

# REHABILITATION PLAN FOR THE WORKING FOR WETLANDS REHABILITATION PROGRAMME, EASTERN CAPE

## PROJECT: BAVIAANSKLOOF L81A, L81B and L81C

SEPTEMBER 2015



Agriculture, Forestry and Fisheries  
Environmental Affairs  
Water Affairs and Sanitation



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**REHABILITATION PLAN FOR THE BAVIAANSKLOOF WETLAND PROJECT,  
EASTERN CAPE: PLANNING YEAR 2015/2016  
AS PART OF  
THE WORKING FOR WETLANDS PROGRAMME  
FOR THE  
DEPARTMENT OF ENVIRONMENTAL AFFAIRS  
DIRECTORATE: NATURAL RESOURCE MANAGEMENT**

**MAIN REPORT  
September 2015**

*Prepared by:* Aurecon South Africa (Pty) Ltd  
PO Box 19553  
Tecom  
5214  
South Africa  
Tel: 043 721 0900  
Fax: 043 721 0902  
Email: [Jenny.Youthed@aurecongroup.com](mailto:Jenny.Youthed@aurecongroup.com)

*Prepared for:* Working for Wetlands Programme  
Department of Environmental Affairs:  
Natural Resource Management  
Private Bag X447  
Pretoria  
South Africa  
Tel: 012 399 8970  
Email: [FTerera@environment.gov.za](mailto:FTerera@environment.gov.za)

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## PROJECT DETAILS

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**TITLE** Rehabilitation Plan for the Baviaanskloof Wetland Project, Eastern Cape Province: Planning Year 2015/2016

**PREPARED BY** Jenny Youthed of Aurecon South Africa (Pty) Ltd

**CONTRIBUTORS** Japie Buckle Assistant Director: Working for Wetlands Programmes for Eastern Cape Province  
Damian Walters of Ikhwane Wetland Science  
Morné Pienaar of Aurecon South Africa (Pty) Ltd

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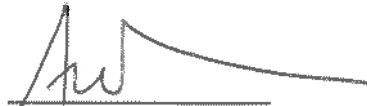
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**Prepared for the Working for Wetlands Programme by:**



**Franci Gresse**  
Project Leader  
Aurecon SA (Pty) Ltd.



**Andries van der Merwe (PrEng)**  
Technical Director  
Aurecon SA (Pty) Ltd.

**Approved for the Working for Wetlands Programme by:**



**Japie Buckle**  
Assistant Director: Wetlands Programmes for Eastern Cape Province  
Department of Environmental Affairs: Natural Resource Management Programmes

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# WORKING FOR WETLANDS: CONTEXT DOCUMENT

## 1. Introduction

Working for Wetlands (WfWetlands) is a government managed by the Natural Resource Management Programmes (NRMP) 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). 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" (UNECA GEO, 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.

The two main objectives of the WfWetlands Programme are **wetland conservation** in South Africa and **poverty reduction** through **job creation** and **skills development** amongst **vulnerable** and **marginalised** groups.

**Wetland conservation:** The strategic framework of the WfWetlands Programme underlines the need for a more refined planning process at catchment scale. Catchment scale planning seeks to promote ecosystem-scale outcomes, long-term custodianship, and the entrenchment 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 the process draws in a much wider stakeholder base.

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.

**Skills development:** 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 11 years since 2004, the WfWetlands Programme has invested over R765 million in wetland rehabilitation and has been involved in over 980 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 110 million, of which R 38.5 million is allocated directly to paying wages. Being part of the EPWP, the WfWetlands Programme has created more than 21 000 jobs and over 2.5 million person-days of paid work. The local teams are made up of a minimum of 55% women, 55% youth and 2% disabled persons.

Wage information sourced from the PIP guidelines suggests that workers and contractors would be paid daily rates of R95.40 and R 362.19 respectively and would be employed on limited term contracts. Employment of workers complies with the Ministerial Determination on Special Public Works Programmes (Government Notice No. 9475, 4 May 2012) and the Code of Good Practice for Employment and Conditions of Work for Expanded Public Works Programmes (Government Notice No. 129, 18 February 2012). Targets for employment specify that the programme's workforce should comprise at least 55% women, 55% youth and 2% disabled people.

### Training and Capacity Building during the Working for Wetlands Programme

The WfWetlands Programme has established a working relationship with the Department of Public Works through the Working for Water programme. This partnership provides accredited training in accordance with the special public works Code of Good Practice agreements. Capacity building in the WfWetlands Programme operates primarily at two levels:

- The first concerns the need to ensure the development of adequate capacity to rehabilitate, manage and conserve wetlands in South Africa.
- The second relates to the commitment of the WfWetlands Programme as an EPWP to provide appropriate training to its workers in order for them to exit the programme with marketable skills and enhanced personal development.

Workers receive two days of training for every 22 days worked, of in total, 60% of the training must be vocational and 30% accredited. Vocational training includes technical matters related to project activities, occupational health and safety, first aid, fire awareness, and business skills (contractor development). Social development includes literacy, primary health, personal finance, HIV/Aids and diversity awareness.

The WfWetlands Programme 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. In particular, compatibility with Integrated Development Plans (IDPs) and rehabilitation project objectives will be a key area of future focus. The WfWetlands Programme encourages municipalities to participate in provincial wetland forums as these forums are the platform for the roll out of all the programmes' processes, including planning for future work. Provincial 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.

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 215 371 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).

### Increased labour requirement for the Working for Wetlands Programme

In response to the government request to increase the labour component of all government funded projects, the WfWetlands Programme project team has had to consider, and where practically feasible incorporate, more labour intensive ways of rehabilitating wetlands in order to obtain the increased labour component. Accordingly the project team members have factored this requirement into their planning when designing structures for wetland rehabilitation.

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

## 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 36 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 provincial Assistant Directors for Wetlands Programmes (ASDs)<sup>1</sup> 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 may also attend the site visits on some occasions. 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

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<sup>1</sup> Previously referred to as Provincial Coordinators (PCs).

investigated. The details of the proposed interventions are discussed, some survey work is undertaken by the engineers, and 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. These include:

- WW(0): Standard operating procedure,
- WW(1): Wetland survey and Inspection consent,
- WW(2): Terms and Conditions for carrying out wetland rehabilitation,
- WW(3): Wetland Rehabilitation Activities Consent,
- WW(4): Property Inspection Prior to Wetland Rehabilitation, and
- WW(5): Notification of Completion of Rehabilitation.

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 the Department of Environmental Affairs (DEA), the work detailed for the project will be implemented within a year with on-going monitoring being undertaken

thereafter. The Rehabilitation Plans are considered to be the primary working document for the implementation of the project via the construction/ undertaking of interventions<sup>2</sup> listed in the Plan.

It is typically at this point in the process when the final construction drawings are issued to the Implementing Agents (IAs). Seventeen Implementing Agents 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.

### **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.

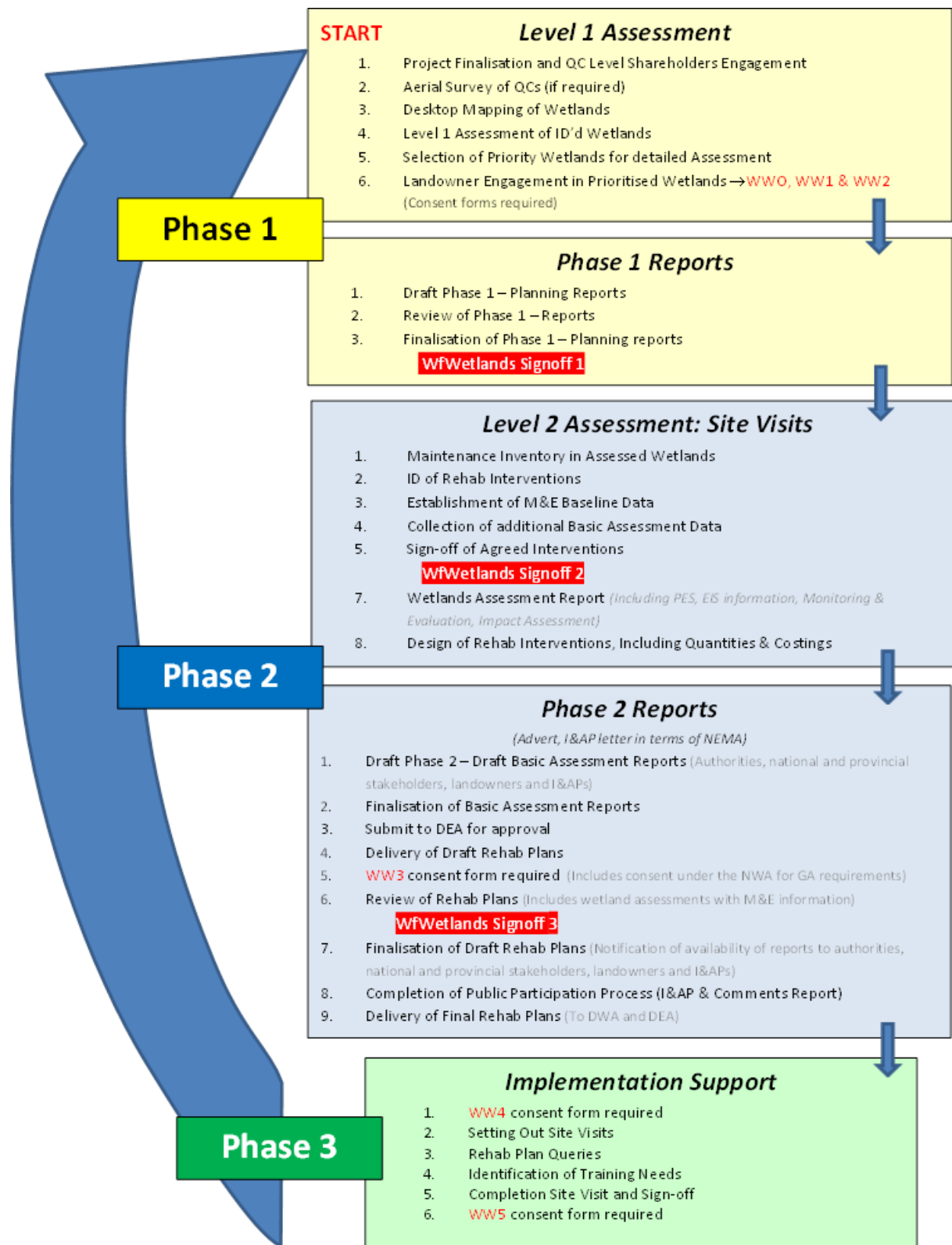
Recognising the ecosystem services provided by floodplain wetlands and the extent to which they have been transformed, WfWetlands do not intend to stop undertaking rehabilitation work in floodplains entirely. Instead, WfWetlands propose to adopt an approach to the rehabilitation of floodplain areas that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

- As a general rule, avoid constructing hard interventions within an active floodplain channel; and rather
- 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.

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<sup>2</sup> This could include soft options such as alien clearing, eco-logs, gabion structures as well as hard structures for example weirs.



Suite of Landowner Consent Forms required by the Provincial Coordinators:	
<b>WW0</b> = Standard Operating Procedure	<b>WW3</b> = Wetland Rehabilitation Activity Consent
<b>WW1</b> = Wetland Survey and Consent	<b>WW4</b> = Property Inspection
<b>WW2</b> = Terms and Conditions for rehabilitation	<b>WW5</b> = Notification of Completion of Rehabilitation

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



## 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. The WfWetlands Programme operates within the context of the Constitution of South Africa, Act No. 108 of 1996, whereby everyone has the right to have the environment protected and conserved for the benefit of present and future generations. The following legislation (listed in **Table A**) informs and guides the WfWetlands Programme in terms of its vision and objectives, whilst simultaneously regulating the wetland rehabilitation activities which WfWetlands carries out.

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

### Memorandum of Understanding for Working for Wetlands Programme

A Memorandum of Understanding (MOU) has been entered into between DEA, DAFF and DWS for the WfWetlands Programme. Through co-operative governance and partnerships, this MOU aims to streamline the authorisation processes required by the National Environmental Management Act, No. 107 of 1998, the National Water Act, No. 36 of 1998, and the National Heritage Resources Act, No. 25 of 1999 to facilitate efficient processing of applications for authorisation of wetland rehabilitation activities.

**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

Title of legislation, policy or guideline:	Administering authority:	Date:
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
<ul style="list-style-type: none"> <li>• EIA Guideline Series, in particular:</li> <li>• Guideline 5 – Companion to the NEMA EIA Regulations, 2010 (DEA, October 2012)</li> <li>• Guideline 7 – Public Participation in the EIA process, 2012 (DEA, October 2012)</li> <li>• Guideline 9 - Guideline on Need and Desirability, 2010 (DEA, October 2014)</li> <li>• DEA&amp;DP. 2013. Guideline on Public Participation (DEA&amp;DP, March 2013).</li> <li>• DEA&amp;DP. 2013. Guideline on Alternatives (DEA&amp;DP, March 2013).</li> </ul>	Department of Environmental Affairs	2006 - 2013
International Conventions, in particular: <ul style="list-style-type: none"> <li>• The Ramsar Convention</li> <li>• Convention on Biological Diversity</li> <li>• United Nations Conventions to Combat Desertification</li> <li>• New Partnership for Africa's Development (NEPAD)</li> <li>• The World Summit on Sustainable Development (WSSD)</li> </ul>	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 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)** will be 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.

- 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<sup>3</sup> (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*<sup>4</sup>' and '*altering the bed, banks, course or characteristics of a watercourse*<sup>5</sup>' where they are specifically undertaken for the purposes of rehabilitating<sup>6</sup> 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.

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<sup>3</sup>Government Notice No. 1198, 18 December 2009

<sup>4</sup>Section 21(c) of the NWA, No. 36 of 1998

<sup>5</sup>Section 21(i) of the NWA, No. 36 of 1998

<sup>6</sup>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*"

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## ii. 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 the 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 respectively).

In order to meet the requirements of the Regulations pursuant to NEMA, it was necessary to undertake a Basic Assessment Processes outlined in Section 19 and Appendix 1 of Regulation 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).

The EA that has been applied for will be inclusive of all Listed Activities that may be triggered whilst implementing the wetland rehabilitation interventions. Essentially this EA would authorise any typical wetland rehabilitation activities on condition that the specific intervention proposals are submitted in a Rehabilitation Plan to DEA for approval.

The Rehabilitation Plans for each Wetland Project will be prepared annually after sufficient field work and stakeholder consultation has been undertaken in the wetlands that have an EA. These Rehabilitation Plans will be submitted to DEA for approval as a condition of the EA for the respective Provincial BAR.



### iii. CONTACT DETAILS

<b>Details of the applicant: Working for Wetlands Programme</b>	
<b>Contact Person:</b>	Dr Farai Tererai
<b>Street Address:</b>	Environment House, 1563 Arcadia Ext. 6 Cnr Soutpansberg and Steve Biko Road, Pretoria
<b>Postal Address:</b>	Private Bag X447, Pretoria, 0001
<b>Tel:</b>	012399 8970
<b>Fax:</b>	086 520 7829
<b>Email:</b>	Ftererai@environment.gov.za
<b>Details of the ASD: Working for Wetlands Programme</b>	
<b>Contact Person:</b>	Mr Japie Buckle
<b>Street Address:</b>	31 Newcombe Avenue, Miramar, Port Elizabeth
<b>Postal Address:</b>	31 Newcombe Avenue, Miramar, Port Elizabeth, 6070
<b>Tel:</b>	041 368 3866
<b>Fax:</b>	-
<b>Email:</b>	jbuckle@environment.gov.za
<b>Details of the EAP: Aurecon South Africa (Pty) Ltd</b>	
<b>Contact Person:</b>	Jenny Youthed
<b>Street Address:</b>	No 1 Pearce Street, Berea, East London
<b>Postal Address:</b>	PO Box 19553, Tecoma, 5214
<b>Tel:</b>	043 721 0900
<b>Fax:</b>	043 721 0902
<b>Email:</b>	Jenny.youthed@aurecongroup.com

#### iv. ABBREVIATIONS

ASD	Assistant Director: Wetland Programmes <sup>7</sup>
BAR	Basic Assessment Report
BGIS	Biodiversity Geographical Information System
BMP	Best Management Practise
CARA	Conservation of Agricultural Resources Act
CEMP	Construction 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
HIA	Heritage Impact Assessment
IA	Implementing Agent
I&APs	Interested and Affected Parties
IDP	Integrated Development Plans
M&E	Monitoring and Evaluation
MAP	Mean Annual Precipitation
NEMA	National Environmental Management Act (Act 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act
NRMP	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
SANParks	South African National Parks
SMME	Small, Medium and Micro Enterprises
WfWetlands	Working for Wetlands

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<sup>7</sup> Previously referred to as the Provincial Coordinator (PC)

## v. GLOSSARY OF TERMS

**Bedrock:** The solid rock that underlies unconsolidated material, such as soil, sand, clay, or gravel (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

**Basic Assessment Report (BAR):** A report as described in regulation 23 of the EIA regulation, 2006 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.

**Biophysical:** The biological and physical components of the environment (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 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 (consult DWAF [1994]) (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 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.

**Eco-log:** A cylindrical wire mesh sleeve 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).

**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 Plan (EMP):** Details the methods and procedures for achieving environmental targets and objectives.

**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.

**Interested and Affected Parties (I&APs):** People and organizations that have interest(s) in the proposed activities.

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

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

**Intervention:** An engineered structure such as a concrete or gabion weir, earthworks or revegetation that achieves identified objectives within a wetland e.g. raising of the water table within a drainage canal.

**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 Groundwater Dictionary. Available online: [http://www.dwaf.gov.za/Groundwater/Groundwater\\_Dictionary/index.html?introduction\\_quaternary\\_catchment.htm](http://www.dwaf.gov.za/Groundwater/Groundwater_Dictionary/index.html?introduction_quaternary_catchment.htm)).

**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.

**Rehabilitation:** Restoring processes and characteristics that are sympathetic to and not conflicting with the natural dynamic of an ecological or physical system (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

**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.

**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."* (SA Water Act 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"* (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

## vi. 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, and the Assistant Directors for Wetlands Programmes (ASD)) and their subsequent input into the Reporting, which includes intervention design drawings, the alluvial fan 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. These include:
  - WW(0): Standard operating procedure,
  - WW(1): Wetland survey and Inspection consent,
  - WW(2): Terms and Conditions for carrying out wetland rehabilitation,
  - WW(3): Wetland Rehabilitation Activities Consent,
  - WW(4): Property Inspection Prior to Wetland Rehabilitation, and
  - WW(5): Notification of Completion of rehabilitation.
- 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) and Construction Environmental Management Plan (CEMP), the recommendations of the Basic Assessments and the requirements of the Environmental Authorisation (EA) for 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.
- Due to the dynamic nature of site conditions and associated biophysical changes within wetlands, this Rehabilitation Plan is only valid for the 2015/16 financial year. Where appropriate interventions have not been implemented previously or included in the 2009/10, 2010/11, 2011/12, 2012/2013, 2013/14, 2014/15 Project Implementation Plans (PIPs), these have been reviewed and where necessary re-designed for inclusion into the 2015/16 Rehabilitation Plan. This Rehabilitation Plan

therefore supersedes all previous plans for this project and only interventions from this plan should be included in the 2015/16 PIP.

- Should it be necessary to exclude interventions from the Rehabilitation Plan, the prioritisation of interventions across the project should strictly be followed.

#### **vii. 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.

Aurecon South Africa (Pty) Ltd (Aurecon) acknowledges the authorship of any information contained in this document from previous planning years, to the previous provider: Land Resources International (LRI).

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

1. Basic Assessment Report (2015), and the
2. Alluvial Fan Status Quo Report (2015) (**Appendix A** of this report).



## **viii. DISCLAIMER**

- This Rehabilitation Plan is for the Baviaanskloof Wetland Project in the Eastern Cape Province. The plan is to be used to implement the interventions identified as necessary to rehabilitate the Baviaanskloof wetlands, and is to be approved by the DEA as part of the conditions of EA.
- The intervention points and wetland boundary polygons provided in this report are based on the shapefiles that have been provided by the wetland specialist. The datasets included in the Phase 1 Reports have been updated by the Wetland Specialists and verified by the ASDs. All reasonable efforts have therefore 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.

**ix. DISTRIBUTION LIST**

<b>NAME</b>	<b>TITLE</b>	<b>FOR ACTION</b>	<b>FOR INFORMATION</b>	<b>RECEIVED PRIOR TO RELEASE</b>
<b>PROPONENT</b>				
Dr Farai Tererai	Deputy Director: Planning, Monitoring and Evaluation		✓	
Mr Japie Buckle	Assistant Director: Wetlands Programmes	✓		✓
<b>NATIONAL STAKEHOLDERS</b>				
Refer to <b>Appendix F</b>			✓(E-copy of Rehab Plan)	
<b>PROVINCIAL STAKEHOLDERS &amp; I&amp;APs</b>				
Refer to <b>Appendix G</b>			✓(E-mail notification)	
<b>LANDOWNERS</b>				
Refer to <b>Appendix E</b>			✓(E-copy of Rehab Plan )	

# 1 INTRODUCTION

## 1.1 Document outline

This document comprises the Rehabilitation Plan for the Baviaanskloof 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 2015/16, which are necessary to meet the rehabilitation objectives that have been determined in earlier phases of the WfWetlands Programme. The Rehabilitation Plan includes the following alluvial fan system(s):

- Baviaanskloof

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 Baviaanskloof 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.
- **Chapters 4-7:** These sections focus on an alluvial fan system within the Baviaanskloof Wetland Project and include a description of the respective alluvial fan, motivation for the alluvial fan selection, summary of the problems identified within the fan, and outlines some of the main rehabilitation objectives for the alluvial fan. A table of proposed interventions is provided in these sections together with any specific Environmental Management Plan issues to be considered when implementing the interventions. The sections also include the baseline data needed to undertake future monitoring of the interventions.

Reports on the current status of each alluvial fan are included as **Appendix A** of this report and should be consulted for the detailed findings of the site investigations. The Construction Environmental Management Plan (CEMP) is included as **Appendix B** of this report and is supported by Interventions and Design Drawings (as well as site specific mitigation measures), which are included as **Appendix C** of this report. The Environmental Authorisation (EA), to be included as **Appendix D**, and the Landowner Agreements, included as **Appendix E**, are to be in place prior to the implementation of any of the interventions taking place. **Appendices F and G** provide the national and Provincial Stakeholder databases.

## **1.2 Environmental Authorisation**

The drylands nature of the work to be carried out in the Baviaanskloof project did not trigger the need for a basic assessment this year. An annual rehabilitation plan is however still required and must undergo a public participation process. The Final Rehabilitation Plan will be submitted to the DEA in October 2015 for consideration.

As part of this public participation process, the Rehabilitation Plan is circulated to Registered Interested and Affected Parties (I&APs) and directly affected landowners for comment. 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 (NRMP) 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 11 years since 2004, the WfWetlands Programme has invested over R765 million in wetland rehabilitation and has been involved in over 980 wetlands, thereby improving or securing the health of over 70 000 hectares of wetland environment. The WfWetlands Programme has created more than 21 000 jobs and over 2.5 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, 55% 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 36 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 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;
- The fencing off of 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.
- 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; and
- In some instances, the use of appropriate fire management and burning regimes.

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 two 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 as 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 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 Eastern Cape Wetland Projects

Projects for the 2015/2016 planning cycle were restricted, by the provincial coordinator, to projects in the Baviaanskloof. Work by a Working for Wetlands partner organisation (Living Lands) led to the development of a *de facto* Phase 1 report that identified 13 alluvial fans within the Baviaanskloof that required rehabilitation. The top four priority fans identified in the Phase 1 report (Commonland, 2015) were selected for phase 2 planning. The work in the Baviaanskloof is congruent with the Programme's current five year strategic plans as well as recommendations in terms of priorities for freshwater ecosystems restoration and management from the National Freshwater Ecosystem Priority Areas (NFEPA) project.

Based on this process, quaternary catchments and associated wetland systems were identified for the 2015/2016 planning cycle in the Eastern Cape Province (**Table 1**). As explained in Section 1.2 above, the need for a Basic Assessment Process was not triggered. Approval of this Rehabilitation Plan is however required before any rehabilitation work can take place.

**Table 1: Eastern Cape Projects**

<b>Project Name</b>	<b>Alluvial Fan System</b>
Baviaanskloof	Fan 4
	Tchandokloof
	Spitzkloof
	Dam se Drif

### **2.3.1 The Baviaanskloof Project**

The Baviaanskloof project this year is focused on the rehabilitation of alluvial fans and forms part of a holistic catchment management strategy for the Baviaanskloof River. A key element of this is the control of sediment through the system, thus the importance of rehabilitation work in sediment sources.

Alluvial fans are cone-shaped depositional features that form along mountain fronts where steep sediment laden channels emerge from narrow tributary valley and debauch onto the valley plain below (Charlton, 2010). Deposition is a result of loss of confinement where a change in stream width (an increase) and a reduction in depth and volume reduces the stream's ability to carry sediment, resulting in deposition (Ellery, et al., 2009) (Morisawa, 1968) (Leopold, et al., 1964). Fans tend to be found in arid locations where rainfall is highly variable and sediments are mobile due limited vegetation cover. Fans can vary in size from hundreds and thousands of square meters to hundreds if not thousands of hectares. Alluvial Fans are not specifically classified within the classification system for wetland or rivers in South Africa (Ollis, et al., 2013). Some are well supplied with water and have wetland habitats on their surface while drier fans may have vegetation more characteristic of terrestrial habitats while on other fans only the vegetation close to distributary channels and active depositional nodes on the fan surface may have characteristic wetland or riparian vegetation but away from these areas the fans are dry with terrestrial vegetation (Walters, 2006 – Alluvial Fan Status Quo Report). Bobbins (2011) notes that alluvial fans can provide fluvial connectivity, recharge groundwater and attenuate floods. Thus many of their functions are aligned with “wetlands” proper furthermore the alluvial fans in the Baviaanskloof play a critical role in structuring the wetlands and channel morphology of the Baviaanskloof River.

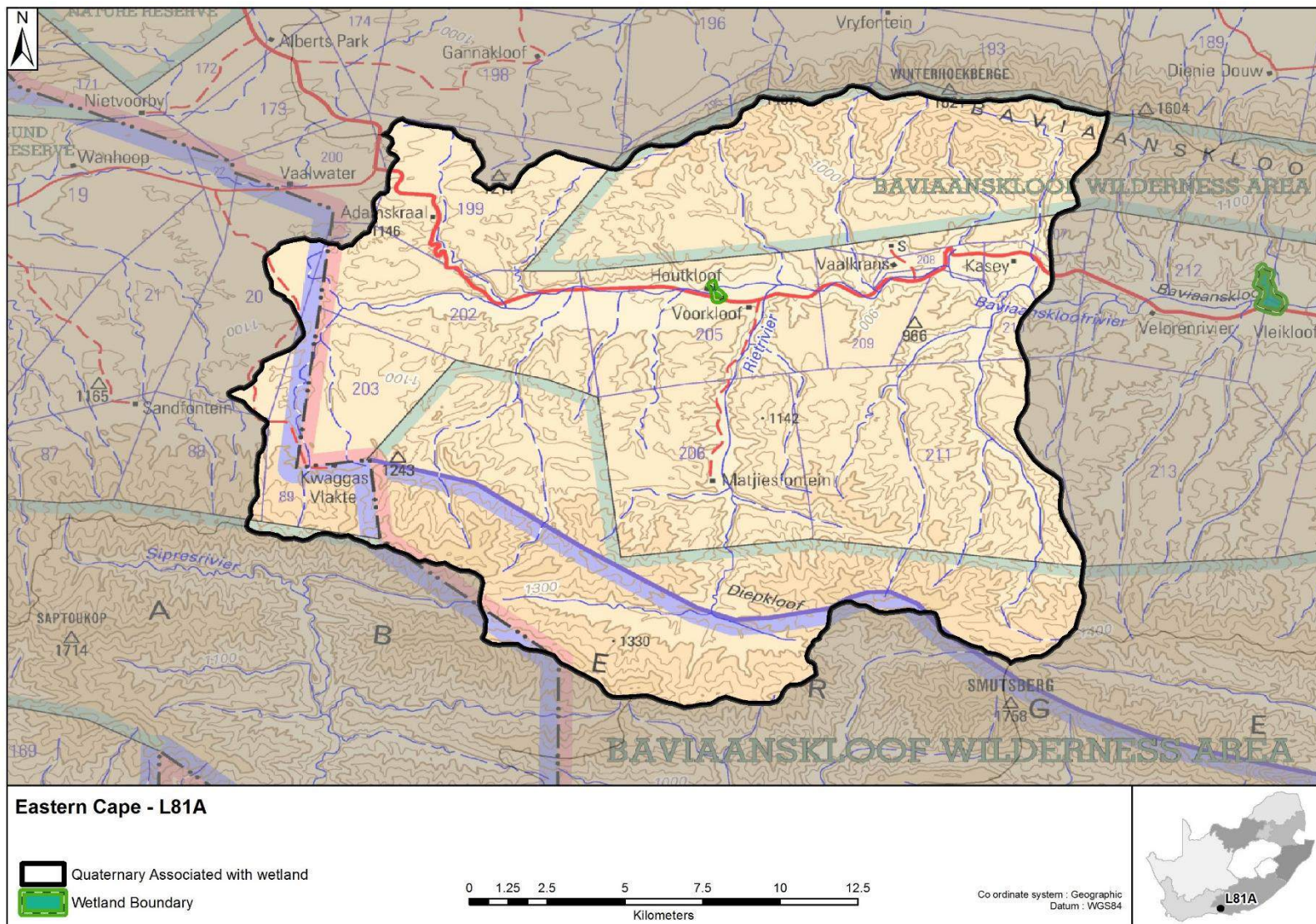
The Baviaanskloof Wetland Project for this year is focussed in the L81A, L81B, L81C quaternary catchments (refer to **Figure 1; Figure 2** and **Figure 3**).

**Alluvial fans selected:** The four alluvial fans within the Baviaanskloof Project that have been identified for rehabilitation efforts for this planning cycle are as reflected in **Table 2** below.

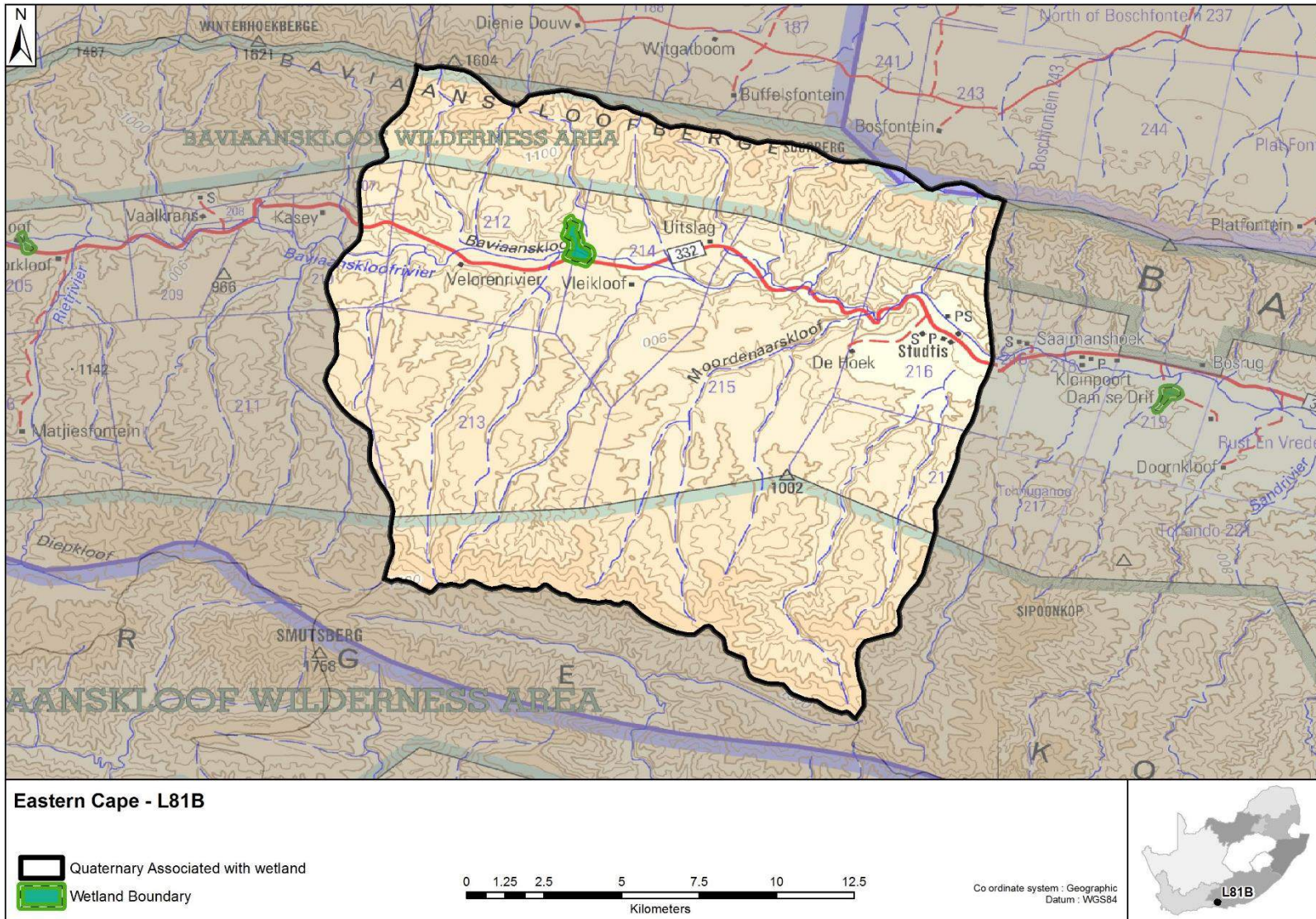


**Table 2: Location of the identified alluvial fans within the Baviaanskloof Project**

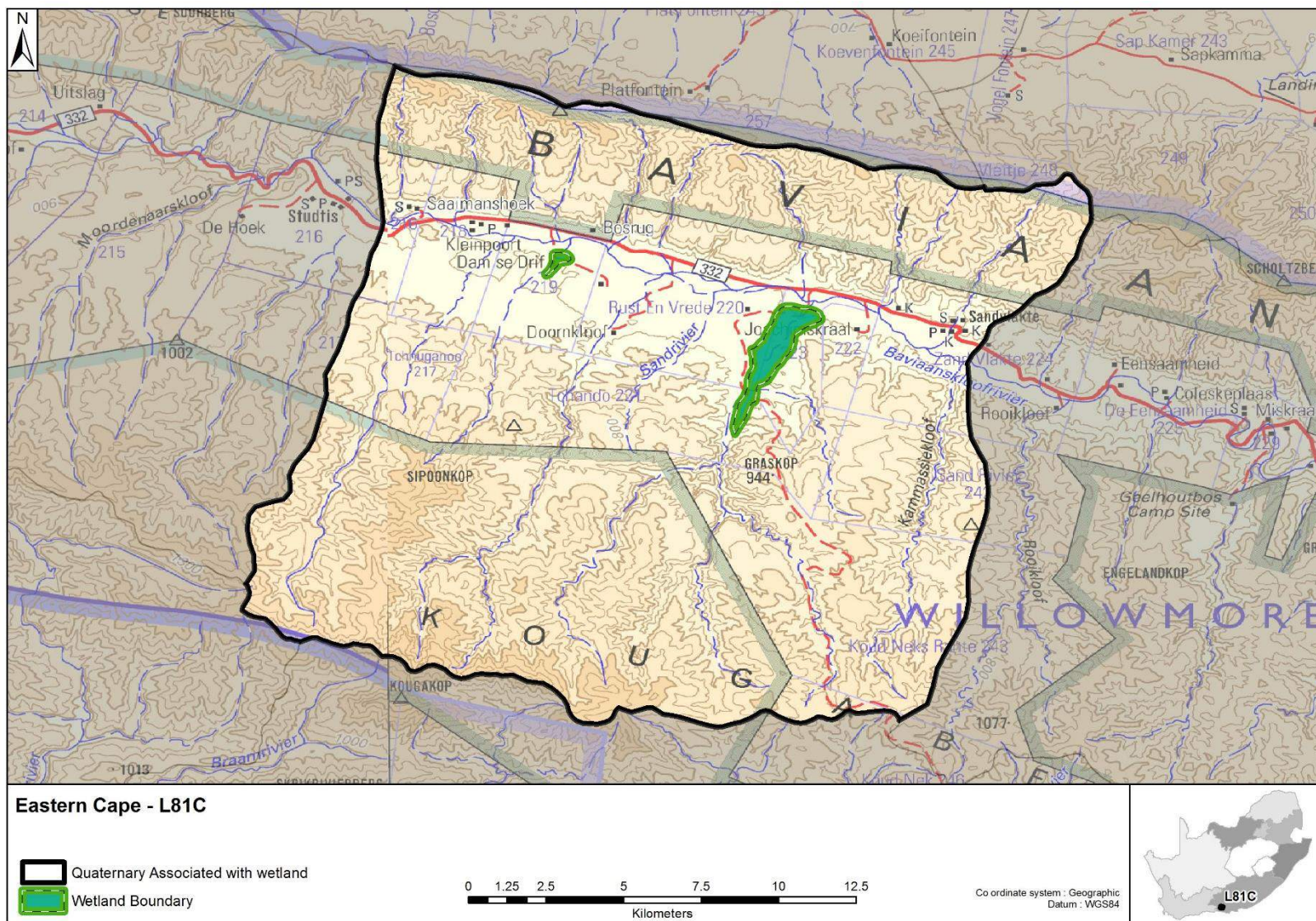
<b>Fan Number</b>	<b>Alluvial Fan Name</b>	<b>Latitude</b>	<b>Longitude</b>
L81A-01	Fan 4	33°31'06.41"S	23°43'09.88"E
L81B-01	Spitzkloof	33°30'34.86"S	23°52'33.09"E
L81C-05	Tchandokloof	33°35'46.23"S	24° 6'18.41"E
L81C-06	Dam se Drif	33°33'35.70"S	24° 2'55.85"E



**Figure 1: Topographic map showing location, cadastral boundaries and access routes of quaternary catchment L81A.**



**Figure 2. Topographic map showing location, cadastral boundaries and access routes of quaternary catchment L81B**



**Figure 3. Topographic map showing location, cadastral boundaries and access routes of quaternary catchment L81C**

### 2.3.2 Project Scope

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

**Table 3: Project Scope**

Province & Wetland Project	Eastern Cape: Baviaanskloof			
Quaternary Catchments	L81A	L81B	L81C	
Quaternary Catchment areas (Ha)	39954 Ha	31481.3 Ha	39977.2Ha	
Planning Category	Category 2	Category 2	Category 2	
Nearest Town/s	Willowmore	Willowmore	Willowmore	
Partnership	Living Lands	Living Lands	Living Lands	Living Lands
Number of fans identified during the assessment	1	1	2	
Fan names	Fan 4	Spitzkloof	Tchandokloof	Dam se Drif
Extension of existing work (previous financial year)	No	No	No	No
Work to commence at new fans in 2016/ 2017	No	Yes	Yes	No
Available budget for new interventions <sup>8</sup>	Total R 1 575 000			
	R 0	R 245 700	R 1 329 300	R 0
Estimated cost of new interventions	Total: R 2 041 996.20			
	R 482 790.00	R 381 462.80	R 1 329 286.60	R 39 188.20
Estimated cost of maintenance to existing interventions	N/A			

### 2.3.3 Prioritisation of the alluvial fans

All four of the fans have approximately equal priority thus the order of implementation should be determined by operational factors. The order of implementation of interventions within each fan is of greater importance (see below).

### 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 components of the specified systems. In theory this information could be converted into a hectare equivalent which could serve as a baseline indicator to then provide a projection of the area of wetland habitat gained or secured. In practice the level of confidence associated with interpretations of this nature are usually low and difficult to defend and hence should be interpreted with

<sup>8</sup> Should more funding become available, work will be implemented in 2016/2017 as far as possible.

great caution. For example, this approach should not be followed for hectare equivalents secured 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. In well-known systems Rehabilitation Plans can outline the following projected values for the proposed wetland rehabilitation, which can be used as an indicator of wetland rehabilitation success within each wetland system

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 hectares likely to be physically 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 4** 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.

#### 3.1 Landowner consent

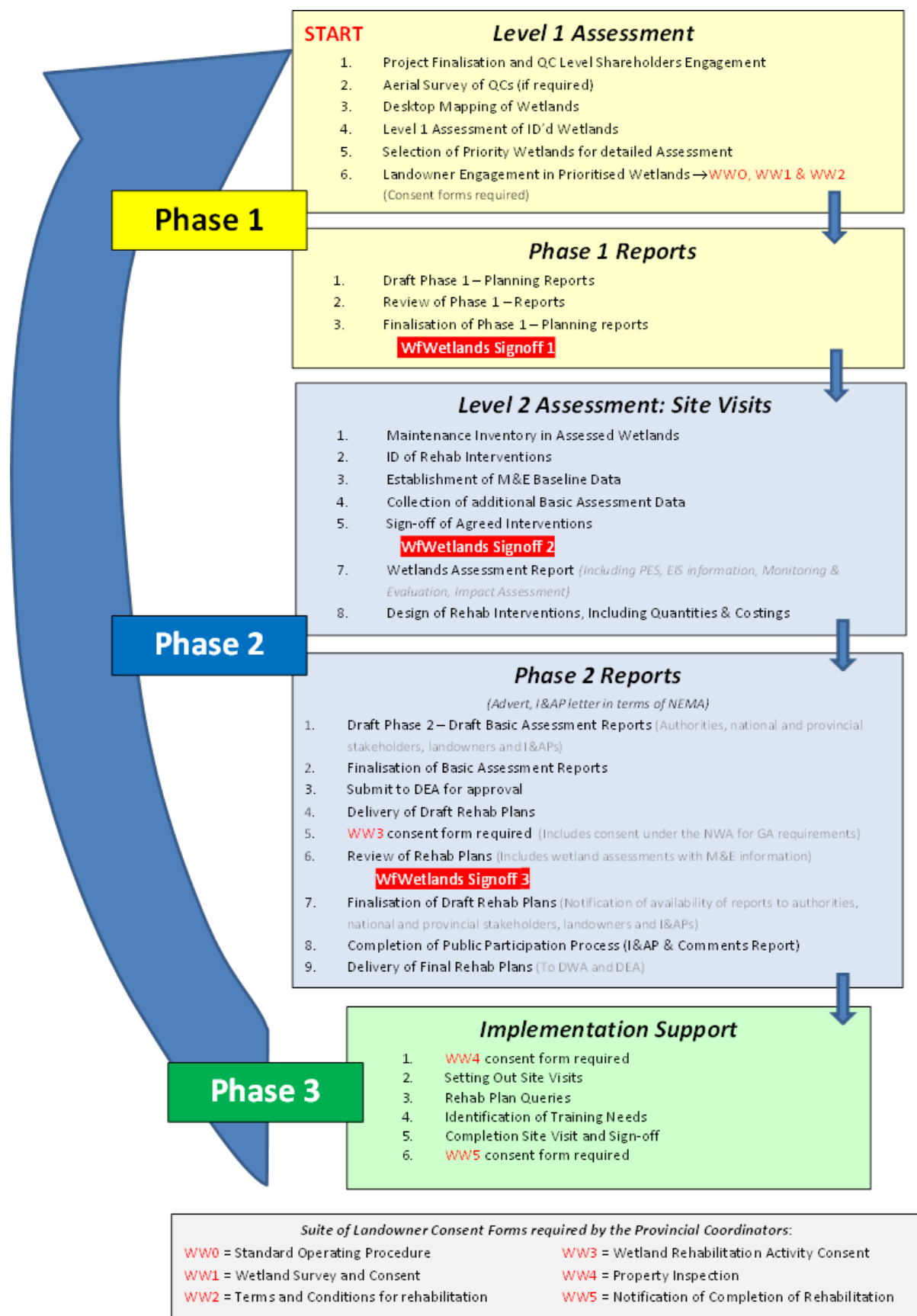
The flow diagram (refer to **Figure 4**) clearly demonstrates the point at which various consent forms must be approved via signature from the directly affected landowner. The ASDs are responsible for undertaking the necessary landowner engagement and for ensuring that the requisite landowner consent forms required as part of Phase 1 and 2 of this project are signed. These include:

- WW(0): Standard operating procedure
- WW(1): Wetland survey and Inspection consent,
- WW(2): Terms and Conditions for carrying out wetland rehabilitation,
- WW(3): Wetland Rehabilitation Activities Consent,
- WW(4): Property Inspection Prior to Wetland Rehabilitation, and
- WW(5): Notification of Completion of Rehabilitation.

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

#### 3.2 Phase 1

Previous research on alluvial fans in the Baviaanskloof has been carried out, in particular by Bobbins (2011) as part of her Masters degree at Rhodes University. Some work has also been undertaken by the NGO Living Lands. This work was used to inform the selection of fans most suitable for rehabilitation efforts. This phase also involved initial communication with local land-owners and other I&APs to gauge the social benefits of the work.



**Figure 4: The three phases that must be undertaken for the successful rehabilitation of 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. 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 following site visits were undertaken for the Baviaanskloof Wetland Project:

1. Tchandokloof (21 April 2015)
2. Dam se Drif (21 April 2015)
3. Fan 4 (22 April 2015)
4. Spitzkloof (22 April 2015)

The following team members attended the site visits:

- Japie Buckle (ASD)
- Morné Pienaar (Engineer)
- Damian Walters (Wetland Specialist)
- Jenny Youthed (EAP)

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.

During Phase 2, monitoring systems were put in place to support the continuous evaluation of interventions. The systems monitor both the environmental and social benefits of the interventions.

#### 3.3.2 Alluvial Fan Reports

The time and resources required to determine the current status of the alluvial fans was generally limited, and thus a rapid procedure was adopted to assist the project team in systematically carrying out the assessments under constraints.

It should be noted that there is no formal assessment methodology or approach for fan systems in South Africa. The WET Health and WET-EcoServices assessment methods do not allow for the assessment of fans and as such were not employed. The assessment of the fans instead used a simple approach where clear anthropogenic impacts on the fans were identified and those that interfere with the fan hydrological and geomorphic process were prioritised for rehabilitation. The types of impacts that were considered important in terms of the fan hydrology and geomorphology were those that modified the location, depth or course of the stream on the fan surface. Typical impacts included the canalization of the fan stream through excavation and channel straightening, the constriction of the movement of the stream and flood waters over the fan surface through dykes and berms.

Refer to **Appendix A** which contains the Alluvial Fan Status Quo Report(s).

### 3.3.3 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 alluvial fans. Choices of intervention options were also informed by the increased labour component as required by DEA. Any previously planned interventions that had not been implemented or included into the previous planning cycle reports were assessed and included into the current year's selection, if appropriate to the re-assessed rehabilitation objectives for the system. Operational considerations and larger scale project objectives were also taken into account.

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
<b>00</b>	<b>New</b> intervention
<b>01</b>	<b>Maintenance</b> 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.

### **3.3.4 Collection of Monitoring & Evaluation Baseline and Basic Assessments Data**

In accordance with WET-Rehab-Evaluate (Cowden & Kotze, 2007) the collection of baseline monitoring information is important to allow for the evaluation of the performance of rehabilitation activities. Monitoring and evaluation facilitate the dissemination of lessons learnt and provide a means of reporting on the success of specific rehabilitation initiatives. The monitoring and evaluation (M&E) of an identified rehabilitation project's performance is therefore considered vital to inform the evaluation of 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 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 & Kotze, 2007);

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.

### **3.3.5 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:

- A hydrological assessment was undertaken to evaluate the volume of water expected to be dealt with by the intervention during high flood occurrences. The result of this assessment allowed the engineer to select the most appropriate sizing and type of structure to be applied to the intervention.
- 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.
- Bills of quantities were calculated for the designs and cost estimates were made based on unit costs and norms for each project area, as agreed with the ASD.
- 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.

### **3.3.6 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 alluvial fan, based on, *inter alia*, the information collected during the implementation of WET-Tools where appropriate, were prepared by the Wetland Specialist, and are included as **Appendix A** to this report.

This Rehabilitation Plan was submitted to the WfWetlands ASD and Wetland Specialist 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.

#### **a. 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 FAN 4 –L81A-01

The assessment of the Fan 4 alluvial fan, its problems, and the development of the rehabilitation objectives are described in detail in the specialist's report **Appendix A**. The following subsections provide a brief summary for this alluvial fan system.

### 4.1 Landowner details

The Fan 4 project area comprises of privately-owned land, and the focus of the wetland rehabilitation efforts is on a property where the landowner's are enthusiastic about the proposed rehabilitation, and have agreed to the proposed rehabilitation interventions.

The landowner has been identified for the rehabilitation project (**Table 4**) and consent for any proposed rehabilitation (subject to the approval of the Rehabilitation Plans) on these properties has been requested. Copies of the consent forms obtained are provided in **Appendix E**.

**Table 4: Fan 4 Landowner/s and SGKey**

Wetland Number	Property SG Key	Owner / Trust	Consent Obtained
L81A-01	C08300000000020500002	Du Preez Family Trust	24 August 2015

### 4.2 Alluvial fan details

The Fan 4 alluvial fan is located in Quaternary Catchment L81A (refer **Figure 1** in Section 2.3.1 of this report). The fan can be accessed – with permission of the landowner – off the gravel provincial road R332 on the section that runs between the Baviaanskloof reserve and Willowmore. **Table 5** provides a summary of the wetland details.

**Table 5: Summary of the wetland details**

Alluvial Fan Name	Fan 4
Alluvial Fan Number	L81A-01
River System Name	Baviaanskloof
Land Use in Catchment	Agriculture (grazing and cultivation)
Land Use in Fan	Historic cultivation/grazing
No. of Properties Intersecting Fan Area	1
Date of Planning Site Visit	22 April 2015
Wetland Assessor(s)	Damian Walters
Alluvial Fan Size	7.7 ha

#### 4.2.1 Motivation for selection

Fan 4 was prioritised and selected for further assessment and rehabilitation as part of a phase 1 assessment conducted by Living Lands (see Commonland, 2015). Key criteria used in selecting were:

1. Clear human impacts on the fans hydrology, geomorphology and vegetation.
2. Land owner cooperation.
3. Importance of the fan with regards to its functioning and role in shaping the Baviaanskloof wetlands and river

#### 4.2.2 Description

Fan 4 is a small (7.7ha) alluvial fan system. The land use is natural grazing for livestock and the area has been cultivated in the past. As part of cultivation a cut-off berm has been constructed that runs along the toe of the fan. Surface flows from the fan are captured by the cut off berm at its base and the water is lead into an off channel dam (now defunct). This has resulted in the distal portion of the fan at its junction with the Baviaanskloof River has being altered.

**Catchment:** The Baviaanskloof wetland system rises within the Baviaanskloof Mountains and forms part of the larger Eastern Cape catchments (Grundling 2014).The Baviaanskloof River is the main river in the Baviaanskloof and flows through the central portion of the valley. At certain sections the river proceeds as interflow through the permeable top section of the alluvial deposits or through joints in the underlying rocks and is thus not always visible. In the Fan 4 alluvial fan an ephemeral channel has been diverted into a small dam, but under normal circumstances would discharge directly into the Baviaanskloof River which is immediately downstream.

Land use in the overall catchment includes conservation (the Baviaanskloof Mega Reserve), and farming. The western side of the Baviaanskloof is characterised by commercial agriculture and game farming. Various crops including vegetable seed and tobacco are grown. Pastures are also cultivated as a fodder source. Ecotourism ventures are becoming more common with an apparent change in land use (Commonland 4 return from landscape restoration , 2015). Land use in the fan is occasional grazing.

**Climate:** The local climate is characterised by summer rainfall with very dry winters Annual rainfall is low with frequent thunder storms in summer. The average annual rainfall is 300mm but with large temporal and spatial variation. Although no measuring stations occur in the project area, evapotranspiration is estimated at 1125mm per annum (Bobbins, 2011).

Temperatures can be highly variable between the summer and winter months. Average summer temperatures range between 16°C and 32°C, sometimes rising to 44°C during berg winds. Winter temperatures vary between 5°C and 20°C with snow sometimes occurring on the mountain peaks (Bobbins, 2011)

**Vegetation:** As fans are a transitional environment, a variety of vegetation types are often present (Bobbins, 2011). According to Mucina & Rutherford (2010), the fans here are dominated by the Albany Alluvial vegetation type. Typically the fans in an un-altered state are dominated by woody species such as *Acacia natalitia*, *A caffra* and *A karroo*. A grassy and forb component is also present dominated by *Sporobolus nitens*, *Erogrositis obtusa*, *E curvula* and *Digiteria eriantha*. *Cynodon dactylon* was common in wetter areas. In the drier parts of the fan surface various succulents (*Aloe sp.*) are common as are various species of tall and low shrubs.

In Fan 4 the vegetation shows clear signs of having been transformed via selective grazing. There is a predominance of shrubby vegetation.

**Geology and soils:** The geology of the Baviaanskloof is dominated by sandstones and quartzites of the Table Mountain Group (TMG) interspersed with small amounts of shales of the Bokkeveld Group (Illgner and Haigh, 2003). The mountains in the Baviaanskloof are made up by the arenaceous rocks of the Table Mountain Group, whereas the valley floor (in the central portion of the Baviaanskloof) consists of shales of the Bokkeveld Group (Welman and Barnard, 2007). These shales daylight at a number of farms (Illgner and Haigh, 2003). Both formations have been subject to intensive folding. A major fault is running east-west through the valley, with steep mountain slopes to the north. The Enon Conglomerate, consisting of rounded to angular pebbles in a sandy matrix, and recent alluvial sands and gravels (mainly present in the valley) unconformably overlie the Bokkeveld shale and low-lying Table Mountain Formations (Welman and Barnard, 2007). Colluvial deposits are covering the lower mountain slopes. The conglomerates outcrop intermittently from Nieuwekloof in the west to Kruisrivier (near the confluence between the Kouga River and the Baviaanskloof River) in the east (Illgner and Haigh, 2003).

**4.2.3 Site photos**



View north towards the source of the fan



View south across the berm towards the Baviaanskloof River (visible as white boulders in background)



View west along the berm



View east along the berm towards the dam



View down the fan towards the Baviaanskloof River and flat valley bottom



Channel just below the start of the fan



### 4.3 Alluvial fan problems

The key impact is that the distal portion of the fan at its junction with the Baviaanskloof River has been altered. A cut-off berm has been constructed that run along the toe of the fan. Surface flows from the fan are captured by a cut off berm at its base and the water is led into a (now defunct) off-channel dam (Figure 5).

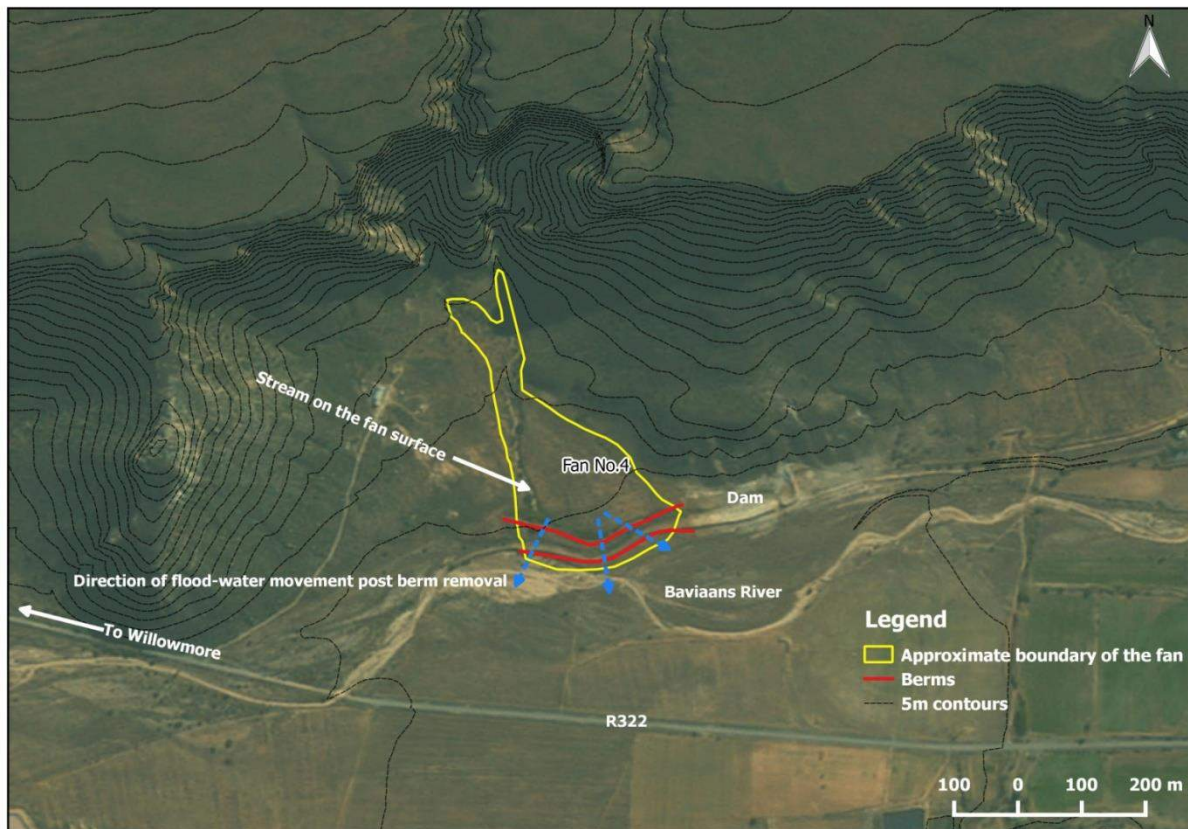


Figure 5: Problems identified within alluvial fan L81A-01.

### 4.4 Rehabilitation objectives

The berms have thus disconnected the alluvial fan from the downstream river. The removal or deactivation of the berm will allow sediment and water to reach the river as what would have occurred naturally. The main aim of the rehabilitation work is to thus reconnect the fan, hydrologically and geomorphically, with the Baviaanskloof River.

The specific rehabilitation objectives and accompanying rehabilitation strategies associated with Fan 4 are shown in **Table 6**.

**Table 6: Rehabilitation objectives for alluvial fan L81A-01**

Rehabilitation Objectives	Rehabilitation Strategy
To reconnect the fan, hydrologically and geomorphically, with the Baviaanskloof River.	Removal of segments of the berms to allow for floodwater and sediment to pass into the Baviaanskloof River

## **4.5 Summary of proposed interventions**

### **4.5.1 Work undertaken in previous planning cycles**

The Fan 4 alluvial fan is a new one and no previous planning has thus taken place.

### **4.5.2 New interventions proposed**

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 7** below.

The intervention designs/ drawings included in this Rehabilitation Plan have been labelled according to the **new naming convention** only. The “implementation order” as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first).

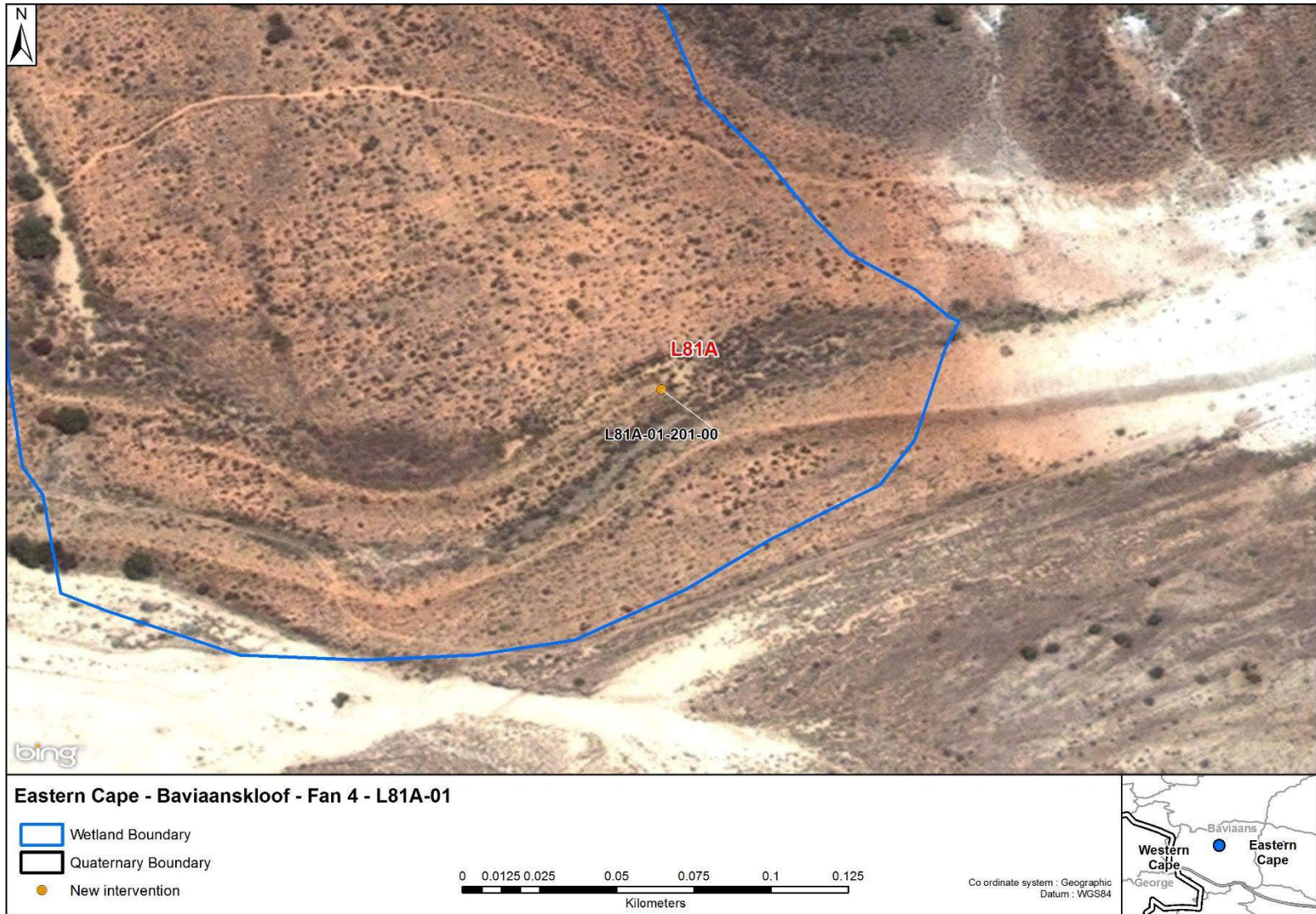
*Please note that the location of the interventions (**Figure 6**) may change slightly as a result of changes in the landscape (due to continued erosion, for example) that may occur during the time period between the initial planning site visit and the actual implementation of the interventions. It is 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.*

### **4.5.3 Design selection and sizing**

The objectives of the interventions are to allow flow back to the Baviaanskloof River. The most appropriate and cost effective method of doing this was considered to involve the removal of the berm to allow flow back to the river.

**Table 7: Summary of the Fan 4 interventions**

<b>Intervention Structure Type</b>	<b>Intervention Number</b>	<b>Proposed Action</b>	<b>Implementation Order</b>
Earthworks	L81A-01-201-00	Removal of segments of the berms to allow for floodwater and sediment to pass into the Baviaanskloof River	1



**Figure 6: Image of alluvial fan L81A-01 with proposed new interventions indicated**

## **4.6 Construction Environmental Management Plan issues**

The proposed rehabilitation is to be undertaken on privately owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the landowner. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the CEMP, the recommendations of the approved Basic Assessments and Environmental Authorisation for the project. The Intervention Booklet, Environmental Authorisation and CEMP are included as **Appendices B, D and G** of this report, respectively, and shall accompany the Implementers to site.

## **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 rehabilitation activities.

### **4.7.1 Baseline WET-Health data**

The WET-Health assessment system is not appropriate for the assessment of alluvial fans and this traditional type of baseline data is thus not possible to provide in this report. For general information on the status of the fan refer to the specialist's report in **Appendix A**.

## 5 SPITZKLOOF – L81B-01

The assessment of the Spitzkloof alluvial fan, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A: Alluvial Fan Status Quo Report**. The following subsections provide a brief summary for this alluvial system.

### 5.1 Landowner details

The Spitzkloof project area comprises of privately-owned land, and the focus of the rehabilitation efforts is on a property where the landowner's are enthusiastic about the proposed rehabilitation, and have agreed to the proposed rehabilitation interventions.

The Spitzkloof landowner has been identified (**Table 8**) and consent for any proposed rehabilitation (subject to the approval of the Rehabilitation Plans) on these properties has been requested. Copies of the consent forms obtained are provided in **Appendix E**.

**Table 8: Spitzkloof Landowner/s and SGKey**

Wetland Number	Property SG Key	Owner / Trust	Consent Obtained
L81B-01	C08300000000021200000 C08300000000021400000	W.J. Janse van Rensburg	21 August 2015

### 5.2 Alluvial fan details

The Spitzkloof alluvial fan is located in Quaternary Catchment L81B (refer **Figure 1** in Section 2.3.1 of this report). The fan can be accessed – with permission of the landowner – from the R322 provincial gravel road where it runs between the Baviaanskloof reserve and Willowmore. **Table 9** provides a summary of the wetland details.

**Table 9: Summary of the alluvial fan details**

Alluvial Fan Name	Spitzkloof
Alluvial Fan Number	L81B-01
River System Name	Baviaans
Land Use in Catchment	Agriculture (grazing and cultivation);
Land Use in Fan	Historic cultivation
No. of Properties Intersecting Fan Area	1
Date of Planning Site Visit	22 April 2015
Wetland Assessor(s)	Damian Walters
Fan size	71.25 ha

### 5.2.1 Motivation for selection

Spitzkloof was prioritised and selected for further assessment and rehabilitation during a phase 1 assessment conducted by Living Lands (see Commonland, 2015). Key criteria used in selecting were:

1. Clear human impacts on the fan's hydrology, geomorphology and vegetation.
2. Land owner cooperation.
3. Importance of the fan with regards to its functioning and role in shaping the Baviaanskloof wetlands and river.

### 5.2.2 Description

The Spitzkloof alluvial fan system is 71.25ha in extent. The land use is natural grazing for livestock and the area has been cultivated in the past. Incision of the trunk stream (Baviaanskloof River) has led to the lowering of the fan base and the incision of the fan along the primary stream. The incision of the stream has been aggravated by channel confinement caused by berms constructed to protect now abandoned cultivated lands along the edge of the stream channel in the medial distal sections of the fan.

**Catchment:** The Baviaanskloof wetland system rises within the Baviaanskloof Mountains and forms part of the larger Eastern Cape catchments (Grundling 2014). The Baviaanskloof River is the main river in the Baviaanskloof and flows through the central portion of the valley. At certain sections the river proceeds as interflow through the permeable top section of the alluvial deposits or through joints in the underlying rocks and is thus not always visible.

Land use in the overall catchment includes conservation (the Baviaanskloof Mega Reserve), and farming. The western side of the Baviaanskloof is characterised by commercial agriculture and game farming. Various crops including vegetable seed and tobacco are grown. Pastures are also cultivated as a fodder source. Ecotourism ventures are becoming more common with an apparent change in land use (Commonland, 2015).

**Climate:** The local climate is characterised by summer rainfall with very dry winters. Annual rainfall is low with frequent thunder storms in summer. The average annual rainfall is 300mm but with large temporal and spatial variation. Although no measuring stations occur in the project area, evapotranspiration is estimated at 1125mm per annum (Bobbins, 2011).

Temperatures can be highly variable between the summer and winter months. Average summer temperatures range between 16°C and 32°C, sometimes rising to 44°C during berg winds. Winter temperatures vary between 5°C and 20°C with snow sometimes occurring on the mountain peaks (Bobbins, 2011).

**Vegetation:** As fans are a transitional environment, a variety of vegetation types are often present (Bobbins, 2011). According to Mucina & Rutherford (2010), the fans here are dominated by the Albany Alluvial vegetation type. Typically the fans in an un-altered state

are dominated by woody species such as *Acacia natalitia*, *Acaffra* and *A karroo*. A grassy and forb component is also present dominated by *Sporobolus nitens*, *Erogrositis obtusa*, *E curvula* and *Digiteria eriantha*. *Cynodon dactylon* was common in wetter areas. In the drier parts of the fan surface various succulents (*Aloe sp.*) are common as are various species of tall and low shrubs.

**Geology and soils:** The geology of the Baviaanskloof is dominated by sandstones and quartzites of the Table Mountain Group (TMG) interspersed with small amounts of shales of the Bokkeveld Group (Illgner and Haigh, 2003). The mountains in the Baviaanskloof are made up by the arenaceous rocks of the Table Mountain Group, whereas the valley floor (in the central portion of the Baviaanskloof) consists of shales of the Bokkeveld Group (Welman and Barnard, 2007). These shales daylight at a number of farms (Illgner and Haigh, 2003). Both formations have been subject to intensive folding. A major fault is running east-west through the valley, with steep mountain slopes to the north. The Enon Conglomerate, consisting of rounded to angular pebbles in a sandy matrix, and recent alluvial sands and gravels (mainly present in the valley) unconformably overlie the Bokkeveld shale and low-lying Table Mountain Formations (Welman and Barnard, 2007). Colluvial deposits are covering the lower mountain slopes. The conglomerates outcrop intermittently from Nieuwekloof in the west to Kruisrivier (near the confluence between the Kouga River and the Baviaanskloof River) in the east (Illgner and Haigh, 2003).



### 5.2.3 Site photos



View north up channel towards source of fan



View south down channel towards the Baviaanskloof River



View west



View east from channel

### 5.3 Alluvial fan problems

The key problems in the fan are the incision of the trunk stream (Baviaanskloof River) that has led to the lowering of the fan base and the incision of the fan along the primary stream. The incision of the stream has been aggravated by channel confinement caused by berms constructed along the edge of the stream channel in the distal section of the fan (**Figure 7**).

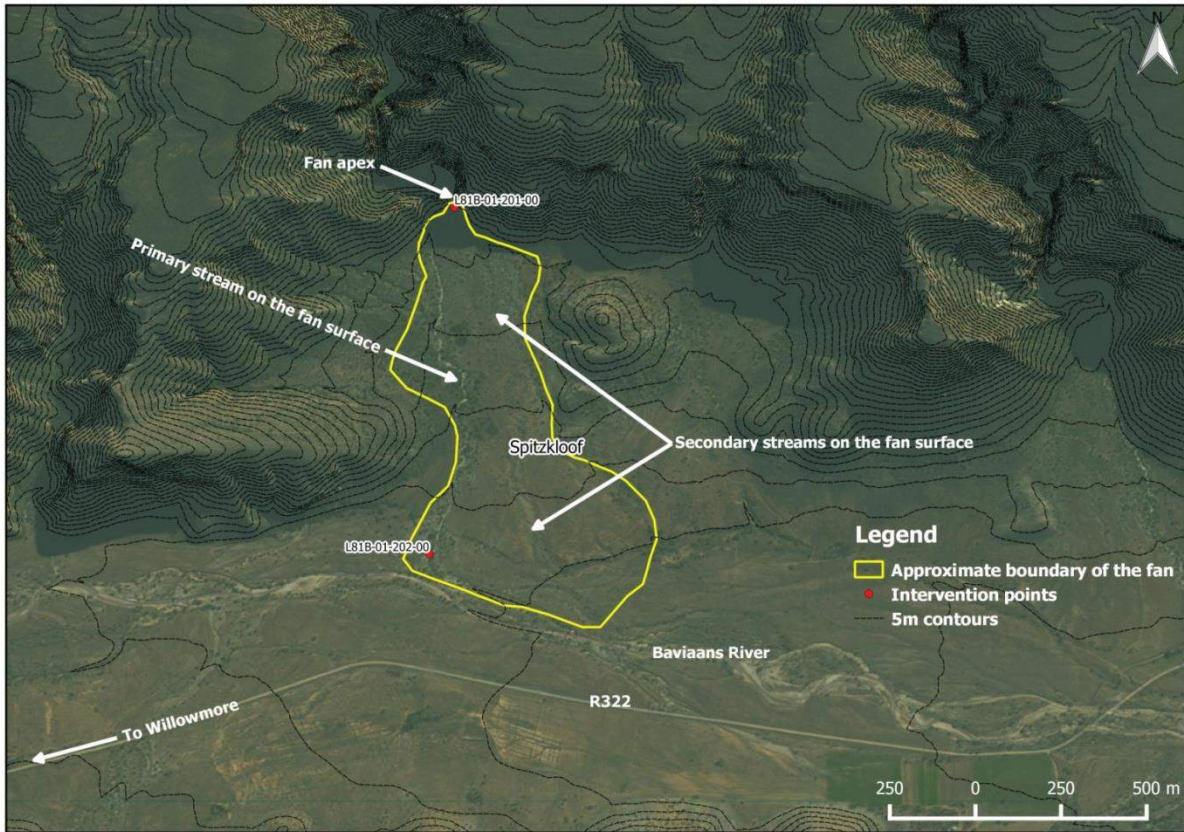


Figure 7: Problems identified within alluvial fan L81B-01.

#### 5.4 Rehabilitation objectives

The key rehabilitation objective is to reduce the competency and capacity of the primary stream on the fan surface to encourage increased aggradation within the stream channel and flooding across the fan.

The specific rehabilitation objectives and accompanying rehabilitation strategies associated with Spitzkloof are shown in **Table 10**.

**Table 10: Rehabilitation objectives for alluvial fan L81B-01**

Rehabilitation Objectives	Rehabilitation Strategy
To reduce the competency and capacity of the primary stream on the fan surface to encourage increased aggradation within the stream channel and flooding across the fan.	<p>Split the surface flows at the apex of the fan into two channels, the current primary stream channel and a historic channel. The reduction of flows into the primary channel will reduce the stream capacity to carry sediment and thus stop further degradation and encourage aggradation of the channel.</p> <p>Remove the berm from the bank of the primary channel. The removal of the berm should allow for the more frequent flooding of the lower part of the fan</p>

## 5.5 Summary of proposed interventions

### 5.5.1 Work undertaken in previous planning cycles

The Spitzkloof alluvial fan is a new one and no previous planning has thus taken place.

### 5.5.2 New interventions proposed

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 11** below.

The intervention designs/ drawings included in this Rehabilitation Plan have been labelled according to the **new naming convention** only. 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 (Figure 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.*

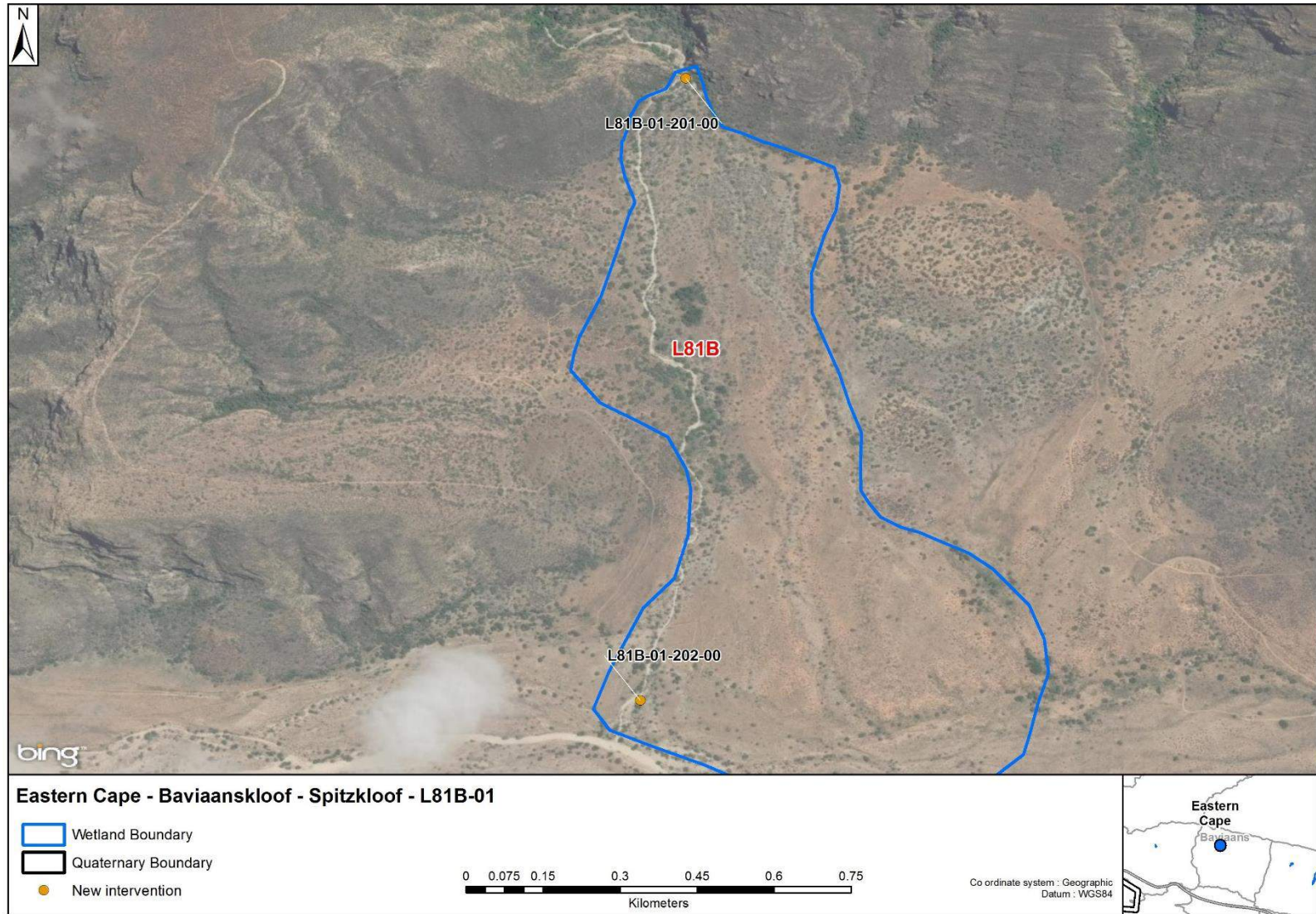
### **5.5.3 Design selection and sizing**

The objectives of the interventions are to deactivate drains and diversions and to encourage spread of flow. The most appropriate and cost effective method of doing this was considered to involve:

- The construction of hard structures (concrete or gabion weirs) were specified in high energy areas, with concrete specified in areas where impermeable intervention were required e.g. headcut stabilisation;
- Earthen diversions were specified in areas of low energy and will be vegetated to increase their stability;
- Removal of existing berms and utilising the material for the construction of plugs was specified where possible to increase person days.

**Table 11: Summary of the Spitzkloof interventions**

<b>Intervention Structure Type</b>	<b>Intervention Number</b>	<b>Proposed Action</b>	<b>Implementation Order</b>
Earthworks	L81B-01-201-00	Split the surface flows at the apex of the fan into two channels, the current primary stream channel and a historic channel.	
Earthworks	L81B-01-201-00	Remove the berm from the bank of the primary channel.	



**Figure 8: Image of alluvial fan L81B-01 with proposed new interventions indicated**

## **5.6 Construction Environmental Management Plan issues**

The proposed rehabilitation is to be undertaken on privately owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the landowner. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the CEMP, the recommendations of the approved Basic Assessments and Environmental Authorisation for the project. The Intervention Booklet Environmental Authorisation and CEMP are included as **Appendices B, D and G** of this report, respectively, and shall accompany the Implementers to site.

## **5.7 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 rehabilitation activities.

### **5.7.1 Baseline WET-Health data**

The WET-Health assessment system is not appropriate for the assessment of alluvial fans and this traditional type of baseline data is thus not possible to provide in this report. For general information on the health and determination of the alluvial fan status quo refer to the specialist's report attached in **Appendix A**.

## 6 TCHANDOKLOOF– L81C-05

The assessment of the Tchandokloof alluvial fan, its problems, and the development of the rehabilitation objectives are described in detail in the specialist's report in **Appendix A**. The following subsections provide a brief summary for this alluvial fan system.

### 6.1 Landowner details

The Tchandokloof project area comprises of privately-owned land, and the focus of the rehabilitation efforts is on a property where the landowner's are enthusiastic about the proposed rehabilitation, and have agreed to the proposed rehabilitation interventions.

The landowner has been identified (**Table 12**) and consent for any proposed rehabilitation (subject to the approval of the Rehabilitation Plans) on these properties has been requested. Copies of the consent forms obtained are provided in **Appendix E**.

**Table 12: Tchandokloof Landowner/s and SG Key**

Wetland Number	Property SG Key	Owner / Trust	Consent Obtained
L81C-05	C08300000000022300000 C08300000000022100000 C08300000000022200009	Lamprecht Boerdery Trust	20 August 2015

### 6.2 Wetland details

The Tchandokloof alluvial fan is located in Quaternary Catchment L81C (refer **Figure 3** in Section 2.3.1 of this report). The fan can be accessed – with permission of the landowner – from the R322 provincial road where it runs between the Baviaanskloof reserve and Willowmore. **Table 13** provides a summary of the alluvial fan details.

**Table 13: Summary of the alluvial fan details**

Alluvial Fan Name	Tchandokloof
Alluvial Fan Number	L81C-05
River System Name	Baviaans
Land Use in Catchment	Agriculture (grazing and cultivation);
Land Use in Fan	Historic cultivation
No. of Properties Intersecting the Fan Area	1
Date of Planning Site Visit	21 April 2015
Wetland Assessor(s)	Damian Walters
Fan size	307ha



### 6.2.1 Motivation for selection

Tchandokloof was prioritised and selected for further assessment and rehabilitation during a phase 1 assessment conducted by Living Lands (see Commonland, 2015). Key criteria used in selecting the fans were:

1. Clear human impacts on the fans hydrology, geomorphology and vegetation.
2. Land owner cooperation.
3. Importance of the fan with regards to its functioning and role in shaping the Baviaanskloof wetlands and river.

### 6.2.2 Description

Tchandokloof is a large alluvial fan system (307ha) located in the Baviaans Local Municipality South-East of the town of Willowmore.

The land use is natural grazing for livestock and the area has been cultivated in the past. Similarly to Spitzkloof, incision of the trunk stream (Baviaanskloof River) has led to the lowering of the fan base and the incision of the fan along the primary stream. The incision of the stream has been aggravated by channel confinement caused by berms constructed to protect now abandoned cultivated lands along the edge of the stream channel in the medial distal sections of the fan.

**Catchment:** The Baviaanskloof wetland system rises within the Baviaanskloof Mountains and forms part of the larger Eastern Cape catchments (Grundling 2014). The Baviaanskloof River is the main river in the Baviaanskloof and flows through the central portion of the valley. At certain sections the river proceeds as interflow through the permeable top section of the alluvial deposits or through joints in the underlying rocks and is thus not always visible.

Land use in the overall catchment includes conservation (the Baviaanskloof Mega Reserve), and farming. The western side of the Baviaanskloof is characterised by commercial agriculture and game farming. Various crops including vegetable seed and tobacco are grown. Pastures are also cultivated as a fodder source. Ecotourism ventures are becoming more common with an apparent change in land use (Commonland 4 return from landscape restoration, 2015).

In the fan the predominant land use is grazing (mostly goats), with some crop and pasture farming taking place at the bottom section of the fan.

**Climate:** The local climate is characterised by summer rainfall with very dry winters. Annual rainfall is low with frequent thunder storms in summer. The average annual rainfall is 300mm but with large temporal and spatial variation. Although no measuring stations occur in the project area, evapotranspiration is estimated at 1125mm per annum (Bobbins, 2011).

Temperatures can be highly variable between the summer and winter months. Average summer temperatures range between 16°C and 32°C, sometimes rising to 44°C during berg







winds. Winter temperatures vary between 5°C and 20°C with snow sometimes occurring on the mountain peaks (Bobbins, 2011)

**Vegetation:** As fans are a transitional environment, a variety of vegetation types are often present (Bobbins, 2011). According to Mucina & Rutherford (2010), the fans here are dominated by the Albany Alluvial vegetation type. Typically the fans in an un-altered state are dominated by woody species such as *Acacia natalitia*, *Acaffra* and *A karroo*. A grassy and forb component is also present dominated by *Sporobolus nitens*, *Erogrositis obtusa*, *E curvula* and *Digitaria eriantha*. *Cynodon dactylon* was common in wetter areas. In the drier parts of the fan surface various succulents (*Aloe sp.*) are common as are various species of tall and low shrubs.

The vegetation in the alluvial fan has been considerably modified by selective grazing and cultivation. There is a predominance of scrubby and small tree species, in particular *Acacia spp.*

**Geology and soils:** The geology of the Baviaanskloof is dominated by sandstones and quartzites of the Table Mountain Group (TMG) interspersed with small amounts of shales of the Bokkeveld Group (Illgner and Haigh, 2003). The mountains in the Baviaanskloof are made up by the arenaceous rocks of the Table Mountain Group, whereas the valley floor (in the central portion of the Baviaanskloof) consists of shales of the Bokkeveld Group (Welman and Barnard, 2007). These shales daylight at a number of farms (Illgner and Haigh, 2003). Both formations have been subject to intensive folding. A major fault is running east-west through the valley, with steep mountain slopes to the north. The Enon Conglomerate, consisting of rounded to angular pebbles in a sandy matrix, and recent alluvial sands and gravels (mainly present in the valley) unconformably overlie the Bokkeveld shale and low-lying Table Mountain Formations (Welman and Barnard, 2007). Colluvial deposits are covering the lower mountain slopes. The conglomerates outcrop intermittently from Nieuwekloof in the west to Kruisrivier (near the confluence between the Kouga River and the Baviaanskloof River) in the east (Illgner and Haigh, 2003).

**6.2.3 Site photos**

	
<p>View northwards from the lower end of the fan. Note berm on left hand side</p>	<p>View south west up the system towards the source of the fan</p>
	
<p>View south west from the berm above the lands that needs to be breached</p>	<p>View east at lower end of the system</p>
	
<p>One of the berms located at the distal part of the system that will be breached</p>	<p>View over the lands in the valley looking up towards the source of the fan</p>

### 6.3 Alluvial Fan problems

The primary fan problem is incision of the trunk stream (Baviaanskloof River) which has led to the lowering of the fan base and the incision of the fan along the primary stream. The incision of the stream has been aggravated by channel confinement caused by berm constructed along the edge of the stream channel in the medial distal sections of the fan. A second problem is cultivation of the fan adjacent to the above mentioned berms. (Figure 9).

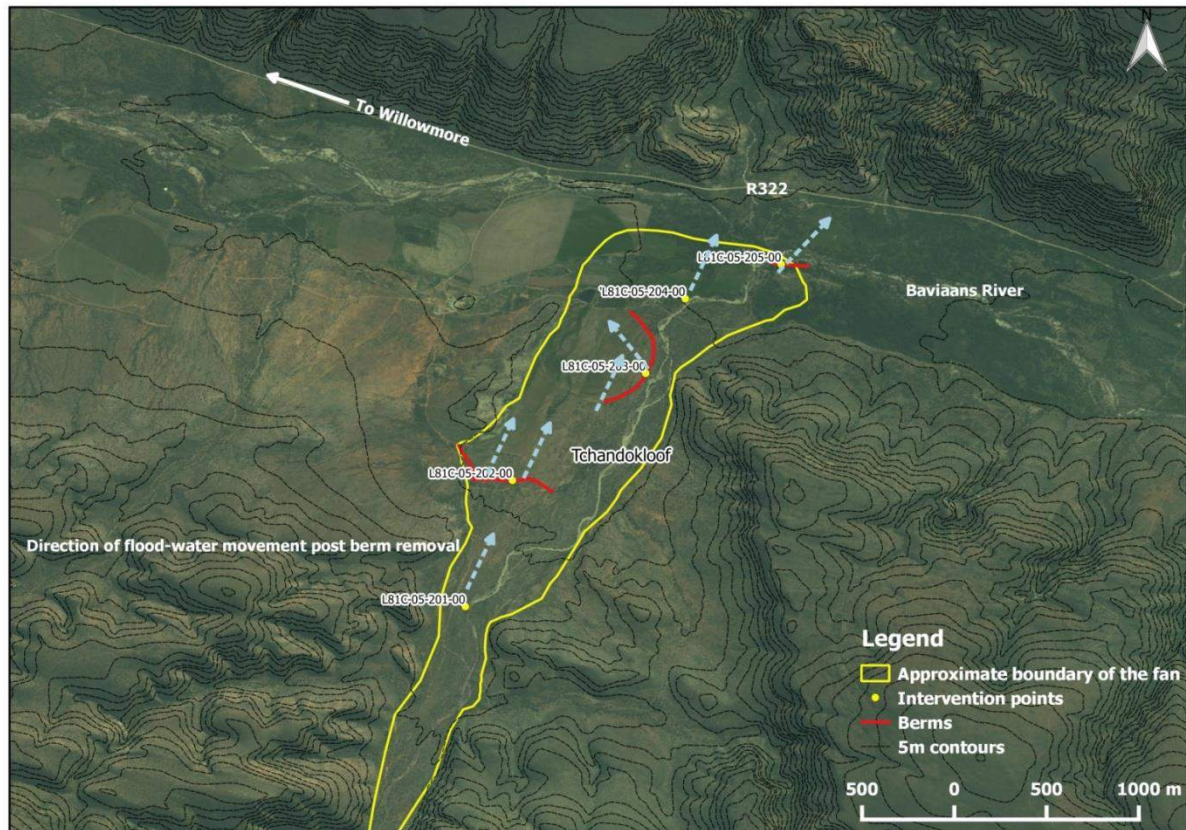


Figure 9: Problems identified within fan L81C-05.

### 6.4 Rehabilitation objectives

The berms have thus disconnected the alluvial fan from the downstream river. The removal or deactivation of the berm will allow sediment and water to reach the river as what would have occurred naturally. The main aim of the rehabilitation work is to thus reconnect the fan, hydrologically and geomorphically, with the Baviaanskloof River.

The specific rehabilitation objectives and accompanying rehabilitation strategies associated with Tchandokloof are shown in Table 14.

**Table 14: Rehabilitation objectives for fan L81C-05**

Rehabilitation Objectives	Rehabilitation Strategy
To reconnect the fan, hydrologically and geomorphically, with the Baviaanskloof River.	Removal of segments of the berms to allow for floodwater and sediment to pass into the Baviaanskloof River

## 6.5 Summary of proposed interventions

### 6.5.1 Work undertaken in previous planning cycles

The Tchandokloof alluvial fan is a new one and no previous planning has thus taken place.

### 6.5.2 New interventions proposed

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 15** below.

The intervention designs/ drawings included in this Rehabilitation Plan have been labelled according to the **new naming convention** only. 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 (**Figure 10**) 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.*

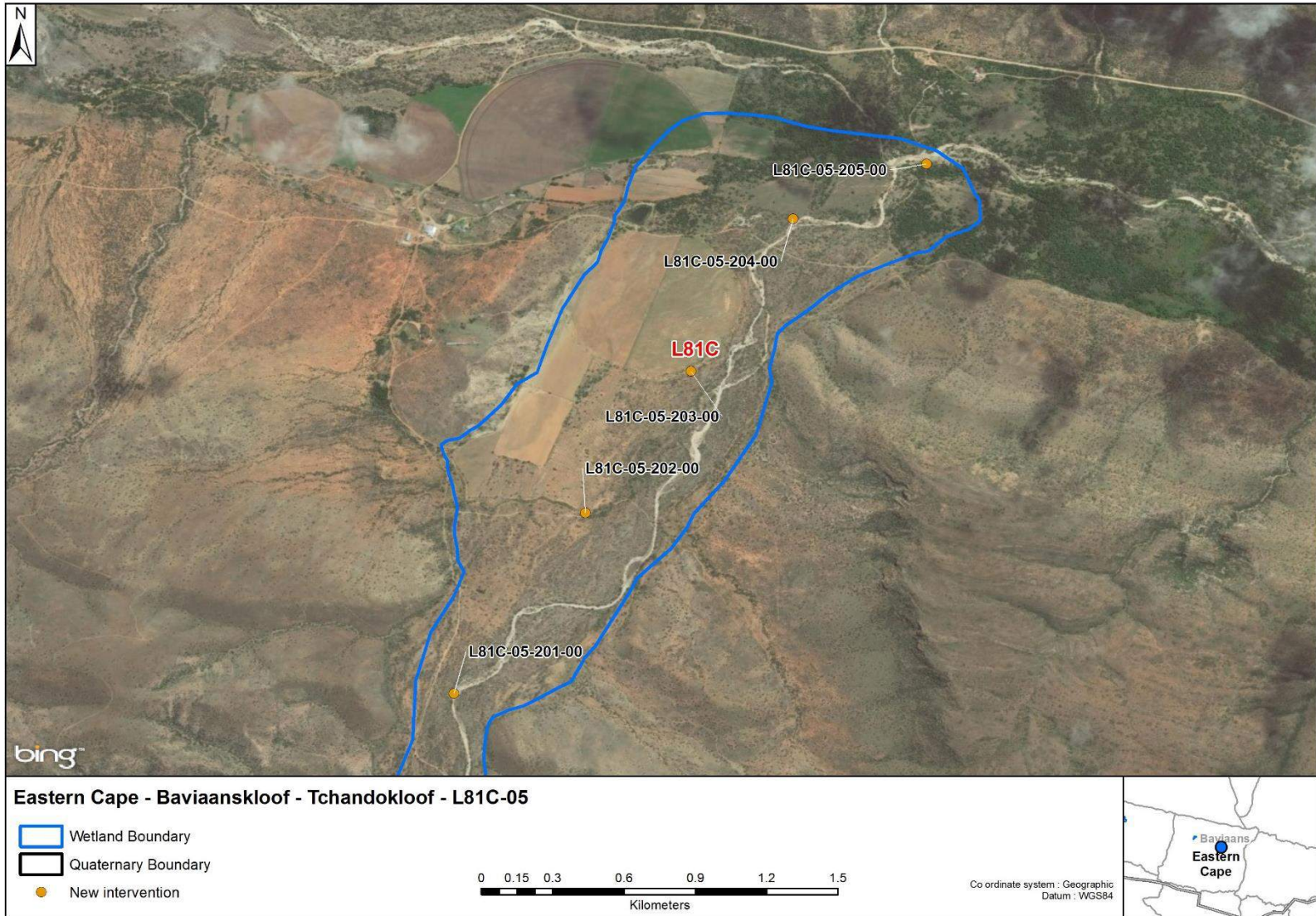
### 6.5.3 Design selection and sizing

The objectives of the interventions are to deactivate drains and diversions and to encourage spread of flow. The most appropriate and cost effective method of doing this was considered to involve:

- The construction of hard structures (concrete or gabion weirs) were specified in high energy areas, with concrete specified in areas where impermeable intervention were required e.g. headcut stabilisation;
- Earthen diversions were specified in areas of low energy and will be vegetated to increase their stability;
- Removal of existing berms and utilising the material for the construction of plugs was specified where possible to increase person days.

**Table 15: Summary of the Tchandokloof interventions**

<b>Intervention Structure Type</b>	<b>Intervention Number</b>	<b>Proposed Action</b>	<b>Implementation Order</b>
Earthworks	L81C-05-201-00	Removal of segments of the berms to allow for floodwater and sediment to pass into the Baviaanskloof River	5
Earthworks	L81C-05-202-00	Removal of segments of the berms to allow for floodwater and sediment to pass into the Baviaanskloof River	4
Earthworks	L81C-05-203-00	Removal of segments of the berms to allow for floodwater and sediment to pass into the Baviaanskloof River	3
Earthworks	L81C-05-204-00	Removal of segments of the berm to allow floodwater and sediment to return to its natural path of flow into the Baviaanskloof River	2
Earthworks	L81C-05-205-00	Removal of segments of the berms to allow for floodwater and sediment to pass into the Baviaanskloof River	1



**Figure 10: Image of fan L81C-05 with proposed new interventions indicated**

## **6.6 Construction Environmental Management Plan issues**

The proposed rehabilitation is to be undertaken on privately owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the landowner. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the CEMP, the recommendations of the approved Basic Assessments and Environmental Authorisation for the project. The Intervention Booklet Environmental Authorisation and CEMP are included as **Appendices B, D and G** of this report, respectively, and shall accompany the Implementers to site.

## **6.7 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 rehabilitation activities.

### **6.7.1 Baseline WET-Health data**

The WET-Health assessment system is not appropriate for the assessment of alluvial fans and this traditional type of baseline data is thus not possible to provide in this report. For general information on the health and determination of the alluvial fan status quo refer to the specialist's report attached in **Appendix A**.



## 7 DAM SE DRIF – L81C-06

The assessment of the Dam se Drif alluvial fan, its problems, and the development of the rehabilitation objectives are described in detail in the specialist's report in **Appendix A**. The following subsections provide a brief summary for this alluvial fan system.

### 7.1 Landowner details

The Dam se Drif project area comprises of privately-owned land, and the focus of the rehabilitation efforts is on a property where the landowner's are enthusiastic about the proposed rehabilitation, and have agreed to the proposed rehabilitation interventions.

The landowner has been identified for the Dam se Drif Project (**Table 16** and consent for any proposed rehabilitation (subject to the approval of the Rehabilitation Plans) on these properties has been requested. Copies of the consent forms obtained are provided in **Appendix E**.

**Table 16: Dam se Drif Landowner/s and SG Key**

Fan Number	Property SG Key	Owner / Trust	Consent Obtained
L81C-06	C08300000000021900004 C08300000000021900016	R Janse van Rensburg	21 August 2015

### 7.2 Alluvial fan details

The Dam se Drif fan is located in Quaternary Catchment L81C (refer **Figure 3** in Section 2.3.1 of this report). The alluvial fan can be accessed – with permission of the landowner – from the R322 provincial gravel road where it runs between the Baviaanskloof reserve and Willowmore. **Table 17** provides a summary of the alluvial fan details.

**Table 17: Summary of the alluvial fan details**

<b>Fan Name</b>	Dam se Drif
<b>Fan Number</b>	L81C-06
<b>River System Name</b>	Baviaans
<b>Land Use in Catchment</b>	Agriculture (grazing and cultivation);
<b>Land Use in Fan</b>	Historic cultivation
<b>No. of Properties Intersecting Fan Area</b>	1
<b>Date of Planning Site Visit</b>	21 April 2015
<b>Wetland Assessor(s)</b>	Damian Walters
<b>Fan size</b>	32.18 ha

### 7.2.1 Motivation for selection

Dam Se Drif was prioritised and selected for further assessment and rehabilitation during a phase 1 assessment conducted by Living Lands (see Commonland, 2015). The key criteria used in selecting the fan were:

1. The fan had clear indications of human impacts on the fan hydrology, geomorphology and vegetation.
2. The program had secured land owner cooperation.
3. Importance of the fan with regards to its functioning and role in shaping the Baviaanskloof wetlands and river.

### 7.2.2 Description

The fan is currently being used for cultivation. The construction of berms (on both banks) to stop flooding in adjacent cultivated lands have canalized the stream that flows over the fan.

**Catchment:** The Baviaanskloof wetland system rises within the Baviaanskloof Mountains and forms part of the larger Eastern Cape catchments (Grundling 2014). The Baviaanskloof River is the main river in the Baviaanskloof and flows through the central portion of the valley. At certain sections the river proceeds as interflow through the permeable top section of the alluvial deposits or through joints in the underlying rocks and is thus not always visible.

Land use in the fan catchment is primarily cultivation and grazing.

**Climate:** The local climate is characterised by summer rainfall with very dry winters. Annual rainfall is low with frequent thunder storms in summer. The average annual rainfall is 300mm but with large temporal and spatial variation. Although no measuring stations occur in the project area, evapotranspiration is estimated at 1125mm per annum (Bobbins, 2011).

Temperatures can be highly variable between the summer and winter months. Average summer temperatures range between 16°C and 32°C, sometimes rising to 44°C during berg winds. Winter temperatures vary between 5°C and 20°C with snow sometimes occurring on the mountain peaks (Bobbins, 2011)

**Vegetation:** As fans are a transitional environment, a variety of vegetation types are often present (Bobbins, 2011). According to Mucina & Rutherford (2010), the fans here are dominated by the Albany Alluvial vegetation type. Typically the fans in an un-altered state are dominated by woody species such as *Acacia natalitia*, *Acaffra* and *A karroo*. A grassy and forb component is also present dominated by *Sporobolus nitens*, *Erogrositis obtusa*, *E curvula* and *Digiteria eriantha*. *Cynodon dactylon* was common in wetter areas. In the drier parts of the fan surface various succulents (*Aloe sp.*) are common as are various species of tall and low shrubs.

The berms towards the top end of the fan are fairly densely vegetated with a vegetation mix dominated by *Acacia spp.* The lower portion of the fan is cultivated and more sparsely vegetated. Refer also to the site photos.

**Geology and soils:** The geology of the Baviaanskloof is dominated by sandstones and quartzites of the Table Mountain Group (TMG) interspersed with small amounts of shales of the Bokkeveld Group (Illgner and Haigh, 2003). The mountains in the Baviaanskloof are made up by the arenaceous rocks of the Table Mountain Group, whereas the valley floor (in the central portion of the Baviaanskloof) consists of shales of the Bokkeveld Group (Welman and Barnard, 2007). These shales daylight at a number of farms (Illgner and Haigh, 2003). Both formations have been subject to intensive folding. A major fault is running east-west through the valley, with steep mountain slopes to the north. The Enon Conglomerate, consisting of rounded to angular pebbles in a sandy matrix, and recent alluvial sands and gravels (mainly present in the valley) unconformably overlie the Bokkeveld shale and low-lying Table Mountain Formations (Welman and Barnard, 2007). Colluvial deposits are covering the lower mountain slopes. The conglomerates outcrop intermittently from Nieuwekloof in the west to Kruisrivier (near the confluence between the Kouga River and the Baviaanskloof River) in the east (Illgner and Haigh, 2003).

### 7.2.3 Site photos



View north down the channel. One of the berms is visible on the left hand side.



View south up the channel. Note the thick vegetation on the berms.



View west from the berm to cultivated lands



View east looking across one of the berms towards the cultivated lands

### 7.3 Fan problems

The main problem is that the stream that flows over the fan has been canalized by the construction of berm on both of its banks. The berms stop flooding in adjacent cultivated lands. The fan has and is being used for cultivation. (**Figure 11**).

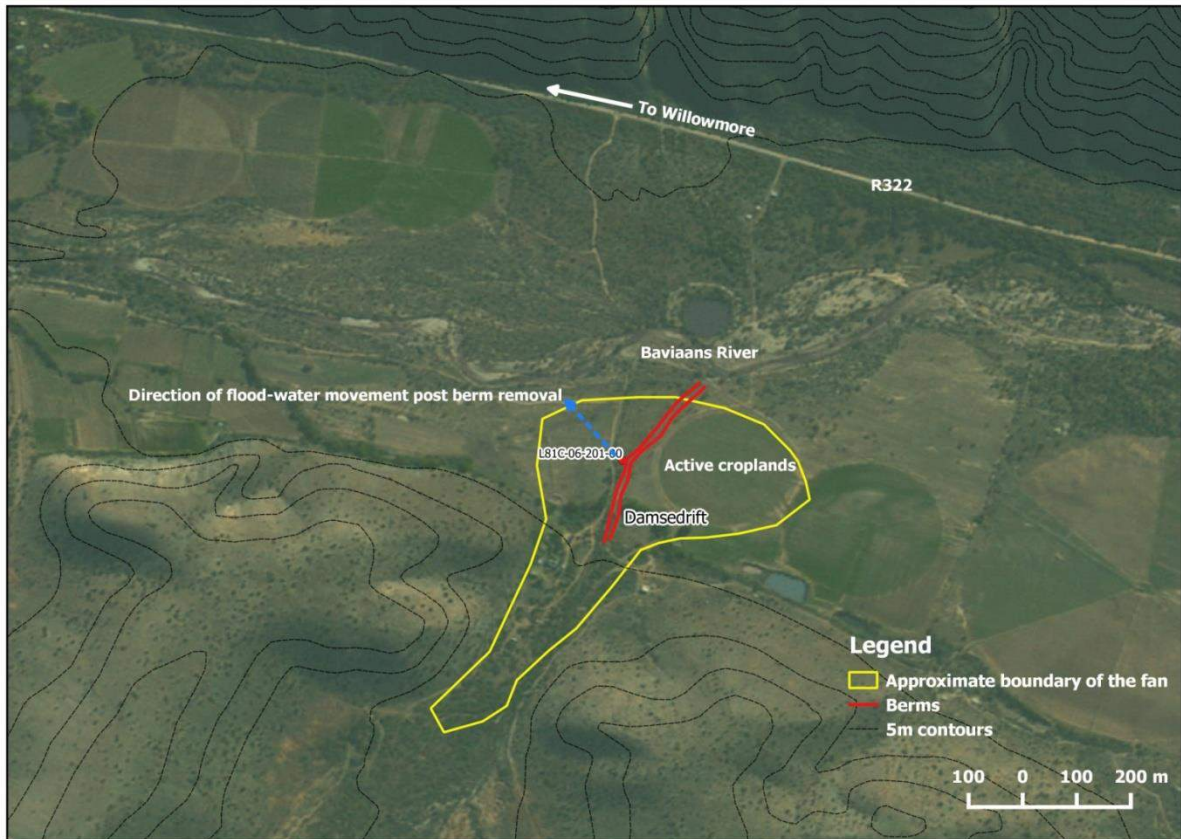


Figure 11: Problems identified within alluvial fan L81C-06.

#### 7.4 Rehabilitation objectives

The berms have thus disconnected the alluvial fan from the downstream river. The removal or deactivation of the berm will allow sediment and water to reach the river as what would have occurred naturally. The main aim of the rehabilitation work is to thus reconnect the fan, hydrologically and geomorphically, with the Baviaanskloof River.

The specific rehabilitation objectives and accompanying rehabilitation strategies associated with Dam se Drif are shown in **Table 18**.

**Table 18: Rehabilitation objectives for fan L81C-06**

Rehabilitation Objectives	Rehabilitation Strategy
To reconnect the fan, hydrologically and geomorphically, with the Baviaanskloof River.	Removal of segments of the berms to allow for floodwater and sediment to pass into the Baviaanskloof River

## 7.5 Summary of proposed interventions

### 7.5.1 Work undertaken in previous planning cycles

No previous planning has taken place as the Dam se Drif alluvial fan is a new one identified for rehabilitation.

### 7.5.2 New interventions proposed

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 19** below.

The intervention designs/ drawings included in this Rehabilitation Plan have been labelled according to the **new naming convention** only. 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 (**Figure 12**) 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.*

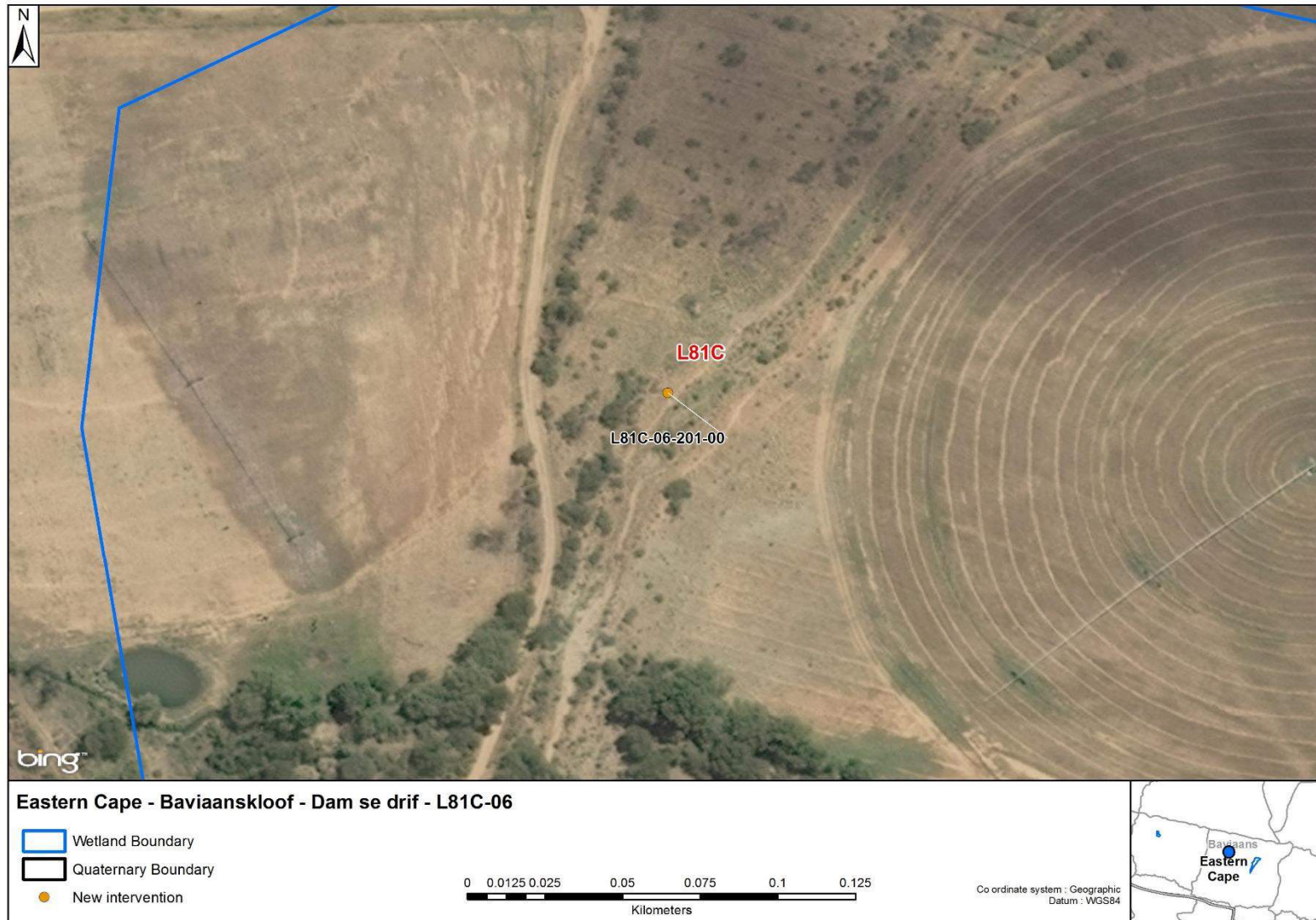
### 7.5.3 Design selection and sizing

The objectives of the interventions are to deactivate drains and diversions and to encourage spread of flow. The most appropriate and cost effective method of doing this was considered to involve:

- The construction of hard structures (concrete or gabion weirs) were specified in high energy areas, with concrete specified in areas where impermeable intervention were required e.g. headcut stabilisation;
- Earthen diversions were specified in areas of low energy and will be vegetated to increase their stability;
- Removal of existing berms and utilising the material for the construction of plugs was specified where possible to increase person days.

**Table 19: Summary of the Dam se Drif interventions**

<b>Intervention Structure Type</b>	<b>Intervention Number</b>	<b>Proposed Action</b>	<b>Implementation Order</b>
Earthworks	L81C-06-201-00	Removal of segments of the berms to allow for floodwater and sediment to pass into the Baviaanskloof River	1



**Figure 12: Image of Fan L81C-06 with proposed new interventions indicated**



## **7.6 Construction Environmental Management Plan issues**

The proposed rehabilitation is to be undertaken on privately owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the landowner. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the CEMP, the recommendations of the approved Basic Assessments and Environmental Authorisation for the project. The Intervention Booklet Environmental Authorisation and CEMP are included as **Appendices B, D and G** of this report, respectively, and shall accompany the Implementers to site.

## **7.7 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 rehabilitation activities.

### **7.7.1 Baseline WET-Health data**

The WET-Health assessment system is not appropriate for the assessment of alluvial fans and this traditional type of baseline data is thus not possible to provide in this report. For general information on the health and determination of the alluvial fan status quo refer to the specialist's report attached in **Appendix A**.

## 8 REFERENCES

- Commonland (2015). *Rehabilitation of the Alluvial fans in the Baviaanskloof Hartland*, project proposal.
- Bobbins, K (2011) Developing A Form-Process Framework To Describe The Functioning Of Arid Alluvial Fans In The Baviaanskloof Valley, South Africa. Unpublished Masters Thesis, Rhodes University.
- Mucina and Rutherford (2006) *The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19*. Pretoria: South African National Biodiversity Institute
- Walters, D (2015) Alluvial Fan Status Quo Report: Baviaanskloof Project. Prepared for Aurecon by Ikhwane Wetland Science, June 2015.