylsvley
	Ms Helette Dunne	SANParks: BSP
	Martin Engelbrecht	Mapungubwe Conservation manager
	Prof Paul Fauche	University of Venda

Stakeholder	Contact	Organisation
	Ms Navashni Govender	SANParks
	Ms Cathy Greaver	SANParks
	Mr Zebulon Hlungwane	SANParks
	Steven Khoza	Private I&AP
	Ernest Lesoalo	University of Limpopo
	Ntombi Majozi	Private I&AP
	Mr Jerome Mandoma	Zwisimane
	Manoko Masilo	LEDET
	Ms Doris Maumela	Department of Water and Sanitation
	Mr Stephen Midzi	SANParks
	Mr Zebulon Modilkwe	Lepelle Northen Water Board
	Tumelo Mokgotho	Marakele Project Manager
	Mr Kesentseeng Mosotho	Limpopo Department of Agriculture
	Nketso Mphake	SANParks
	M.S. Mugivhi	LEDET
	Mr Daniel Mundalamo	Mutale Community Representative
	Mr Hector Muvhenzhe	SANParks: Field Assistant
	Anathi Nabi	Private I&AP
	Mr David Neguyuni	Mutale Community Representative
	Mphadeni Nthangeni	Marakele National Park
	Mr Kenny Phasha	Tsogang Water and Sanitation
	Ms Winnie Phuluwa	Department of Water and Sanitation
	Abel Ramavhale	Private I&AP
	Mr Marius Renke	SANParks
	Mr B Schroder	Welgevonden Game Reserve
	Mr Richard Selemela	Department of Agriculture
	CJ Smith	Roosvlei
	Mr Marius Snyders	Ripzone

Stakeholder	Contact	Organisation
	Mr Peter Tsheola	LEDET
	M.S Tshikundamalema	Tshikundamalema
	Kennedy Tshivase	Senior Traditional Leader
	Mr Eddie Ubisi	SANParks
	Mrs C West	Elangeni DooranDraai
	Nick Zambatis	Biodiversity Conservation
	Moses Ratshivhadelo	Tswelopele Ya Rena Tra. Co.
	Lorraine Maloma	Tswelopele Ya Rena Tra. Co.
	Sello Ledwaba	Department of Environmental Affairs
	Pamole Motshana	Private I&AP
	Thuso Maphuthu	Private I&AP
	Mr John Wesson	WESSA
	Thomas Tshivhandekano	Private I&AP

APPENDIX H

EAP & SPECIALIST CVs

Anton Linström

Idi nr. 6303265035081

58 Church Street
Lydenburg
1120

Tel. 013 235 2889
Cell. 083 226 1089

Education

National Diploma (Nature Conservation). SA Technikon. 1989
National Higher Diploma (Environment management). Port Elizabeth Technikon. 1994
Masters Degree in Environmental Management (River Ecology). Orange Free State University. 1999.

Affiliations

International Mire Conservation Group.
Animal Demographic Unit (ADU).
South African Wetland Society (SAWS)
The South African Council for Natural Scientific Professions (SACNASP – 400275/11)
Affiliated with the Wildlife Resource Association

Experience

June 2010 -

Free Lance Wetland Ecologist

- Undertake specialist wetland and riparian studies.
- Lecturing at the Advanced Wetland Course and the Wetland Rehabilitation Course at the University of the Free State.
- Undertook one-day course in Riparian Vegetation Response Assessment Index (VEGRAI) for the Mpumalanga Tourism and Parks Agency staff.
- Undertook a one-day course in Riparian Vegetation Response Assessment Index (VEGRAI) for the Department of Water Affairs and Sanity.

November 2008 to May 2010

Golder Associates Africa — South Africa

Wetland Ecologist

- Undertake specialist wetland investigations as part of EIA's.
- Undertook a Wetland Biomonitoring Project at the Kusile Power Station.
- Completed two wetland scoping reports for Comprehensive Reserve Determinations for Riparian Areas.
- Specialist wetland studies further afield in the Democratic Republic of the Congo for the Frontier Mine.

1998 to 2008

Mpumalanga Tourism and Parks Agency — Mpumalanga, South Africa

Wetland Scientist.

- Managed the participation of MTPA in the development application process through the evaluation of and commenting on development applications with specific reference to that of wetlands in Mpumalanga to ensure proper mitigation of possible negative environmental impacts.
- Coordinated the Bi-annual Co-ordinated Water Bird Counts in collaboration with the University of Cape Town Animal Demography Unit for several years. A total of 8 wetland sites in the province were surveyed and reported on. This took place in cooperation with Bird Clubs and private volunteers.

- Implement and manage a service of specialist aquatic wetland research for the Mpumalanga Parks Board to solve specific management problems.
- Compile and work on a Wetland Inventory for the Mpumalanga Province in South Africa.
- Was actively involved in the development of a Riparian Vegetation Index as part of the National Biomonitoring Programme on all the main rivers in the Mpumalanga Province.
- Authored the Ecological Reserve Determination for riparian vegetation in the Elands River and the Crocodile River in the Mpumalanga Province.
- Initiated and actively involve with the establishment of a "Wetlands/Riparian Habitats: A practical field procedure for identification and delineation" as a policy within the Forestry Industry and all the other major land-users in South Africa.
- Initiate and actively involve with the South African Wetland National Indaba.
- Initiate and actively involve with the Mpumalanga Wetland Forum.
- Actively involve with local communities and wetlands, i.e. Delmas Municipality, Chrissiesmeer Community, the Wakkerstroom Community, Khadishi Community and the Emhlangeni Community Wetland Project.
- Initiate and driving the Ramsar Application for Verloren Valei, Wakkerstroom Wetland and the Chrissiesmeer Pan System. International recognition was given to the Verloren Valei Wetlands during 2001. The Wakkerstroom Wetland Information Sheet is handed in for Ramsar recognition.
- Initiate and actively involve with several wetland rehabilitation projects in the Province. This is part of a Poverty Relieve project with the Working for Water programme.
- Received a Merit Award in 1998/9 for the "Best Research & Development Contribution".
- Actively involve and contribute to the South African White-winged Flufftail (*Sarothrura ayresi*) Action Plan Workshop, 2003.
- Present and lead a wetland training session in the form of a fieldtrip and a lecture for the final students of the University of Tswane.
- Take part in the bi-annual Coordinated Avifauna Road Counts.

1996 to 1998 **Mpumalanga Parks Board** **Mpumalanga, South Africa**

Assistant Director

Served as Sub-Regional Head in MPB.

- Supervision over three nature reserves and the Southern Drakensberg Sub-Region.
- Managed 23 General Assistants, three Reserve Managers and a Law Enforcement Officer.

Managed all Nature Conservation related matters in this Region.

1994 to 1996 **Transvaal Provincial Administration** **Transvaal, South Africa**

Officer in Charge – Sterkspruit Mountain Catchment

- Officer in charge of the Sterkspruit Nature Reserve.
- Managed a 10 000 hectare Mountain Catchment Area.
- Supervise a total of 15 General Assistants.
- Chaired the Mountain Catchment Committee and the Water Quality Sub-committee

1991 to 1993 **Transvaal Provincial Administration** **Transvaal, South Africa**

Lydenburg, South Africa

Scarce and Protected Plant Project – Technical Support

- Scarce and Protected Plant Inventory – Helicopter Arial Surveys.
- Reestablishment of a Critical Endangered Plant – Stapelia clavicorona.
- Reassess all Conservation Plans of Scarce and Protected Plants in the Province.

- Monitor the conservation status of several scarce and protected plants.

1990 to 1991 **Transvaal Provincial Administration** **Transvaal, South Africa**
Hans Hoheisen Wildlife Research Station
Elephant Project – Technical Assistance

- Monitor movement of Elephant on two Private Nature Reserves.
- Aerial game counts on two Private Nature Reserves.

1986 to 1990 **Transvaal Provincial Administration** **Transvaal, South Africa**
Boskopdam Nature Reserve, South Africa
Officer in Charge – Boskopdam Nature Reserve.

- Managed a 4000 hectare grassland Nature Reserve and all related activities.
- Supervision over 25 General Assistants.
- Execute all reserve monitoring programmes: game counts, condition indexes, culling operations, burning programmes, bird programmes, etc.

PUBLICATIONS AND REPORTS

- Impesa. 2003. Classification and mapping of Peatlands in Southern Africa including Lesotho.
- Intermediate Ecological Reserve Determination for the Elands River Catchment, Incomati System, Mpumalanga. Chapter 7: Riparian Vegetation. Report no: ENV-P-C 2000-090.
- Intermediate Ecological Reserve Determination for the Crocodile River Catchment, Mpumalanga, Chapters: Wetlands and Riparian Vegetation. Report no.: ENV-P-C 200 2009.
- The Evaluation of Riparian Vegetation and its application on Riverine Management. Masters Degree in Environmental Management. In the Faculty of Natural Sciences (Centre for Environmental Management). University of the Orange Free State Bloemfontein. November 1999.
- Anton Linström and Danie Otto for the Department of Water Affairs and Forestry (DWAF), 2008. *Resource Directed Measures: Comprehensive Reserve determination study of the Integrated Vaal River System*. Lower Vaal Water Management Area Technical Component: Inception Report. Report no: RDM/ WMA10 C000/ 01/CON/0107 (Golder Associates). Pretoria, South Africa.
- Anton Linstrom and Johan Engelbrecht. 2009. Frontier Mine (Congo): Aquatic Biodiversity Survey. For First Quantum Mineral Limited. Report nr. 12377-9162-1 (Golder Associates).
- Anton Linstrom, 2009. *Groot Marico and Crocodile West River Reserve Determination Study – Wetland Scoping Report* (Golder Associates). Department of Water Affairs and Forestry (DWAF). Pretoria. 0001.
- Linström, A., De Wet, K., Engelbrecht, J., De Wet, F., Matthews, W., and Cilliers, J.P. 2012. *Biodiversity Action Plan: SASOL Secunda and Sasolburg.* Wet-Earth Eco-Specs.
- Van Rooy, J. Linström, A., and Grundling, P. 2013. Bryological Notes New national and regional bryophyte records, 35 Journal of Bryology, 35: 2, 129-139(11)
- Linström, A. 2014. Wetland Vegetation in the Kruger National Park. In Press. Part of a wetland characterisation project of the Savanna Parks in South Africa.
- Lesotho Highlands Water Project – Phase 2. 2014. Part of the Specialist Consultants undertaking baseline studies and Instream Flow Requirements for Phase 2. Institute of Natural Resources. A project for the Lesotho Highlands Development Authority.
- *S*tassen, R. Graham, M, Linstrom, A., Otto, D., O'Brien, G., Pike, T., and Bruton, S. 2014. *Intermediate Ecological Reserve Determination Study for the Spook and Vaalbankspruit.* BHP Billiton: Mpumalanga.
- Implementation of the River Health Programme in the Crocodile (West) Marico WMA. 2013-2015. Focus area is the Riparian Vegetation Component by using the Riparian Vegetation Response Assessment Index (VEGRAI).

- Baseline monitoring of aquatic ecosystem health in the Orange-Senqu River basin. 2010 – 2011. Focus area is the Riparian Vegetation Component by using the Riparian Vegetation Response Assessment Index (VEGRAI).
- Goodman, P.S., Matthews, W.S. and Linström, A. (2016). A Review of the Biophysical Environment and Conservation Importance of the Sasol Secunda Property. Unpublished report, Sasol Secunda, Secunda, South Africa.
- Grundling, P-L., Linstrom, A., Pretorius, M.L., Bootsma, A., Job, N., Delport., L., Elshehawi, S., Grootjans, A., Grundling, A., Mitchell. S. 2015. Investigation Of Peatland Characteristics And Processes As Well As Understanding Of Their Contribution To The South African Wetland Ecological Infrastructure. Water Research Commission Project: KSA 2: K5/2346
- Linstrom, A., Rossouw, P.S., and Grundling, P-L. 2016. Grass Pan Rehabilitation - Graspan (Glencore) at Middelburg, Mpumalanga, South Africa. Evaluation and guidelines for rehabilitation of a pre-rehabilitated pan by Wet-Earth Eco-Specs. Unpublished report, 127 pp.

Franci Gresse

Programme Manager

Qualifications

BSc (Hons) Conservation Ecology

Member, International Association of Impact Assessment South Africa (IAIAsa)

Specialisation

Environmental Impact Assessment Practitioner

Years in industry

10,08

Franci is a senior environmental practitioner in Aurecon's Cape Town office. She has been involved in various environmental investigations, including environmental impact assessments (EIA's), environmental management plans (EMP's), environmental management programmes (EMP's), rehabilitation plans maintenance management plans (MMP's) and fatal flaw analysis.

Franci has been involved with the Working for Wetlands rehabilitation programme for the past five years, of which she has been acting as the Team Leader for the environmental assessment practitioners (EAP's) for the last three years. The Working for Wetlands project won the 2012 Aurecon Chairman's Award for its positive contribution to the natural and social environmental. In addition, Franci has also been involved with a number of projects in the renewable energy sector.

Franci served on the committee of the South African affiliate of the International Association for Impact Assessment (IAIA) for the Western Cape Branch from 2009 to 2011, and remains a member. She completed a Bachelor of Science and an Honours Degree in Conservation Ecology at the University of Stellenbosch (South Africa).

Experience

Implementation of the Hoekplaas environmental authorisation (EA), Northern Cape Province, South Africa, Mulilo Renewable Energy, 11/2013 - 05/2015, Project Leader

Aurecon assisted the holder of the environmental authorisation (EA) for the 100 MW photovoltaic (PV) facility in De Aar with the implementation of the environmental conditions to ensure compliance to all relevant environmental legislation. Responsible for the management of tasks and review of all documentation. Also assisting client with questions on the environmental impact assessment (EIA) process.

Environmental impact assessment and compilation of an environmental management plan (EMP) for the Swakopmund-Mile 7 Water Supply, Phase 2, Swakopmund, Namibia, NamWater, 11/2013 - 10/2015, Project Leader

NamWater appointed Aurecon to assist with the environmental impact assessment process for the proposed construction of a new bulk water pipeline between Swakopmund and Mile 7. Responsible for the management and review of the environmental impact assessment (EIA) reports and processes, as well as the project's finances.

Working for Wetlands plan 2014 - 2017, Regional South Africa, South African National Biodiversity Institute (SANBI), 06/2013 - Date, Task Leader

The South African National Biodiversity Institute (SANBI) appointed Aurecon to provide environmental and engineering services for the Working for Wetlands Programme which is a national wetland rehabilitation programme. Responsible for the management of the environmental authorisation component of the project,

as well as the compilation of basic assessment reports (BAR) for the country. Other responsibilities include the compilation of wetland rehabilitation plans for the Western Cape, Northern Cape, North West and Limpopo Provinces, liaison with authorities and the public (public participation process) and management of wetland specialists.

Maintenance management plans (MMP's) for flood damaged road infrastructure, Western Cape Province, South Africa, Western Cape Provincial Government Department of Transport and Public Works, 06/2013 - Date, Project Staff

The project entails the compilation of maintenance management plans (MMP's) for two local municipal areas (Laingsburg and Worcester), as well as obtaining the necessary permits/ water use authorisations. Personally involved during the project commencement with regards to strategy development, meetings with the relevant authorities and assistance with the development of the MMP's.

Environmental impact assessment (EIA) for the expansion of approved solar energy facilities located near Prieska and De Aar, Northern Cape Province, South Africa, Mulilo Renewable Energy, 03/2013 - 09/2015, Phase Leader

Mulilo Renewable Energy decided to expand the approved solar energy facilities on the farms Hoekplaas and Klipgats in Prieska, as well as on the farms Badenhorst Dam and Du Plessis Dam in De Aar. The expasion of Hoekplaas farm in Prieska includes ten additional 75 MW photovoltaic (PV) facilities and six additional PV units at Klipgats Pan farm. The expansion at Badenhorst Dam farm includes four additional 75 MW PV facilities and three additional PV units at Du Plessis Dam farm. Responsible for the management and review of the environmental impact assessment (EIA) reports and processes, as well as the project's finances.

Fatal flaw study for two potential Wind Energy Facility (WEF) sites, Northern and Western Cape Provinces, South Africa, Juwi Renewable Energies (Pty) Ltd, 03/2013 - 04/2013, Environmental Practitioner

The study entailed a fatal flaw analysis of two potential wind energy facility (WEF) sites in the Northern and Western Cape Provinces. Responsible for the assessment of the sites and compilation of the fatal flaw report.

Richtersveld wind energy facility (WEF), Northern Cape Province, South Africa, TRE Tozzi Renewable Energy S.p.A and Guma Group, 07/2012 - 09/2013, Environmental Practitioner

The project entailed a due diligence of the proposed wind energy facility (WEF) to review compliance with the requirements of the Department of Energy's independent power producer (IPP) process. Responsible for the review of the environmental reports and compilation of the due diligence report.

Three photovoltaic (PV) energy facilities near Copperton, Northern Cape Province, South Africa, Mulilo Renewable Energy (MRE), 09/2011 - 05/2015, Environmental Practitioner

The project entailed three environmental impact assessments (EIA's) for three photovoltaic (PV) energy facilities comprising 75 MW to 150 MW, located near Copperton. Responsible for the management the EIA process and project specialists, compilation of scoping and EIA reports and liaison with authorities.

Fatal flaw study for four potential wind energy facility (WEF) sites, Northern and Western Cape Provinces, South Africa, Mainstream Renewable Power South Africa, 11/2011 - 05/2012, Environmental Practitioner

The study entailed a fatal flaw analysis of four potential wind energy facility (WEF) sites across the Northern and Western Cape Provinces. Responsible for the management of specialists, review of reports, assessment of the sites and compilation of the fatal flaw report.

Implementation of the Klipgats Pan environmental authorisation (EA), Northern Cape Province, South Africa, Mulilo Renewable Energy, 09/2011 - 05/2015, Project Leader

Aurecon was appointed to undertake three environmental impact assessments (EIA's) for three proposed phtovoltaic (PV) solar energy plants near Copperton. The first PV solar energy plant will generate around 100 MW (preferred alternative) or 150 MW (alternative) on the Hoekplaas Farm (Farm 146/RE). The proposed PV plant will cover approximately 300 ha (preferred alternative) or 450 ha (alternative). The second includes a PV solar energy plant to generate roughly 100 MW on the farm Klipgats Pan (Farm 117/4) near Copperton in the Northern Cape. The proposed PV plant will cover an estimated 300 ha. An alternative site for a 100 MW PV plant with a 300 ha footprint is also being considered. The third comprises a PV solar energy plant to generate about 100 MW (preferred alternative) or 300 MW (alternative) on the farm Struisbult (Farm 104, portion 1) which will cover 300 ha to 900 ha. Responsible for managing tasks and reviewing all documentation for updating the environmental management plan (EMP) and implementing the environmental authorisation (EA). Also assisted client with questions on the EIA process.

Proposed rehabilitation of Wetlands as part of the Working for Wetlands, Regional, South Africa, South African National Biodiversity Institute (SANBI), 08/2011 - 09/2013, Environmental Practitioner

Appointed by the South African National Biodiversity Institute (SANBI) to conduct environmental impact assessments (EIA's) for the rehabilitation of specific wetlands in all provinces of South Africa over a five year period. Responsible for the compilation of basic assessment reports (BAR) and Wetland Rehabilitation Plans for the Western Cape, Northern Cape, Gauteng and Limpopo Provinces. Other responsibilities included liaison with authorities, public participation process, management of specialists and general project management of the environmental component of the project.

Repair of flood damage to road structures in the Eden District Municipality, Western Cape Province, South Africa, Western Cape Provincial Department of Transport and Public Works, 01/2011 - Date, Environmental Practitioner

The project entails the compilation of maintenance management plans (MMP) for seven areas with the Eden District Management Area to repair. Responsible for compilation of MMP's, review of reports and liaison with stakeholders and authorities.

Environmental impact assessment (EIA) for the proposed extension of the Ash Dam facility at Kriel power station, Mpumalanga Province, South Africa, Eskom Holdings, 11/2009 - 12/2015, Environmental Practitioner

Appointed by Eskom to conduct an environmental impact assessment (EIA) for the proposed construction of a fourth ash dam facility at the Kriel power station. Responsible for the general project management and finances, screening process, compilation of the scoping and EIA reports, public participation and the compilation of a waste management licence application.

Environmental impact assessment (EIA) for proposed relocation of solar energy facility, Onder Rietvlei Farm, Aurora, Western Cape Province, South Africa, Solaire Direct Southern Africa, 2010 - 2011, Project Leader

Appointed by Solaire Direct to undertake a basic environmental impact assessment (EIA) process for the proposed relocation of an approved, but not yet constructed 10 MW solar energy facility. Responsible for the management and review of the EIA process and finances.

Environmental impact assessment (EIA) for proposed solar energy facility, Onder Rietvlei Farm, Western Cape Province, South Africa, Solaire Direct Southern Africa, 07/2010 - 02/2012, Environmental Practitioner

Appointed by Solaire Direct to undertake a basic environmental impact assessment process for the proposed construction of a 10 MW solar energy facility. Responsible for the compilation of the draft and final reports, public participation process, management of specialists and general project management.

Proposed Paarl Mountain and Ysterbrug pumping main upgrades, Western Cape Province, South Africa, Drakenstein Municipality, 06/2010 - Date, Environmental Advisor

The Drakenstein Municipality appointed Aurecon's engineers to investigate and plan the proposed upgrade of the Paarl Mountain and Ysterbrug Pumping Scheme. The upgrading of the pipelines feeding the Meulwater Water Treatment Works from the Bethel and Nantes dams, also part of this scheme, was also investigated. Responsible for providing advice on environmental processes required. Other responsibilities included the management of the independent environmental assessment practitioner and the review of all environmental impact assessment (EIA) documentation.

Environmental sensitivity study (ESS) for a proposed solar energy facility on a farm Near Aurora, Western Cape Province, South Africa, Solaire Direct Southern Africa, 2010, Environmental Practitioner

Appointed to provide and environmental sensitivity study (ESS) which inter alia highlights the potential constraints ('red flags') and opportunities presented by the site from an environmental perspective. Responsible for the compilation of the ESS.

Proposed erection of Eskom communication sirens and public anouncement (PA) systems, Blaauwberg, Western Cape Province, South Africa, Eskom, 2009 - 2010, Environmental Practitioner

The project entailed three environmental impact assessment (EIA) processes for the (a) erection of 10 new sirens in the Parklands area, (b) the relocation of one siren in Bloubergstrand, and (c) the upgrade of five sirens on farms near Melkbosstrand. Responsible for compiling environmental impact assessment (EIA) reports, and the public participation process.

Proposed remediation, rehabilitation and restoration of the Spruit, Krom, Leeu and Palmiet Rivers, Western Cape Province, South Africa, Drakenstein Municipality, 2009 - 2010, Environmental Practitioner

Appointed by the Drakenstein Municipality to undertake the requisite environmental impact assessment (EIA) process for the rehabilitation, remediation and stabilisation of four rivers in Paarl and Wellington. Responsible for the EIA and public participation processes.

Proposed construction of a new pipeline from Bovlei Winer to Withoogte Dam, Wellington, Western Cape Province, South Africa, Drakenstein Municipality, 2009 - 2010, Environmental Practitioner

The Drakenstein Municipality proposed to replace a section of the existing pipeline extending from the Withoogte Dam to the Welvanpas Reservoir near Wellington as part of the municipality's water master plan in order to improve the overall water supply. Responsible for the compilation of the environmental impact assessment (EIA) report, management of specialists and the public participation process.

Overberg District Municipality integrated transport plan (ITP) strategic environmental informants, Western Cape Province, South Africa, Overberg District Municipality, 2009, Environmental Practitioner

Aurecon's Transportation Unit was appointed to revise the integrated transport plan (ITP). The Environmental Unit was subcontracted to provide environmental input. Responsible for identifying and describing the relevant informants.

Annandale Commercial: development of petrol filling station on portion of Erf 5561, Kuils River, Western Cape Province, South Africa, Communicate, 2009, Environmental Practitioner

Appointed to compile a construction environmental management plan (CEMP) for the construction of a filling station on the corner of Gladioli Street and Amandel Drive, Kuils River. Responsible for the compilation of the project specification document as part of the CEMP.

Overberg District Municipality integrated transport plan (ITP): strategic environmental informants, Western Cape Province, South Africa, Overberg District Municipality, 2009, Environmental Practitioner

Aurecon's Transportation Unit was appointed to revise the integrated transport plan (ITP). The Environmental Unit was subcontracted to provide environmental input. Responsible for identifying and describing the relevant informants.

Environmental impact assessment (EIA) for the proposed Langezandt Quays development in Struisbaai Harbour, Western Cape Province, South Africa, Golden Falls (Pty) Ltd, 2008 - Date, Environmental Practitioner

Aurecon was appointed to undertake an environmental impact assessment (EIA) process for the proposed development of a four storey development on Erf 848 within the Struisbaai harbour precinct. Responsible for drafting responses to the Department of Environmental Affairs' independent review report on the proposed development.

Pre-feasibility and feasibility studies for augmenting the Western Cape water supply system, South Africa, Department of Water Affairs (DWA), 2008 - 2013, Project Staff

The Department of Water Affairs commissioned pre-feasibility and feasibility studies for the augmentation of the Western Cape water supply system through the further development of the surface water resources. Surface water schemes to be investigated were identified by the Western Cape water supply system reconciliation strategy study. Responsible for the public participation process, managing environmental specialists, and compiling a socio-economic overview of the study area.

Proposed redevelopment of the Blaauwberg Conservation Area: Eerstesteen Node, Western Cape Province, South Africa, City of Cape Town, 2008 - 2010, Environmental Practitioner

The project entailed an environmental impact assessment (EIA) process for redeveloping the Eerstesteen Conservation Area on the West Coast. Responsible for compiling the EIA report, as well as managing specialists and the public participation process.

Table Mountain Group aquifer feasibility study and pilot project, Western Cape Province, South Africa, City of Cape Town, 2008 - 2010, Environmental Control Officer

The City of Cape Town initiated a study into the Table Mountain Group Aquifer as a potential water source to augment the city's supply. The feasibility and pilot project phase record of decision (RoD) required completion for site-specific environmental management plans (EMP's) for drilling sites that were assessed to be environmentally sensitive. Site-specific EMP's were designed for sensitive sites to ensure minimal environmental impact during the drilling phase. Responsible for monitoring compliance with the RoD and EMP during the drilling phase.

Application for rectification in terms of Section 24G of the National Environmental Management Act (NEMA) for the unlawful commencement of a fruit processing factory on Op de Tradouw Farm, Number 69, Barrydale, Western Cape Province, South Africa, Schoonies Family Trust, 2008 - 2009, Environmental Practitioner

The project consisted of an application for rectification in terms of Section 24G of NEMA. Responsible for compiling an environmental impact report and an environmental management plan (EMP) for the application, as well as managing the public participation process.

Proposed development of apple and pear orchards on Soetmelksvlei Farm, Western Cape Province, South Africa, BETCO, 2008 - 2009, Project Staff

This Agri-development project involved the development of 50 ha of apple and pear orchards in the Riviersonderend region. Responsible for compiling the basic assessment report, environmental management plan (EMP), and managing the specialists and public participation process.

Proposed extension of Lock Road, Kalk Bay, Western Cape Province, South Africa, Mr Rick Bartlett, 2008 - 2009, Project Staff

The project comprised an environmental impact assessment (EIA) process for extending Lock Road to an existing erf. Involved during the final stages of the application.

Water reconciliation strategy for the Algoa water supply area, Eastern Cape Province, South Africa, 2008 - 2009, Environmental Practitioner

This project provided an assessment of the environmental opportunities and constraints for a suite of water schemes in the Algoa water supply area. This was undertaken as part of a broader study in the area.

C.A.P.E. Olifants-Doring Catchment Management Agency project: Development of a catchment management strategy water resource protection sub-strategy for the Olifants-Doring Catchment, South Africa, CapeNature, 2008 - 2009, Environmental Practitioner

Appointed by CapeNature to compile a catchment management strategy water resource protection sub-strategy for the Olifants-Doorn catchment. Responsible for compiling a database that lists all institutions and their respective mandates in terms of water resource protection and biodiversity conservation decision making for the Olifants-Doring Catchment, workshop arrangements, and general project related work.

Environmental sensitivity study for the proposed Dasdrif poultry farm in Moorreesburg, Western Cape Province, South Africa, Eikenhoff Poultry Farms (Pty) Ltd, 2008, Project Staff

The project consisted of an environmental sensitivity study (ESS) which, inter alia, highlighted the potential constraints ('red flags') and opportunities presented by the site from an environmental perspective. Responsible for compiling the ESS.

Joint Maputo River Basin water resources study, Mozambique, Swaziland and South Africa, 2008, Project Staff

The project provided an environmental opportunities and constraints assessment of a suite of potential dams in South Africa and Swaziland, within the Maputo River Catchment. This was undertaken as part of a broader study into the catchment.

Department of Economic Affairs, Environment and Tourism (DEAET) decision-making support, South Africa, Department of Economic Affairs, Environment and Tourism (DEAET), 2008, Project Staff

Responsible for assisting the DEAET with the review and processing of environmental impact assessment (EIA) applications in terms of the Environment Conservation Act.