



WORKING FOR WETLANDS REHABILITATION PROGRAMME, EASTERN CAPE

REHABILITATION PLAN PROJECT: AMATHOLE S32E

JULY 2019



Agriculture, Forestry and Fisheries
Environmental Affairs
Water Affairs and Sanitation



EXPANDED PUBLIC WORKS PROGRAMME
Creating opportunities towards human fulfillment

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**REHABILITATION PLAN FOR THE AMATHOLE WETLAND PROJECT,
EASTERN CAPE: PLANNING YEAR 2018/2019
AS PART OF
THE WORKING FOR WETLANDS PROGRAMME
FOR THE
DEPARTMENT OF ENVIRONMENTAL AFFAIRS
DIRECTORATE: WORKING FOR WETLANDS**

**MAIN REPORT
July 2019**

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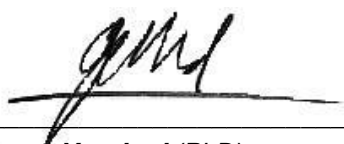
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PROJECT DETAILS

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WORKING FOR WETLANDS: CONTEXT DOCUMENT

1. Introduction

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

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

2. Wetlands and their importance

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

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

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

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

The Ramsar Convention defines wetlands as:

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

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



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

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

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



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

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

3. Wetland degradation

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

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

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

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

4. The Working for Wetlands Programme

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

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

Working for Wetlands pursues its mandate of wetland protection, wise use and rehabilitation in a manner that maximises employment creation, supports small emerging businesses, and transfers skills amongst vulnerable and marginalised groups. In the 15 years since 2004, the WfWetlands Programme has invested just under R1.1 billion in wetland rehabilitation and has been involved in over 1 500 wetlands, thereby improving or securing the health of over 70 000 hectares of wetland environment. The WfWetlands Programme has a budget of just over R 130 million per annum, of which approximately 35% is allocated directly to paying wages. Being part of the EPWP, the WfWetlands Programme has created more than 34 000 jobs and over 3.2 million person-days of paid work. The local teams are made up of a minimum of 55% women, 65% youth and 2% disabled persons. The WfWetlands Programme provides an average of 2000 jobs per annum.

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

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

Other activities that form part of the WfWetlands Programme include:

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

5. Rehabilitation interventions

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

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

Typical activities undertaken within the projects include:

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

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

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

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

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

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

6. Programme, projects and phases

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

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

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

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

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

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

Phase 2 requires site visits attended by the fieldwork team comprising a Wetland Specialist, a Design Engineer, an EAP, and an ASD. Other interested stakeholders or authorities, landowners and in some instances the Implementing Agents (IAs) may also attend the site visits. This allows for a highly collaborative approach, as options are discussed by experts from different scientific disciplines, as well as local inhabitants with deep anecdotal knowledge. While on site, rehabilitation opportunities are investigated. The details of the proposed interventions are discussed, some survey work is undertaken by the engineers, and Global Positioning System (GPS) coordinates and digital photographs are taken for record purposes. Furthermore, appropriate dimensions of the locations are recorded in order to design and calculate

¹ Previously referred to as Provincial Coordinators (PCs).

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 ASDs are responsible for undertaking the necessary landowner engagement and for ensuring that the requisite landowner consent forms required as part of Phase 1 and 2 of this project are signed. Without the signed consent forms the WfWetlands Programme will not be able to implement rehabilitation interventions on the affected property.

Phase 3 requires that certain Environmental Authorisations are obtained before work can commence in the wetlands (please see subsequent sections of this document for detail on Environmental Authorisations). Upon approval of the wetland Rehabilitation Plans by DEA, the work detailed for the project will be implemented within a year with on-going monitoring being undertaken thereafter. The Rehabilitation Plans are considered to be the primary working document for the implementation of the project via the construction/ undertaking of interventions² listed in the Plan.

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

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

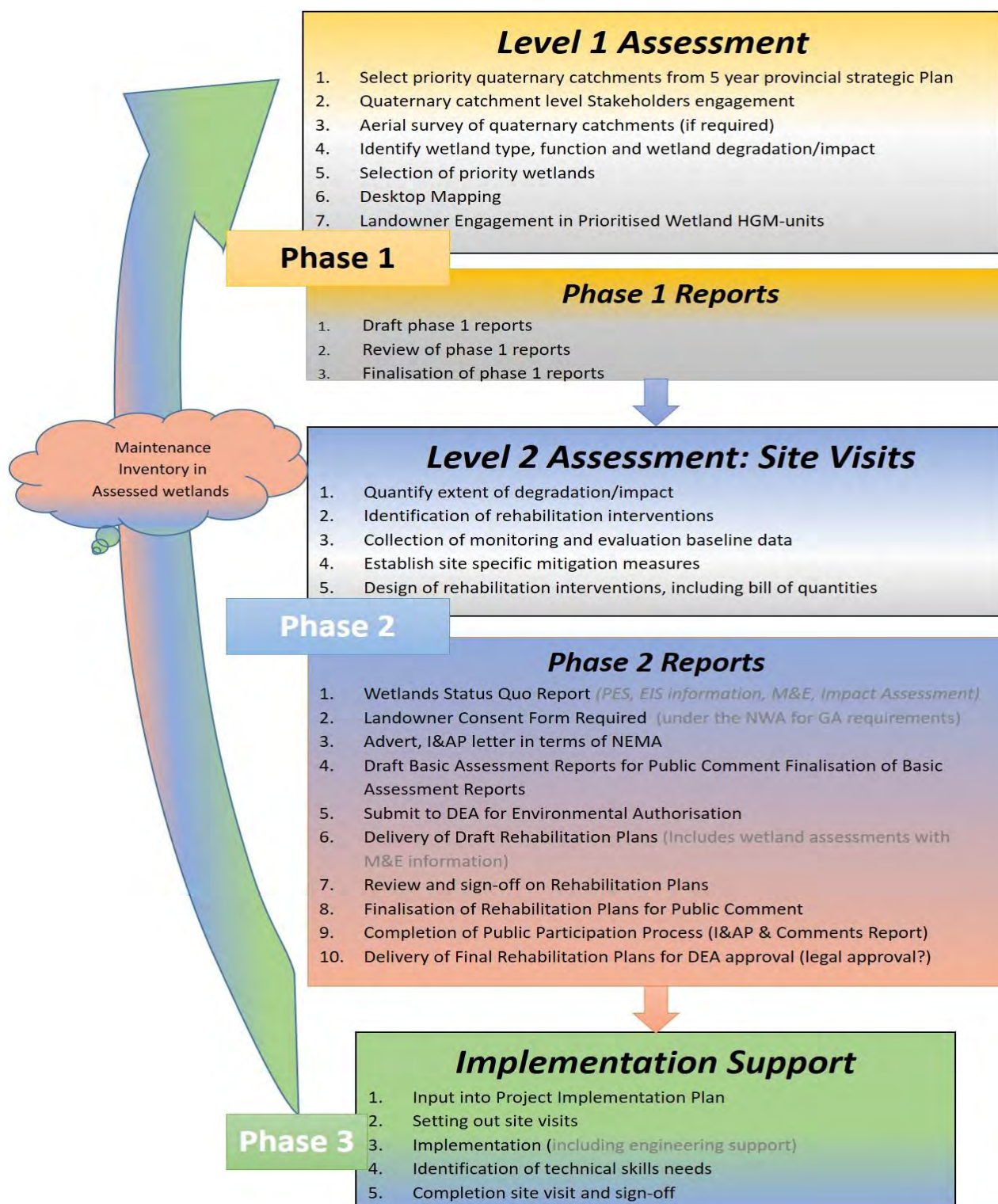


Plate C: The Working for Wetlands planning process (Phase 1 to Phase 3)

Rehabilitation work within floodplain systems

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

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

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

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

7. Environmental legislation

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

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

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

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

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

Table A: List of applicable legislation

Title of legislation, policy or guideline	Administering authority	Date
The Constitution of South Africa, Act No.108 of 1996	National Government	1996
National Environmental Management Act, No.107 of 1998	Department of Environmental Affairs	1998
The National Water Act, No. 36 of 1998	Department of Water and Sanitation	1998
Conservation of Agricultural Resources Act, No. 43 of 1983	Department of Agriculture, Forestry & Fisheries	1983
National Heritage Resources Act, No. 25 of 1999	National Heritage Resources Agency	1999
World Heritage Conventions Act, No. 49 of 1999	Department of Environmental Affairs	1999
The National Environmental Management: Biodiversity Act, No. 10 of 2004	Department of Environmental Affairs	2004
National Environmental Management: Protected Areas Act, No. 57 of 2003	Department of Environmental Affairs	2003
The Mountain Catchments Areas Act, No. 63 of 1970	Department of Water and Sanitation	1970
EIA Guideline Series, in particular: <ul style="list-style-type: none"> Guideline 5 – Companion to the NEMA EIA Regulations, 2010 (DEA, October 2012) Guideline 7 – Public Participation in the EIA process, 2012 (DEA, October 2012) Guideline 9 - Guideline on Need and Desirability, 2010 (DEA, October 2014) 	Department of Environmental Affairs	2012 - 2014
International Conventions, in particular: <ul style="list-style-type: none"> The Ramsar Convention Convention on Biological Diversity United Nations Conventions to Combat Desertification New Partnership for Africa's Development (NEPAD) The World Summit on Sustainable Development (WSSD) 	International Conventions	N/A

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

- The National Environmental Management Act, No. 107 of 1998 (NEMA), as amended
 - In terms of the 2014 Environmental Impact Assessment Regulations pursuant to the NEMA, certain activities that may have a detrimental impact on the environment (termed Listed Activities) require an Environmental Authorisation (EA) from the DEA. The implementation of interventions will trigger NEMA Listing Notices 1 and 3 (GN R983 and GN R985, as amended, respectively). In order to meet the requirements of these Regulations, it is necessary to undertake a Basic Assessment (BA) Process and apply for an EA. This was previously undertaken on an annual basis per Province for each individual wetland unit. However as of 2014, applications were submitted (per Province) for wetland systems, allowing WfWetlands to undertake planning in subsequent years within these wetlands without having to undertake a BA process. The rehabilitation plans still however require approval from the competent authority (i.e. DEA).
 - **Basic Assessment Reports (BARs)** 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 EAs will be inclusive of all Listed Activities that may be triggered and will essentially authorise any typical wetland rehabilitation activities required during the WfWetlands Programme implementation phase. Note that certain Listed

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

- **Rehabilitation Plans** will be prepared for each of the project areas and 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 authorisation³ (GA) has been granted for certain activities that are listed under the NWA that usually require a Water Use License; as long as these activities are undertaken for wetland rehabilitation. These activities include '*impeding or diverting the flow of water in a watercourse*⁴' and '*altering the bed, banks, course or characteristics of a watercourse*⁵' where they are specifically undertaken for the purposes of rehabilitating⁶ 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.

³Government Notice No. 1198, 18 December 2009

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

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

⁶Defined 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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i. CONTEXT OF THE INFORMATION CONTAINED IN THIS REHABILITATION PLAN

Approach to the NEMA Environmental Process

The legislation protecting the environment in South Africa was not written with the intention of preventing wetland rehabilitation efforts, but rather at curtailing development in sensitive environments. It is important to remember that the Working for Wetlands (WfWetlands) Programme is not a development proposal, and although this programme technically requires authorisations, licenses and permits, such rehabilitation projects were never meant to be sent through legislative processes aimed at preventing negative environmental impact.

In terms of the environmental management principles of the National Environmental Management Act, No. 107 of 1998 (NEMA), as amended, certain activities that may have a detrimental impact on the environment (termed Listed Activities) require Environmental Authorisation (EA) from DEA. The WfWetlands Programme will require that interventions be implemented and/or constructed in the wetland systems to ultimately restore some of the more natural wetland functions that have been lost to unsustainable land use practices or development. The implementation of interventions will trigger Listing Notices 1 and 3 (GN R 983 and GN R 985, as amended, respectively).

In order to meet the requirements of the Regulations pursuant to NEMA, it was necessary to undertake a Basic Assessment Process as outlined in Part 2 and Appendix 1 of GN R 982. Basic Assessment Report (BARs) were prepared and these reports presented all Wetland Projects for each Province, together with information regarding the quaternary catchments and the wetlands that were prioritised for the next few planning cycles (anywhere from one to three planning cycles depending on the information gained through the Catchment Prioritisation Process).

Rehabilitation Plans, associated with the Wetland Projects described in the BARs, have also been prepared and provide detail on the wetland problems, proposed rehabilitation interventions and rehabilitation objectives. These reports are also subject to a 30-day public comment period after which it is submitted to DEA for approval.

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iii. ABBREVIATIONS

ASD	Assistant Director: Wetlands Programmes ⁷
BAR	Basic Assessment Report
BGIS	Biodiversity Geographical Information System
BMP	Best Management Practice
CARA	Conservation of Agricultural Resources Act
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
GPS	Global Positioning System
HGM	Hydrogeomorphic [unit]
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
MoU	Memorandum of Understanding
NEMA	National Environmental Management Act (Act 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act
NRM	Natural Resource Management Programmes
NWA	National Water Act (Act 36 of 1998)
NWI	National Wetlands Inventory
PET	Potential Evapotranspiration
PIP	Project Implementation Plan
PPP	Public Participation Process
RSA	Republic of South Africa
SANParks	South African National Parks
SAHRA	South African Heritage Resources Agency
SMME	Small, Medium and Micro Enterprises
UNESCO	United Nations Educational, Scientific and Cultural Organization
WfWetlands	Working for Wetlands

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

iv. GLOSSARY OF TERMS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

v. ASSUMPTIONS AND LIMITATIONS

In compiling this report, the following has been assumed:

- The information provided in this report is based on site visits that have been undertaken by the project team (Environmental Assessment Practitioner (EAP), Engineer, Wetland Specialist, the Assistant Directors for Wetlands Programmes (ASD)) and their subsequent input into the Reporting, which includes intervention design drawings, the wetland status quo report, in addition to input from the ASD. It is understood that this information is sufficient for the authorisation processes and associated Phase 3 (Implementation phase). This data and relevant information has informed the findings and conclusions of this report.
- Information contained in this Report will be used during Phase 3 to guide and inform the Implementing Agents on design and construction specifications as part of Phase 3. Implementing Agents will thus use this Rehabilitation Plan and the information contained herein when constructing all interventions, the designs of which have been included in this Report.
- The ASDs will be undertaking the landowner engagement and have obtained the requisite landowner consent forms required as part of Phase 1 and 2 of this project.
- The WfWetlands Programme has provided all relevant information and documentation required to compile this Rehabilitation Plan.
- Rehabilitation activities should not be carried out until the Wetland Rehabilitation Plan has been approved by DEA and formally signed off by WfWetlands.
- The implementation of this Rehabilitation Plan must take into account all relevant provisions of Working for Wetlands Best Management Practices (BMPs), the generic Environmental Management Programme (EMPr), as well as specific recommendations of the Basic Assessments and the requirements of the Environmental Authorisation (EA) for the all stages of the project.
- The requirement to spend at least 42% on wages out of the project budget has been taken into consideration by the project team during the planning process for wetland rehabilitation.
- Where appropriate interventions have not been implemented previously or included in the 2009/10, 2010/11, 2011/12, 2012/2013, 2013/14, 2014/15, 2015/16, 2016/17 or 2017/18 Project Implementation Plans (PIPs), these have been reviewed and where necessary re-designed for inclusion into the 2017/18 Rehabilitation Plan. This wetland Rehabilitation Plan therefore supersedes all previous plans for this project and only interventions from this plan should be included in the 2019/20 PIP.
- Should it be necessary to exclude interventions from the Rehabilitation Plan, the prioritisation of interventions across the project should strictly be followed.

vi. GAPS IN KNOWLEDGE

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

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 2018/2019 Eastern Cape Basic Assessment Report.

vii. DISCLAIMER

- This Rehabilitation Plan is for the Amathole Wetland Project in the Eastern Cape Province. The plan is to be used to implement the interventions identified as necessary to rehabilitate the Kolomane 1, Kolomane 2, Kolomane 5 and Kolomane 16 wetlands, and is to be approved by the DEA as part of the environmental authorisation process required in terms of Government Notice Regulation 982 of 4 December 2014, as amended (GN R982).
- The intervention points and wetland boundary polygons provided in this report are based on the shapefiles that have been provided by the wetland specialist. 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.

viii. DISTRIBUTION LIST

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

1 INTRODUCTION

1.1 Document outline

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

- Kolomane 1
- Kolomane 2
- Kolomane 5
- Kolomane 16

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 Amathole 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 each focus on a wetland system within the Amathole Wetland Project and include a description of the respective wetland, motivation for the wetland selection, summary of the problems identified within the wetland, and outline some of the main rehabilitation objectives for the wetland. A table of proposed interventions is provided in each of these sections together with any specific Environmental Management Plan issues to be considered when implementing the interventions. Finally, each of the sections includes the baseline data needed to undertake future monitoring of the interventions.

Reports on the current status of each wetland are included as **Appendix A** of this report and should be consulted for the detailed findings of the site investigations. The General Construction Notes are included as **Appendix B** of this report and describe construction methods for various interventions. The specific Interventions and Design Drawings (as well as site specific mitigation measures) are included as **Appendix C** of this report in the form of an Intervention Booklet. 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. **Appendix F** of this report represents the generic Environmental Management Programme. **Appendices G and H** provide the national and provincial stakeholder databases.

1.2 Environmental Authorisation

The Amathole Wetland Project for this planning cycle was the subject of a Basic Assessment Process in terms of the Environmental Impact Assessment (EIA) Regulations (GN R982 of 4 December 2014, as amended) of the National Environmental Management Act (Act 107 of 1998) (NEMA) which culminated in the compilation of a Basic Assessment Report (BAR) and this Rehabilitation.

It is intended that this Rehabilitation Plan is read in conjunction with the 2018/2019 Eastern Cape Basic Assessment Report, and requires that the Rehabilitation Plan be circulated to Registered Interested and Affected Parties (I&APs) and directly affected landowners for comment before being submitted to the DEA for approval. The public participation process for the Rehabilitation Plan and the BAR was combined and allowed registered I&APs a 30-day period to review and provide comment on the documents. The work detailed for the project will be implemented within a year of obtaining the necessary approvals for the Rehabilitation Plan, and on-going monitoring of the interventions will be undertaken from thereafter.

2 PROJECT CONTEXT

2.1 Working for Wetlands programme overview

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

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

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

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

2.1.1 Programme, projects and phases

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

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

2.1.2 Methods of rehabilitation

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

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

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

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

2.1.3 Intervention options

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

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

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

- The revegetation of stabilised areas with appropriate wetland and riparian plant species;
- Fencing off 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; and
- The removal of undesirable plant and animal species as part of the Working for Water initiative. Alien invasive plant clearing is an important part of wetland rehabilitation.

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

2.2 **Project team**

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

Aurecon South Africa (Pty) Ltd (Aurecon) has been appointed to undertake the project activities and associated reporting required by the WfWetlands Programme. The Aurecon team comprises Design Engineers and Environmental Assessment Practitioners (EAPs) who undertake the planning, design and authorisation components of the project. The Aurecon Team, in partnership with GroundTruth, is assisted by an external team of Wetland Specialists who provide scientific insight into the operation of wetlands and bring expert and often local knowledge of the wetlands. The project team is also complimented by the WfWetlands ASDs who are each responsible for provincial planning and implementation. The team responsible for the field work specific to this Rehabilitation Plan is listed in **Section 3.3.1**.

2.3 Amathole Wetland Projects

Wetland Projects for the 2018/2019 planning cycle were identified during the Phase 1 activities associated with the WfWetlands Programme. Catchment and wetland prioritisation assessments were undertaken by the Wetland Specialist/s to identify priority catchments and associated wetlands within which rehabilitation work needed to be undertaken. A review was undertaken to determine local knowledge and identify existing studies of the quaternary catchments in the province. The Programme's current five-year strategic plans were further used as a guide to identify wetlands, as well as data from the National Freshwater Ecosystem Priority Areas (NFEPA) project. Decisions on priority areas were informed by input from wetland forums, biodiversity / conservation plans, municipalities, state departments and various other stakeholders.

Based on this process, the following quaternary catchments and associated wetland systems were identified for the 2018/2019 planning cycle in the Eastern Cape Province (**Table 1**).

Table 1: Eastern Cape Wetland Projects

Project Name	Wetland System
A. Amathole	Ai Kolomane 1
	Aii Kolomane 2
	Aiii Kolomane 5
	Aiv Kolomane 16

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

2.3.1 The Amathole Wetland Project

The Amathole wetland project is located in the Amathole mountains near the towns of Seymore and Hogsback in the Eastern Cape. The project is situated within the S32E quaternary catchment; parts of which fall into the ex-homeland area of the Ciskei.

Working for Wetlands has been involved with the rehabilitation of wetlands in the adjacent catchments around Hogsback for many years, but the majority of the rehabilitation opportunities there have been exhausted. A need to expand beyond Hogsback was necessary; and, after stakeholder consultation and wetland rehabilitation potential assessments, the nearby Amathole area was identified as a good option.

Apart from there being good opportunities for wetland rehabilitation, most of the systems are located on communally owned land. Rehabilitation projects have traditionally focussed on privately or conservation owned land and there is a need to include more communally-owned areas.

The Amathole 2018/2019 planning year focuses on four wetland systems in the S32E quaternary catchment. The location of these wetlands is listed below in **Table 2** and illustrated within their quaternary boundary in **Figure 1**.

Descriptions of these wetlands, along with the identified problems and rehabilitation objectives are detailed below in **Chapters 4** to **7**.

Table 2: Location of the identified wetlands within the Amathole Wetland Project

Wetland Number	Wetland Name	Latitude	Longitude
S32E-01	Kolomane 1	32°25'18.86"S	26°46'59.60"E
S32E-02	Kolomane 2	32°27'2.35"S	26°46'10.20"E
S32E-03	Kolomane 5	32°24'38.07"S	26°45'48.40"E
S32E-04	Kolomane 16	32°24'14.95"S	26°45'45.69"E

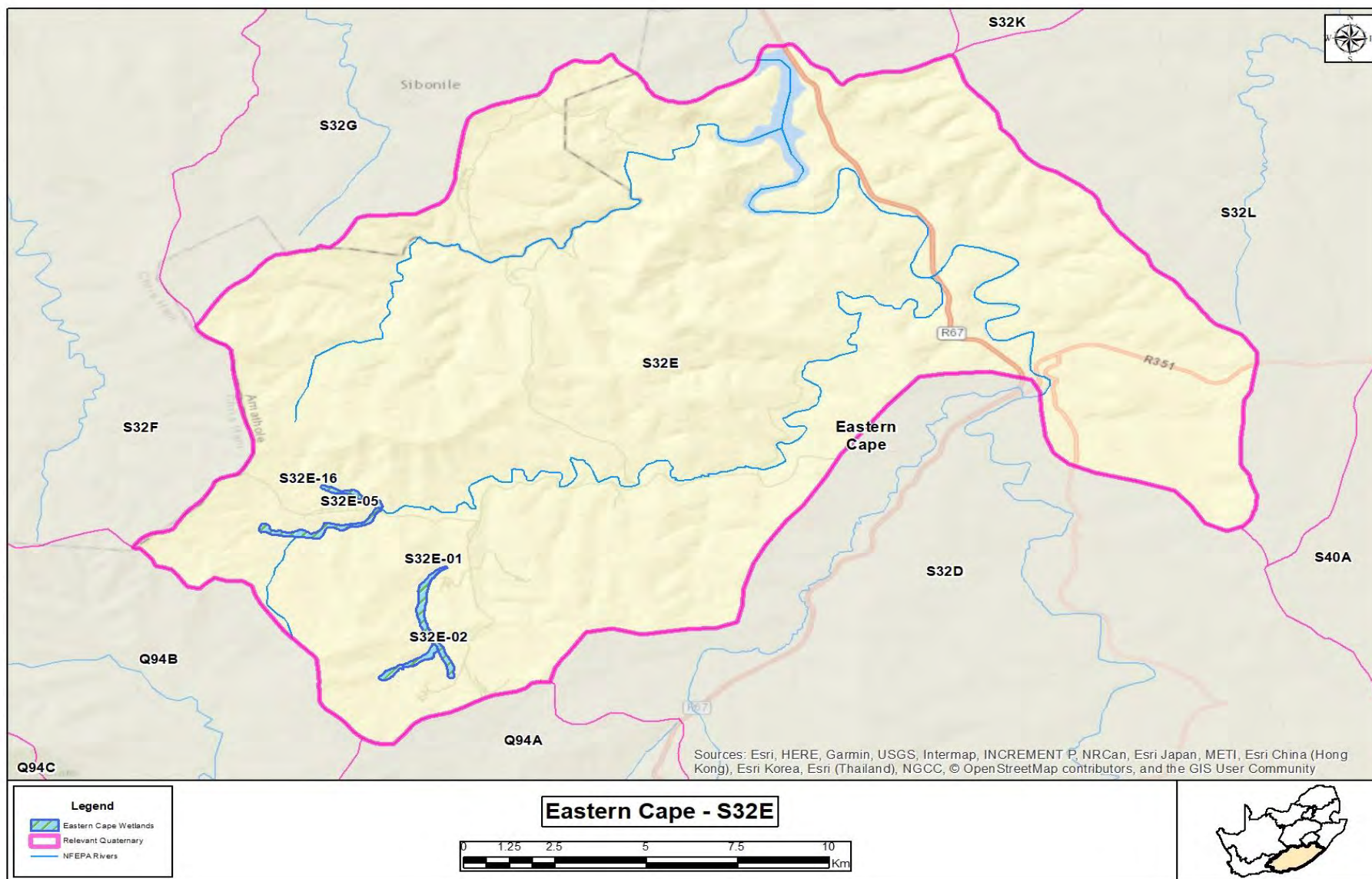


Figure 1: Map showing the location, cadastral boundaries and access routes of quaternary catchment S32E

2.3.2 Project Scope

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

Table 3: Project Scope

Province & Wetland Project	Eastern Cape: Amathole
Quaternary Catchments	S32E
Quaternary Catchment area (Ha)	35 037
Nearest Town/s	Seymore
Partnership	None
Number of wetlands identified during the assessment	4
Wetland names	Kolomane 1 Kolomane 2 Kolomane 5 Kolomane 16
Extension of existing work	No
Work to commence at new wetlands in 2018/ 2019	Yes
Available budget for new interventions	Total R 1,946,530.12
Estimated cost of new interventions⁸	R 14,735,137.74

2.3.3 Prioritisation of wetlands

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

Table 4: Prioritisation of wetlands

Priority	Wetland number	Wetland name	Rationale
3	S32E-01	Kolomane 1	This large HGM unit has been significantly affected by historical cultivation practises over the years, which has led to the desiccation of a significant portion of the system. The implementation of the proposed rehabilitation strategy will influence a large area of this HGM unit and it is assumed that the return of investment of implementing the rehabilitation will be substantial.
4	S32E-02	Kolomane 2	This system has been assigned the lowest priority rating as the HGM unit is significantly smaller than the remaining three wetland systems and there are no direct threats of erosion within the system. As with Wetland S32E-01, the HGM unit has been impacted by historical cultivation practises over the years. The implementation of the proposed rehabilitation strategy will

⁸ Please note that the estimations for revegetation and alien plant clearing were determined per square metre or hectare from previous values, altered for inflation. These values are subject to change and as such, the values should be seen as indicative only.

Priority	Wetland number	Wetland name	Rationale
			aim to reverse the impacts of these practises, reinstating the natural functioning within the system.
2	S32E-03	Kolomane 5	Active erosion was noted along various section of the active channel associated with this HGM unit. In addition to the eroding channel banks, numerous unstable re-entry points were identified along the channel. Upstream of these re-entry points, pristine wetland habitat was noted. Should the erosion associated with these re-entry points continue, it is likely that a large area of pristine wetland may be lost. As such, the stabilisation of this wetland should be a high priority.
1	S32E-04	Kolomane 16	There is an actively eroding headcut and unstable slopes at the toe of the wetland. Upstream of this active erosion is fairly pristine wetland habitat that, should the erosion continue, may be lost. As such, the stabilisation of the toe of this HGM unit is crucial.

2.3.4 Projected rehabilitation indicators

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

Table 5: Projected Values

Wetland No.	Area (ha)	Current hectare equivalents	Projected hectare equivalents gained	Total projected hectare equivalents	% Increase on current hectare equivalents
S32E-01	54.7	32.9	13.9	46.8	25.4%
S32E-02	24.4	19.1	3.0	22.2	12.5%
S32E-03	43.3	38.7	0.6	39.4	1.5%
S32E-04	18.5	13.0	0.3	13.2	1.5%
	140.9	103.7	17.8	121.6	40.9

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

3 GENERAL METHODOLOGY

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

3.1 Landowner consent

The flow diagram (refer to **Figure 2**) clearly demonstrates the point at which various consent forms must be approved via signature from the directly affected landowner. 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. Please refer to **Appendix E** for a copy of the landowner agreements.

3.2 Phase 1

The Wetland Specialist responsible for the Eastern Cape Province undertook a desktop study to determine the most suitable wetlands for the WfWetlands rehabilitation efforts. This phase also involved initial communication with local land-owners and other I&APs to gauge the social benefits of the work.

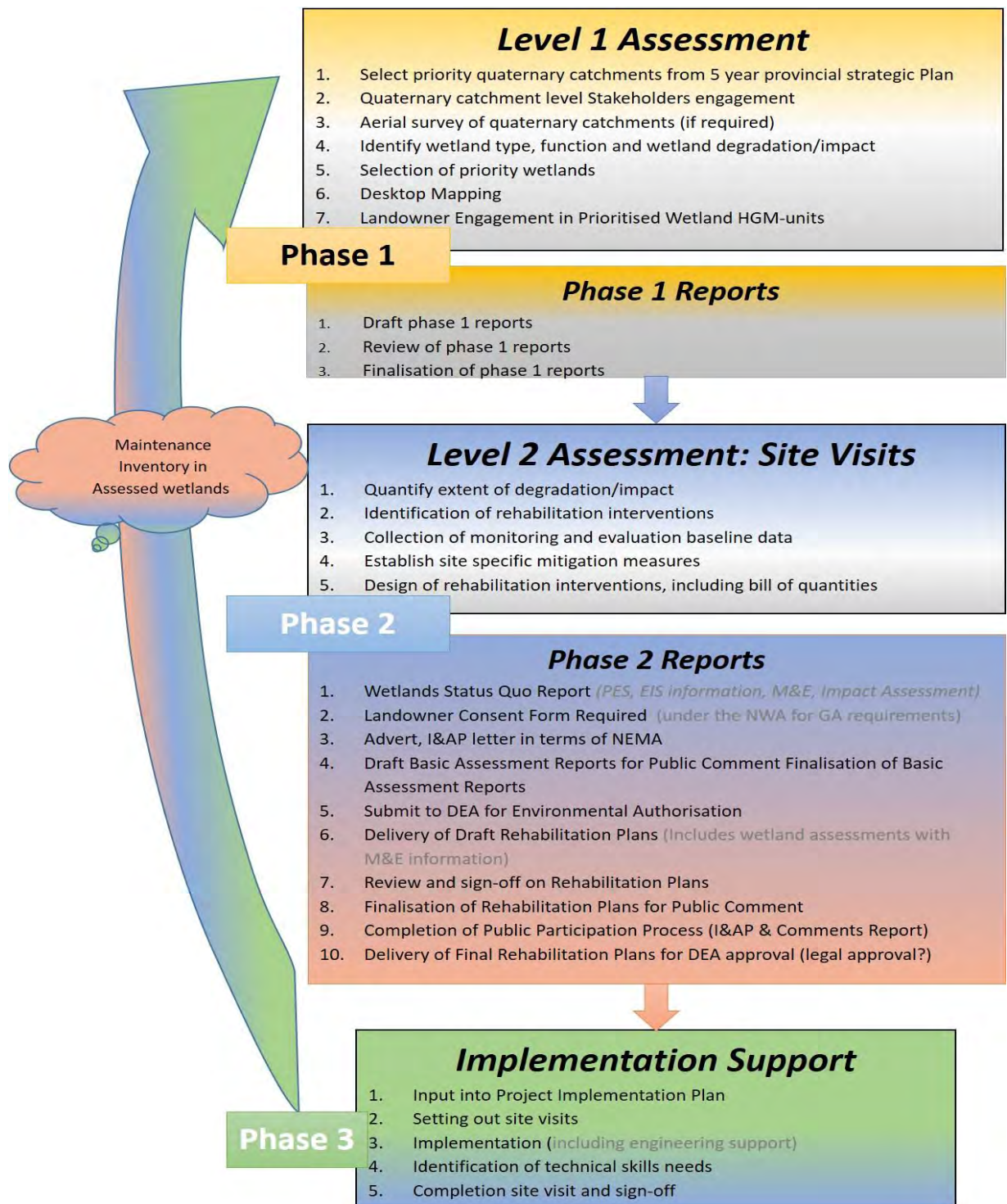


Figure 2: The three phases that must be undertaken for the successful rehabilitation of wetlands

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. The following site visits were undertaken for the Amathole Wetland Project:

1. Kolomane 5 and Kolomane 16 (23 October 2018)
2. Kolomane 1 (24, 25 October 2018)
3. Kolomane 2 (25 October 2018)

The following team members attended the site visits:

- Unathi Tshayingca-Makati (ASD)
- Tyler Harvey and Trevor Pike (Engineers)
- Craig Cowden and Megan Grewcock (Wetland Specialists)
- Jenny Youthed (EAP)

The team was also joined for part of the time by Mr Eric Qonya of the Department of Economic Development, Environmental Affairs and Tourism.

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. An inventory of any existing interventions that were damaged and/or failing and thus requires maintenance is also compiled by the ASD during this phase, in consultation with the Design Engineer.

3.3.2 Wetland Reports

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

a. Assess impacts and threats

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

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

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

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

was assisted by the Wetland Specialist in selecting appropriate interventions to achieve the identified rehabilitation objectives.

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

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

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

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

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

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

3.3.3 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 wetland. 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 wetland. Agreed cost/benefit ratios in terms of 'Rands per hectare of rehabilitated wetland' were taken into account, along with operational considerations and larger scale project objectives.

After the appropriate intervention options were selected by the planning team, the engineer, in consultation with the Wetland Specialist determined the most appropriate designs and locations for the identified interventions in order to achieve the rehabilitation objectives for the wetland in question. GPS coordinates and digital photographs – sufficiently detailed to clearly identify the selected locations were then taken for record purposes. Appropriate dimensions of the locations were measured in order to be able to design and calculate quantities for the interventions.

i. Intervention naming convention

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

A00A-00-000-00 (new),

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

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

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

In addition, the new naming convention also added a '200' digit in the front of the intervention number to avoid confusion from previously named interventions.

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

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

While the engineer was working on measurement of the intervention locations, the Wetland Specialist gathered the additional data required for M&E baselines which included the following:

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

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

At the end of the site visit a location layout of the agreed interventions and rehabilitation objectives was signed off by the ASD and landowner, as indicated by WfWetlands Signoff 2 in **Figure 2**.

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 quantify the volume of water expected to be dealt with by the intervention for various recurrence intervals. The results of this assessment allowed the engineer to select a design flow 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 wetland, based on, *inter alia*, the information collected during the implementation of WET-Tools, were prepared by the Wetland Specialist, and are included as **Appendix A** to this report.

This Rehabilitation Plan was submitted to the WfWetlands ASD 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.

3.3.7 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 KOLOMANE 1 – S32E-01

The assessment of the Kolomane 1 wetland, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A: Wetland Status Quo Report**. The following subsections provide a brief summary for this wetland system.

4.1 Landowner details

The Kolomane 1 project area is situated on communally owned land, under the administration of a Chief (**Table 6**). Consent for any proposed wetland rehabilitation (subject to the approval of the Rehabilitation Plans) on this property has been obtained and is available in **Appendix E**.

Table 6: Kolomane 1 Landowner/s and SG Key

Wetland Number	Property SG Key	Owner / Trust	Consent Obtained
S32E-01	C01800000000009900000	Chief S. Tyali	22 January 2019

4.2 Wetland details

The Kolomane 1 wetland falls within Quaternary Catchment S32E and is located in the Kolomane area to the north-east of the town of Seymore in the Eastern Cape. The wetland can be accessed via a network of small gravel roads that lead off from the R67 that runs between Fort Beaufort and Queenstown. The relevant Chief should be alerted before accessing the site. **Table 7** provides a summary of the wetland details.

Table 7: Summary of the wetland details

Wetland Name	Kolomane 1
Wetland Number	S32E-01
River System Name	Klipplaat
Land Use in Catchment	Communal grazing lands, natural grassland, rural and small urban settlements, pockets of indigenous forest
Land Use in Wetland	Communal livestock grazing, historical cultivation
No. of Properties Intersecting Wetland Area	1
Date of Planning Site Visit	24, 25 October 2018
Wetland Assessor(s)	Megan Grewcock
Wetland size	54.7 ha

4.2.1 Motivation for selection

The Kolomane 1 wetland was selected for rehabilitation for the following reasons:

- It is located on communal land. For reasons of land-ownership, there has traditionally been a focus on work on privately owned land, and/or in nature conservation areas. It was felt that more attention now needed to be paid to communally owned areas, particularly those in the ex-

homeland regions. During discussions with various stakeholders, including the Eastern Cape Wetland Forum, the Amathole area was identified as a suitable focus area.

- The Chief owning the land on which the wetland is situated has granted consent and is in full support of the proposed rehabilitation
- The wetland offers good opportunities for rehabilitation, with a good potential return-on-investment.
- The ratio of hard to soft structures is favourable (i.e. there are high number of soft structure options such as earth berms available), thus maximising the number of labour days that can be created.

4.2.2 Description

Kolomane 1 is situated within a communally owned area, and the wetland is utilised primarily for grazing, mostly by cattle, sheep and goats. Grazing is communal, with no formal land management practices, and some overgrazing has taken place as a result. Limited small-scale subsistence farming takes place in the scattered rural communities that are located above the wetland.

The wetland can be classified as a weakly-channelled valley-bottom system. Upon a review of the historical imagery for this system, intensive cultivation practises were evident within most of the wetland valley-bottom from before 1954. As a result of these practises, impacts such as drains, channel straightening, berms and cut-off drains have contributed to the shifting of the system into a channelled one, desiccating portions of the HGM unit entirely as a result. Although the wetland is no longer actively cultivated, the impacts associated with the historical farming of the system are still evident and are significantly altering the natural functioning of the wetland system.

The main wetland channel runs along the left-hand bank of the wetland, and although it is assumed that the historical channel ran down a similar route, the current channel has been straightened and deepened; which can be mostly attributed to channel incision as a result of the straightening. A significant section of the channel has been colonised by alien tree species, which include the goat or pussy willow (*Salix caprea*) as well as some pine trees (*Pinus sp.*)

A substantial berm runs along the right-hand edge of the wetland in parallel to the main channel. Although this berm has generally reduced the diffuse movement of water from the adjacent slopes and seeps into the valley-bottom, there are some sections in the middle and lower reaches of the HGM unit where it has become breached, allowing some diffuse flow to take place. These reaches are dominated by large patches of permanent wetness zones. The high-water table associated with these sections of the wetland may also be linked to shallow bedrock, providing an impermeable layer and limiting the ability of the water to move vertically, thereby maintaining the permanently wet areas. These wet areas are typically characterised by a combination of the obligate plant species *Juncus effusus* and *Carex sp.* As a disturbance-tolerant plant, *Juncus effusus* is dominating, which is unfavourable as it is not representative of the benchmark vegetation.

Multiple plough lines and cut-off drains are also clearly visible within the middle reaches of the HGM unit. An alluvial mound was noted near the ploughed areas, as the natural ground level was notably higher than the rest of the wetland. It is assumed that this alluvium may have been deposited by the tributary linking into the main stem, depositing material as it lost stream power and carrying capacity. This section of the wetland is much drier, colonised by terrestrial grasses and patches of bramble (*Rubus fruticosus*) rather than the obligate wetland species noted downstream in the wetter portions of the wetland.

The wetland is currently used for grazing, and the impacts of livestock on the HGM unit are clearly evident, particularly in terms of trampling, the creation of pathways and damage to the channel banks where livestock cross.

4.2.3 Site photos



Damage to the banks of the main channel caused by livestock crossing.



One of the unstable entry points where water from a seep enters the main channel



One of the drains that will be deactivated in the channel that has avulsed.



View across the lower reaches of the wetland towards the community above the wetland.



View up the wetland system from the banks of the main channel. The alien trees along the channel and the berm running adjacent to the channel are notable



View across the upper reaches of the HGM unit where deactivation of ridges and furrows is planned. Patches of brambles are evident

4.3 Wetland problems

Most of problems in the wetland arise from historical cultivation practices. As a result of these practises, impacts such as drains, channel straightening, berms and cut-off drains were the main contributing factors to shifting the system into a channelled system, desiccating portions of the HGM unit entirely as a result. Although the wetland is no longer actively cultivated, the impacts associated with the historical farming of the system are still evident and are significantly altering the natural functioning of the wetland system.

The following problems in particular were noted:

- Most of the original diffuse flows were directed into a straightened channel, which has resulted in the desiccation of portions of the HGM. A substantial berm runs along the left-hand (looking downstream) edge of the wetland in parallel to the main channel, reducing the diffuse movement of water from the adjacent slopes and seeps into the valley-bottom
- Water entering the valley-bottom from the adjacent seepage wetlands has led to some unstable re-entry points, with eroding headcut features having formed as a result.
- A significant section of the main channel has been colonised by alien vegetation, in particular the goat or pussy willow (*Salix caprea*), as well as a few pine trees and patches of bramble (*Rubus cuneifolius*).
- Livestock in the wetland have resulted in trampling and the creation of pathways, as well as disturbance to channel banks at the informal crossing places.
- Multiple plough lines and cut-off drains are clearly visible within the middle reaches of the HGM unit. This section of the wetland is much drier, colonised by terrestrial grasses and patches of bramble (*Rubus fruticosus*) rather than the benchmark obligate wetland species such as *Carex* species.

4.4 Rehabilitation objectives

The primary objective of the wetland rehabilitation for all of the wetlands is to secure and improve the overall integrity of the systems, particularly focusing on the removal of historical cultivation impacts and promoting the recovery of the hydrology, geomorphology and vegetation within each of the systems.

The second objective is to stabilise active erosion, thereby securing the wetland habitat upstream and improving the integrity of the wetlands overall.

4.5 Summary of proposed interventions

4.5.1 Work undertaken in previous planning cycles

The Kolomane 1 wetland has not been part of the WfWetlands Programme before.

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 8** below. The “implementation order” as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first).

Please note that the location of the interventions (Figure 3) 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

Portions of the main channel will be deactivated using a number of earthen berms incorporating a base-flow pipe, with some structures being reinforced with concrete-filled geocells to protect the integrity of the structures from livestock. These geocell-covered berms are those berms that are likely to be used as livestock crossing points across the channel. The objective of these structures is to lift the water table within the channel, forcing water out into the middle reaches of the system. In addition, with less water flowing through the main channel, there will be less energy in the channel to lead to any channel scour and widening. A concrete structure will be placed at the head of the HGM unit to secure the rehabilitation implemented downstream of it, and to deflect a portion of the upstream water both into the left-hand channel and into the middle reaches of the wetland.

Re-entry points entering into the valley-bottom from the adjacent seepage wetlands have led to the presence of a few unstable re-entry points, with eroding headcut features having formed as a result. These headcuts will be sloped and stabilised and timber pole structures will be implemented to halt the active erosion, trap sediment to a degree and encourage the reestablishment of vegetation; thereby protecting the integrity of the wetland system upstream of the erosion.

The identified berm that runs in parallel to the channel along the right-hand bank will be deactivated through the implementation of a cut-and-fill activity, levelling out the berm to be aligned with the natural ground level. This will allow for a more diffuse movement of water through the main valley line and also allow seepage from the adjacent slopes and wetlands to link into the valley-bottom. Plough lines that were noted within the valley-bottom will also be deactivated and levelled to encourage more of a diffuse movement of water across a larger section of the HGM unit.

The alien vegetation species will need to be removed, taking into account the comment from the community that invasive species within the wetland itself can be removed, but species in formal woodlots need to be left.

Table 8: Summary of the Kolomane 1 interventions

Intervention Structure Type	Intervention Number	Proposed Action	Implementation Order
Earthen berm with base-flow pipe	S32E-01-201-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system. A baseflow pipe will allow some flow to remain in the channel 	1
Earthen berm with base-flow pipe	S32E-01-202-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system 	2
Earthen berm with base-flow pipe and skimming of berm	S32E-01-203-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system 	3
Earthen berm with base-flow pipe	S32E-01-204-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system 	4
Earthen berm with base-flow pipe	S32E-01-205-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system 	5
Earthen berm with base-flow pipe and skimming of berm	S32E-01-206-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system 	6
Earthen berm with a geocell-covered crest (3m wide) with base-flow pipe and skimming of berm. TriAx for cattle	S32E-01-207-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system. Provision of a geocell crest to protect the structure from damage by livestock walking over it 	7

Intervention Structure Type	Intervention Number	Proposed Action	Implementation Order
Excavation of berm and backfilling drain.	S32E-01-208-00	<ul style="list-style-type: none"> Deactivation of drain by excavating the adjacent berm and using the material to fill the drain 	8
Slope banks. Geocell-covered earthen berm	S32E-01-209-00	<ul style="list-style-type: none"> Slope channel banks to a less acute angle to slow flow and repair damage by livestock. Provide a berm to lift the water level. Provide a protective geocell layer over the berm to prevent damage by livestock 	9
Slope banks. Construct an earthen berm every 25m.	S32E-01-210-00	<ul style="list-style-type: none"> Slope channel banks to a less acute angle to slow flow and repair damage by livestock. Construct earthen berms to slow flow 	10
Excavation of berm and backfilling drain	S32E-01-211-00	<ul style="list-style-type: none"> Deactivation of drain by excavating the adjacent berm and using the material to fill the drain 	35
Earthen berm with base-flow pipe	S32E-01-212-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system. 	11
Earthen berm with base-flow pipe	S32E-01-213-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system. 	12
Earthen berm with base-flow pipe	S32E-01-214-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system. 	13
Earthen berm with base-flow pipe	S32E-01-215-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system. 	14
Earthen berm with base-flow pipe	S32E-01-216-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system. 	15

Intervention Structure Type	Intervention Number	Proposed Action	Implementation Order
Geocell-covered earthen berm with base-flow pipe and deactivation of plough lines	S32E-01-217-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system. Provision of a geocell crest to protect the structure from damage by livestock walking over it 	16
Concrete buttress weir	S32E-01-218-00	<ul style="list-style-type: none"> Construct a concrete buttress weir to secure downstream structures 	17
3x Pole barriers	S32E-01-218-00	<ul style="list-style-type: none"> Stabilisation of headcuts by sloping and placing pole barriers to halt erosion, trap sediment and encourage reestablishment of vegetation 	17
Earthen berm with base-flow pipe and debris removal	S32E-01-219-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out. Removal of debris (such as broken vegetation blocking the channel) 	18
Earthen berm with base-flow pipe	S32E-01-220-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out 	19
Earthen berm with base-flow pipe	S32E-01-221-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out 	20
Earthen berm with a geocell-covered crest (3m wide) with base-flow pipe. TriAx for cattle	S32E-01-222-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out into the middle reaches of the system. Provision of a geocell crest to protect the structure from damage by livestock walking over it 	21
Earthen berm with base-flow pipe	S32E-01-223-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out 	22
Earthen berm with base-flow pipe and skim side bank down to wetland level	S32E-01-224-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out 	23

Intervention Structure Type	Intervention Number	Proposed Action	Implementation Order
Deactivation of ridge-and-furrow	S32E-01-225-00	<ul style="list-style-type: none"> Deactivation of the furrows by cutting the ridges and backfilling the material into the furrows so as to level the area to encourage more diffuse movement of water 	24
Earthen berm with base-flow pipe and skim side bank down to wetland level	S32E-01-226-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out 	25
Earthen berm with base-flow pipe	S32E-01-227-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out 	26
Earthen berm with base-flow pipe and additional berm downstream in wetland.	S32E-01-228-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out 	27
Earthen berm with base-flow pipe and skim levy to wetland level	S32E-01-229-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out 	28
Earthen berm with base-flow pipe and skim levy to wetland level	S32E-01-230-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out 	29
Earthen berm with base-flow pipe and skim levy to wetland level Pole barrier	S32E-01-231-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out Stabilisation of headcuts by sloping and placing pole barriers to halt erosion, trap sediment and encourage reestablishment of vegetation 	30
Geocell covered earthen berm with base-flow pipe	S32E-01-232-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out. Provision of a 	31

Intervention Structure Type	Intervention Number	Proposed Action	Implementation Order
and skim levy to wetland level		geocell crest to protect the structure from damage by livestock walking over it	
Geocell covered earthen berm with base-flow pipe and skim levy to wetland level. 33m concrete sill at ground level.	S32E-01-233-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out. Provision of a geocell crest to protect the structure from damage by livestock walking over it. Skimming of the berm to wetland level to promote more diffuse flow 	32
Geocell covered earthen berm with base-flow pipe. 16m concrete sill at ground level.	S32E-01-234-00	<ul style="list-style-type: none"> Deactivation of the main channel by constructing berms to lift the water table within the channel, forcing water out. Provision of a geocell crest to protect the structure from damage by livestock walking over it 	33
Concrete buttress weir	S32E-01-235-00	<ul style="list-style-type: none"> Construct a concrete buttress weir to secure downstream structures 	34
Concrete buttress weir	S32E-01-236-00	<ul style="list-style-type: none"> Construct a concrete buttress weir to secure downstream structures 	36
Concrete buttress weir	S32E-01-237-00	<ul style="list-style-type: none"> Construct a concrete buttress weir to secure downstream structures 	37
Alien plant removal along length of main channel	S32E-01-238-00	<ul style="list-style-type: none"> Removal of alien plants 	38

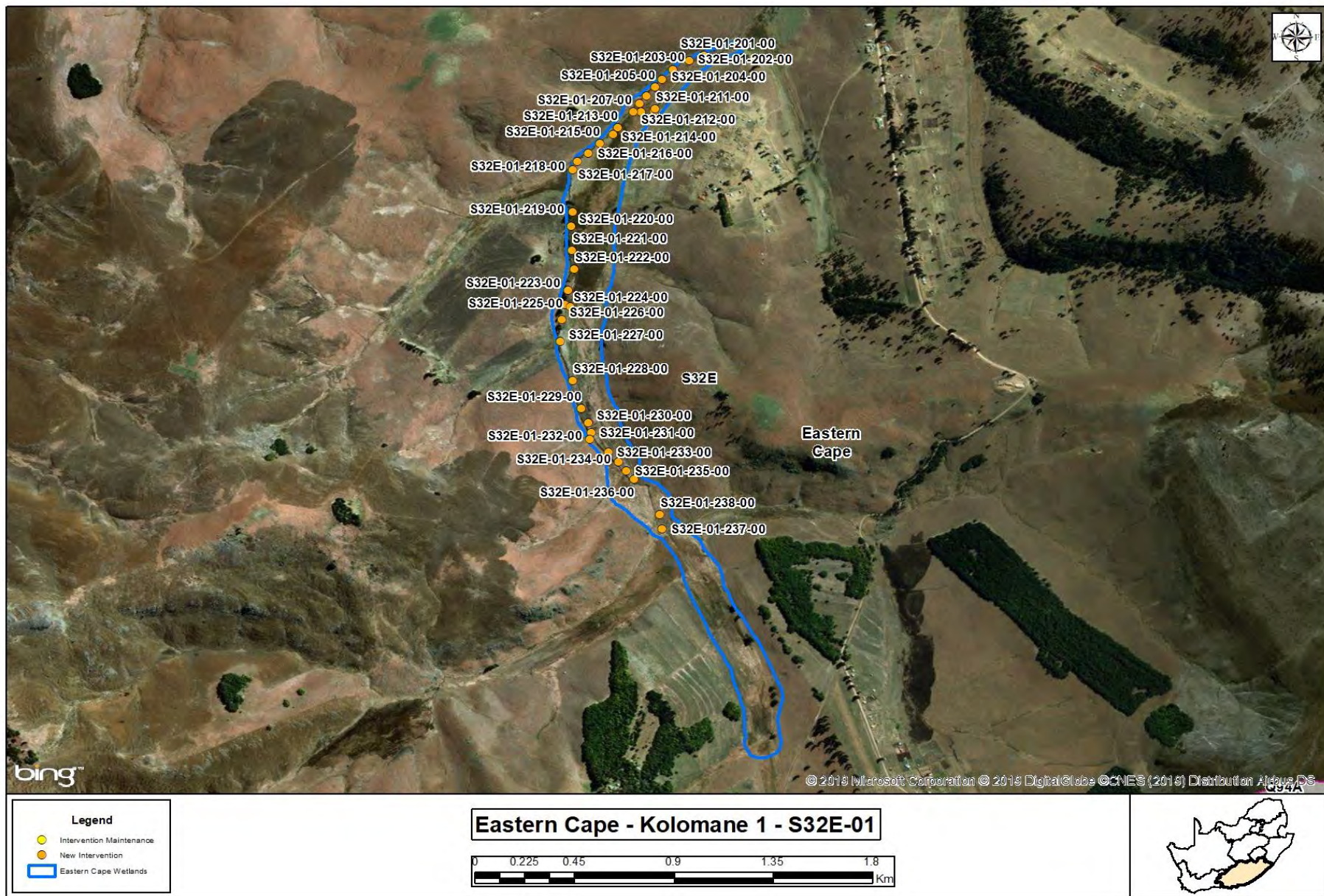


Figure 3. Wetland map, S32E-01 with proposed new wetland interventions indicated

4.6 Construction Environmental Management Programmes issues

The proposed rehabilitation is to be undertaken on communally owned land and the project team should access and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the local community. 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 C, D and F** 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 wetland rehabilitation activities.

An adaptive management strategy is proposed especially at intervention S32E-01-225 (deactivation of furrows), where the effect of water pushed out of the channel on the furrows is uncertain, particularly in terms of the extent of deactivation that will result. The shallower furrows may well stabilise without further intervention. It is proposed that the deeper ones be deactivated now, and the situation monitored over the next two years. Should further deactivation be required, this should be included in the next planning cycle.

4.7.1 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes three years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the Kolomane 1 Wetland (refer to **Appendix A**):

Table 9: Summary of present wetland health of S32E-01 based on the Wet-Health assessment

Wetland Unit	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Trajectory	Impact Score	Change Trajectory	Impact Score	Change Trajectory
S32E-01	54.7	5	0	2.4	0	4.1	-1
PES Category		D	→	C	→	D	↓
Wetland Impact Score		4					
Wetland PES		D					

5 KOLOMANE 2 – S32E-02

The assessment of the Kolomane 2 wetland, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A: Wetland Status Quo Report**. The following subsections provide a brief summary for this wetland system.

5.1 Landowner details

The Kolomane 2 project area is situated on communally owned land under the administration of a Chief (**Table 10**). Consent for any proposed wetland rehabilitation (subject to the approval of the Rehabilitation Plans) on this property has been obtained and is available in **Appendix E**.

Table 10: Kolomane 2 Landowner/s and SG Key

Wetland Number	Property SG Key	Owner / Trust	Consent Obtained
S32E-02	C01800000000010000000	Chief S. Tyali	22 January 2019

5.2 Wetland details

The Kolomane 2 wetland falls within Quaternary Catchment S32E and is located in the Kolomane area to the north-east of the town of Seymore in the Eastern Cape. The wetland can be accessed via a network of small gravel roads that lead off from the R67 that runs between Fort Beaufort and Queenstown. The relevant Chief should be alerted before accessing the site. **Table 711** provides a summary of the wetland details.

Table 11: Summary of the wetland details

Wetland Name	Kolomane 2
Wetland Number	S32E-02
River System Name	Klipplaat
Land Use in Catchment	Communal grazing lands, natural grassland, rural and small urban settlements
Land Use in Wetland	Communal grazing
No. of Properties Intersecting Wetland Area	1
Date of Planning Site Visit	24, 25 October 2018
Wetland Assessor(s)	Megan Grewcock
Wetland size	24.4 ha

5.2.1 Motivation for selection

The Kolomane 2 wetland was selected for rehabilitation for the following reasons:

- It is located on communal land. For land-ownership reasons, there has traditionally been a focus on work on privately owned land, and/or in nature conservation areas and it was felt that more attention needed to be paid to communally owned areas. During discussions with various stakeholders, including the Eastern Cape Wetland Forum, the Amathole area was identified as a suitable focus area.

- The Chief owning the land on which the wetland is situated has granted consent for the rehabilitation work and is in full support of the proposed rehabilitation
- The wetland offers good opportunities for rehabilitation, with a good potential return-on-investment.
- The ratio of hard to soft structures is favourable (i.e. there is a high number of soft structure options such as earth berms available), thus maximising the number of labour days that can be created.

5.2.2 Description

Kolomane 2 is a tributary of the Kolomane 1 HGM and shares many of the same catchment characteristics. It is also located within a communal area and is utilised for grazing. The catchment of Kolomane 2 is fairly extensive, roughly 620ha, and is still relatively intact; possibly due to the remoteness of the area and low settlement density. Most impacts are related to historical cultivation and current grazing regimes.

Kolomane 2 is a weakly channelled valley bottom wetland and was historically cultivated, as evidenced by plough lines, berms, drains and a straightened/modified channel. A review of the historical imagery showed that fairly intensive cultivation along the banks and encroaching slightly into the wetland was occurring in 1949. However, between then and 1985, cultivation moved directly into the wetland, specifically in the lower and middle reaches of the HGM unit, where ploughed fields are evident in the historical imagery and the impacts of this disturbance were still evident in the current functioning of the wetland. Due to the impacts of the historical cultivation activities, the HGM unit is functioning as a much drier wetland relative to the expected natural state. In addition to the changes in the HGM unit affecting the hydrology of the system, the excessive ploughing has led to the disturbance of the soils and the introduction of alien plants (eg *Pinus sp*) and disturbance-tolerant vegetation such as *Juncus sp*.

Prior to the cultivation and transformation of this wetland, the wetland largely functioned as a weakly-channelled system, with a main flow path running along the left-hand bank of the system, and diffuse flows and flood waters moving across majority of the wetland. There are multiple seeps flowing into the main valley-bottom, thereby sustaining the wetland through a combination of lateral and sub-surface flows. The implementation of the berms and drains within the HGM unit during the cultivation practises has significantly impacted on the functioning of the system, confining flows and reducing the diffuse movement of water into and through the system, leading to the desiccation of portions of the wetland. A few permanently wet areas remain but are mainly confined to the lower points created by the drains, berms and shallow plough lines. Although it was assumed that the main channel ran along the left-hand bank of the HGM unit naturally, the current channel, although running along a similar course, has been modified and possibly incised as a result. The channel is currently larger in terms of cross-sectional area and as such able to accommodate greater volumes of water before overtopping, thereby reducing the amount of water entering the wetland and reducing the extent of the permanent wetness zones within the system. Portions of the channel upstream of the HGM unit were more meandering and much shallower than the channel within the HGM unit.

There was no evidence of active erosion within the HGM unit, and as such no direct threat to the integrity of the wetland. However, through the removal of the berms and drains, and the deactivation of portions of the modified channel, it is anticipated that this wetland's integrity will improve significantly.

5.2.3 Site photos



View down the wetland system towards Kolomane 1 (which Kolomane 2 feeds into)



View up the wetland system. The main drain runs along the base of the slope to the right in the photo.



Ridge and furrow to be evened out by cutting and filling



The main drain in the system that will be deactivated. The berm adjacent to the channel will be removed where necessary



A diversion structure is planned at this point to help divert water out of the main channel and promote a more diffuse flow



Livestock in the wetland have resulted in some damage to the channel banks and have also trampled paths through the wetland

5.3 Wetland problems

The main problems in the Kolomane 2 wetland are related to historical cultivation practices. The implementation of the berms and drains within the HGM unit during this historic cultivation has significantly impacted on the functioning of the system, confining flows and reducing the diffuse movement of water into and through the system, leading to the desiccation of portions of the wetland. The current channel has been modified and is larger in terms of cross-sectional area compared to the original, natural channel. As such it is able to accommodate greater volumes of water before overtopping, thereby reducing the amount of water entering the wetland and reducing the extent of the permanent wetness zones within the system

In addition to the changes in the HGM unit affecting the hydrology of the system, the excessive ploughing has led to the disturbance of the soils and the introduction of alien plants (such as pines) and disturbance-tolerant vegetation.

An additional, indirectly related issue that was raised by the community, was the potential for drownings if the water table was raised. The Chief's house is located on the hill above the wetland, and community members sometimes take shortcuts across the valley in which the wetland is situated to get to his house.

5.4 Rehabilitation objectives

The primary objective of the wetland rehabilitation for all of the wetlands is to secure and improve the overall integrity of the systems, particularly focusing on the removal of historical cultivation impacts and promoting the recovery of the hydrology, geomorphology and vegetation within each of the systems.

As the previous cultivation activities within the Kolomane 2 wetland are the main drivers affecting the functioning and integrity of the system, the rehabilitation strategy focuses on reinstating system functioning through the removal of the historical berms, drains and plough lines.

The following strategies in particular are proposed:

- Removing drains, plough lines and portions of berms by skimming the berms and using the material to backfill and/or plug the drains and furrows. Reworking the wetland's surface to a more natural topography will assist in ensuring that the movement of water through the

rehabilitated system is not restricted to any artificial low points, but instead that the water can move diffusely through the system.

- Constructing a spreader canal at the point where the berm and the main drainage channel meet. This spreader canal will be used to deflect some flows out of the main channel and down a section of the berm running slightly perpendicular to the flow of water. It was decided that portions of this berm would not be completely removed, but sections would be deactivated to allow the water to move laterally into the middle portion of the HGM unit. An earthen plug will be positioned within the section of berm running down the right-hand side of the wetland, to deflect flows into the main valley-bottom.
- A rock masonry structure would be provided to make a crossing point for the community to cross the wetland.

5.5 Summary of proposed interventions

5.5.1 Work undertaken in previous planning cycles

The Kolomane 2 wetland has not been part of the WfWetlands Programme before.

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 812** below. The “implementation order” as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first).

Please note that the location of the interventions (**Figure 4**) 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 stabilise instream erosion and trap sediment, deactivate the main drain by removing the right-hand berm and backfilling the drain. Earthen berms will be used to raise the water table in the drain to push water out to the middle of the wetland. Upstream of the drain, an armoured earthen berm will be installed with a rock masonry walkway leading up to it to allow for a safe means of crossing the drain.

The identified ridge-and-furrow network and remnant plough lines will be reworked to be aligned with the natural ground level to limit confined flow paths moving through the wetland by means of cut to fill activities and NRM erosion control logs. The reworking of this HGM unit will encourage a more diffuse flow of water through the wetland, as a result of the removal and deactivation of the cultivation impacts.

Table 12: Summary of the Kolomane 2 interventions

Intervention Structure Type	Intervention Number	Proposed Action	Implementation Order
Deactivation of ridge-and-furrows	S32E-02-201-00	<ul style="list-style-type: none"> Level the ridges and use the material to fill or plug the furrows to re-establish natural, flatter topography and allow a more diffuse flow of water 	1
Ecologs every 25m along parallel drains	S32E-02-202-00	<ul style="list-style-type: none"> Plug the drains to deactivate them and promote more diffuse flow 	2
Deactivate berm and construct earth plug in drain	S32E-02-203-00	<ul style="list-style-type: none"> Remove the berm and use the material to construct an earth plug in the drain to deactivate it and promote a more diffuse flow 	3
Deactivate berm and backfill channel	S32E-02-204-00	<ul style="list-style-type: none"> Remove the berm and use the material to backfill the channel and deactivate it. The re-establishment of the natural, flatter topography will promote a more diffuse flow 	4
Geocell-covered earthen berm. Removal of existing berms. Earthen plug. Rock masonry walkway.	S32E-02-205-00	<ul style="list-style-type: none"> Removal of existing berms to encourage more diffuse flow and construction of new, geo-cell covered one to help direct the flow away from the channel. Deactivation of the lateral drain by putting a plug in the channel. Construct a rubble masonry structure that will allow pedestrian access across the wetland 	5
Earthen berm removal and construction of diversion plug	S32E-02-206-00	<ul style="list-style-type: none"> Removal of existing berm and construction of an earthen plug in the drain to direct the water being pushed out of the channel at that point. 	7
Earthen berm removal and construction of diversion plug	S32E-02-207-00	<ul style="list-style-type: none"> Removal of existing berm and construction of an earthen plug in the drain to direct the water being pushed out of the channel at that point. 	6

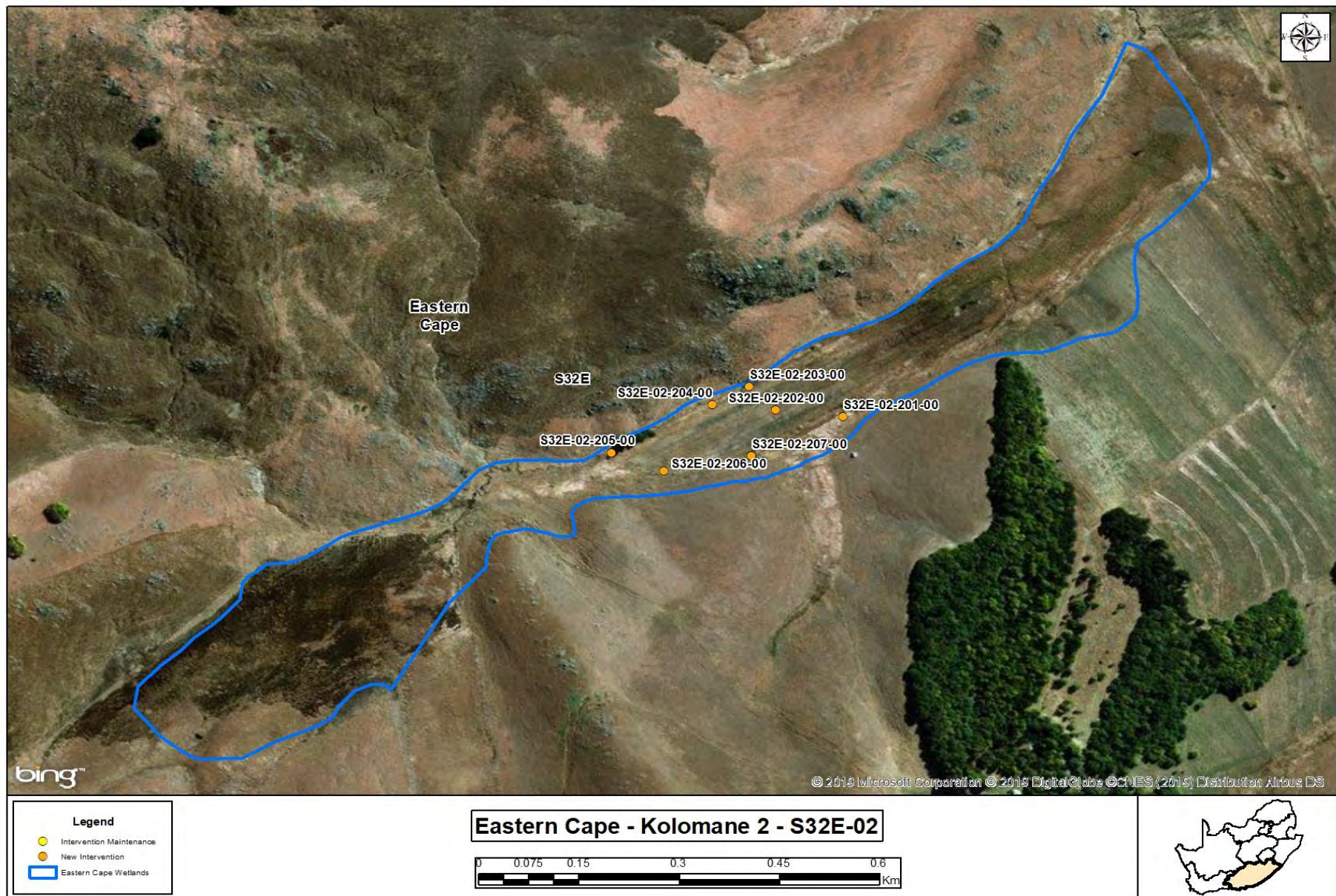


Figure 4: Wetland map, S32E-02 with proposed new wetland interventions indicated

5.6 Construction Environmental Management Programmes issues

The proposed rehabilitation is to be undertaken on communally 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 local community. 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 C, D and F** of this report, respectively, and shall accompany the Implementers to site.

Specific points to be noted:

- The local Chief (Chief Tyali) should be alerted before the site is accessed as access is past his house
- The woodlot of wattle trees above the wetland should not be disturbed, or the wood utilised without permission
- The wetland can be subject to fairly high flows and a community member previously drowned. The implementers should take note and ensure safety, especially if a lot of rain is anticipated

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 wetland rehabilitation activities.

5.7.1 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes three years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the Kolomane 2 Wetland (refer to **Appendix A**):

Table 13: Summary of present wetland health of S32E-02 based on the Wet-Health assessment

Wetland Unit	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Trajectory	Impact Score	Change Trajectory	Impact Score	Change Trajectory
S32E-02	24.4	3.0	→	0.8	→	2.3	→
PES Category		C		A		C	
Wetland Impact Score		2.2					
Wetland PES		C					

6 KOLOMANE 5 – S32E-03

The assessment of the Kolomane 5 wetland, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A: Wetland Status Quo Report**. The following subsections provide a brief summary for this wetland system.

6.1 Landowner details

The Kolomane 5 project area is situated on a privately owned farm within a communal area under the administration of a Chief (**Table 14**). Consent for any proposed wetland rehabilitation (subject to the approval of the Rehabilitation Plans) on this property has been obtained and is available in **Appendix E**.

Table 14: Kolomane 5 Landowner/s and SG Key

Wetland Number	Property SG Key	Owner / Trust	Consent Obtained
S32E-03	C06200000000042300000	Solsbury Commercial Farming	12 March 2019

6.2 Wetland details

The Kolomane 5 wetland falls within Quaternary Catchment S32E and is located in the Cairns area north east of the town of Seymore in the Eastern Cape. The wetland can be accessed via a network of small gravel roads that lead off from the R67 that runs between Fort Beaufort and Queenstown. The relevant landowners should be alerted before accessing the site. **Table 15** provides a summary of the wetland details.

Table 15: Summary of the wetland details

Wetland Name	Kolomane 5
Wetland Number	S32E-03
River System Name	Krom (tributary of the Klipplaat)
Land Use in Catchment	Communal grazing lands, natural grassland, rural and small urban settlements
Land Use in Wetland	Grazing
No. of Properties Intersecting Wetland Area	1
Date of Planning Site Visit	23 October 2018
Wetland Assessor(s)	Megan Grewcock
Wetland size	43.3 ha

6.2.1 Motivation for selection

The Kolomane 5 wetland was selected for rehabilitation for the following reasons:

- The landowners and traditional authority in the area have given consent and are in full support of the proposed rehabilitation.
- The wetland offers good opportunities for rehabilitation, with a high potential return-on-investment.

- Active erosion was noted along various section of the active channel as well as numerous unstable re-entry points. The wetland habitat upstream of these re-entry points is pristine, and if the erosion of these points is allowed to continue, it is likely that a large area of pristine wetland may be lost.
- A balance of hard (e.g. concrete weirs) and soft (e.g. earth berms) intervention options are available, thus helping to maximise the number of labour days created (soft options being more labour intensive to construct than hard options).

6.2.2 Description

Kolomane 5 (S32E-03) is a moderately sized valley-bottom wetland system that alternates between an unchanneled and channelled system, with weakly-channelled sections in-between. The wetland is fed by both surface and sub-surface flows and the upper reaches of the wetland are dominated by seasonal and permanent wetness zones, with large areas covered by surface water retained in natural depressions. The permanently wet zones are dominated by *Carex sp*, while mixed sedge meadow (largely obligate and facultative positive species) characterises the more seasonal wetland edges. Vegetation in the wetland and the surrounding area has been impacted on by the communal grazing that takes place, and moderate over-grazing outside the wetland was noted.

Hydrologically, based on the gentle gradient and weakly-channelled system, flow through the wetland under natural conditions would have been slow moving and diffuse. An attempt to drain the wetland was however made, which has resulted in a faster and less diffuse water flow. This has contributed to the erosion of the lower reaches of the system, which has now reached bedrock as the system works to achieve a natural equilibrium following anthropogenic impacts. The upper reaches of the HGM unit are regarded as being fairly stable and not in need of any rehabilitation work. A historical channel runs along the left-hand edge of the HGM unit, which was abandoned possibly as a result of the headcut advancement years ago. This has led to channel avulsion, and the channel now runs through the middle to right-hand side of the HGM unit. Rehabilitation work will be primarily focused on addressing issues related to this.

6.2.3 Site photos



One of the active small headcuts to be stabilised. Livestock have also created a path (visible lower left in photo) leading to trampling damage



The main channel towards the lower reaches of the wetland where a drop inlet weir is proposed



View towards the upper reaches of the system. A permanent wetness zone in good condition is visible across the channel.



View down the lower reaches of the wetland towards Kolomane 16. Erosion of the channel at this point has taken place down to bedrock



Helichrysum sp that is present in the very over-grazed areas just above the wetland at the base of the system. It's presence suggests that livestock management practices are needed



One of the cattle crossing places and the informal "bridge" that will be replaced by formal structures for both livestock and pedestrians

6.3 Wetland problems

Although a large headcut was identified within the middle reaches of the HGM unit, it has eroded down to bedrock level and is thus stable and cannot progress further upstream.

A historical channel runs along the left-hand (facing downstream) edge of the HGM unit, which was abandoned possibly as a result of the headcut advancement years ago. This has led to channel avulsion, and the channel now runs through the middle to right-hand side of the HGM unit. The channel showed signs of active erosion, as unstable banks and channel deepening were evident. In addition, unstable re-entry points were noted along sections of the channel that, although not eroding heavily, may become an erosion risk in the future especially during storm events, where the energy within the system increases substantially. It is anticipated that this lateral/re-entry erosion will continue, and although the channel cannot erode upstream due to the presence of bedrock, it is still able to widen and erode horizontally, leading to the direct loss of the adjacent wetland habitat.

The movement and presence of livestock within the wetland has also led to a slight degradation of wetland features, such as trampling of wetland vegetation and damage to channel banks at informal crossing points. Over-grazing of the vegetation within the wetland was not identified as a serious concern at this point in time, although moderate to severe over-grazing is evident in places just above the wetland. A semi-formal livestock crossing was noted towards the middle to upper reaches of the HGM unit. The community noted this crossing was dangerous, especially during high rainfall events. The provision of safe crossing points thus formed an important part of the intervention planning.

6.4 Rehabilitation objectives

The primary objective of the wetland rehabilitation for all of the wetlands is to secure and improve the overall integrity of the systems, particularly focusing on the removal of historical cultivation impacts and promoting the recovery of the hydrology, geomorphology and vegetation within each of the systems.

6.5 Summary of proposed interventions

6.5.1 Work undertaken in previous planning cycles

The Kolomane 5 wetland has not been part of the WfWetlands Programme before.

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 16** below. The “implementation order” as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first).

Please note that the location of the interventions (Figure 5) 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 reactivate the historical channel moving down the left-hand side of the wetland. In this way the newly formed eroding channel will receive reduced base flows, thereby reducing the energy moving through the main channel. The reactivation of the historical channel will encourage the rewetting of the left-hand portions of the wetland, re-establishing the hydrological functioning within the currently desiccated portions of the system.

No intervention for the large headcut is planned as the headcut has eroded to bedrock and is thus stable. However, at this point a weir with a diversion pipe has been specified as a means of reactivating the historical channel on the left-hand side of the wetland. The reactivation of the historical channel will encourage the rewetting of the left-hand portions of the wetland, re-establishing the hydrological functioning within the currently desiccated portions of the system.

In order to raise the water table within the current channel, deactivate continued channel erosion, and stabilise eroding re-entry points along the channel, a concrete drop inlet weir was specified. The weir will raise the water table behind the structure, flooding out the unstable re-entry points and reducing the overall energy within the system.

A concrete buttress weir has been proposed at the base of the HGM unit to secure the returns of the upstream concrete structure and assist in raising the water table within the lower reaches of the channel.

To address the community's concerns about dangerous stream crossings, a formal concrete splash-through crossing will be implemented just upstream of the existing semi-formal crossing structure.

Table 16: Summary of the Kolomane 5 interventions

Intervention Structure Type	Intervention Number	Proposed Action	Implementation Order
Concrete splash-through	S32E-03-201-00	<ul style="list-style-type: none"> Provide a splash through crossing for livestock at the existing eroding crossing 	6
Rock masonry chute	S32E-03-202-00	<ul style="list-style-type: none"> Stabilise cattle path via construction of a smooth rock masonry chute 	5
Concrete spillway across channel and trickle pipe	S32E-03-203-00	<ul style="list-style-type: none"> Construct a spillway with a diversion pipe at the base of the large headcut to reactivate the historical channel on the left-hand side of the wetland (looking downstream) and thus rewet desiccated parts of the wetland 	4
Concrete drop-inlet weir	S32E-03-204-00	<ul style="list-style-type: none"> Construct a concrete drop inlet weir to raise the water table within the current channel, deactivate continued channel erosion, and stabilise eroding re-entry points along the channel 	3
Earthen berm with base-flow pipe	S32E-03-205-00	<ul style="list-style-type: none"> Construct an earthen berm with baseflow pipe to slow flow and push water out of the channel 	2
Concrete buttress weir	S32E-03-206-00	<ul style="list-style-type: none"> Construct a concrete buttress weir to secure the upstream structures by back-flooding and assist in raising the water table in the lower reaches of the channel 	1

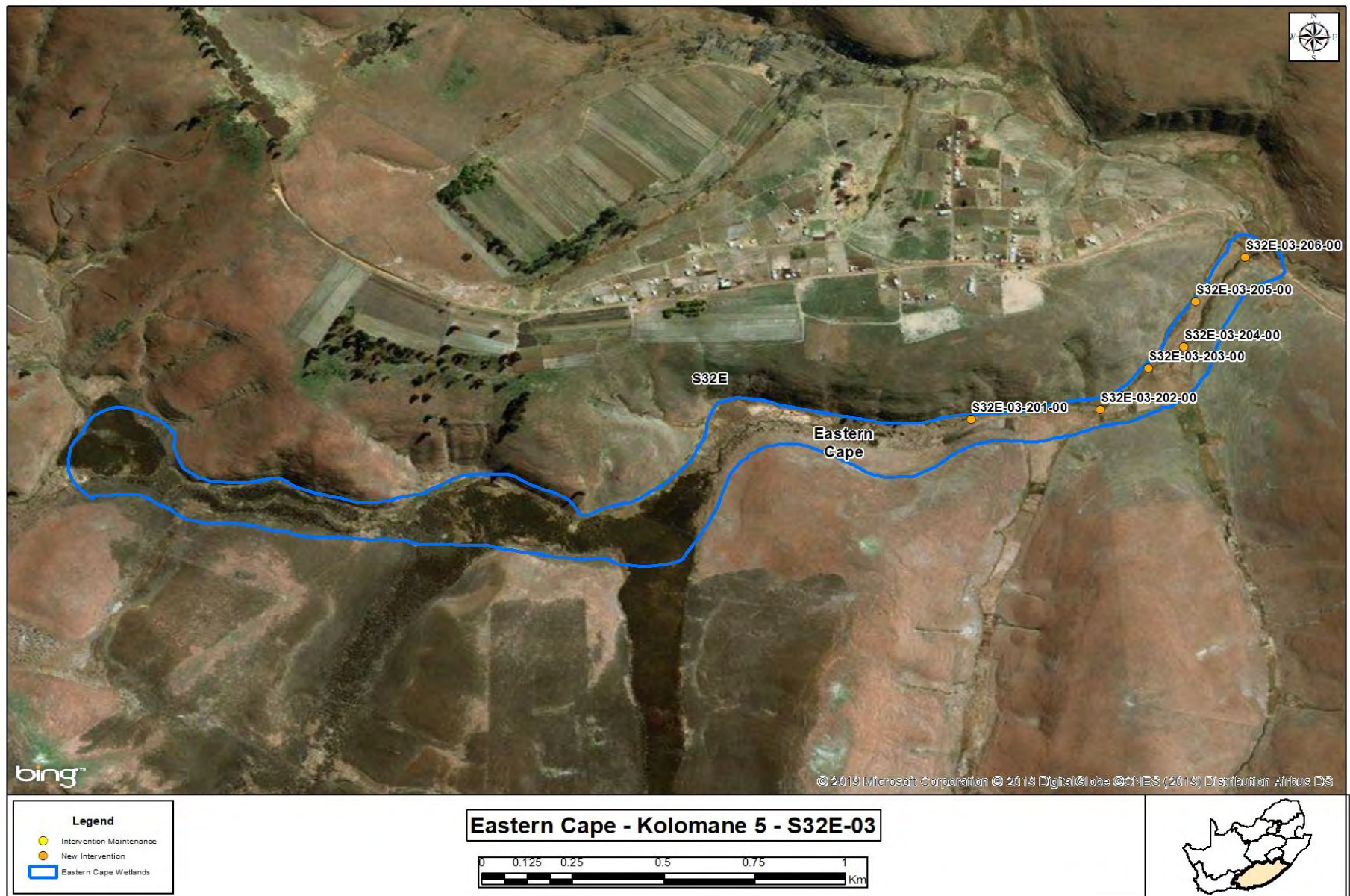


Figure 5: Wetland map, S32E-03 with proposed new wetland interventions indicated

6.6 Construction Environmental Management Programmes issues

The proposed rehabilitation is to be undertaken on privately owned land but that also falls within an area administered by a traditional leader. The project team should access and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the local landowners and Chief. 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 C, D and F** of this report, respectively, and shall accompany the Implementers to site.

Specific issues include:

- Safe access across the channel for pedestrians and livestock should be provided during the construction of the new crossing points
- Subject to approval of the landowner, access should be from the lower end of the wetland which has direct access from the gravel road. This end of the wetland is also drier and more disturbed. Access across the permanent wetness zones in the middle and upper reaches should be limited as far as possible

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 wetland rehabilitation activities.

6.7.1 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes three years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the Kolomane 5 Wetland (refer to **Appendix A**):

Table 17: Summary of present wetland health of S32E-03 based on the Wet-Health assessment

Wetland Unit	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Trajectory	Impact Score	Change Trajectory	Impact Score	Change Trajectory
S32E-03	43.3	1.0	→	0.5	↓	1.8	↓
PES Category		B		A		B	
Wetland Impact Score		1.1					
Wetland PES		B					

7 KOLOMANE 16 – S32E-04

The assessment of the Kolomane 16 wetland, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A: Wetland Status Quo Report**. The following subsections provide a brief summary for this wetland system.

7.1 Landowner details

The Kolomane 16 project area is situated on communally owned land administered by a Chief (**Table 18**). Consent for any proposed wetland rehabilitation (subject to the approval of the Rehabilitation Plans) on this property has been obtained and is available in **Appendix E**.

Table 18: Kolomane 16 Landowner/s and SG Key

Wetland Number	Property SG Key	Owner / Trust	Consent Obtained
S32E-04	C06200000000042100001	Chief Hebe	12 March 2019

7.2 Wetland details

The Kolomane 16 wetland falls within Quaternary Catchment S32E and is located in the Cairns area to the north east of the town of Seymore in the Eastern Cape. The wetland can be accessed via a network of small gravel roads that lead off from the R67 that runs between Fort Beaufort and Queenstown. The relevant Chief should be alerted before accessing the site. **Table 19** provides a summary of the wetland details.

Table 19: Summary of the wetland details

Wetland Name	Kolomane 16
Wetland Number	S32E-04
River System Name	Krom (tributary of the Klipplaat)
Land Use in Catchment	Communal grazing lands, grassland, rural and small urban settlements
Land Use in Wetland	Communal grazing
No. of Properties Intersecting Wetland Area	1
Date of Planning Site Visit	23 October 2018
Wetland Assessor(s)	Megan Grewcock
Wetland size	18.5 ha

7.2.1 Motivation for selection

The Kolomane 16 wetland was selected for rehabilitation for the following reasons:

- It is located on communal land. There has traditionally been a focus on work on privately owned land, and/or in nature conservation areas and it was felt that more attention needed to be paid to communally owned areas. During discussions with various stakeholders, including the Eastern Cape Wetland Forum, the Amathole area was identified as a suitable focus area.
- The Chief owning the land on which the wetland is situated has been approached and is in full support of the proposed rehabilitation

- There is an actively eroding headcut and unstable slopes at the toe of the wetland. Upstream of this active erosion is fairly pristine wetland habitat that will be lost should the erosion continue. As such, the stabilisation of the toe of this HGM unit is crucial and rehabilitation should be carried out sooner rather than later.
- There is a high potential return-on-investment.

7.2.2 Description

Kolomane 16 (S32E-04) is a large channelled valley-bottom wetland and forms part of the main valley-bottom wetland system, into which Wetland S32E-03 drains. There are multiple freshwater ecosystems merging into the valley-bottom system, making the hydrological contributions to the system a combination of surface and sub-surface inputs.

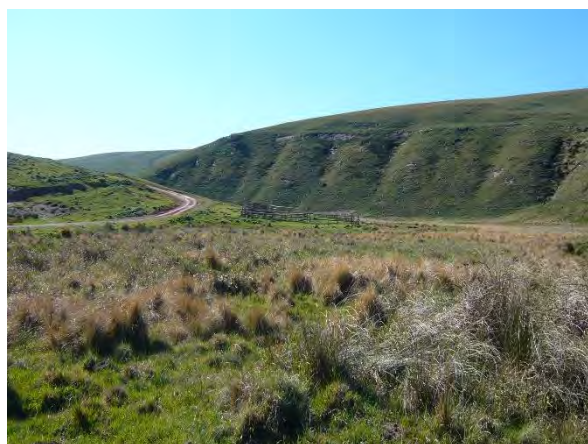
It is probable that the Kolomane 16 system was originally a weakly-channelled one, but various drivers of in-system erosion, particularly historical cultivation, have led to significant channel incision throughout a large portion of the HGM unit. Some stabilisation has taken place where a tributary enters the middle to lower reaches of the HGM due to sediment being deposited and the eroded channel consequently being plugged; but channel incision occurs again downstream of the sediment deposition area.

The catchment of Kolomane 16 is mostly intact although there has been some disturbance related to human activity, such as the construction of gravel roads, historical cultivation and low-density settlement. Vegetation has also been impacted on by small-scale alien plant invasion and over-grazing. The vegetation cover in the greater system is however relatively good, which promotes the infiltration of rain.

As noted, portions of the system have previously been cultivated, thus disturbing the natural functioning and integrity of the system's hydrology, geomorphology and vegetation. These historical farming activities, such as ploughing, drains and altering the natural surface levels and movement of water, have led to the disturbance of the soils which has provided a platform for the encroachment of alien invasive species. In addition to impacts from cultivation, there is also a gravel road that crosses the toe of the wetland that has had an impact on the system. This is largely due to the culverts that direct water under the road. The culverts have the effect of concentrating flow, thus increasing in-system energy and the development of erosion.

Rehabilitation efforts this planning cycle will focus on this area (i.e. toe of the wetland near the road) in order to first stabilise the headcut erosion here that could impact on rehabilitation in the adjoining Kolomane 5 wetland.

7.2.3 Site photos



View from the toe of the wetland looking downstream. The gravel road that crosses the wetland is evident to the left



View from the toe of the wetland looking upstream across the gravel road and towards Kolomane 5. The eroded area is at the discharge point of the culverts that run under the road



Looking across part of the toe of the wetland towards one of the headcut features to be stabilised (visible below the vehicles in the photograph)



Location of weir in channel. Patches of bramble are evident to the forefront of the photo

7.3 Wetland problems

The primary wetland problem for Kolomane 16 is related to erosion. It was assumed that this wetland originally operated as a weakly-channelled system, but various drivers of in-system erosion (in particular historical cultivation practices) have led to significant channel incision through a large portion of the HGM unit. The construction of a road at the toe of the HGM has also contributed to the multiple small headcut erosion in this area. Concentrated and increased surface water flows associated with the road culverts may be one of the drivers of the degradation, as the flows are confined through the road culverts and directed downstream, causing an increase in the in-system energy.

Some trampling of vegetation by livestock is also present but was not identified as requiring intervention at this point. There is also a cattle dip nearby, which will make rehabilitation involving measures to direct livestock difficult as animals will continue to be driven through the wetland.

7.4 Rehabilitation objectives

The main rehabilitation objective for Kolomane 16 is to stabilise the active erosion. Three headcuts at the toe of the HGM unit were prioritised for rehabilitation to reduce the risks of this erosion progressing upstream into the Kolomane 5 HGM unit and eventually reaching the already incised channel. Should the headcuts erode into the HGM unit and link with the incised channel, it may lead to an exacerbation of the current erosion within the system and subsequent loss of the remaining wetland habitat upstream.

7.5 Summary of proposed interventions

7.5.1 Work undertaken in previous planning cycles

The Kolomane 16 wetland has not been part of the WfWetlands Programme before.

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 20** below. The “implementation order” as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first).

Please note that the location of the interventions (**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.

7.5.3 Design selection and sizing

A multi-part intervention has been designed to achieve the objective of stabilising the headcut erosion. A concrete drop-inlet weir has been proposed just downstream of the headcuts so as to backflood the headcuts and thus reduce the energy associated with the erosion. Three sets of NRM erosion control log “pyramids” have been designed to stabilise the headcuts themselves. The combination of the concrete weir raising the water table, and the pole barriers stabilising the eroded areas, is anticipated to adequately stabilise the erosional features and any threats to the upstream system.

Table 20: Summary of the Kolomane 16 interventions

Intervention Structure Type	Intervention Number	Proposed Action	Implementation Order
Concrete drop inlet weir and backfilling with Ecologs at gradient changes and supporting pole structures	S32E-04-201-00	<ul style="list-style-type: none"> • Construction of a concrete weir to flood out the headcuts • Sloping of the eroded sections of the headcuts and stabilising them with Ecologs and supporting pole/timber barriers 	1

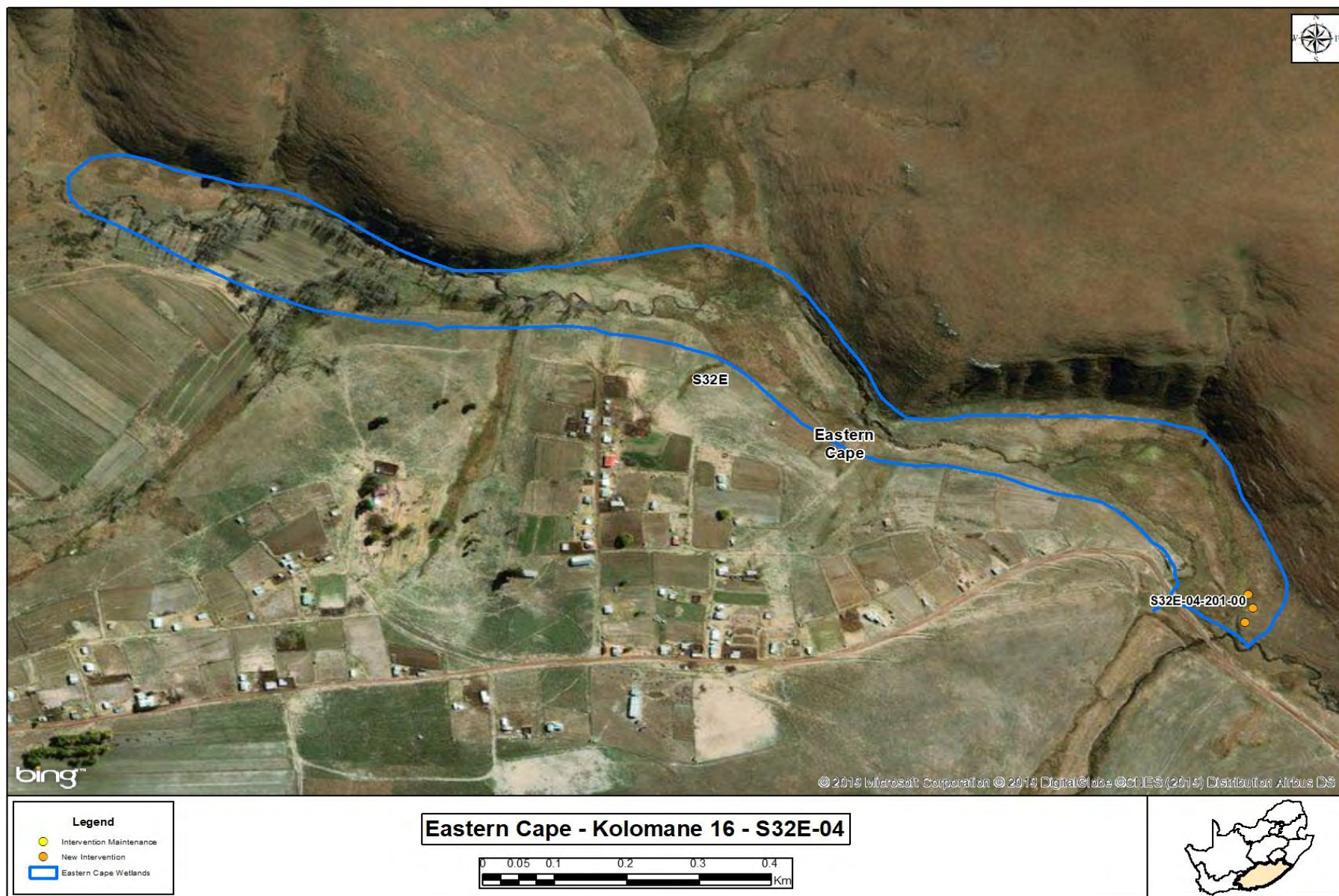


Figure 6: Wetland map, S32E-04 with proposed new wetland interventions indicated

7.6 Construction Environmental Management Programmes issues

The proposed rehabilitation is to be undertaken on communal land and the project team should access and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the local community. 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 C, D and F** 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 wetland rehabilitation activities.

7.7.1 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes three years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the Kolomane 16 Wetland (refer to **Appendix A**):

Table 21: Summary of present wetland health of S32E-04 based on the Wet-Health assessment

Wetland Unit	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Trajectory	Impact Score	Change Trajectory	Impact Score	Change Trajectory
S32E-04	18.5	3.0	↓	1.9	↓↓	4.1	↓
PES Category		C			↓	D	
Wetland Impact Score		3.00					
Wetland PES		C					

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APPENDIX A
WETLAND STATUS QUO REPORT

WORKING FOR WETLANDS
PROVINCE: EASTERN CAPE
PROJECT: AMATHOLE



Phase 1: Wetland Rehabilitation Planning Report

FINAL

FEBRUARY 2019

Report Reference: GTW561-040219-01



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List of Acronyms

Acronym	Explanation
ASD	Assistant Directors
AZf 3	Eastern Temperate Freshwater Wetlands
DAFF	Department of Agriculture, Forestry and Fisheries
DWS	Department of Water and Sanitation
EPWP	Expanded Public Works Programme
FEPA	Freshwater Ecosystem Priority Area
Gd 1	Amathole Montane Grassland
GIS	Geographic Information System
IDPs	Integrated Development Plans
MAP	Mean Annual Precipitation
NDA	National Department of Agriculture
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PET	Potential Evapotranspiration
PIP	Project Implementation Plan
SMMEs	Small, Medium and Micro Enterprises
WfWets	Working for Wetlands

Glossary of Terms

Term	Explanation
Best Management Practise (BMP)	Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWetlands implementers. Such practises are informed by applied research.
Biophysical	The biological and physical components of the environment (Cowden and Kotze 2008).
Catchment	All the land area from mountaintop to seashore which is drained by a single river and its tributaries. Each catchment in South Africa has been subdivided into secondary catchments, which in turn have been divided into tertiary catchments. Finally, all tertiary catchments have been divided into interconnected quaternary catchments. A total of 1946 quaternary catchments have been identified for South Africa. These subdivided catchments provide the main basis on which catchments are subdivided for the integrated catchment planning and management (Cowden and Kotze 2008).
Ecosystem services or 'eco services'	The service, such as sediment trapping or water supply, supplied by an ecosystem (in this case a wetland ecosystem).
Enhancement	The modification of specific structural features of an existing wetland to increase one or more functions based on management objectives, typically done by modifying site elevations or the proportion of open water
Intervention	A method of wetland rehabilitation that aims to address the objectives of the particular wetland system, namely to restore the hydrological integrity of the system and support associated biodiversity. It can be in the form of hard (structures made of hard materials which are fixed e.g. a concrete weir) or soft (e.g. re-vegetation) interventions
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, the same location, having the same capacity and performing the same function as the previous structure ('like for like').
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.
Quantum GIS	A GIS software programme that is used to present data at a spatial scale
Quaternary catchments	"A fourth order catchment in a hierarchical classification system in which a primary catchment is the major unit: and that is also the "principal water management unit in South Africa' (DWS, 2011).
Rehabilitation	1) The recovery of a degraded wetland's health and ecosystem service delivery by reinstating the natural ecological driving forces or 2) halting the decline in health of a wetland that is in the process of degrading, so as to maintain its health and ecosystem service-delivery" (Kotze et al. 2008:p14) . A system that is rehabilitated is not expected to be restored back to its reference state/benchmark

Significant impact	An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.
Wetland	“Wetland means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil” (National Water Act No. 36 of 1998).
Working for Wetlands	Working for Wetlands (WfWets) is a government programme managed under the Natural Resource Management Programme (NRM) of the Department of Environmental Affairs. It is a joint initiative with the Departments of Water and Sanitation (DWS), and Agriculture, Forestry and Fisheries (DAFF).

1 OVERVIEW OF WORKING FOR WETLANDS

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

The programme is mandated to protect pristine wetlands, promote their wise-use and rehabilitate those that are degraded 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.

While the programme's primary focus is wetland rehabilitation; the protection, rehabilitation and sustainable use of those wetlands is simultaneously entrenched in the programme's core objectives. Given this approach of linking wetland conservation to sustainable socio-economic development, the programme shares in its focus on incorporating unemployed, poor people into employment and skills development opportunities.

The newly identified strategic framework of WfWets has underlined the need for a more refined process that the programme is embarking on with catchment-scale planning. Catchment-scale planning seeks to promote ecosystem-scale outcomes, long-term custodianship, and embedding of rehabilitation in broader local institutions and frameworks. The recent move to a systematic wetland rehabilitation planning process has provided a fertile and conducive platform for partnerships to be formed and/or strengthened as it draws in a much wider stakeholder base. Furthermore, WfWets is undergoing a strategic shift from focussing on heavily degraded wetland systems to lightly degraded ones. This will enable the programme to achieve a wider footprint with less complex, "softer" and cheaper interventions. Leveraging the benefits of the application of legislation and a strong advocacy drive are other strategies being considered in order to stretch the rand value given the enormous number of wetlands that require conservation.

1.1 Objectives of Working for Wetlands

WfWets 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 partnership. In particular, coherence of Integrated Development Plans (IDPs) and wetland rehabilitation projects' objectives will be a key area of future focus. WfWets encourages municipalities to participate in provincial wetland forums because they are the platform for the roll out of all the programme's processes, including planning for future work. Provincial forums also offer support from the government departments and private sectors that are represented. Partnerships with non-governmental

organizations 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.

1.2 Relevant legislation, policies and guidelines applicable to the project

WfWets operates within the context of the Constitution (1996), which states that everyone has the right to have the environment protected, and the following national legislation, amongst others, by which the environment is protected:

- National Environmental Management Act, No 107 of 1998 (NEMA), as amended;
- National Environmental Management: Biodiversity Act, No 10 of 2004 (NEMBA);
- National Water Act, No 36 of 1998 (NWA); and
- Conservation of Agricultural Resources Act, No 43 of 1983 (CARA).

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

2 STUDY AREA

This section provides an overview of the study area, in terms of the biophysical (geography, vegetation, geomorphology etc.) and climate attributes.

2.1 Project description

The Amathole study site includes the wetland areas within the Amathole mountain range and the Hogsback areas. WfWet has been involved in rehabilitation planning and implementation within the Hogsback area, situated within the Q94A quaternary catchment. Since majority of the rehabilitation opportunities within the Hogsback area have been exhausted, systems beyond Hogsback and into the Amathole mountain ranges were reviewed. A need to expand into the greater project area was identified in 2018 through consultation with relevant stakeholders (**Table 2.1**). As such, priority areas were identified in the S32E quaternary catchment, near the Amathole mountain range and just outside the towns of Seymour and Hogsback in the Eastern Cape Province. Following a desktop review and discussion with members of the rehabilitation team, large wetland systems were identified as having rehabilitation opportunities with fairly large gains and these systems were prioritised for Phase 1 planning.

Table 2.1 Key stakeholders involved in identifying the focus areas within the greater Amathole project area

Stakeholder	Organisation
Unathi Makati	Working for Wetlands
Margaret Lowies	Aurecon
Japie Buckle	Department of Environmental Affairs: Natural Resource Management
Hennie Swanevelder	Eastern Cape Department: Economic Development, Environmental Affairs and Tourism
Eric Qonya	Eastern Cape Department: Economic Development, Environmental Affairs and Tourism
Craig Cowden	GroundTruth
Jenny Youthed	Aurecon
Piet-Louis Grundling	Working for Wetlands

As mentioned, the focus area for this rehabilitation planning is a new area for WfWets rehabilitation, and exhibits great opportunities to rehabilitate fairly intact wetlands mostly affected by active erosion, historical cultivation initiatives, and alien invasive vegetation encroachment; where the anticipated gains associated with rehabilitation within this area is promising. The study area as described in this rehabilitation plan refers to the wetlands visited within Chief Tyhali's tribal land boundary, which is located within S32E (**Figure 2.1**).

Table 2.2 Description of the quaternary catchment included in the study

Province	Eastern Cape
Quaternary Catchment	S32E
Project Name	Amathole
Land Owner / Partnership	Tribal land
Planning Phase	Phase 1
Nearest Town	Seymour
Previous Work	No

2.2 Quaternary catchment location

The S32E quaternary catchment is the focus of the study area, as described in **Table 2.2** and illustrated in **Figure 2.1**. The systems within the catchment flow north into Waterdown Dam on the Klipplaat River, near Whittlesea. This dam is the main source of drinking water for the Queenstown residents. The system then flows east ultimately joining into the Great Kei River and entering the ocean through the Kei River mouth.

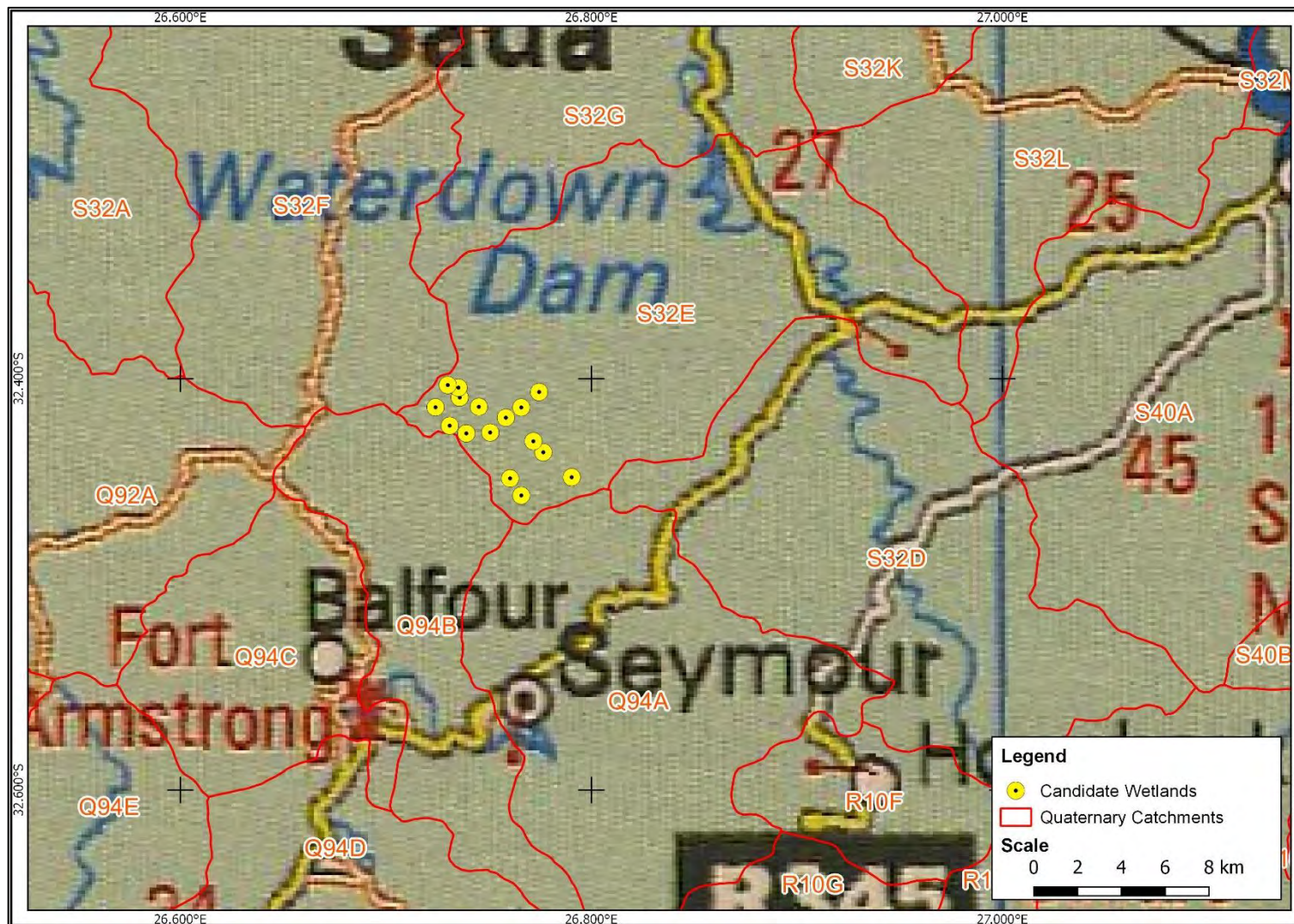


Figure 2.1 Location of identified wetlands within, and in relation to, their respective quaternary catchments

2.3 Wetland conservation context

South Africa is a semi-arid country, and thus wetlands are important features within the landscape as they provide ecosystem services directly related to water quantity and quality. Approximately 300'000ha of wetlands or 2.4% of South Africa's surface area remain. It is estimated that over 50% of South Africa's wetlands have been lost, and of the remaining systems, 48% are classified as critically endangered (Nel and Driver 2012).

Within the Eastern Cape region, wetlands have been subjected to high levels of modification and destruction (Kotze *et al.* 1995). The factors contributing towards the degradation of the systems vary greatly, but the predominant impacts include urbanisation, abstraction, dams, current and historical cultivation, drainage and over-grazing. The loss of wetland habitat within Eastern Cape is considered to be of concern due to the value of wetlands in terms of contributions to water quantity and quality, supporting unique biological diversity and other ecosystem services (Kotze *et al.* 2007).

Taking into consideration the above-mentioned degradation of wetland ecosystems, ecosystem rehabilitation is viewed as a means of maintaining the current levels of ecosystem service delivery, and where possible, enhancing the systems' ability to supply these benefits and services.

2.4 Climate

This section provides an overview of the climate within the quaternary catchment associated with the project area. An understanding of the climate, *i.e.* the sensitivity of catchments to hydrological impacts influences rehabilitation planning activities. The candidate wetlands are all located within the S32E quaternary catchment. The Mean Annual Precipitation (MAP) is 641.9mm and the Potential Evapotranspiration (PET) is 1730.2mm (Schulze 2007) for the S32E catchment, making the hydrological sensitivity of the wetlands within this catchment to be *Moderately High* (Macfarlane *et al.* 2007).

2.5 Vegetation types

Under natural conditions the surrounding landscape and study site would have been characterised by particular vegetation types. The historical dominant vegetation type present would have been a combination of two vegetation types (**Figure 2.2**), including:

- Amathole Montane Grassland (Gd 1); and
- Eastern Temperate Freshwater Wetlands (AZf 3).

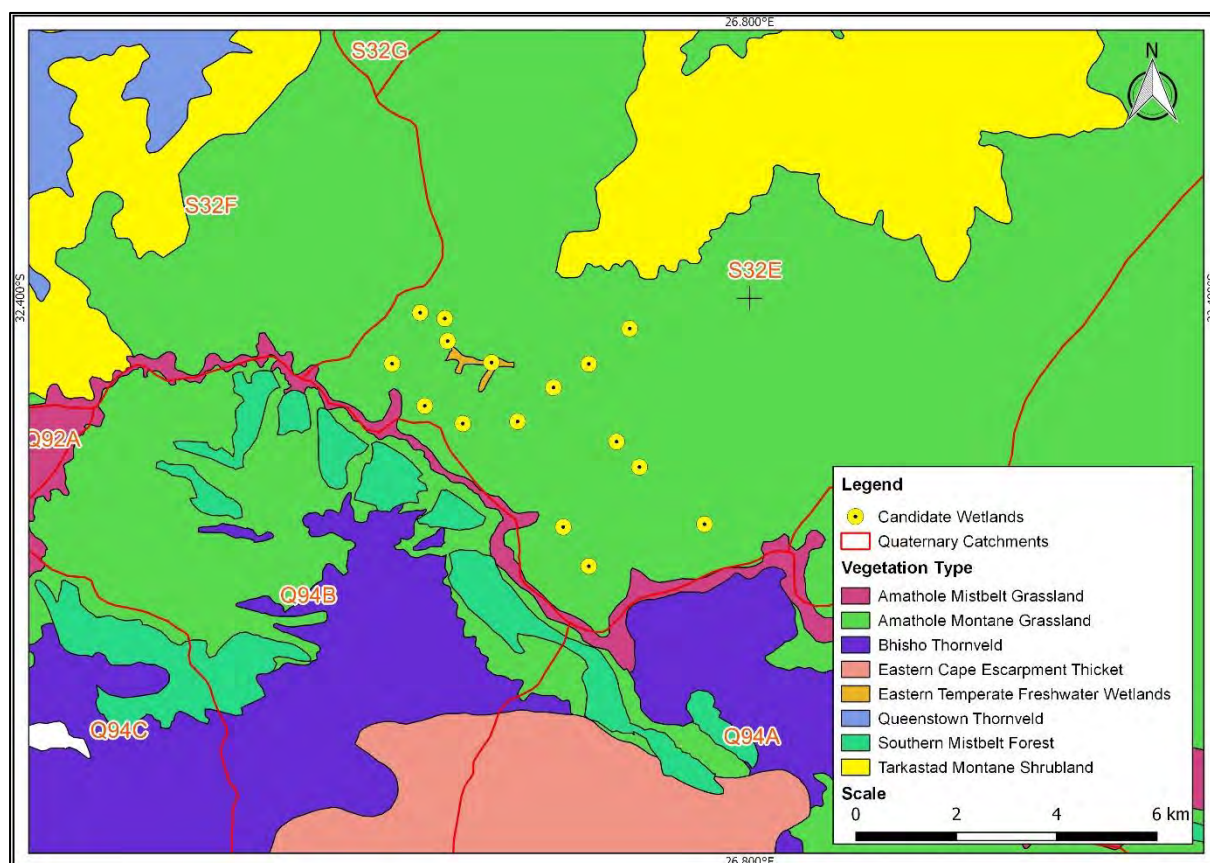


Figure 2.2 Overview of historical dominant vegetation types in the vicinity of the identified wetlands (Mucina and Rutherford 2006)

The Amathole Montane Grassland (Gd 1) falls under the Drakensberg Grassland (Gd) bioregion (Mucina and Rutherford 2006; Nel et al. 2011). The vegetation type has been classified as 'Least Threatened'. Of the remaining 89.7%, a small percentage (5%) is statutorily conserved in the Mpofu Game Reserve, Fort Fordyce, Bosberg, Kubusi, Hogsback and a few more conservation areas. The vegetation extends through the Eastern Cape, ranging from Amathole, Winterberg and Kologha Mountains, as well as the mountains just north of Somerset East. The vegetation can be found at altitudes between 650 – 1500m (Mucina and Rutherford 2006).

The Eastern Temperate Freshwater Wetlands (AZF 3) falls under the Azonal Vegetation bioregion (AZ) (Mucina and Rutherford 2006). The vegetation type has been classified as 'Least Threatened'. Of the remaining 85.1%, a small percentage (4.6%) is statutorily conserved in the Blesbokspruit, Hogsback, Seekoeivlei, Wakkerstroom Wetland and Umngeni Vlei Nature Reserves. The majority of the impacts stem from the transformation to cultivated land and plantations. The vegetation extends through the Northern Cape, Free State, North-West, Gauteng, Mpumalanga and KwaZulu-Natal Provinces and can be found at altitudes ranging from 750-2000m (Mucina and Rutherford 2006).

2.6 National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA) is a tool developed to assist in the conservation and sustainable use of South Africa's freshwater ecosystems, including rivers, wetlands and estuaries. Nel et al. (2011) classified the freshwater ecosystems according to their Present Ecological State 'AB', 'C', and 'DEF' or 'Z' (**Table 2.3**).

Table 2.3 Description of NFEPA wetland condition categories

(Nel et al., 2011, p.37)

PES equivalent	NFEPA condition	Description	% of total national wetland area*
Natural or Good	AB	Percentage natural land cover $\geq 75\%$	47
Moderately modified	C	Percentage natural land cover 25-75%	18
Heavily to critically modified	DEF	Riverine wetland associated with a D, E, F or Z ecological category river	2
	Z1	Wetland overlaps with a 1:50 000 'artificial' inland water body from the Department of Land Affairs: Chief Directorate of Surveys and Mapping (2005-2007)	7
	Z2	Majority of the wetland unit is classified as 'artificial' in the wetland locality GIS layer	4
	Z3	Percentage natural land cover $\leq 25\%$	20

*this percentage excludes unmapped wetlands, including those that have been irreversibly lost

According to the available NFEPA wetlands coverage, a portion of the wetland systems within the study area and the broader landscape have been classified as a combination of NFEPA and 'low priority' wetlands (**Figure 2.3**). The wetlands within the middle to western reaches of the site have been classified as NFEPA wetlands, which have been defined as largely natural systems, which are made up of a fairly large, interconnected wetland system. Two low priority wetlands are located within the eastern and southern sections of the study area (as defined by Chief Tyhali's land).

According to the available NFEPA river coverage, a perennial tributary of the Klipplaat River, which flows in an easterly direction through the study site, has been classified as a NFEPA river system, which has been largely modified, with a PES score of *D*. Numerous hydrologically isolated FEPA rivers were identified within the broader study site, which were regarded as important since they support important fish populations and are part of the upstream management areas.

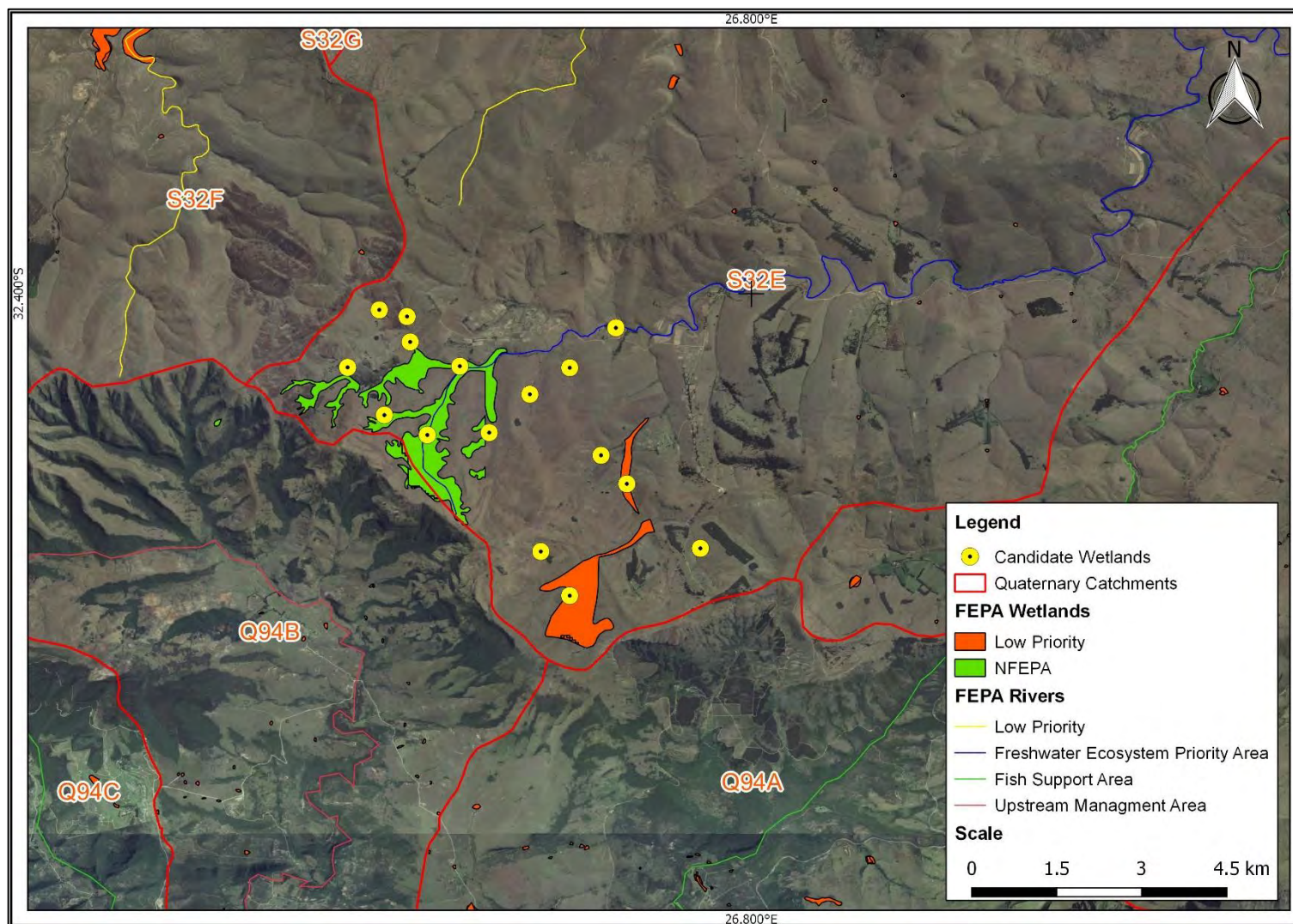


Figure 2.3 Overview of NFEPA systems within the greater study area

3 STUDY METHODOLOGY

The Phase 1 planning for wetland rehabilitation is fundamentally a wetland identification and 'screening' exercise to identify a manageable number of wetlands that can most effectively be assessed in further detail for rehabilitation by WfWets. This process is informed by a prioritisation process, undertaken with key stakeholders as mentioned previously.

3.1 Review of project history

Since the current project area within the Amathole region is a new site for the WfWets programme, there were no existing rehabilitation plans for the area. However, a review of the work implemented near Hogsback was included and it was determined whether any structures required maintenance, which included an audit of previously planned interventions that have not yet been implemented or included into the current Project Implementation Plan (PIP). These intervention designs were assessed and if necessary updated during the rest of the planning process to determine whether or not these should be included into future PIPs.

3.2 Desktop analysis

At the outset, a desktop analysis of the project area was undertaken to identify potential candidate wetlands for rehabilitation. This process was strongly informed by input from WfWet representatives (Piet-Louis Grundling and Unathi Makati). The desktop analysis further served to inform the overall wetland rehabilitation planning process. The objectives of the desktop study were to:

- Develop a full inventory of all wetlands investigated during the desktop analysis;
- Conduct a preliminary evaluation of the identified wetland systems based on:
 - Ecological/functional importance/ priority;
 - Level of transformation;
 - Visibility of problem areas; and
 - Location in relation to access roads.
- Identify potential candidate wetlands for rehabilitation and protection;
- Prioritise those wetland systems that may warrant rehabilitation;
- Establish problem points within the wetland habitat that may require rehabilitation; and
- Determine the possible level of rehabilitation required.

The desktop mapping process encompassed the overlaying of numerous GIS coverages to determine the probability of wetland systems, which primarily includes aerial imagery, SPOT 5 satellite imagery, contour data and river coverages. The combination of these layers assisted in determining the probability of wetland habitat within the landscape. During the desktop analysis of available coverages, a number of wetlands within the study site were identified. Wetland identification was based primarily on differences in vegetation patterns between wetland habitat and terrestrial areas, as well as landscape setting based on topography. Impacts such as the advancement of headcut erosion and drains and berms within wetlands were identified. These currently impacted systems were identified as requiring rehabilitation. Infield verification of the identified wetlands was still required to determine the magnitude of identified impacts within the wetlands.

3.3 Identification of candidate wetlands

The identification of suitable wetlands for rehabilitation purposes was undertaken at a desktop level utilising available satellite and aerial imagery, data supplied by WfWets, and contour data. The systems were mapped at a desktop level, with limited field verification. The desktop mapping relied largely on changes in topography and vegetation cover to define the extent of wetland habitat. The desktop level mapping/analysis was performed in Quantum GIS at a scale of 1:5000 to create a Geographical Information System (GIS) spatial coverage of the candidate wetland ecosystems within the project area.

3.4 Assessment of catchment impacts

The sub-catchments of the identified wetland systems were interrogated using available satellite and aerial imagery in order to determine the various land use practices within the catchments. The extent and possible intensity of the activities were broadly assessed, provisionally highlighting the extent of the impacts on the wetlands. The greater the transformations within the landscape the more likely the wetland habitat will be substantially altered and therefore, require rehabilitation.

3.5 Assessment of the wetlands' rehabilitation potential

The wetland systems were reviewed for rehabilitation opportunities. The aerial imagery was interrogated for headcut erosion, channel incision, drains, and/or berms and/or alien invasive vegetation within the wetlands. The extent of the impacts were considered in comparison to the size of the wetland habitat in question, to determine the potential costs of rehabilitating the system, so as to eliminate wetlands with the least potential of being successfully rehabilitated from the prioritisation process.

3.6 Field assessments

A site visit was conducted between the 25th-27th of September 2018 to verify the extent of wetland ecosystems within the study site and assess the current level of ecological integrity and ecosystem services provided by the wetland habitat and rehabilitation opportunities.

In addition, the Assistant Directors (ASD) for Eastern Cape identified additional work required in a wetland system that is currently being implemented, just outside the town of Hogsback. This additional work would assist in achieving the rehabilitation aims and objectives and improve the functioning of the system in the post-rehabilitation scenario. These additional measures proposed will be reviewed infield during the Phase 2 rehabilitation planning field trip to determine the potential benefits of the additional work proposed. Since new wetland sites were identified, no maintenance requirements were identified.

3.7 Finalisation of prioritised wetlands

The selected wetlands were prioritised based on relative importance, based on the following two categories of criteria:

1. Habitat characteristics:
 - a. Biodiversity and functional value (taking into consideration the impacts within the systems);
 - b. Potential for partnerships;

- c. Catchment characteristics;
 - d. Biophysical (hydrological, biodiversity connectivity etc.) links to other rehabilitation projects;
 - e. Uniqueness of wetlands systems;
2. Practical/convenience attributes:
- a. Number of wetlands (HGMs) to be rehabilitated;
 - b. Number of person-days to be generated (labour intensity);
 - c. Ease of access to wetland;
 - d. Intervention size (with large-scale interventions preferably being avoided).

As multiple wetlands would be included in the Phase 1 assessment, it was necessary to prioritize the identified wetlands according to anticipated rehabilitation gains, prioritising those with higher potential gains. The wetlands were prioritised to ensure that a suitable number of wetlands are to be rehabilitated and the budget is not exceeded and to ensure that the ratio between 'hard' rehabilitation interventions and 'soft' rehabilitation interventions is proportionate to the objectives of WfWets.

3.8 Study assumptions and limitations

This report has been developed under certain constraints. The attention of users is drawn to the following particular areas in which caution in the use of this document should be exercised:

- The report only describes the initial screening of wetlands for further, more detailed rehabilitation planning. Detailed field assessments / measurements of the prioritized wetlands will be carried out in the Phase 2 of the planning process.

4 RESULTS AND FINDINGS

4.1 Desktop Analysis

Majority of the existing rehabilitation work for the WfWets projects in this area has been undertaken closer to the town of Hogsback, where majority of the wetland rehabilitation options have been exhausted. As such, opportunities for rehabilitation have been identified further away from the Hogsback town, and closer to Seymour and the Amathole Mountain range. Apart from incorporating additional rehabilitation measures into an existing rehabilitation plan near Hogsback, no maintenance of structures was identified.

During the desktop mapping process, a number of wetlands within the project area (**Figure 4.1**) were identified and investigated for possible rehabilitation opportunities. It should be noted that the project area refers to the lands belonging to Chief Tyhali, since it was on his land that the team were given permission to work.

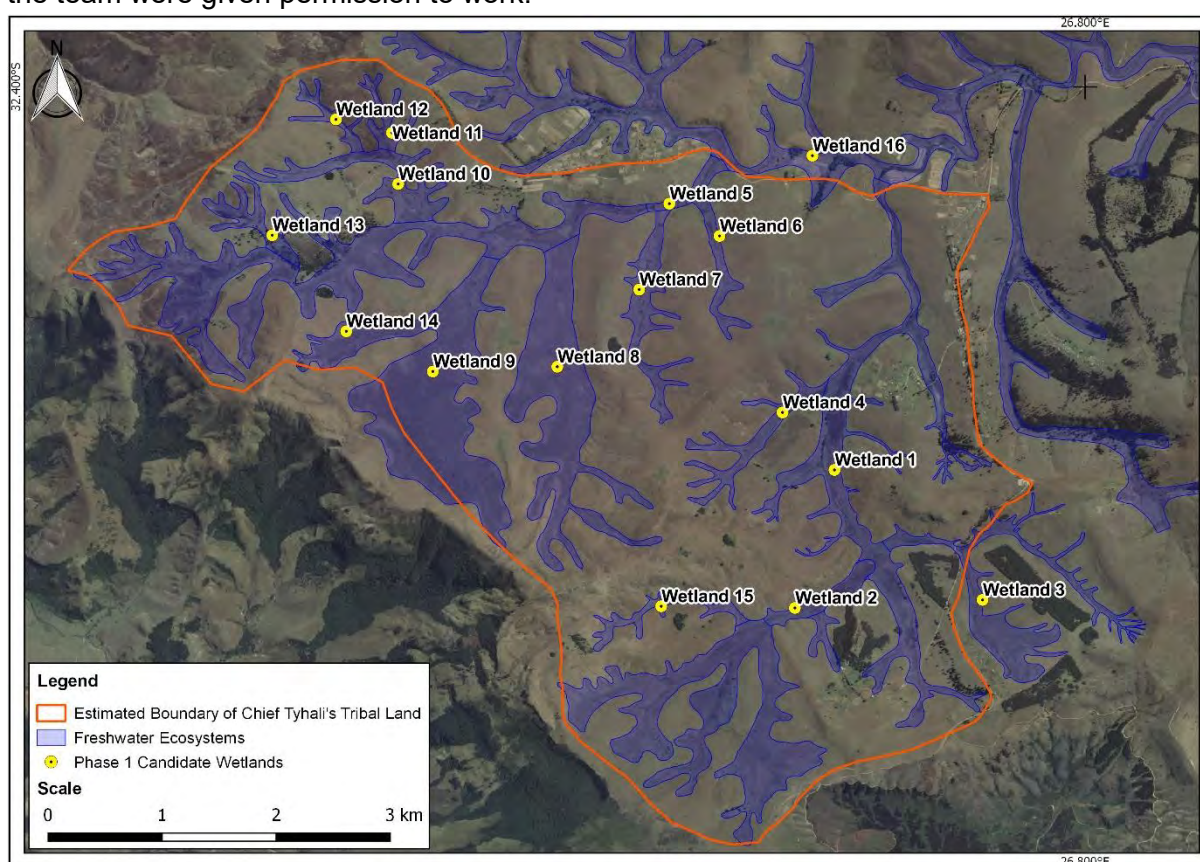


Figure 4.1 Overview of the candidate wetlands identified for the Phase 1 Planning of the Amathole wetland rehabilitation

The various wetlands, their areas, location and whether they will be included in the Phase 2 planning are presented in **Table 4.1**.

Table 4.1 Wetlands investigated during the desktop analysis process and the reason for the inclusion or exclusion from the Phase 2 infield verification process

Quaternary Catchment	Wetland Label and Number	WET IS Label	Latitude (DMS)	Longitude (DMS)	Included for Phase 1 infield verification	Reason for inclusion/exclusion
S32E	Wetland 1	S32E-01	32° 26' 08.55" S	26° 46' 35.83" E	Yes	Great opportunities for rehabilitation, that showed potential for an ideal balance between 'hard' and 'soft' rehabilitation interventions.
	Wetland 2	S32E-02	32° 26' 54.87" S	26° 46' 22.53" E	Yes	Great opportunities for rehabilitation, that showed potential for an ideal balance between 'hard' and 'soft' rehabilitation interventions.
	Wetland 3	N/A ¹	32° 26' 52.18" S	26° 47' 25.55" E	No	Although opportunities for rehabilitation were evident at a desktop level, there were concerns whether this wetland was located within the study site and within Chief Tyhali's tribal lands.
	Wetland 4	N/A	32° 25' 49.24" S	26° 46' 19.83" E	No	Upon a desktop review of the wetland, it was noted that there were limited issues within the system that required rehabilitation measures.
	Wetland 5	S32E-03	32° 24' 39.14" S	26° 45' 30.47" E	Yes	A large wetland system that can be secured and its functioning enhanced through fairly simple rehabilitation initiatives; combining both 'hard' and 'soft' intervention options to secure the rehabilitation.
	Wetland 6	N/A	32° 24' 50.00" S	26° 45' 57.22" E	No	A desktop and infield verification of the condition of this wetland highlighted that the potential for effective rehabilitation was limited.
	Wetland 7	N/A	32° 25' 07.98" S	26° 45' 30.24" E	No	Desktop and infield verification of the condition of this wetland highlighted that the potential for effective rehabilitation was limited.

¹ It should be noted that those systems that were not prioritised for inclusion in the rehabilitation planning for this year's cycle were not assigned formal WET IS labels. Only those systems that have been identified for rehabilitation would receive labels since they will be incorporated into the WfWets planning cycle.

Quaternary Catchment	Wetland Label and Number	WET IS Label	Latitude (DMS)	Longitude (DMS)	Included for Phase 1 infield verification	Reason for inclusion/exclusion
	Wetland 8	N/A	32° 25 33.90 S	26° 45 02.74 E	No	Due to limited existing roads within the study area, and the poor quality of the roads moving north-west through the site, site access was an issue and limited the team's ability to access these wetlands and as such would pose a serious constraint to the implementation of any identified interventions. Should the road access be upgraded through other processes, these wetlands can be reconsidered for the planning of wetland rehabilitation measures as some issues were identified at a desktop level.
	Wetland 9	N/A	32° 25 35.49 S	26° 44 20.95 E	No	
	Wetland 10	N/A	32° 24 32.54 S	26° 44 09.32 E	No	
	Wetland 11	N/A	32° 24 15.35 S	26° 44 07.20 E	No	
	Wetland 12	N/A	32° 24 10.85 S	26° 43 48.42 E	No	
	Wetland 13	N/A	32° 24 49.73 S	26° 43 27.00 E	No	
	Wetland14	N/A	32° 25 22.00 S	26° 43 51.86 E	No	
	Wetland 15	N/A	32° 26 54.30 S	26° 45 37.65 E	No	Opportunities to stabilise headcut erosion identified at the toe of this wetland system were identified, which will protect the wetland system from eroding further.
	Wetland16	S32E-03	32° 24 23.02 S	26° 46 28.43 E	Yes	
Q94A	Q94A-01	Q94A-01	32° 32 17.02 S	26° 55 25.64 E	No	The review of this site, and the proposed extension of the current rehabilitation plan, was only identified during Phase 2 of the project.

4.2 Identified wetlands

Based on the findings of the desktop analysis, infield verification of the identified wetlands took place. Based on the desktop analysis, three (3) wetlands (**Figure 4.2** and **Table 4.2**) that cover an area of approximately 258.1ha, were prioritised as candidate wetlands for the Phase 1 fieldwork.

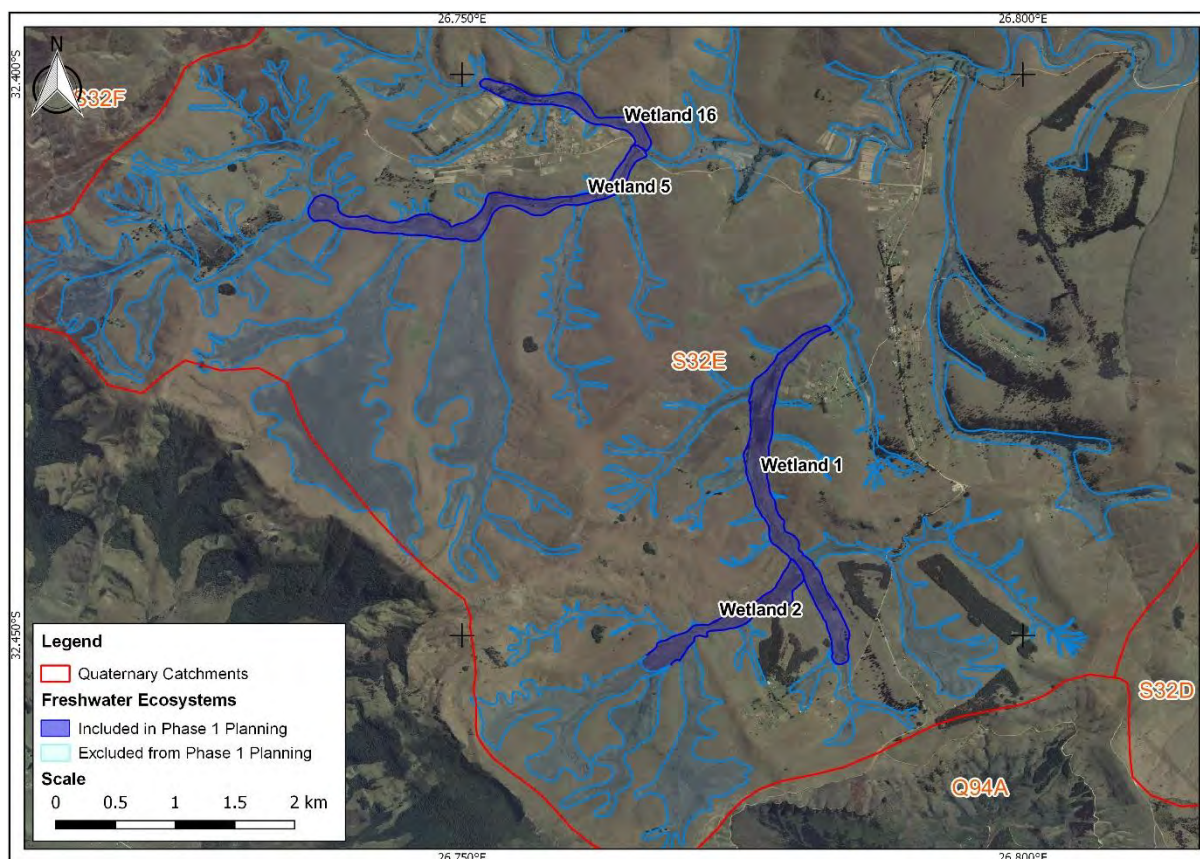


Figure 4.2 Wetlands identified during the desktop mapping process and in-field verification processes within S32E quaternary catchment

The wetlands identified as possible candidate wetlands within the study area (as defined above), were initially identified at a desktop level according to the rehabilitation potential within the systems. Although there were a number of wetlands identified at a desktop level as having rehabilitation potential, site access was limited due to the restricted number of roads to these wetlands. As such, in addition to rehabilitation potential, road access was also taken into account. A large focus of the rehabilitation for this area was to remove drains, berms and ridges and furrows associated with historical cultivation practises and the removal of alien invasive vegetation in an attempt to improve the system hydrology and overall wetland functioning and integrity in the post-rehabilitation landscape.

Table 4.2 Identified wetlands based on the desktop analysis and infield verification processes within the Amathole study area

Wetland Name and Number	Wetland Label	Hydrogeomorphic Unit	Area (ha)
Wetland 1	S32E-01	Weakly channelled valley-bottom	54.7
Wetland 2	S32E-02	Weakly channelled valley-bottom	24.4
Wetland 5	S32E-03	Weakly channelled valley-bottom	43.3
Wetland 16	S32E-04	Channelled valley-bottom	18.5

Should additional systems within the study be identified as potential wetlands to be incorporated into the WFWets programme in the future, comprehensive desktop assessments of rehabilitation opportunities should be reviewed, and fieldwork should be undertaken accordingly.

4.2.1 Wetland 1

Wetland 1 is a large valley-bottom wetland system, fed by valley-bottom and hillslope seepage wetlands (**Figure 4.3**). Historically, it was assumed that the system functioned as a weakly channelled valley-bottom, with very diffuse flows moving through the system and supporting wetland habitat by permanent wetness regimes. However, as the land was transformed from natural to cultivation, the functioning of the system changed fundamentally. A channel was excavated along the left bank of the wetland (looking downstream), which led to the desiccation of the mid-section of the wetland as the channel served to draw down the water table of the wetland. Alien invasive tree and shrub species have colonised a large section of the channel. In addition, a cut-off berm and drain was excavated along the right-hand bank of the wetland, preventing the seepage from the adjacent banks from entering the main valley bottom. Cut-off drains, berms and plough lines were identified running through portions of the wetland, altering the functioning of the system substantially. Despite the attempts at draining the wetland, the wetland comprised a mosaic of seasonal to permanent wetness zones within the middle to lower reaches of the system, with drier more desiccated areas towards the middle reaches of the wetland. Impacts associated with channel straightening, cut-off drains, berms and unstable re-entry points motivated for further detailed planning associated with the Phase 2 component of the study.

Livestock paths through sections of the wetland, and across the channel were identified, as well as active grazing in the wetland. Livestock pathways across the wetland and channel should be formalised to protect the wetland from continued trampling and to prevent the livestock from potentially getting stuck in the wetland and channel during high rainfall events.

It should be noted that the middle to lower portion of Wetland 1 was earmarked for rehabilitation only, since the upper reaches appeared to be fairly intact. The HGM unit was, therefore, defined at where the excavated channel and berm began and ended.

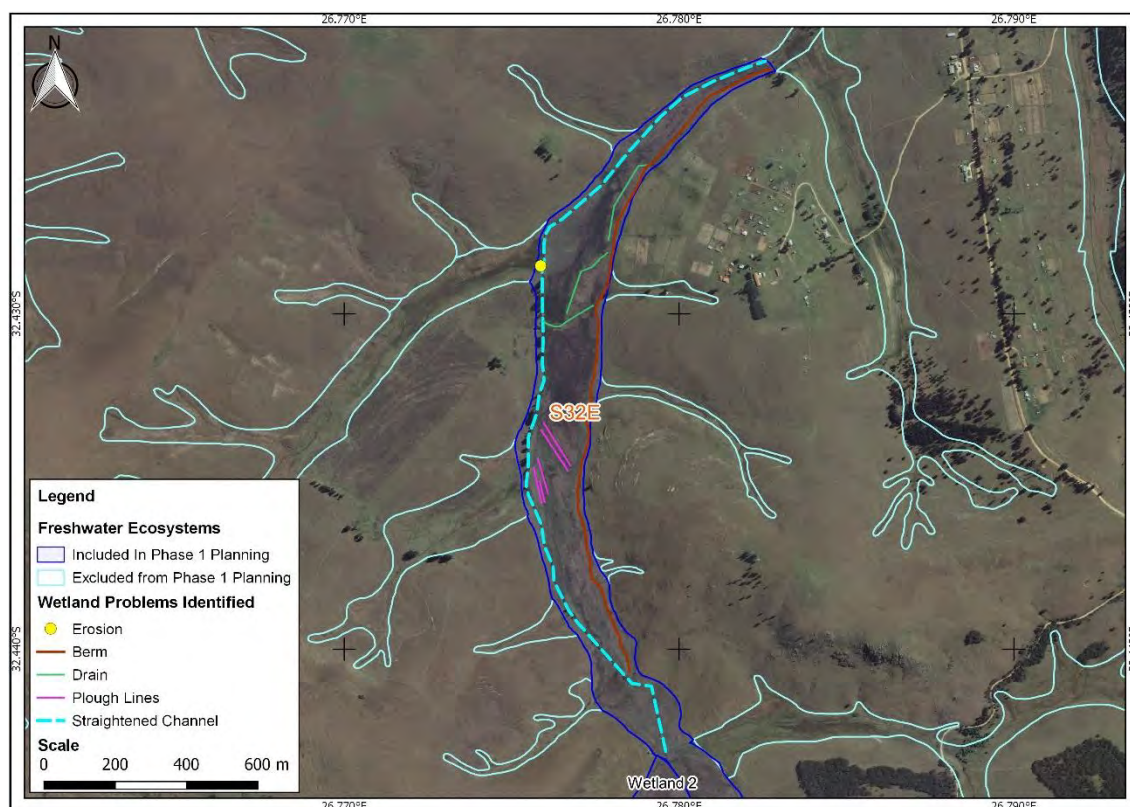


Figure 4.3 Overview of Wetland 1 and the location of the channel and drain



Figure 4.4 Straightened channel colonised by alien invasive tree species (left), and large berm running down the right-hand side of the wetland (right)

4.2.2 Wetland 2

Wetland 2 is a weakly channelled valley-bottom wetland, which drains into the larger Wetland 1 system. The system is roughly 39ha in extent and is fed by a number of hillslope seepage wetland systems (**Figure 4.5**). It is anticipated that Wetland 2 was historically characterised by permanent and seasonally wet conditions, with diffuse flows moving through majority of the system. However, as a result of historical cultivation practises, the hydrology of the system has been largely altered. A combination of berms, drains, plough lines and stream channel modifications has led to the desiccation of portions of the HGM unit, making the system much drier than what the system would have been under natural conditions (**Figure 4.6**). Due to the changes in the natural hydrology of the system, disturbance tolerant vegetation such as

Arundinella nepalensis, *Eragrostis plana*, were the main vegetation types identified within the system. As with the case of Wetland 1, Wetland 2 extends further upstream than what the HGM unit has been defined as, since the area of focus for this study was the middle to lower reaches of the system. Signs of livestock grazing were noted within the system, and, should it be an option, better grazing management systems should be employed into these systems to ensure sustainable land use. Tributaries associated with Wetland 2 were visited during the Phase 1 fieldwork, however, issues associated with land owner permission and site access were of a concern. As such, these features were flagged infield during Phase 1, but were excluded from the Phase 2 planning.

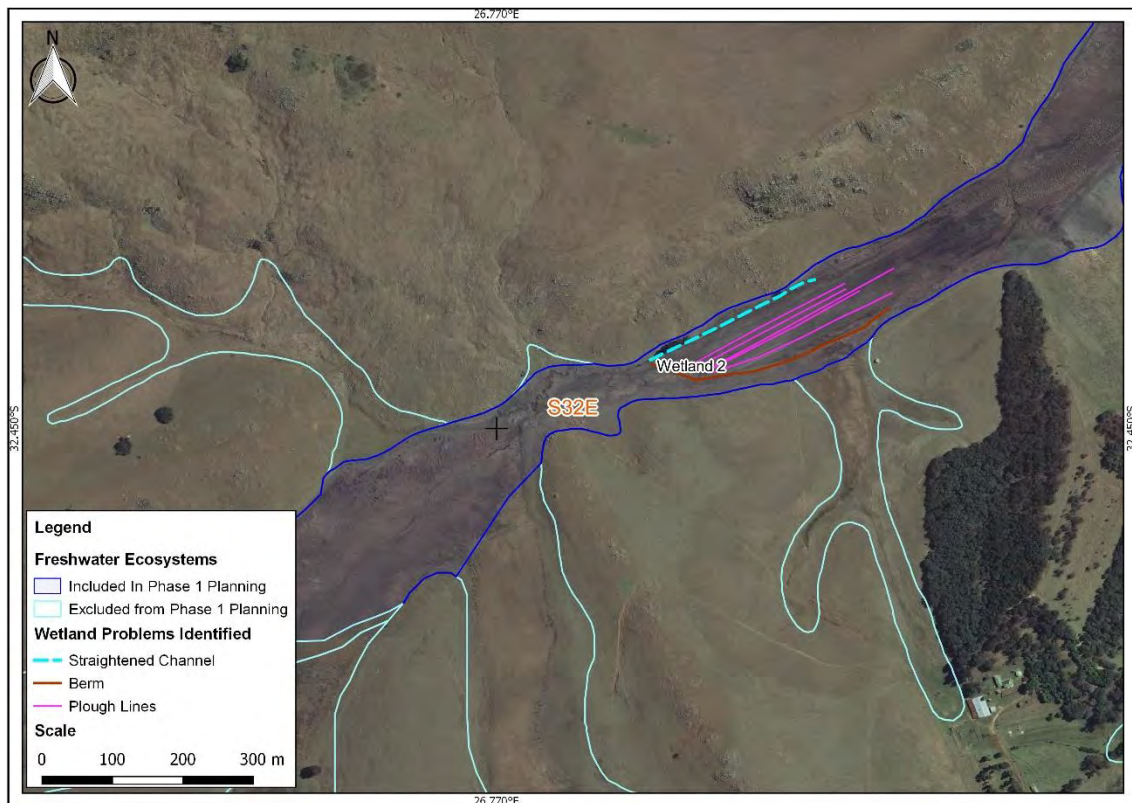


Figure 4.5 Overview of Wetland 2 indicating the location of the wetland problems



Figure 4.6 The straightened channel running down the left-hand bank of the wetland (left), and a berm limiting diffuse flows through the wetland (right)

4.2.3 Wetland 5

Wetland 5 is a channelled valley-bottom wetland, however it may have been less channelled historically before anthropogenic changes to the system took place (**Figure 4.7**). The movement of water is largely through a channel, which flows along the left bank of the wetland, moving across to the right-hand bank closer to the toe of the wetland before it is directed underneath an existing road. Remnants of the natural channel are clearly visible along the left-hand bank of the wetland towards the toe of the system. However, the lower-most section of the channel has since avulsed and flows through an incised channel to the right of the historical channel. This portion of the *new* channel is fairly incised, and some of the channel banks are eroding. A headcut is located just above where the channel avulsion has occurred, however the headcut has eroded to bedrock, limiting any threats of continued erosion and scour in that portion of the channel. Multiple unstable re-entry points were identified along the *new* channel, which may pose a threat to the wetland habitat upstream of these erosion features and should, therefore be secured to avoid the loss of wetland habitat. An informal sheep crossing was noted upstream of the headcut that should be stabilised to ensure that the crossing can be used safely by sheep and/or goats and the herdsman, especially during times of high flood waters through the system (**Figure 4.8**).

Upstream of the livestock crossing the system was noted to be in a stable condition and no signs of erosion or rehabilitation potential was noted during the desktop and infield assessment. As such, rehabilitation potential was focussed mainly on the lower to middle reaches of the system.



Figure 4.7 Overview of Wetland 5 and some observation points



Figure 4.8 The headcut erosion on bedrock (left), and the livestock stream crossing that requires attention (right)

4.2.4 Wetland 16

Wetland 16 is a fairly large channelled valley-bottom system, which has been affected by historical cultivation practises which have negatively altered the functioning and integrity of the system. The HGM unit has been defined from the confluence of this wetland and Wetland 5 up to where the gradient change was noted. A number of hillslope seeps feed into the HGM unit, as well as lateral flows from the upstream valley-bottom system. The HGM unit is characterised by a fairly incised channel, which moves through the upper to middle portion of the wetland and dissipates towards the toe of the wetland. The upper reaches have sections of actively farmed portions, with drains and cultivated vegetation and alien invasive vegetation species. Since this wetland largely falls out of the permitted land access, only the toe of the wetland was considered, so as not to encroach further onto a site where no permissions had previously been arranged. The toe of the wetland had multiple headcuts and active erosion. These areas were prioritised for rehabilitation to stabilise the localised erosion before it led to further loss of wetland habitat further upstream.

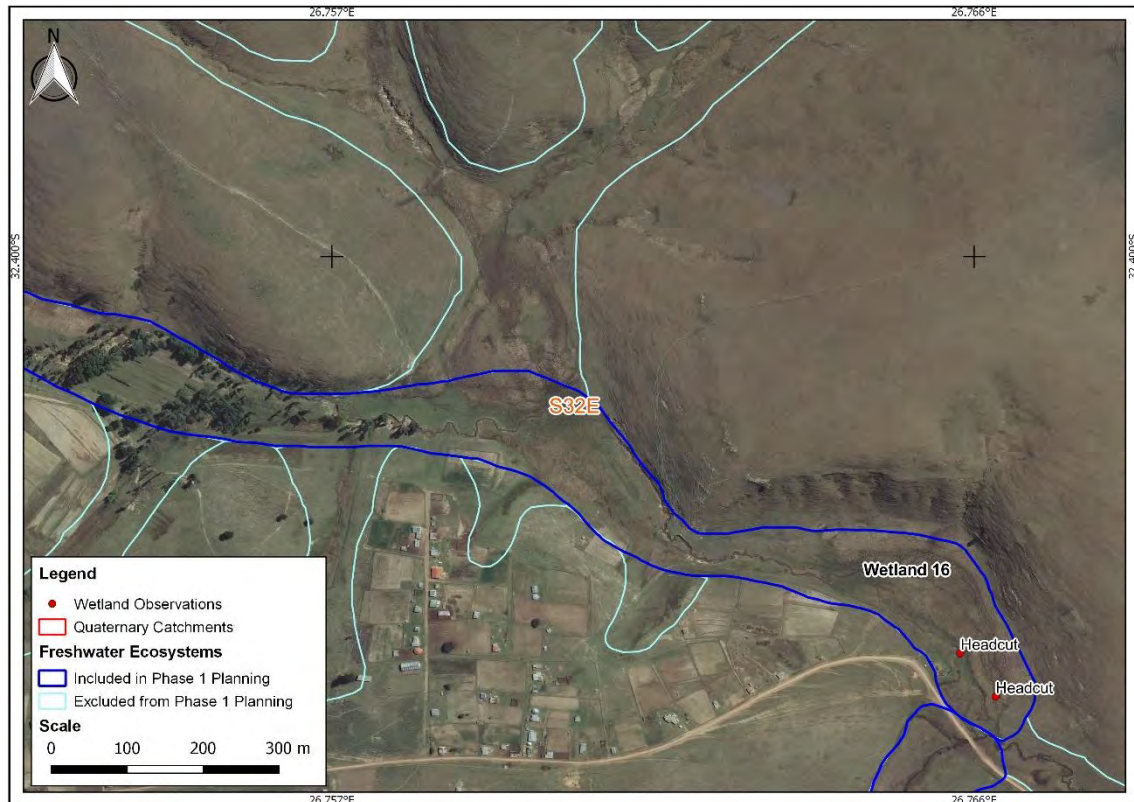


Figure 4.9 Overview of Wetland 16 and some observation points



Figure 4.10 The headcut erosion identified at the toe of Wetland 16

4.3 Prioritized Wetlands

Due to the limitations regarding site access to numerous wetlands identified at a desktop level for Phase 1 planning, many of the systems could not be visited infield. As such, those wetland systems that were in close proximity to accessible roads (i.e. facilitated access for implementation) were prioritised for inclusion in the Phase 2 planning. The wetlands were prioritised to ensure a suitable number of wetlands were identified for rehabilitation taking into consideration the budget requirements for approximately three years. In addition, prioritisation of the wetland considered the need to balance the quantity of 'hard' rehabilitation interventions and 'soft' rehabilitation interventions.

Furthermore, the following considerations were taken into account when prioritizing the different candidate wetlands:

- Severity of impacts;
- Biodiversity contributions;
- Cost of the required rehabilitation strategy the number and type of interventions; and
- Ease of access to get material and machinery/people to site to undertake the rehabilitation.

Although all three wetlands identified during the Phase 1 desktop planning have been prioritised for rehabilitation, it is recommended that the wetlands be prioritised in the following order:

- Wetland 1;
- Wetland 5,
- Wetland 2; and then
- Wetland 16.

Wetland 1 is considered the highest priority due to the anticipated gains associated with deactivating the main channel and berm within the wetland. These rehabilitation measures are anticipated to be a combination of 'hard' and 'soft' rehabilitation interventions; providing a favourable balance between the two. In addition, the anticipated gains associated with the rehabilitation of this system is deemed to be highly beneficial and cost-effective. The removal of the alien invasive vegetation located along the channel banks is also anticipated to improve the overall vegetation integrity of the system.

Wetland 5 has been prioritised as the next system to be rehabilitated due to the anticipated gains associated with the rehabilitation of the system. Although the identified headcut, and portions of the system have eroded to bedrock posing little threat of further erosion, the incised channel downstream of the headcut is likely to continue eroding laterally if rehabilitation interventions are not implemented. Should this erosion continue, the integrity of the wetland upstream will be significantly affected, with portions of the wetland being lost as a result of this erosion. There may also be potential of diverting flows down the historical channel, thereby reactivating this portion of the wetland that has since become inactive and desiccated and will reduce the energy of the flows moving down the incised channel. It is anticipated that this rehabilitation may allow for a favourable balance between hard and soft interventions, whilst securing maximum gains from the rehabilitation.

Wetland 2, situated upstream of Wetland 1 is a smaller wetland in comparison to the two above-mentioned wetlands, and the rehabilitation identified within this wetland is more related to improving wetland functioning than securing or stabilising erosion. As such, there is less urgency to implement the rehabilitation initiatives; which is related mostly to the removal of drains, berms and plough lines associated with historical cultivation.

Wetland 16 has been prioritised for rehabilitation due to the active erosion identified at the toe of the wetland. Although it was recognised that the HGM unit is fairly degraded, the wetland habitat towards the toe of the wetland was noted as worth protecting from further degradation

and loss. However, since no formal land access permissions were granted for this wetland, permission will need to be attained prior to the commencement of any rehabilitation work. In addition, it was anticipated that more rehabilitation work could be investigated for this wetland system once land access permissions have been granted.

Based on the prioritization process, and the identification of the three wetlands to be incorporated into the rehabilitation plan, the systems have been labelled according to the WfWets labelling protocol (**Table 4.3**) for Phase 2 rehabilitation planning purposes.

Table 4.3 Wetland prioritization

Wetland Name	Wetland Label	Hydrogeomorphic Unit	Priority
Wetland 1	S32E-01	Channelled valley-bottom	High
Wetland 2	S32E-02	Channelled valley-bottom	Medium
Wetland 5	S32E-03	Channelled valley-bottom	High
Wetland 16	S32E-04	Channelled valley-bottom	Low ²

4.4 Landowner Consent

The study area, as defined in **Figure 4.1**, is under custodianship by Chief Tyhali and, as such, the wetlands within the study area are under his management and control. The ASD for this WfWet area has been in contact with the Chief regarding work to be undertaken within the identified systems. A comprehensive meeting including the Chief and the interested community members was undertaken with the ASD. This meeting allowed the ASD to discuss and describe the proposed systems to be rehabilitated and the general anticipated outcomes of such rehabilitation (for example: the removal of the berms will lead to the rewetting of a large area of wetland possibly making the system inaccessible to livestock). Some of the issues that the community raised at the meeting included:

- Whether the rewetting and raising of the water table will lead to the potential drowning of livestock and herders, specifically during high flood events;
- Whether the proposed removal of alien vegetation, including wattle (*Acacia mearnsii*), pine (*Pinus pinaster*) and poplars (*Populus sp.*) may result in the loss of firewood lots for the communities and the importance of finding a balance between removals and agreed upon wood lots will be necessary;
- The question as to whether the rehabilitation of these systems would require more intensive livestock management and whether this would influence the number of livestock able to graze in these areas;
- The effects of implementing more intensive livestock management associated with the rehabilitation and whether it will force the communities to decrease their total livestock counts; and
- Whether the community will benefit from job creation associated with the rehabilitation implementation and ongoing WfWets work in the area.

Through these meetings, it was communicated that the community sell the wool from their sheep directly to HBK, a company situated in Port Elizabeth. Therefore, the wetland rehabilitation plan would need to find a balance between instilling sustainable livestock

² The *low* priority is associated with the lack of land access permissions at the time of the site visit and Phase 1 planning. As such, formal access to the site should be granted prior to the implementation of any rehabilitation.

management without hindering the earning potential of the community. In this regard, the community communicated that they would happily introduce rotational grazing into their ongoing livestock control to support sustainability in the area. With regards to the wood lots, following much discussion, the community were happy that the alien invasive plants within the water courses can be removed, whilst the wood lots outside of these areas may be kept for biofuel.

Overall, the community seemed positive about the proposed introduction of rehabilitation measures into their systems and a positive partnership between the entities can be established going forward. A transparent and open relationship will be built from the very beginning, ensuring that all stakeholders are aware of the proposed work and the consequences thereof. A good relationship with the community from the start of the project may ensure that wetland rehabilitation work for the future can be secured. To ensure that the livestock stocking rates on the grazed lands are according to best practise recommendations, guidelines on livestock stocking rates will be reviewed and integrated into the Phase 2 recommendations.

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WORKING FOR WETLANDS
PROVINCE: EASTERN CAPE
PROJECT: AMATHOLE



Phase 2: Wetland Status Quo Report
DRAFT

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List of Acronyms

Acronym	Explanation
ASD	Assistant Directors
CARA	Conservation of Agricultural Resources Act
DAFF	Department of Agriculture, Forestry and Fisheries
DWAF	Department Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIS	Ecological Importance and Sensitivity
EPWP	Expanded Public Works Programme
HGM	Hydrogeomorphic
IDP's	Integrated Development Plans
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NRM	Natural Resource Management Programme
NWA	National Water Act
PES	Present Ecological State
PGS	Present Geomorphic State
PHS	Present Hydrological State
PIP	Project Implementation Plan
PVS	Present Vegetation State
WCA	Water Catchment Areas
WfWet	Working for Wetlands

Glossary of Terms

Term	Explanation
Best Management Practise (BMP)	Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWet implementers. Such practises are informed by applied research.
Biophysical	The biological and physical components of the environment (Cowden and Kotze, 2008).
Catchment	All the land area from mountaintop to seashore which is drained by a single river and its tributaries. Each catchment in South Africa has been subdivided into secondary catchments, which in turn have been divided into tertiary catchments. Finally, all tertiary catchments have been divided into interconnected quaternary catchments. A total of 1946 quaternary catchments have been identified for South Africa. These subdivided catchments provide the main basis on which catchments are subdivided for the integrated catchment planning and management (Cowden and Kotze, 2008).
Ecosystem services or 'eco services'	The service such as sediment trapping or water supply, supplied by an ecosystem (in this case a wetland ecosystem).
Enhancement	The modification of specific structural features of an existing wetland to increase one or more functions based on management objectives, typically done by modifying site elevations or the proportion of open water
Facultative wetland plant negative	Plants that occur for <25% of the time in wetland or water saturated areas.
Facultative wetland plant positive	Plants that occur for between 67% and 99% of the time in wetland or water saturated areas.
Facultative wetland plant	Plants that occur 50% of the time in wetland or water saturated areas.
Intervention	A method of wetland rehabilitation that aims to address the objectives of the particular wetland system, namely to restore the hydrological integrity of the system and support associated biodiversity. It can be in the form of a hard (structures made of hard materials which are fixed e.g. a concrete weir or soft interventions e.g. re-vegetation))
Intervention – hard	An intervention that's predominant material comprises concrete and/or gabions
Intervention - soft	An intervention that is considered to be predominantly earthworks based
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, the same location, having the same capacity and performing the same function as the previous structure ('like for like').
Obligate wetland plant	Plants that occur >99% of the time in wetland or water saturated areas.
Project	An area of WfWet intervention generally defined by a quaternary catchment or similar management unit such as a national park in which a single implementer operates.
Quantum GIS	A GIS programme that is used to present all data at a spatial scale
Quaternary catchments	"A fourth order catchment in a hierarchical classification system in which a primary catchment is the major unit: and that is also the "principal water management unit in South Africa' (DWS, 2011).
Rehabilitation	1) The recovery of a degraded wetland's health and ecosystem service delivery by reinstating the natural ecological driving forces or 2) halting the decline in health of a wetland that is in the process of degrading, so as to maintain its health and ecosystem service-delivery" (Kotze et

	al., 2008:p14) . A system that is rehabilitated is not expected to be restored back to its reference state/benchmark
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.
Terrestrial vegetation	Vegetation that is found in drier landscape settings, and can often only survive short periods of inundation or saturated soils.
Wetland	"Wetland means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil" (National Water Act No. 36 of 1998).
Working for Wetlands	Working for Wetlands (WfWets) is a government programme managed under the Natural Resource Management Programme (NRM) of the Department of Environmental Affairs. It is a joint initiative with the Departments of Water and Sanitation (DWS), and Agriculture, Forestry and Fisheries (DAFF).

1. OVERVIEW OF WORKING FOR WETLANDS

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

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

1.1 Objectives of Working for Wetlands

WfWet 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. WfWet encourages municipalities to participate in provincial wetland forums because they are the platform for the roll-out of all the programmes processes, including planning for future work. Provincial wetland forums also offer support from the government departments and private sectors that are represented. Partnerships with non-governmental organizations and the private sector are also critical, requiring collaboration and cooperation with a wider range of stakeholders and role players in the wetland management field. The newly identified strategic framework of WfWet has underlined the need for a more refined process that the programme is embarking on with catchment-scale planning. Catchment-scale planning seeks to promote ecosystem-scale outcomes, long-term custodianship, and embedding of rehabilitation in broader local institutions and frameworks. The recent move to a systematic wetland rehabilitation planning process has provided a fertile and conducive platform for partnerships to be formed and/or strengthened as it draws in a much wider stakeholder base. This is in line with NRM's objective to increase its footprint through Land User Incentive based projects.

1.2 Relevant legislation, policies and guidelines applicable to the project

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

- National Environmental Management Act, 1998 (NEMA)
- National Environmental Management: Biodiversity Act, No 10 of 2004 (NEMBA)
- National Water Act, 1998 (NWA)
- Conservation of Agricultural Resources Act, 1993 (CARA)

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

1.3 Introduction to project

The Amathole study site includes the wetland areas within the Amathole mountain range and the Hogsback areas. Priority areas were identified during the Phase 1 planning process (GroundTruth, 2019) just outside the town of Seymour in the Eastern Cape Province (**Table 1.1**). The focus of the wetland rehabilitation within the S32E quaternary catchment will be the stabilisation of active erosion and the deactivation of drainage canals, straightened channels and berms; which all run through portions of the identified wetland systems. The study area as described in this rehabilitation plan refers to the majority of the wetlands visited within Chief Tyhali's tribal land boundary, which is located within S32E, whilst one wetland was located just offsite of the Chief's boundary (**Figure 1.1**Error! Reference source not found.).

Table 1.1 Project area descriptions of the quaternary catchment included in the study

Province	Eastern Cape
Quaternary Catchment	S32E
Project Name	Amathole
Land Owner / Partnership	Tribal land
Planning Phase	Phase 2
Nearest Town	Seymour
Previous Work	No
Project Description	Identification of rehabilitation opportunities within wetland systems prioritised during the Phase 1 assessments.

All wetlands within the S32E study site are located on tribal lands owned by one chief, Chief Tyhali. WfWet has been involved in rehabilitation planning and implementation within the Hogsback area, situated within the Q94A quaternary catchment. Since majority of the rehabilitation opportunities within the Hogsback area have been exhausted, systems beyond Hogsback and into the Amathole mountain ranges were reviewed. A need to expand into the greater project area was identified in 2018 through consultation with relevant stakeholders. The wetlands in this area have been impacted upon by a combination of drains, berms, channel straightening, erosion and the encroachment of alien invasive vegetation. In addition to the in-system impacts, issues of over-grazing and trampling of sections of the systems was evident during the site visits. Despite these impacts, portions of the wetland systems are still intact (i.e. upstream of the identified impacts) and the rehabilitation and removal of these stressors to the lower reaches of the system may lead to fundamentally improving the overall system functioning.

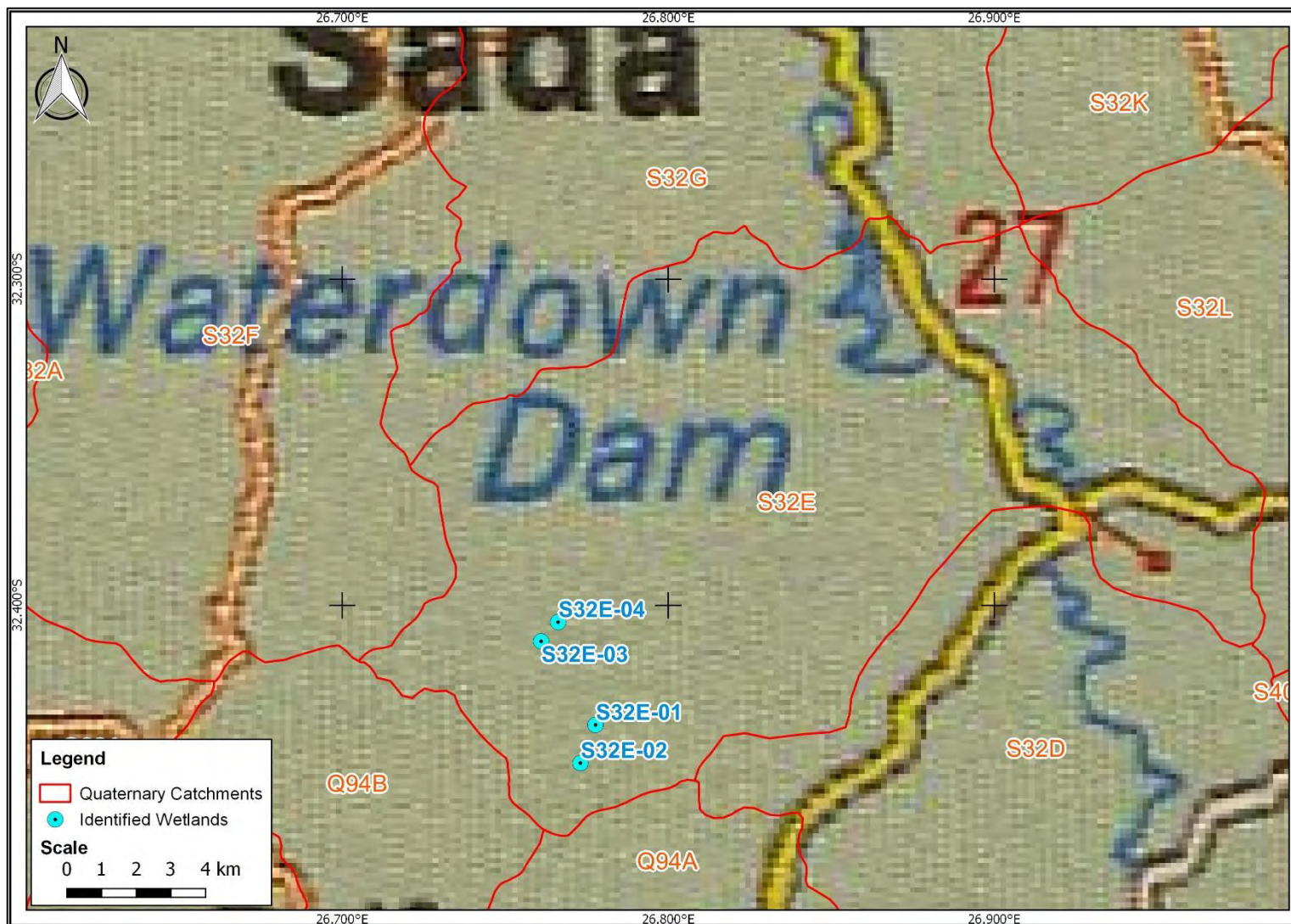


Figure 1.1 Location of the prioritised wetlands within their respective quaternary catchments

2. METHODOLOGY

The rehabilitation of freshwater ecosystems is considered to be a complex undertaking and the planning process involves multiple disciplines. The following methodology was adopted for the project and comprised of multiple steps, using existing information from previous studies and infield observations.

2.1 Assessment of wetland functioning and condition

Determining the impacts on the wetland habitat requires the assessment and thus understanding of the levels of functioning and condition/integrity of the wetlands for the current and post-rehabilitation scenarios. These assessments will be undertaken for those systems identified for rehabilitation.

2.1.1 Assessment of wetland functioning

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

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

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

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

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

Table 2.1 Ecosystem services supplied by wetlands
(Kotze *et al.*, 2007, p14)

Ecosystem services supplied by wetlands				
Indirect benefits		Regulating and supporting benefits		
Water quality enhancement benefits		Flood attenuation		The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream
		Stream flow regulation		Sustaining stream flow during low flow periods
		Sediment trapping		The trapping and retention in the wetland of sediment carried by runoff waters
		Phosphate assimilation		Removal by the wetland of phosphates carried by runoff waters
		Nitrate assimilation		Removal by the wetland of nitrates carried by runoff waters
		Toxicant assimilation		Removal by the wetland of toxicants (e.g. metals, biocides and salts) carried by runoff waters
		Erosion control		Controlling of erosion at the wetland site, principally through the protection provided by vegetation
Carbon storage		The trapping of carbon by the wetland, principally as soil organic matter		
Direct benefits		Biodiversity maintenance		
Provisioning benefits		Through the provision of habitat and maintenance of natural process by the wetland, a contribution is made to maintaining biodiversity		
		Provision of water for human use		The provision of water extracted directly from the wetland for domestic, agricultural or other purposes
		Provision of harvestable resources		The provision of natural resources from the wetland, including livestock grazing, craft plants, fish, etc.
Cultural benefits		Provision of cultivated foods		The provision of areas in the wetland favourable for the cultivation of foods
		Cultural heritage		Places of special cultural significance in the wetland, e.g. for baptism or gathering of culturally significant plants
		Tourism and recreation		Sites of value for tourism and recreation in the wetland, often associated with scenic beauty and abundant birdlife
		Education and research		Sites of value in the wetland for education or research

2.1.2 Ecological importance and sensitivity

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

Table 2.2 Ecological Importance and Sensitivity Classes

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

2.1.3 Assessment of wetland condition/integrity

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

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

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

Table 2.3 Impact scores and present state categories for describing the integrity of wetlands (MacFarlane *et al.*, 2007)

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

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

2.2 Wetland rehabilitation and maintenance planning

A rehabilitation plan was compiled to achieve desired levels of functioning and integrity within the wetland systems. The compilation of the rehabilitation plan was based on a site visit by the relevant specialists, including:

- A wetland specialist responsible for highlighting those problems identified as undermining the hydrological, geomorphic and vegetation integrity of the wetland habitat within the site and providing a rehabilitation strategy and objectives to achieve improvements in system functioning and integrity;
- An environmental/soil conservation engineer responsible for identifying appropriate earthen, gabion and/or concrete interventions to achieve the rehabilitation objectives outlined by the ecologist;
- Project Environmental Assessment Practitioner (EAP) is responsible with over-seeing the proposed rehabilitation and determining whether environmental authorisation will be required for the overall strategy.
- The Assistant Director (ASD) for the province assists in identifying issues within various wetland systems and drives the relationship between the rehabilitation planning team and the affected communities. Often their understanding of the general landscape assists in defining the prioritised systems and identifying existing rehabilitation structures that may require maintenance activities.

2.3 Monitoring and Evaluation

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

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

2.3.1 Fixed point photography/ Site photographs

Pre-implementation photographs were recorded for the wetland and/or wetland complex, to provide a visual baseline of the system prior to the implementation of the proposed rehabilitation activities. Visual monitoring can then be undertaken in subsequent years to document the changes of the systems.

2.3.2 Wetland assessments

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

3. ASSUMPTIONS AND LIMITATIONS

Studies that focus on the potential response of natural systems rely on various assumptions, with the following assumptions and limitations being made during the assessment of these particular wetland systems:

- The extent of wetlands was determined through desktop delineation and verified by means of a rapid field assessment for this study.
- Due to the number of wetland systems delineated at a desktop level, only a few systems were prioritised for the screening fieldwork associated with Phase 1. As such, only those sites prioritised during the Phase 1 component of the study were considered for the Phase 2 component.
- The site access to certain wetland systems, namely the full extent of the S32E-04 wetland, was limited by land owner consent, since it fell outside of Chief Tyhali's land. As such, only the toe of this wetland was specified for rehabilitation, despite there being potential rehabilitation opportunities further upstream.
- The recovery of the vegetation on the site (under anticipated rehabilitated conditions) is expected to follow a pattern of succession from more terrestrial species to a more perennial, stable wetland plant community. For this reason, a lag period of a least five years was adopted to illustrate the medium-term impacts on vegetation following the hypothetical rehabilitation of the site.
- Assessment of impacts and rehabilitation outcomes is informed by a structured process, but is based on opinion rather than exact science (e.g. no supplementary monitoring of actual vegetation sampling was undertaken to assess the current mix of species within different areas).
- The assessment of importance and sensitivity is based on available desktop information and limited interactions with local stakeholders.
- The assessment of the wetland systems' ecological integrity includes catchment conditions and it should be noted that changes in the HGM units' catchments beyond those linked to the rehabilitation, may have an adverse effect on the systems' integrity. The assessment of wetland health is based on limited field assessments.

4. WETLAND DESCRIPTIONS

Phase 1 planning associated with this project included a desktop review and infield verification of the issues within the identified wetland systems, the potential rehabilitation options and the prioritisation of systems based on anticipated returns associated with the proposed wetland rehabilitation initiatives. The Phase 1 component of the study directly informed the Phase 2 site visit, which included the team engineers, to quantify and formalise the wetland rehabilitation approach to optimise the functioning of the selected wetlands. The selected wetlands are located within the S32E quaternary catchment, within Chief Tyhali's tribal land, just outside of Seymour town (**Table 4.1**). The focus of the rehabilitation is to stabilise any existing erosion, remove any historical cultivation impacts within the wetland and eradicate alien invasive vegetation from within the freshwater ecosystems.

Table 4.1 Project area description for the quaternary catchment included in the study

Province	Eastern Cape
Quaternary Catchment	S32E
Project Name	Amathole
Land Owner / Partnership	Community Land
Planning Phase	Phase 2
Nearest Town	Seymour
Previous Work	No
Project Description	Identification of rehabilitation opportunities within wetland systems prioritised during the Phase 1 assessments.

Although there were multiple wetlands identified as candidate systems for rehabilitation during the Phase 1 desktop assessment, due to the size of the systems and the limited road access to some sites, only four systems were prioritised for inclusion into the rehabilitation plan for the study site. These systems were fairly large in extent and the potential return-on-investment regarding the anticipated response of the systems to the proposed rehabilitation initiatives was favourable. **Figure 4.1** provides an overview of the wetlands within the study site area and those prioritised for rehabilitation. **Table 4.2** provides a summary of the wetlands that have been included in the Phase 2 planning, and associated rehabilitation strategy.

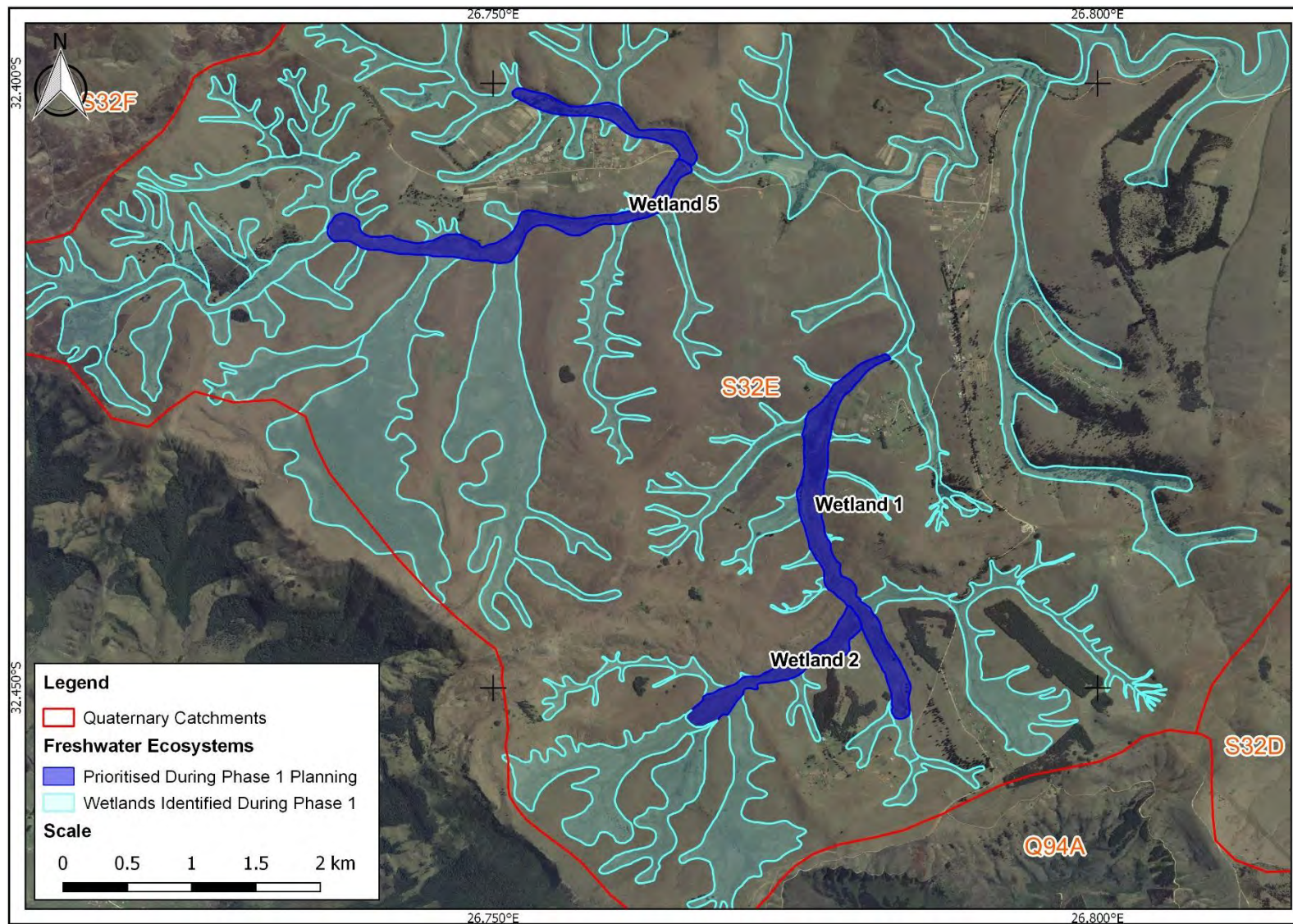


Table 4.2 Wetlands investigated during the desktop analysis process and the reason for the inclusion in terms of the infield verification process

Quaternary Catchment	Wetland Label and Number	WET IS Label	Hydrogeomorphic Unit	Area (ha)	Latitude	Longitude	Reason for inclusion
S32E	Wetland 1	S32E-01	Weakly-channelled valley-bottom	54.7	32° 26' 08.55" S	26° 46' 35.83" E	Great opportunities for rehabilitation, that showed potential for an ideal balance between 'hard' and 'soft' rehabilitation interventions.
	Wetland 2	S32E-02	Weakly-channelled valley-bottom	24.4	32° 26' 54.87" S	26° 46' 22.53" E	Great opportunities for rehabilitation, that showed potential for an ideal balance between 'hard' and 'soft' rehabilitation interventions.
	Wetland 5	S32E-03	Weakly-channelled valley-bottom	43.3	32° 24' 39.14" S	26° 45' 30.47" E	A large wetland system that can be secured and its functioning enhanced through fairly simple rehabilitation initiatives; combining both 'hard' and 'soft' intervention options to secure the rehabilitation.
	Wetland16	S32E-04	Weakly-channelled valley-bottom	18.5	32° 24' 23.02" S	26° 46' 28.43" E	Multiple small headcuts were identified are the toe of the HGM unit, which threaten the upstream wetland habitat. Stabilisation of this erosion will assist in improving the functioning and integrity of the system in the future.

4.1 Wetlands identified for rehabilitation assessment

Based on the findings of the desktop analysis and Phase 1 wetland prioritisation, infield verification of the identified wetlands was undertaken. Based on the findings from the Phase 1 desktop analysis and infield verification exercises, four (4) wetlands (Error! Reference source not found. and **Table 4.2**) that cover an area of approximately 140.9 ha, were prioritised as candidate wetlands for the Phase 2 detailed wetland rehabilitation planning and assessment.

Since only these four wetlands were incorporated into the Phase 1 planning and included in the Phase 2 fieldwork and assessment, they were the only systems that were allocated a formal WET-IS identification number. Should additional systems within the study be identified as potential wetlands to be incorporated into the WFWets programme in the future, comprehensive desktop assessments of rehabilitation opportunities should be reviewed, and Phase 2 fieldwork planning should be undertaken accordingly.

4.2 Wetland 1 (S32E-01)

4.2.1 Wetland Details

Table 4.4 provides a summary of Wetland 1 (S32E-01).

Table 4.3 Wetland 1 (S32E-01) wetland details.

Wetland Name	Wetland 1
Wetland Number/Label	S32E-01
GPS Location	32° 26' 08.55" S 26° 46' 35.83" E
Catchment Land Use	Old abandoned lands, grazing
Wetland Land Use	Current livestock grazing, historical cultivation
Wetland Size	54.7 ha

4.2.2 Wetland Characteristics

Wetland 1 (S32E-01) has been classified as a weakly-channelled valley-bottom wetland system. Upon a review of the historical imagery for this system, intensive cultivation practises were evident within the majority of the wetland valley-bottom from before 1954. As a result of these practises, impacts such as drains, channel straightening, berms and cut-off drains were the main contributing factors to shifting the system into a channelled system, desiccating portions of the HGM unit entirely as a result. Directing majority of the diffuse flows into a straightened channel, thus allowed for a better opportunity for cultivation as the areas became desiccated. Although the wetland is no longer actively cultivated, the impacts associated with the historical farming of the system are still fairly evident in the current scenario, and are significantly altering the natural functioning of the wetland system.

The catchment associated with this wetland is a combination of low-density rural housing, a moderately low density of dirt roads and only slightly disturbed grasslands as a result of over-grazing by livestock. The catchment is fairly extensive (1580ha), however the good vegetation

cover within the catchment assists in ensuring that the rate of infiltration occurring during heavy rainfall events is fairly efficient. However, the steep natural topography of the catchment increases the potential for high storm peak flows entering the wetland system. The main wetland channel runs along the left-hand bank of the wetland, and although it is assumed that the historical channel ran down a similar route, the current channel has been straightened and deepened; which can be mostly attributed to channel incision as a result of the straightening of the channel. A fairly significant section of the channel has been colonised by alien invasive tree species, which included *Poplar sp.* and *Pinus sp.* A substantial berm runs along the right-hand edge of the wetland in parallel to the main channel, reducing the diffuse movement of water from the adjacent slopes and seeps into the valley-bottom. These changes to the system are as a result of historical cultivation practises within the HGM unit. The impacts of livestock on the HGM unit were evident by the trampling and pathways through sections of the wetland and the informal channel crossing points noted within the wetland and across the channel.

Despite the previous attempts to control the movement of water through the system for cultivation purposes, the lower to middle portions of the HGM unit were dominated by large patches of permanent wetness zones, characterised by a combination of *Juncus effusus* and *Carex sp.* The high-water table associated with these portions of the wetland may be linked to shallow bedrock across this portion of the wetland, providing an impermeable layer and limiting the ability of the water to move vertically, thereby maintaining large permanently wet areas.

It was noted during the Phase 2 fieldwork that the berm along the right-hand edge of the wetland has breached at multiple locations along the length, reducing the efficacy of the berm and allowing the pooling and diffuse movement of water into the middle portions of the system. Due to the restored hydrological conditions within these reaches of the system, obligate wetland species such as *Carex sp.* and *Juncus effusus* dominate these portions of the system. Since *J. effusus* is a disturbance tolerant plant, it is currently dominating a large portion of the wetland, which is unfavourable since it is not representative of the benchmark vegetation. Multiple plough lines and cut-off drains were clearly visible within the middle reaches of the HGM unit. An alluvial mound was noted near the ploughed areas, as the natural ground level was notably higher than the rest of the wetland. It was assumed that this alluvium may have been deposited by the tributary linking into the main stem, and depositing material as it lost stream power and carrying capacity. This section of the wetland was much drier, colonised by terrestrial grasses and patches of bramble (*Rubus fruticosus*) rather than the obligate wetland species noted downstream in the wetter portions of the wetland, such as *Carex sp.*.

Headcut erosion was identified at one of the tributary re-entry points into the main channel. This tributary's wetland extent was fairly substantial and looked to be in fairly good condition. Therefore, should the erosion associated with the headcut continue upstream through the wetland, it is likely that a significant portion of the wetland system may be lost. It should be noted that this headcut was associated with the main stream channel, and not within a new wetland HGM unit, since the headcut is occurring along the banks of the wetland's channel. However, the opportunity for additional rehabilitation measures within this additional HGM unit should be investigated during future rehabilitation planning cycles.

The wetland appeared to be in a fairly stable condition, despite the impacts of the berms, drains, channel modifications, alien invasive vegetation encroachment and slightly unstable re-entry points. As such, the rehabilitation of this system is anticipated to be greatly beneficial in improving the overall functioning and integrity of the system.

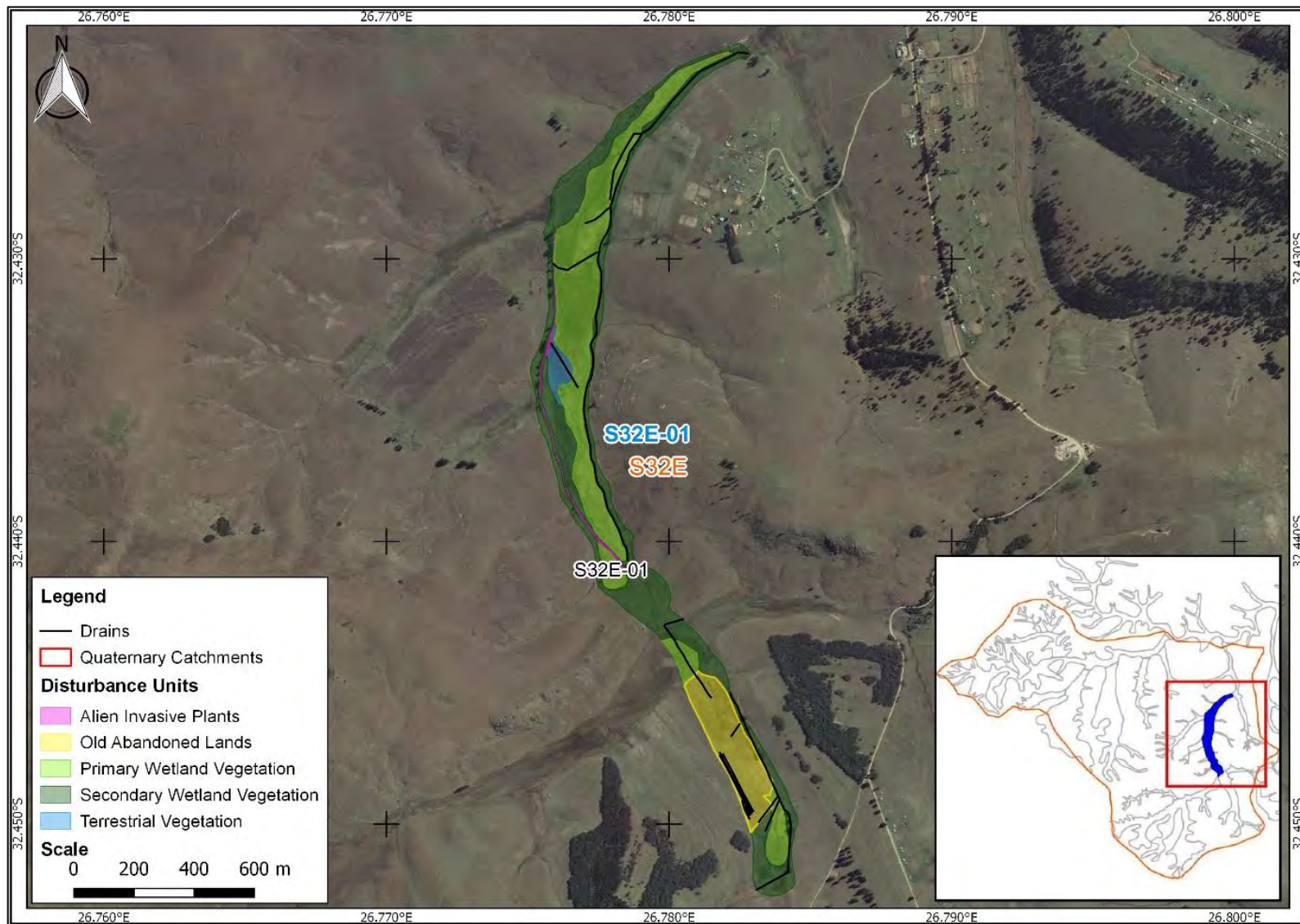


Figure 4.2 Current wetland impacts for wetlands S32E-01

4.2.3 Benchmark or reference state (S32E-01)

Table 4.4 Wetland 1 (S32E-01) reference benchmark state

Characteristic	Description
HGM Unit	Weakly-channelled valley-bottom wetland.
Wetness Regime	Dominated by permanently and seasonally saturated soils. Fed by both surface and sub-surface water flows.
Hydrology	Under natural conditions flow through the wetland would have been slow-moving and diffuse, based on the gentle gradient and weakly-channelled system
Geomorphology	Due to the gentle gradient, limited erosion and transportation of sediment out of the wetland would have occurred.
Vegetation	<i>Carex</i> sp. dominating the permanent zones, whilst a mixed sedge meadow vegetation type characterised the more seasonal wetland edges, largely being obligate and facultative positive plant species.

4.3 Wetland 2 (S32E-02)

4.3.1 Wetland Details

Table 4.6 provides a summary of Wetland 2 (S32E-02).

Table 4.5 Wetland 2 (S32E-02) wetland details.

Wetland Name	Wetland 2
Wetland Number/Label	S32E-02
GPS Location	32° 26' 54.87" S 26° 46' 22.53" E
Catchment Land Use	Old abandoned lands, grazing
Wetland Land Use	Current livestock grazing, historical cultivation
Wetland Size	24.4 ha

4.3.2 Wetland Characteristics

Wetland 2 (S32E-02) was historically cultivated, as indicated by the plough lines, berms, drains and straightened/modified channel noted at a desktop level and verified infield during the Phase 2 rehabilitation planning. A review of the historical imagery showed that fairly intensive cultivation along the banks and encroaching slightly into the wetland was occurring in 1949. However, between then and 1985, cultivation then moved directly into the wetland, specifically in the lower and middle reaches of the HGM unit, where ploughed fields are evident in the historical imagery and the impacts of this disturbance were still evident in the current functioning of the wetland. Due to the impacts of the historical cultivation activities, the HGM unit is functioning as a much drier wetland relative to the expected natural state. In addition to the changes in the HGM unit affecting the hydrology of the system, the excessive ploughing

has led to the disturbance of the soils and the introduction of AIPs and disturbance-tolerant vegetation.

Prior to the cultivation and transformation of this wetland, the historical imagery shows a wetland that largely functioned as a weakly-channelled system, with a main flow path running along the left-hand bank of the system, and diffuse flows and flood waters moving across majority of the wetland. There are multiple seeps flowing into the main valley-bottom, thereby sustaining the wetland through a combination of lateral and sub-surface flows. The implementation of the berms and drains within the HGM unit during the cultivation practises has significantly impacted on the functioning of the system, confining flows and reducing the diffuse movement of water into and through the system, leading to the desiccation of portions of the wetland. During the site visit for Phase 2 planning it was noted that there were still sections of permanently wet areas, however they were mostly confined to the drains, berms and shallow plough lines. Although it was assumed that the main channel ran along the left-hand bank of the HGM unit naturally, the current channel, although running along a similar course, has been modified and possibly incised as a result. The channel is currently larger in terms of cross-sectional area and as such able to accommodate greater volumes of water before overtopping, thereby reducing the amount of water entering the wetland and reducing the extent of the permanent wetness zones within the system. Portions of the channel upstream of the HGM unit were more meandering and much shallower than the channel within the S32E-02 wetland HGM unit. These upstream sections were used to inform an understanding of the characteristics of the stream prior to the channel modifications and was used to guide the formulation of the benchmark state of the wetland, as assessed within the wetland assessments.

The catchment of Wetland 2 (S32E-02) is fairly extensive, roughly 620ha, and is mostly intact with a few impacts linked to alien invasive tree species encroachment. Due to the limited road access to areas within the catchment, there were limited settlements and very limited anthropogenic impacts. Issues associated with livestock grazing were notable, where some areas were slightly more impacted than others. Often the areas closer to the settlements were more heavily impacted by grazing, where disturbed vegetation was identified as colonising the over-grazed and heavily disturbed areas.

There was no evidence of active erosion within the HGM unit, and as such no direct threat to the integrity of the wetland. However, through the removal of the berms and drains, and the deactivation of portions of the modified channel, it is anticipated that this wetland's integrity will improve significantly.

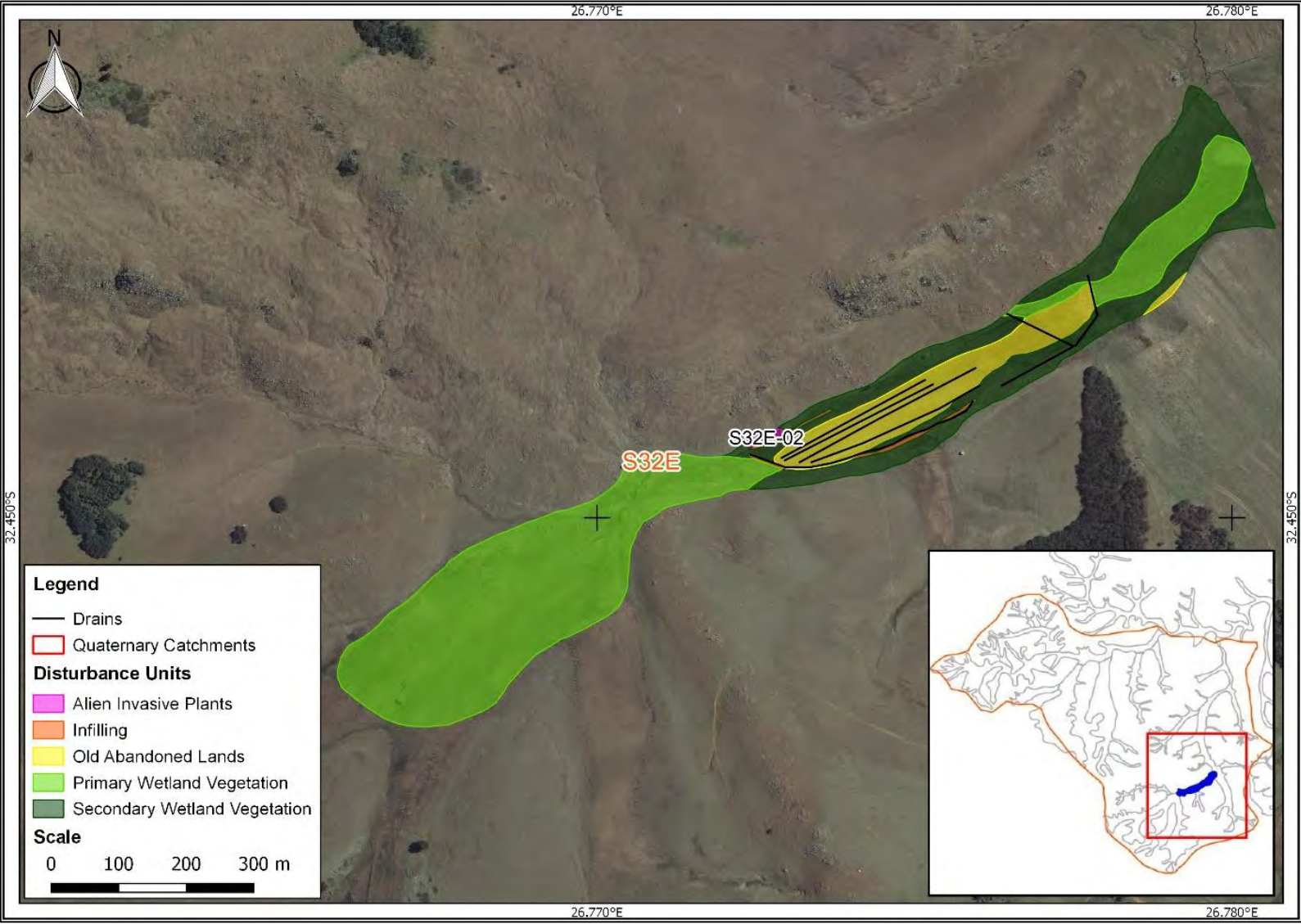


Figure 4.3 Current wetland impacts for wetlands S32E-02

4.3.3 Benchmark or reference state (S32E-02)

Table 4.6 Wetland 2 (S32E-02) reference benchmark state

Characteristic	Description
HGM Unit	Weakly-channelled valley-bottom wetland.
Wetness Regime	Dominated by permanently and seasonally saturated soils. Fed by both surface and sub-surface water flows.
Hydrology	Under natural conditions flow through the wetland would have been slow-moving and diffuse, based on the gentle gradient and weakly-channelled system
Geomorphology	Due to the gentle gradient, limited erosion and transportation of sediment out of the wetland would have occurred.
Vegetation	<i>Carex sp.</i> dominating the permanent zones, whilst a mixed sedge meadow vegetation characterised the more seasonal wetland edges, largely being obligate and facultative positive plant species.

4.4 Wetland 5 (S32E-03)

4.4.1 Wetland Details

Table 4.8 provides a summary of Wetland 5 (S32E-03).

Table 4.7 Wetland 5 (S32E-03) wetland details

Wetland Name	Wetland 5
Wetland Number/Label	S32E-03
GPS Location	32° 24' 39.14" S 26° 45' 30.47" E
Catchment Land Use	Old abandoned lands, grazing
Wetland Land Use	Current livestock grazing, historical cultivation
Wetland Size	43.32ha

4.4.2 Wetland Characteristics

Wetland 5 (S32E-03) is a fairly large valley-bottom wetland system that moves between an unchannelled, to channelled system, with weakly-channelled sections in-between. The upper reaches of the wetland is dominated by seasonal and permanent wetness zones, with large areas covered by surface water retained in what looked to be natural depressions. These depressions are assumed to be a natural feature within this landscape, identified in multiple other wetland systems, and possibly an indicator of wetlands that are largely natural. The catchment of Wetland S32E-03 is large (1808ha) and has minimal human disturbances affecting the overall integrity. The encroachment of alien invasive vegetation and over-grazing are the two main impacts on the system and within the catchment as a whole, however having a limited impact on the overall catchment integrity.

The lower reaches of the system have eroded down to bedrock, as the system works to achieve a natural equilibrium following anthropogenic impacts. Issues affecting the integrity of the system were noted towards the middle to lower reaches of the HGM unit. The upper reaches of the HGM unit were regarded as being fairly stable and did not require any rehabilitation work. A large headcut was identified within the middle reaches of the HGM unit, however the headcut has eroded down to bedrock, and cannot progress further upstream. In addition, portions of the channel upstream and downstream of the headcut are on bedrock. A historical channel runs along the left-hand edge of the HGM unit, which was abandoned possibly as a result of the headcut advancement years ago. This has led to channel avulsion, and the channel now runs through the middle to right-hand side of the HGM unit. The channel showed signs of active erosion, as unstable banks and channel deepening were evident. In addition, unstable re-entry points were noted along sections of the channel that, although not eroding heavily, may become an erosion risk in the future especially during storm events, where the energy within the system increases substantially. It is anticipated that this lateral/re-entry erosion will continue, and although the channel cannot erode upstream due to the presence of bedrock, it is still able to widen and erode horizontally, leading to the direct loss of the adjacent wetland habitat.

The movement and presence of livestock within the wetland has led to a slight degradation of wetland features, such as trampling of wetland vegetation and informal stream crossings, however over-grazing of the vegetation within the wetland was not identified as a serious concern at this point in time. A semi-formal livestock crossing was noted towards the middle to upper reaches of the HGM unit. A community member had raised this crossing as fairly dangerous and unstable, especially during high rainfall events, posing a threat to both the community and their livestock. As such opportunities to upgrade the stream crossing was included in the Phase 2 planning.

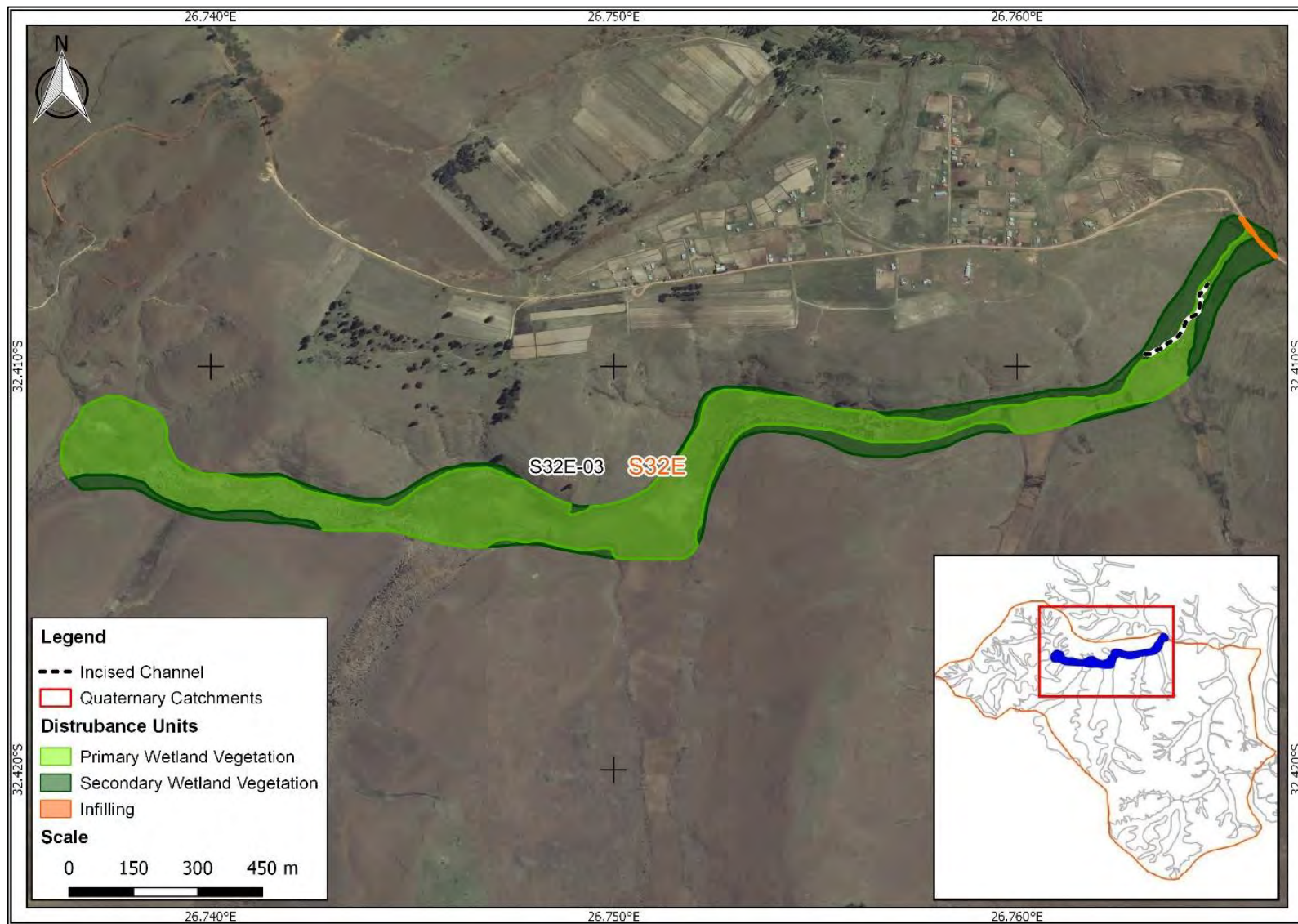


Figure 4.4 Current wetland impacts for wetland S32E-03

4.4.3 Benchmark or reference state (S32E-03)

Table 4.8 Wetland 5 (S32E-03) reference benchmark state

Characteristic	Description
HGM Unit	Alternating between a weakly-channelled to unchannelled valley-bottom wetland.
Wetness Regime	Dominated by permanently and seasonally saturated soils. Fed by both surface and sub-surface water flows.
Hydrology	Under natural conditions flow through the wetland would have been slow-moving and diffuse, based on the gentle gradient and weakly-channelled system
Geomorphology	Due to the gentle gradient, limited erosion and transportation of sediment out of the wetland would have occurred.
Vegetation	<i>Carex</i> sp. dominating the permanent zones, whilst a mixed sedge meadow vegetation characterised the more seasonal wetland edges, largely being obligate and facultative positive plant species.

4.5 Wetland 16 (S32E-04)

4.5.1 Wetland Details

Table 4.4 provides a summary of Wetland 16 (S32E-04).

Table 4.9 Wetland 16 (S32E-04) wetland details.

Wetland Name	Wetland 16
Wetland Number/Label	S32E-04
GPS Location	32° 24' 23.02" S 26° 46' 28.43" E
Catchment Land Use	Old abandoned lands, grazing
Wetland Land Use	Current livestock grazing, historical cultivation
Wetland Size	18.5 ha

4.5.2 Wetland Characteristics

Wetland 16 (S32E-04) is a large channelled valley-bottom wetland. It was assumed that this wetland operated as a weakly-channelled system, however various drivers of in-system erosion has led to fairly significant channel incision through a large portion of the HGM unit. The channel incision occurring within the wetland is likely to have occurred due to system instabilities associated with the historical cultivation activities, aggravating the erosion occurring within the system. A tributary that enters into the wetland towards the middle to lower reaches of the HGM unit has led to the deactivation of the channel incision, possibly as a result of sediment being deposited and the eroded channel being plugged with this sediment and

stabilising slightly. However, further downstream of the sediment deposition area, the channel incision continues as it was not stabilised by the sediment deposition areas.

This system forms part of the main valley-bottom wetland system, into which Wetland S32E-03 drains. Portions of the system have previously been cultivated, disturbing the natural functioning and integrity of the system's hydrology, geomorphology and vegetation. The historical farming activities, such as ploughing, drains and altering the natural surface levels and movement of water, has led to the disturbance of the soils and a platform on which alien invasive species were given the opportunity to encroach. As such, not only have these affected areas been impacted upon by the invasion of alien invasive shrubbery, invasive trees have also taken over a large portion of the upper reaches of the HGM unit.

The catchment is mostly intact with issues of small-scale alien invasive vegetation encroachment, old abandoned farm lands and low-density housing settlements. Over-grazing was noted to be more of an issue closer to the settlements, whilst fairly controlled grazing with limited impacts was noted within the broader catchment. There are multiple freshwater ecosystems merging into the valley-bottom system, making the hydrological contributions to the system a combination of surface and sub-surface inputs.

At the toe of the HGM unit, multiple small headcut erosional features were identified, and it was assumed that these may be as a result of the construction of the road directly downstream of the system. Concentrated and increased surface water flows associated with the road culverts may be one of the drivers of the degradation, as the flows are confined through the road culverts and directed downstream, causing an increase in the in-system energy, possibly leading to the destabilisation of sections of the system and resultant erosion. These headcuts were still well-vegetated and fairly confined in nature. Since these headcuts are located at the base of the large HGM, it was recommended that these should be stabilised before they continue to erode further upstream, eventually reaching the already incised channel. Should the headcuts erode to meet the incised channel, it is assumed that erosion within the HGM unit will be exacerbated and the remaining wetland habitat within the HGM unit could be lost. Due to the constraints in land owner consent for this wetland at this point in time, rehabilitation opportunities were limited to the base of the wetland. However, it is highly likely that more rehabilitation opportunities will exist should the site be considered for rehabilitation planning in the next cycle.

The movement and presence of livestock within the wetland, such as trampling of wetland vegetation, were evident within the HGM unit, however over-grazing of the vegetation did not look to be a major issue, especially within the lower reaches of the system.

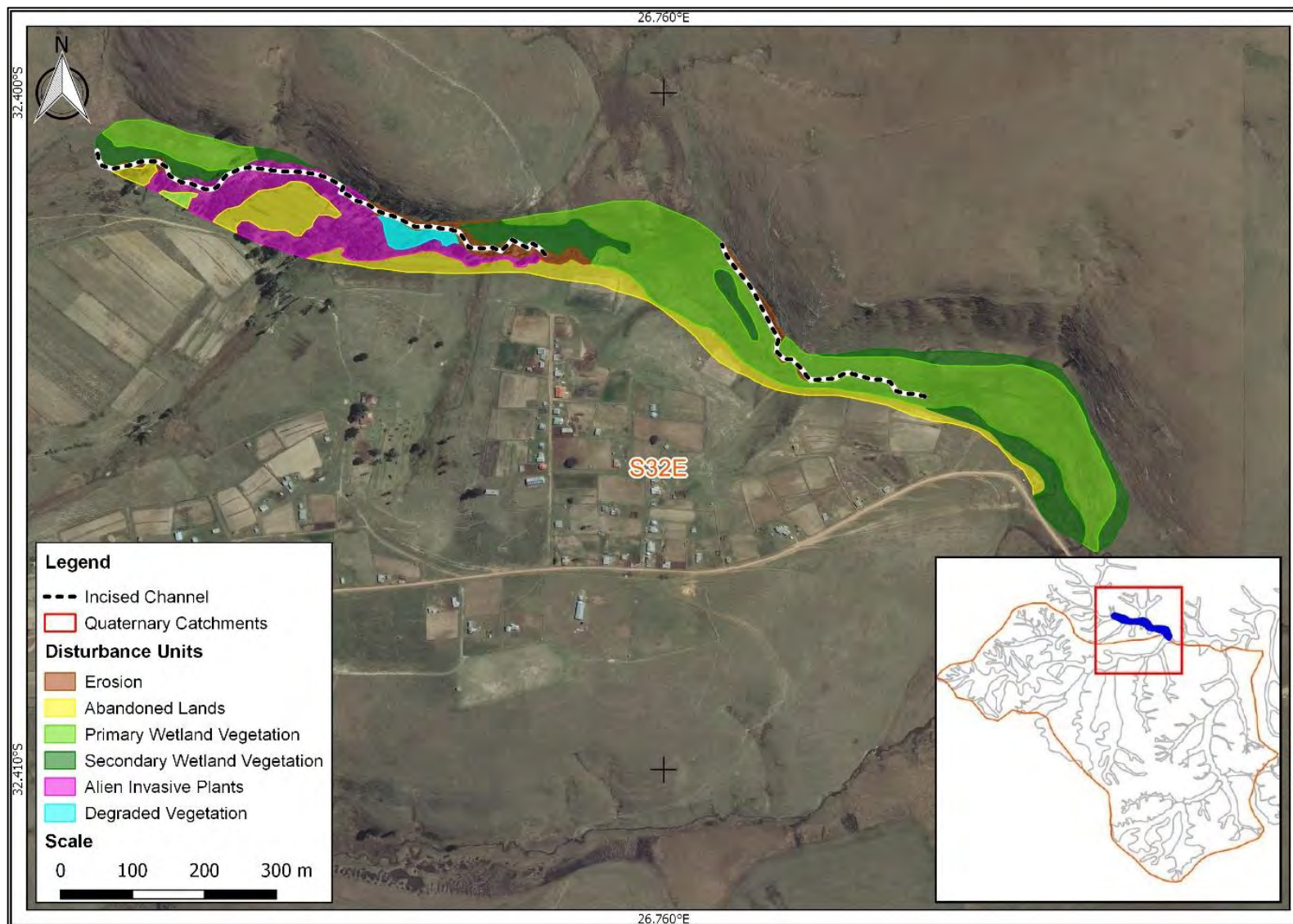


Figure 4.5 Current wetland impacts for wetland S32E-04

4.5.3 Benchmark or reference state (S32E-04)

Table 4.10 Wetland 16 (S32E-04) reference benchmark state

Characteristic	Description
HGM Unit	Alternating between a weakly-channelled to unchannelled valley-bottom wetland.
Wetness Regime	Dominated by permanently and seasonally saturated soils. Fed by both surface and sub-surface water flows.
Hydrology	Under natural conditions flow through the wetland would have been slow-moving and diffuse, based on the gentle gradient and weakly-channelled system.
Geomorphology	Due to the gentle gradient, limited erosion and transportation of sediment out of the wetland would have occurred.
Vegetation	<i>Carex</i> sp. dominating the permanent zones, whilst a mixed sedge meadow vegetation characterised the more seasonal wetland edges, largely being obligate and facultative positive plant species.

5. STUDY RESULTS

5.1 Wetland ecological functioning

The general features of the wetlands were assessed in terms of the ecosystem functioning at a landscape level for the current and post-rehabilitation scenarios. The score for each ecosystem service represents the likely extent to which that benefit is being supplied by the specific wetland and was interpreted based on the following rating outlined by Kotze et al. (2007):

< 0.5 **Low**
0.5-1.2 **Moderately low**
1.3-2.0 **Intermediate**
2.1-2.8 **Moderately high**
> 2.8 **High**

Generally, the wetlands were seen to be supplying regulatory ecosystem services at a **Moderately Low** to **Moderately High** level for the current scenario (**Table 5.1**). This is largely associated with the extent of vegetation cover, surface roughness, hydrological zonation and biodiversity maintenance of the wetlands (Kotze et al. 2007). In some instances, the wetlands' effectiveness at providing a particular ecosystem service differs markedly from the opportunity that exists to supply that ecosystem service. For example, the effectiveness of the wetlands in trapping sediment was considered to be lower than the opportunity of the wetlands to trap sediment.

Overall the wetlands were considered to be important in terms of stream flow regulation, erosion control, enhancing water quality within the landscape and biodiversity maintenance for the current scenario. The systems' provision of direct benefits and services, such as natural resources were fairly high due to the grazing of livestock within the wetland systems, which provides particularly good foliage during the drier winter months. The wetlands received a **Moderately Low** score for tourism and recreation, which could be attributed to the location of the wetlands within tribal lands and being a fair distance from any popular tourist routes or destinations. The scores for biodiversity maintenance ranged between **Moderately High** to **High**, which was associated with the sighting of crowned cranes just outside the wetland areas, and the high potential of these wetlands in providing favourable breeding sites for cranes due to the high permanently wet and well-vegetated wetland areas.

Generally, for the post-rehabilitation scenario, the effectiveness of the systems, in terms of the supply of ecosystem services, is likely to increase (**Table 5.1**), which is as a result of proposed wetland rehabilitation measures. The opportunity of supplying these ecosystems services will be maintained as it was assumed that there will be no catchment-based changes.

Many of the wetlands identified for rehabilitation, were seen to be fairly stable, and the rehabilitation measures were therefore specified to improve the current functioning and integrity of the systems; specifically, for wetlands S32E-01 to S32E-03. However, S32E-04 was identified as having fairly unstable erosion occurring within the toe of the wetland that has the potential of eroding through majority of the wetland system and possibly exacerbating the channel incision and erosion within the upper reaches of the HGM unit. As such, the implementation of the proposed rehabilitation measures within this HGM unit is likely to secure the system and protect the intact portions of the wetland. As such, the averted loss associated

with the S32E-04 wetland is related to the loss in the provision of services associated with flood attenuation, water quality improvements, erosion control. In addition, a decrease in the scenic beauty due to the continued erosion and degradation of the wetland is likely to affect tourism potential.

Table 5.1 Wetland functioning for wetlands S32E-01, S32E-02, S32E-03 and S32E-04

		S32E-01		S32E-02		S32E-03		S32E-04		
Ecosystem Service		Current State	Post-rehab	Current State	Post-rehab	Current State	Post-rehab	Current State	Post-rehab	Averted Loss
		Importance Score	Change Score (%)	Importance Score	Change Score (%)	Importance Score	Change Score (%)	Importance Score	Change Score (%)	Change Score (%) ¹
Regulatory and Supporting Services	Flood Attenuation	1,5	5,0	1,6	2,5	1,3	5,0	1,5	0,0	-4,6
	Stream Flow Regulation	2,7	0,0	2,7	0,0	2,7	0,0	2,5	0,0	0,0
	Sediment Trapping	2,0	2,5	2,2	2,5	2,0	2,5	2,1	0,0	0,0
	Phosphate Trapping	2,0	5,0	2,3	5,0	2,0	5,0	2,0	0,0	0,0
	Nitrate Removal	2,9	5,0	3,0	7,5	2,8	5,0	2,7	0,0	0,0
	Toxicant Removal	2,1	5,0	2,4	5,0	2,1	7,5	2,1	0,0	0,0
	Erosion Control	2,6	10,0	2,8	7,5	2,3	15,0	1,6	5,0	-2,5
	Carbon Storage	2,3	10,0	2,3	10,0	2,3	10,0	1,3	0,0	0,0
	Biodiversity Maintenance	2,6	10,0	2,8	2,5	2,8	2,5	2,5	0,0	-14,1
Provisioning Services	Water Supply	1,1	0,0	1,1	0,0	1,1	0,0	0,9	0,0	0,0
	Harvestable Natural Resources	2,4	0,0	2,4	0,0	2,4	0,0	2,4	0,0	0,0
	Cultivated Foods	1,0	0,0	1,0	0,0	1,0	0,0	1,0	0,0	0,0
Cultural Services	Socio-Cultural Significance	1,0	0,0	1,0	0,0	1,0	0,0	1,0	0,0	0,0
	Tourism and Recreation	0,3	2,5	0,3	2,5	0,3	7,5	0,1	0,0	-2,5
	Education and Research	0,3	0,0	0,3	0,0	0,3	5,0	0,3	0,0	0,0

¹ It should be noted that it is anticipated that the current and post-rehabilitation scenario will remain unchanged/similar assuming that the proposed rehabilitation will protect the wetland in its current state; known as averted loss.

5.2 Ecological importance and sensitivity

The wetlands' EIS scores were mainly within the **C** category, with the S32E-04 wetland scoring a **D** (**Table 5.2**) for the current scenario. The overall importance and sensitivity therefore ranges from moderate to low. In this instance, the EIS category for the wetlands was derived from the ecological importance and sensitivity, and/or hydro-functional importance scores, i.e. the highest of three scores is used to determine the overall ecological importance and sensitivity category of the wetland. The ecological importance and sensitivity was linked to the endangered vegetation type, the Present Ecological Status (PES) of the wetlands and type of wetlands. The hydro-functional importance is strongly linked to the fact that the systems' effectiveness and opportunity to perform water quality enhancement is high.

Although the EIS scores improved in the post-rehabilitation scenario, they did not improve from one category to another. As such, the wetlands remain within the **C-D** categories. The improved scores were largely related to the improvements in erosion control, carbon storage and water quality improvements through the implementation of the wetland rehabilitation strategy.

Table 5.2 Summary of the EIS Scores for wetlands S32E-01 to S32E-04

	S32E-01		S32E-02		S32E-03		S32E-04	
	Current	Post-rehab	Current	Post-rehab	Current	Post-rehab	Current	Post-rehab
Ecological Importance and Sensitivity	2.2	2.4	2.0	2.2	2.2	2.2	2.0	2.0
Hydro-functional Importance	2.3	2.5	2.4	2.6	2.2	2.4	2.0	2.0
Direct Human Benefits	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0
Overall Importance and Sensitivity Score	2.3	2.5	2.4	2.6	2.2	2.4	2.0	2.0
Overall Importance and Sensitivity Category	C	C	C	C	C	C	D	D

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

5.3 Wetland ecological integrity assessment

The ecological integrity or PES of the wetlands was assessed for the hydrology, geomorphology and vegetation components. The integrity of the biophysical components of the wetlands were assessed for the current and post-rehabilitation scenarios, with one wetland being assessed for an averted loss scenario; however only the current scores have been presented. The assessment results of the hydrological, geomorphic and vegetation components are outlined in the following sections.

5.3.1 Assessment of the current hydrological impacts

The four wetland systems have all been largely impacted upon by historical cultivation activities that have impacted the functioning and integrity of these wetlands over the years. Although the systems are no longer actively farmed, the impacts of drains, berms and channel modifications were still evident. There were very limited cases of active erosion within the systems, with S32E-04 possibly being the most threatened system in terms of active in-system erosion in the form of channel incision. The straightening of stream channels has led to increased flow velocities down the channels, leading to a degree of scour within the channels, and drawing down the water table within the adjacent areas; thereby desiccating portions of the wetlands as a result. The combination of the lowering of the water table and the berms and drains, has impacted upon the hydrology within the systems, where the systems are functioning as much drier wetlands then what would have occurred naturally. The encroachment of alien invasive vegetation within the systems may also have contributed to the reduced water levels within the systems.

The impact scores recorded for the hydrological component of the wetlands ranged from **1.0** to **5.0** translating into Present Hydrological State (PHS) categories of **B** to **D** (**Table 5.3**). The change in ecosystem processes therefore ranges from largely natural to largely modified. The water inputs into the systems were largely unmodified as the majority of the catchments associated with the wetlands were fairly intact, with a slight encroachment of alien invasive vegetation, scattered housing and grazing. The changes in water distribution and retention patterns were largely impacted upon by channel incision, berms and impacts associated with historical cultivation activities.

Table 5.3 Hydrological Impact Scores and PES categories for the current scenario

HGM Unit	S32E-01	S32E-02	S32E-03	S32E-04
Impact Type	Impact Score	Impact Score	Impact Score	Impact Score
Changes in water inputs	0.5	0.5	0.5	0.5
Changes in water distribution and retention patterns	5.6	3.0	1.0	2.2
Combined Hydrology Impact Score	5.0	3.0	1.0	3.0
PES Category	D	C	B	C

Description	Impact score	Present state category
Unmodified, natural.	0 – 0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 – 1.9	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2 – 3.9	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4 – 5.9	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 – 10	F

5.3.2 Assessment of the current geomorphic impacts

As the catchments associated with the wetland systems are largely intact and unmodified, limited impacts associated with altered flood peaks have been recorded. The main impact affecting the geomorphology of the wetland systems, similar to the hydrological component, is related to the presence of erosion associated with channel straightening, channel scour and unstable re-entry points within the systems. Wetland S32E-03 and Wetland S32E-04 were regarded as being the most unstable systems due to the degree of erosion occurring within the HGM units. All HGM units were impacted by channel straightening affecting how sediment is transported through the HGM unit, and the natural retention of water and sediments within the system has possibly been affected.

The impact scores recorded for the geomorphology component of the wetlands ranged from **0.5 to 2.4** translating into Present Geomorphic State (PGS) categories of **A to C (Table 5.4)**. The change in ecosystem processes therefore, ranges from natural to moderately modified.

Table 5.4 Geomorphological Impact Scores and PES categories for the current scenario

HGM Unit	S32E-01	S32E-02	S32E-03	S32E-04
Impact Type	Impact Score	Impact Score	Impact Score	Impact Score
Channel Straightening	1.2	0.6	0.0	0.0
Infilling	0.0	0.2	0.1	0.0
Erosional Features	0.5	0.0	0.4	1.2

Depositional Features	0.7	0.0	0.0	0.7
Combined Impact Score²	2.4	0.8	0.5	1.9
PES Category	C	A	A	B

5.3.3 Assessment of the current vegetation impacts

The catchments of the four wetland systems were largely intact, with the limited encroachment of alien invasive species. Due to the hydrological impacts (channelled flow), certain areas of the wetlands have become drier than they were naturally. This change in the hydrological regime has promoted habitat conducive to terrestrial or facultative/facultative negative plant species. Despite the impacts to the natural hydrological functioning of these systems, the wetlands were mostly wet enough to support the presence of favourable wetland species, with the exception of drier patches associated with plough lines leading to the formation of more terrestrial habitats, as noted in Wetland S32E-01 and Wetland S32E-02. Bramble was recorded in the drier areas of Wetland S32E-01 in the upper reaches of the HGM unit, where the wetland was significantly drier than its benchmark condition. In addition, *Poplar sp.* trees colonised majority of the stream channel banks of Wetland S32E-01, further reducing the opportunity of indigenous riparian species to colonise these areas. All wetlands displayed permanent, seasonal and narrow temporary zones, with some sections of the wetlands displaying limited impacts in terms of vegetation present and moisture content. This was especially the case for the S32E-01 HGM unit, towards the middle reaches of the of the HGM unit, where patches of *Carex sp.* was evident, which is likely to have been the dominant natural vegetation prior to disturbances.

The impact scores recorded for the vegetation component of the wetlands ranged from **1.8** to **4.1** translating into Present Vegetation State (PVS) categories of **B** to **D** (Table 5.5). The change in ecosystem processes therefore ranges from mostly natural to largely modified.

Table 5.5 Vegetation Impact Scores and PES categories for the current scenario

HGM Unit	S32E-01	S32E-02	S32E-03	S32E-04
Disturbance Class	Impact Score	Impact Score	Impact Score	Impact Score
Primary Wetland Vegetation	0.8	0.6	0.7	0.5
Secondary Wetland Vegetation	1.6	0.7	0.8	0.5
Degraded Vegetation	0.0	0.0	0.0	0.2
Alien Vegetation	0.3	0.0	0.0	1.4
Eroded Areas	0.0	0.0	0.1	0.4

² Sum of the three highest impact scores.

Infilling	0.2	0.1	0.0	0.0
Abandoned Lands	0.9	1.0	0.0	1.1
Impact Score	4.1	2.3	1.8	4.1
PES Category	D	C	B	D

5.3.4 Overall current state impacts

For ease of interpretation the scores for hydrology, geomorphology and vegetation are able to be simplified into a composite impact score for the HGM units by weighting the scores obtained as outlined in Macfarlane et al. (2007). A summary of the overall results from the current scenario are outlined below (**Table 5.6**). The assessment of the wetland habitat under current conditions identified modifications which include:

- Modifications associated with historic agricultural activities;
- Unstable re-entry points and headcut erosion;
- Impacts associated with the movement of livestock through the wetlands; and
- Alien invasive vegetation within the wetland habitat, increasing the direct uptake of water.

Table 5.6 Overall current wetland impact scores and PES categories

Wetland		S32E-01	S32E-02	S32E-03	S32E-04
Hydrology	Impact Score	5.0	3.0	1.0	3.0
	PES Category	D	C	B	C
Geomorphology	Impact Score	2.4	0.8	0.5	1.9
	PES Category	C	A	A	B
Vegetation	Impact Score	4.1	2.3	1.8	4.1
	PES Category	D	C	B	D
Overall	Impact Score	4.0	2.2	1.1	3.0
	PES Category	D	C	B	C

The composite impact scores were then used to derive hectare equivalents, which were used as the 'currency' for assessing the loss and/or gains in wetland integrity (**Table 5.7**) (Kotze and Ellery 2009).

The 140.9ha of wetland habitat is currently equivalent to 103.7ha of intact wetland habitat. Based on the post-rehabilitation PES scores for the wetlands, the condition of the wetland habitat is likely to improve considerably to the equivalent of 121.5ha of functional wetland habitat through the proposed rehabilitation measures. The rehabilitation interventions proposed for the S32E-01 to S32E-03 wetlands are largely to reinstate and support the natural recovery of the wetland HGM units. However, S32E-04 is actively eroding, which is acting as a potential threat to the current integrity of the wetland HGM unit upstream. As such, this wetland was assessed for averted loss, whereby it has been assumed that 1.2ha of wetland will be lost if the proposed rehabilitation at the toe of the wetland is not implemented. As such,

it is highly recommended to implement the proposed rehabilitation to both improve and secure wetland habitat in the future. It is important to note that rehabilitation measures proposed for the S32E-04 wetland should still be further considered since rehabilitation was only proposed for the toe of the wetland. This is due to the fact that land owner consent was not available for this site at the time of the Phase 2 planning fieldwork.

Securing wetland habitat from further degradation is considered to be just as important as reinstating wetland habitat within the landscape. This ensures that the current integrity and ecosystem services supplied by these systems are at least retained. The assessment of the various future scenarios emphasised the potential losses, should the proposed rehabilitation measures not be implemented, and highlighted that the rehabilitation of the systems would also contribute to reinstating portions of the wetland habitat. The combination of the averted loss and the gain in hectare equivalents from the assessed wetland systems would result in a contribution of 17.8 hectare equivalents. In addition to the rehabilitation of these systems, appropriate management of the catchments³ of these systems is encouraged, and would further enhance the integrity of the wetlands and improve the overall level of ecosystem services supplied by the wetlands. The graphic representation of the functional wetland area within the current, post-rehabilitation and without rehabilitation (averted loss) scenarios (**Figure 5.1**), clearly illustrates that the rehabilitation will result in a gain of approximately 17.8ha equivalents and a loss of approximately 1.2ha equivalents of wetland habitat if no rehabilitation takes place.

³ Erosion and alien invasive plant control

Table 5.7 Overall HGM unit hectare equivalents for each scenario

Wetland		S32E-01	S32E-02	S32E-03	S32E-04
Area (ha)		54.7	24.4	43.3	18.5
Current	Impact Score	4.0	2.2	1.1	3.0
	PES Category	D	C	B	C
	Hectare Equivalents	32.9	19.1	38.7	13.0
With Rehabilitation	Impact Score	1.5	0.9	0.9	N/A
	PES Category	B	A	A	N/A
	Hectare Equivalents	46.8	22.1	39.4	N/A
Averted Loss	Impact Score	N/A	N/A	N/A	3.6
	PES Category	N/A	N/A	N/A	C
	Hectare Equivalents	N/A	N/A	N/A	11.8

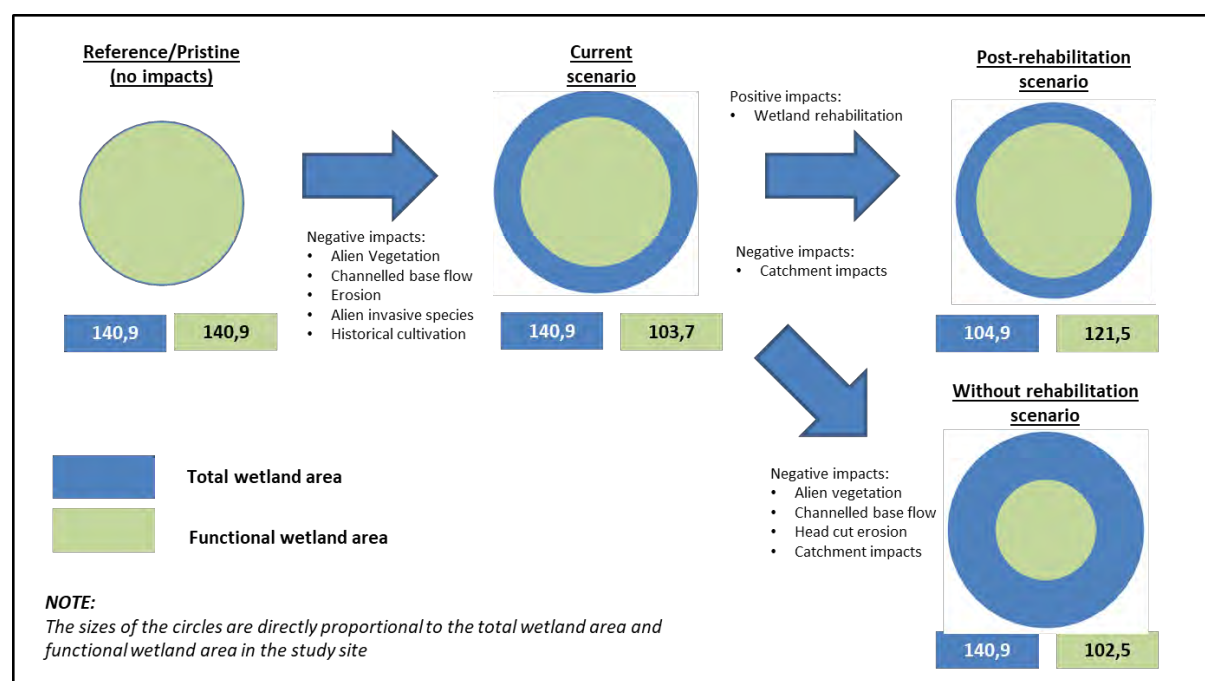


Figure 5.1 A graphic representation of the wetland habitat within the landscape, in terms of both spatial extent and functional area, from reference conditions through to the post-rehabilitation scenario (Cowden et al. 2013).

6. WETLAND REHABILITATION PLAN

Wetland rehabilitation can be described as a process in which the causes and symptoms of the wetland degradation are addressed, ensuring the wetland integrity and functionality are maintained and/or improved to a desired state. A proactive approach in terms of corrective interventions is recommended to address the impacts within the wetland systems. The following section serves to describe the rehabilitation of the wetland ecosystems, including the objectives, which attempt to maximise the levels of ecosystem functioning and integrity. The planning of the rehabilitation interventions was carried out by an environmental engineer, in conjunction with the wetland specialist, project EAP and the provincial ASD.

6.1 Wetland problems within the Amathole Wetlands

The biophysical drivers of the wetlands have been significantly impacted upon by historical activities and will be further impacted upon into the future, including *inter alia*:

- Historical agricultural land use practices;
- Over-grazing closest to the villages;
- Minor/negligible alterations to water flow in the catchments; and
- Alien invasive vegetation encroachment.

The wetlands identified within the Amathole study area were affected mostly by historical cultivation activities within the systems, erosion and slight degradation associated with infrastructure and grazing and movement of livestock through the wetland systems. Due to the size of these wetlands, and the total area of intact wetland within each system, it is anticipated that the implementation of rehabilitation initiatives will prove to be extremely beneficial. Securing any active erosion and deactivating the impacts associated with the historical cultivation activities will assist in improving the functioning of the affected wetlands and securing the systems' integrity for the future. The proposed rehabilitation strategy for the four systems identified for rehabilitation have been described in detail below.

6.2 Wetland rehabilitation aim and objectives

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

Aim:

Due to the intact and pristine nature of many systems within the larger Amathole area, the aim of the rehabilitation is to enhance the functioning and integrity of the wetland systems through the implementation of wetland restoration activities and stabilising those eroding features within wetland systems, thereby securing the wetland habitat upstream of the erosion and reducing the risk of losing fairly intact wetland areas upstream of the erosion.

Objectives:

The primary objective of the wetland rehabilitation is to secure and improve the overall integrity of the systems, particularly focusing on the removal of historical cultivation impacts within the affected wetlands and promoting the recovery of the hydrology, geomorphology and vegetation within each of the systems; thereby encouraging the recolonisation of indigenous wetland species within the wetland habitat, facilitating the provision of higher levels of

ecosystem service delivery, specifically the maintenance of biodiversity. The second objective is to stabilise any active erosion within the prioritised wetland systems through the stabilisation of these erosion features, thereby securing the wetland habitat upstream and improving the integrity of the wetlands overall.

6.3 Wetland rehabilitation strategy for Wetland 1 (S32E-01)

As mentioned in the sections above, only a portion of the larger Wetland 1 (S32E-01) system has been considered for rehabilitation. The area of focus for rehabilitation will aim to remove the impacts of the previous cultivation practises within the system. Portions of the main channel will be deactivated using a number of earthen berms incorporating a base-flow pipe, with some structures being reinforced with concrete-filled geocells to protect the integrity of the structures from livestock. These geocell-covered berms are those berms that are likely to be used as livestock crossing points across the channel. The objectives of these structures is to lift the water table within the channel, forcing water out into the middle reaches of the system. In addition, with less water flowing through the main channel, there will be less energy in the channel to lead to any channel scour and widening. A concrete structure will be placed at the head of the HGM unit to secure the rehabilitation implemented downstream of it, and to deflect a portion of the upstream water both into the left-hand channel and into the middle reaches of the wetland.

Re-entry points entering into the valley-bottom from the adjacent seepage wetlands has led to the presence of a few unstable re-entry points, with eroding headcut features having formed as a result. These headcuts will be sloped and stabilised and timber poles structures will be implemented to halt the active erosion, trap sediment to a degree and encourage the reestablishment of vegetation; thereby protecting the integrity of the wetland system upstream of the erosion. The hillslope seepage wetlands, aside from the re-entries, are in good condition. Majority of the main channel has been colonised by Poplar trees (*Populus sp.*), a small section of pine trees and erratic clumps of invasive vegetation, such as bramble (*Rubus cuneifolius*), all of which are invasive vegetation species, extremely efficient at colonising disturbed areas. As such, these should all be removed from the HGM unit as a whole. The community have agreed that all invasive species within the wetlands can be removed, but it is the woodlot areas, closer to the communities, that should not be removed without appropriate consultation with the communities.

The identified berm that runs in parallel to the channel along the right-hand bank will be deactivated through the implementation of a cut-and-fill activity, levelling out the berm to be aligned with the natural ground level. This will allow for a more diffuse movement of water through the main valley line and also allow seepage from the adjacent slopes and wetlands to link into the valley-bottom. Plough lines that were noted within the valley-bottom will also be deactivated and levelled to encourage more of a diffuse movement of water across a larger section of the HGM unit. It should be noted that some of the remnant drains within the system have not been specified in the rehabilitation, since it was noted that they are having a limited effect on the hydrology of the system; either since they have been deactivated or the natural water table is fairly close to the surface, and diffuse movement of water through the system has still been achieved (**Figure 6.1** and **Table 6.1**). Through the implementation of these initiatives it is anticipated that the integrity and functioning of the system will significantly improve.

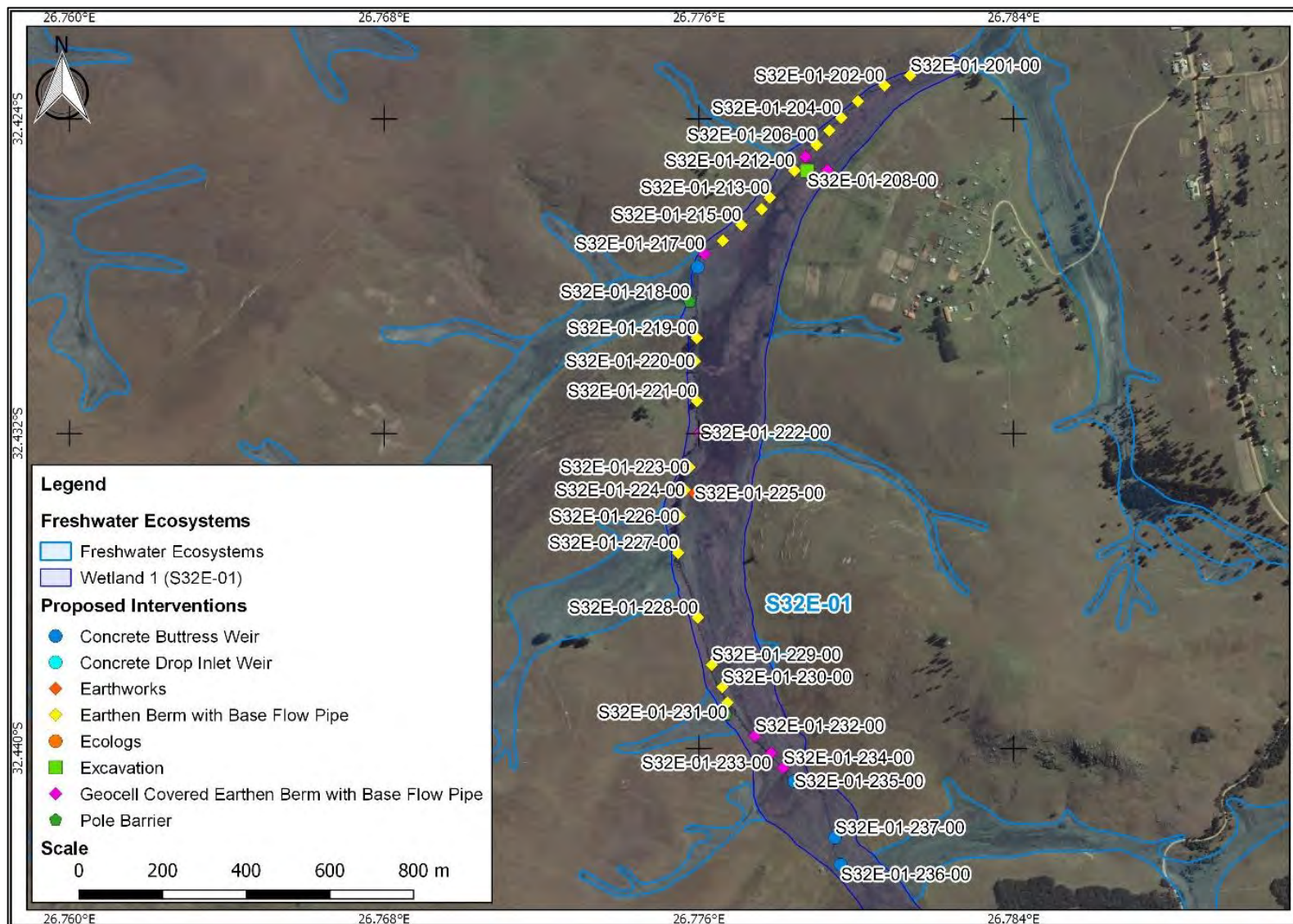


Figure 6.1 S32E-01 wetland rehabilitation strategy

6.3.1 Wetland rehabilitation interventions

Table 6.1 S32E-01 intervention list

Intervention Number	Intervention Type	Location	Priority ⁴
S32E-01-201-00	Earthen berm with base-flow pipe	32° 25' 22.41" S 26° 46' 52.95" E	1
S32E-01-202-00	Earthen berm with base-flow pipe	32° 25' 23.33" S 26° 46' 50.59" E	2
S32E-01-203-00	Earthen berm with base-flow pipe and skimming of berm	32° 25' 24.78" S 26° 46' 48.16" E	3
S32E-01-204-00	Earthen berm with base-flow pipe	32° 25' 26.29" S 26° 46' 46.64" E	4
S32E-01-205-00	Earthen berm with base-flow pipe	32° 25' 27.45" S 26° 46' 45.55" E	5
S32E-01-206-00	Earthen berm with base-flow pipe and skimming of berm	32° 25' 28.76" S 26° 46' 44.38" E	6
S32E-01-207-00	Earthen berm with a geocell-covered crest (3m wide) with base-flow pipe and skimming of berm. TriAx for cattle	32° 25' 29.85" S 26° 46' 43.37" E	7
S32E-01-208-00	Excavation of berm and backfilling drain.	32° 25' 31.13" S 26° 46' 43.53" E	8
S32E-01-209-00	Slope banks. Geocell-covered earthen berm	32° 25' 31.07" S 26° 46' 45.36" E	9
S32E-01-210-00	Slope banks. Construct earthen berm @ every 25m.	Start: 32° 25' 30.99" S 26° 46' 45.57" E End: 32° 25' 21.85" S 26° 46' 56.04" E	10
S32E-01-211-00	Excavation of berm and backfilling drain	Start: 32° 26' 26.72" S 26° 46' 42.50" E End: 32° 25' 32.14" S 26° 46' 44.46" E	11
S32E-01-212-00	Earthen berm with base-flow pipe	32° 25' 31.12" S 26° 46' 42.36" E	12
S32E-01-213-00	Earthen berm with base-flow pipe	32° 25' 33.58" S 26° 46' 40.10" E	13
S32E-01-214-00	Earthen berm with base-flow pipe	32° 25' 34.65" S 26° 46' 39.35" E	14
S32E-01-215-00	Earthen berm with base-flow pipe	32° 25' 36.08" S 26° 46' 37.50" E	15
S32E-01-216-00	Earthen berm with base-flow pipe	32° 25' 37.53" S 26° 46' 35.80" E	16
S32E-01-217-00	Geocell-covered earthen berm with base-flow pipe and deactivation of plough lines	32° 25' 38.72" S 26° 46' 34.13" E	17
S32E-01-218-00	Concrete buttress weir	32° 25' 39.95" S 26° 46' 33.49" E	18
S32E-01-218-00	3x Pole barriers	32° 25' 43.13" S 26° 46' 32.77" E	18

⁴ When prioritising the implementation of interventions, it is often best to implement from the bottom of the system, working upstream.

S32E-01-219-00	Earthen berm with base-flow pipe and debris removal	32° 25' 46.44" S 26° 46' 33.42" E	19
S32E-01-220-00	Earthen berm with base-flow pipe	32° 25' 48.56" S 26° 46' 33.24" E	20
S32E-01-221-00	Earthen berm with base-flow pipe	32° 25' 52.20" S 26° 46' 33.43" E	21
S32E-01-222-00	Earthen berm with a geocell-covered crest (3m wide) with base-flow pipe. TriAx for cattle	32° 25' 55.11" S 26° 46' 33.70" E	22
S32E-01-223-00	Earthen berm with base-flow pipe	32° 25' 58.26" S 26° 46' 32.75" E	23
S32E-01-224-00	Earthen berm with base-flow pipe and skim side bank down to wetland level	32° 26' 00.36" S 26° 46' 32.33" E	24
S32E-01-225-00	Deactivation of ridge-and-furrow	32° 26' 00.65" S 26° 46' 33.18" E	25
S32E-01-226-00	Earthen berm with base-flow pipe and skim side bank down to wetland level	32° 26' 02.77" S 26° 46' 31.85" E	26
S32E-01-227-00	Earthen berm with base-flow pipe	32° 26' 06.09" S 26° 46' 31.71" E	27
S32E-01-228-00	Earthen berm with base-flow pipe and additional berm downstream in wetland.	32° 26' 12.01" S 26° 46' 33.52" E	28
S32E-01-229-00	Earthen berm with base-flow pipe and skim levy to wetland level	32° 26' 16.34" S 26° 46' 34.78" E	29
S32E-01-230-00	Earthen berm with base-flow pipe and skim levy to wetland level	32° 26' 18.37" S 26° 46' 35.76" E	30
S32E-01-231-00	Earthen berm with base-flow pipe and skim levy to wetland level	32° 26' 19.79" S 26° 46' 36.22" E	31
S32E-01-232-00	Geocell covered earthen berm with base-flow pipe and skim levy to wetland level	32° 26' 22.83" S 26° 46' 38.73" E	32
S32E-01-233-00	Geocell covered earthen berm with base-flow pipe and skim levy to wetland level. 33m concrete sill at ground level.	32° 26' 24.42" S 26° 46' 40.22" E	33
S32E-01-234-00	Geocell covered earthen berm with base-flow pipe. 16m concrete sill at ground level.	32° 26' 25.76" S 26° 46' 41.33" E	34
S32E-01-235-00	Concrete buttress weir	32° 26' 26.99" S 26° 46' 42.34" E	35
S32E-01-236-00	Concrete buttress weir	32° 26' 34.62" S 26° 46' 46.59" E	36
S32E-01-237-00	Concrete buttress weir	32° 26' 32.15" S 26° 46' 46.07" E	37
S32E-01-238-00	Alien plant removal along length of main channel	32° 25' 58.26" S 26° 46' 32.75" E	38

6.4 Wetland rehabilitation strategy for Wetland 2 (S32E-02)

The previous cultivation activities within Wetland S32E-02 are the main drivers affecting the functioning and integrity of the system. As such, the rehabilitation strategy aims to reinstate the system functioning through the removal of the berms, drains and plough lines. These activities are often associated with earthworks, whereby the berms are skimmed down to natural surface level and the additional material can be used to fill in the drains and plough lines. Reworking the wetland's surface to a more natural topography will assist in ensuring that the movement of water through the rehabilitated system is not restricted to any artificial low points, but instead that the water can move diffusely through the system.

A spreader canal will be implemented at the point where the berm and main channel meet. This spreader canal will be used to deflect some flows out of the main channel and down a section of the berm running slightly perpendicular to the flow of water. It was decided that portions of this berm would not be completely removed, but sections would be deactivated to allow the water to move laterally into the middle portion of the HGM unit. An earthen plug will be positioned within the section of berm running down the right-hand side of the wetland, to deflect flows into the main valley-bottom.

The identified ridge-and-furrow network and remnant plough lines will be reworked to be aligned with the natural ground level to limit confined flow paths moving through the wetland (**Figure 6.2** and **Table 6.2**). The reworking of this HGM unit will encourage a more diffuse flow of water through the wetland, as a result of the removal and deactivation of the cultivation impacts. As the hydrology of the system improves, the vegetation should begin to respond accordingly, especially as propagules would be available from upstream and adjacent intact wetland systems.

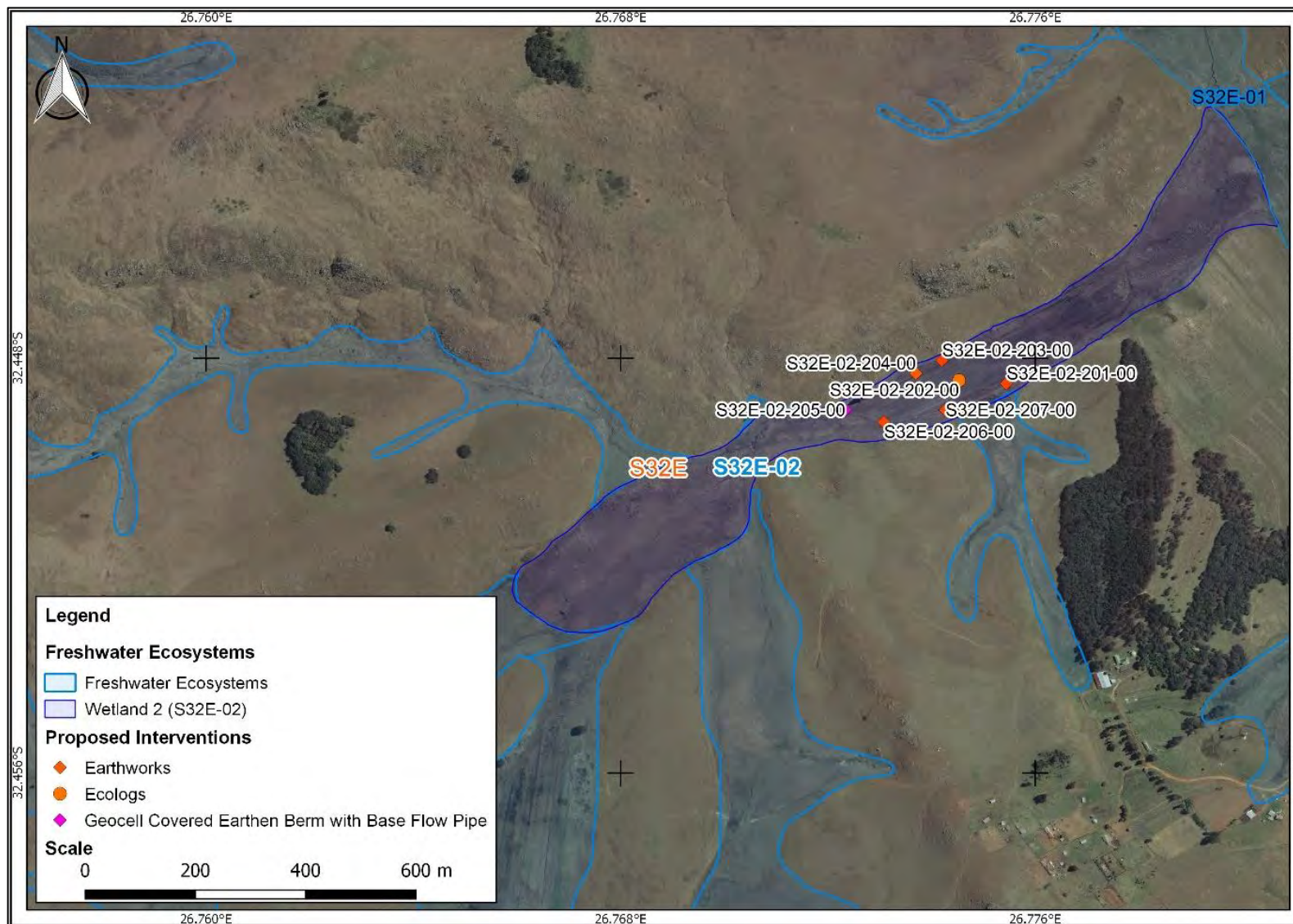


Figure 6.2 S32E-02 wetland rehabilitation strategy

6.4.1 Wetland rehabilitation interventions

Table 6.2 S32E-02 intervention list

Intervention Number	Intervention Type	Location	Priority
S32E-02-201-00	Deactivation of ridge-and-furrows	32° 26' 54.55" S 26° 46' 31.60" E	1
S32E-02-202-00	Ecologs every 25m along parallel drains	32° 26' 54.33" S 26° 46' 28.31" E	2
S32E-02-203-00	Deactivate berm and construct earth plug in drain	32° 26' 52.94" S 26° 46' 27.12" E	3
S32E-02-204-00	Deactivate berm and backfill channel	32° 26' 53.85" S 26° 46' 25.31" E	4
S32E-02-205-00	Geocell-covered earthen berm. Removal of existing berms. Earthen plug. Rock masonry walkway.	32° 26' 56.40" S 26° 46' 20.41" E	7
S32E-02-206-00	Earthen berm removal and construction of diversion plug	32° 26' 57.23" S 26° 46' 23.08" E	6
S32E-02-207-00	Earthen berm removal and construction of diversion plug	32° 26' 56.40" S 26° 46' 27.36" E	5

6.5 Wetland rehabilitation strategy for Wetland 5 (S32E-03)

Since it was noted that the large headcut was stable as it had eroded down to bedrock, no rehabilitation would be required, since the headcut was no longer providing any threats of continued erosion within the system. However, at this point a weir with a diversion pipe has been specified as a means to reactivate the historical channel moving down the left-hand side of the wetland. In this way the *newly formed* eroding channel will receive reduced base flows, thereby reducing the energy moving through the main channel. The reactivation of the historical channel will encourage the rewetting of the left-hand portions of the wetland, re-establishing the hydrological functioning within the currently desiccated portions of the system.

In order to raise the water table within the current channel, deactivate continued channel erosion, and stabilise eroding re-entry points along the channel, a concrete drop inlet weir was specified. The weir will raise the water table behind the structure, flooding out the unstable re-entry points and reducing the overall energy within the system. A concrete buttress weir has been proposed at the base of the HGM unit to secure the returns of the upstream concrete structure and assist in raising the water table within the lower reaches of the channel.

Although not necessarily an intervention that will improve the wetland's integrity, an existing livestock stream channel crossing will be upgraded to a more secure structure. The community had raised concerns of some stream crossings being extremely dangerous during high rainfall events, whereby the crossings become dangerous and inaccessible when the rivers run high (Figure 6.3 and **Table 6.3**). As such, to secure this crossing, a formal concrete splash-through crossing will be implemented juts upstream of the existing bridge crossing.

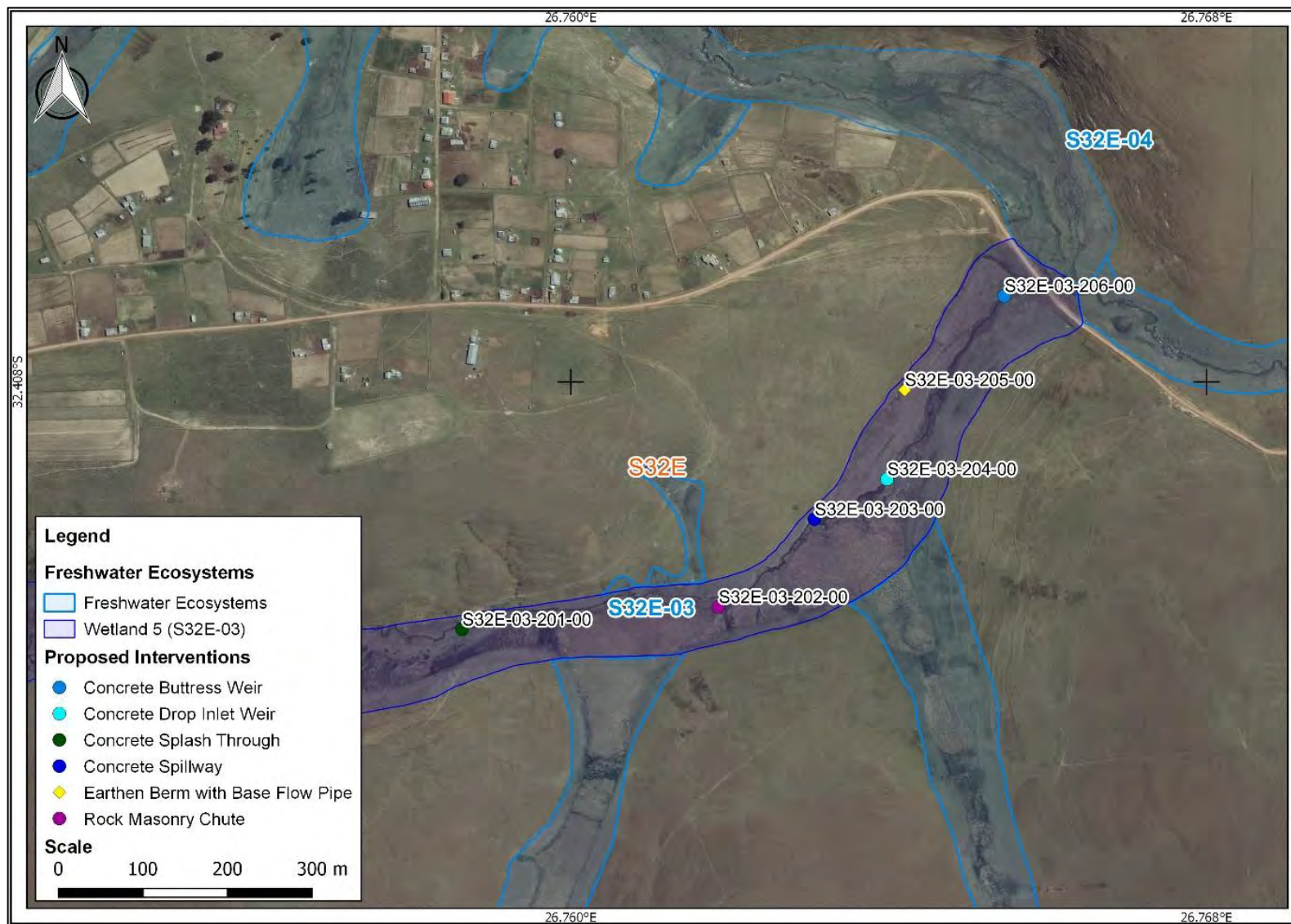


Figure 6.3 S32E-03 wetland rehabilitation strategy

6.5.1 Wetland rehabilitation interventions

Table 6.3 S32E-03 intervention list

Intervention Number	Intervention Type	Location	Priority
S32E-03-201-00	Concrete splash-through	32° 24' 40.01" S 26° 45' 31.08" E	6
S32E-03-202-00	Rock masonry chute	32° 24' 38.99" S 26° 45' 42.69" E	5
S32E-03-203-00	Concrete spillway across channel and trickle pipe	32° 24' 35.02" S 26° 45' 47.04" E	4
S32E-03-204-00	Concrete drop-inlet weir	32° 24' 33.20" S 26° 45' 50.33" E	3
S32E-03-205-00	Earthen berm with base-flow pipe	32° 24' 29.16" S 26° 45' 51.12" E	2
S32E-03-206-00	Concrete buttress weir	32° 24' 24.90" S 26° 45' 55.64" E	1

6.6 Wetland rehabilitation strategy for Wetland 16 (S32E-04)

Following a review of the system, from both a desktop and field level, it was noted that this system has been impacted by active erosion concentrated mostly within the middle to upper reaches of the HGM unit. The identification of the three fairly minor headcuts at the toe of the HGM unit were prioritised for rehabilitation to reduce the risks of this erosion progressing upstream into the HGM unit and eventually reaching the already incised channel. Should the headcut erode into the HGM unit and link with the incised channel, it was anticipated that this may lead to an exacerbation of the current erosion within the system and will lead to the loss of the remaining wetland habitat upstream.

To stabilise the headcut erosion, three structures have been planned. A concrete drop-inlet weir has been proposed just downstream of the headcuts, which has been designed to flood out the headcuts and reduce the energy associated with the erosion specifically. Two pole barrier structures have also been planned at the headcuts themselves to accompany the ecologs, sloping and stabilisation of the erosion that has already occurred as a result of these headcuts. The combination of the concrete weir raising the water table, and the pole barriers stabilising the eroded areas, is anticipated to adequately stabilise the erosional features and any threats to the upstream system (Figure 6.4 and **Table 6.4**).

This system has a large amount of rehabilitation work that can be undertaken over the years to stabilise the current erosion impacts and remove the dense alien invasive tree species upstream. However, these rehabilitation opportunities would need to be assessed in detail for this Phase 2 project. As such, it is highly recommended that additional planning measures are considered for this system in the rehabilitation planning cycles to come.

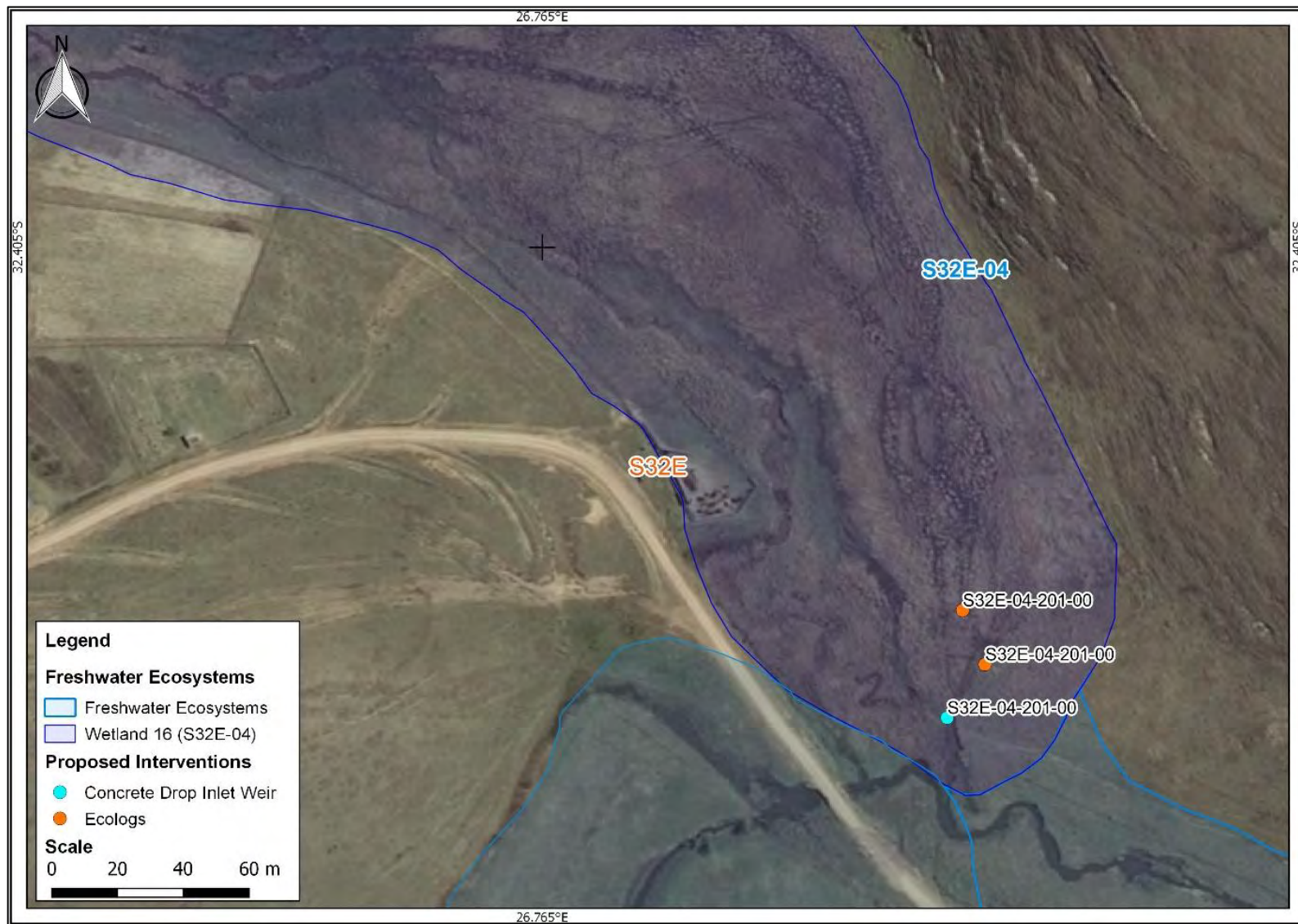


Figure 6.4 S32E-04 wetland rehabilitation strategy

6.6.1 Wetland rehabilitation interventions

Table 6.4 S32E-04 intervention list

Intervention Number	Intervention Type	Location	Priority
S32E-04-201-00	Concrete drop-inlet weir and backfilling with ecologs at gradient changes	32° 24' 23.47" S 26° 45' 58.71" E	1

6.7 Prioritisation of wetland systems

Of the four (4) wetlands prioritised for rehabilitation within the Phase 2 planning, these systems have been further prioritised according to the level of active threats within the wetlands currently affecting the functioning and integrity of the systems. This includes active erosion and unstable re-entry points that, if not rehabilitated/stabilised soon, may lead to the loss of wetland habitat upstream. **Table 6.5** illustrates the prioritisation of the four wetlands and associated motivations.

Table 6.5 Wetland rehabilitation prioritisation

Wetland Name	Wetland Label	Priority	Motivation
Wetland 1	S32E-01	3	This large HGM unit has been significantly affected by historical cultivation practises over the years, which has led to the desiccation of a significant portion of the system. The implementation of the proposed rehabilitation strategy will influence a large area of this HGM unit and it is assumed that the return of investment of implementing the rehabilitation will be substantial.
Wetland 2	S32E-02	4	This HGM unit is significantly smaller than the remaining three wetland systems. There are no direct threats of erosion within the system. As with Wetland S32E-01, the HGM unit has been impacted by historical cultivation practises over the years. The implementation of the proposed rehabilitation strategy will aim to reverse the impacts of these practises, reinstating the natural functioning within the system.
Wetland 5	S32E-03	2	Active erosion was noted along various section of the active channel associated with this HGM unit. In addition to the eroding channel banks, numerous unstable re-entry points were identified along the channel. Upstream of this re-entry points, pristine wetland habitat was noted. Should the erosion associated with these re-entry points continue, it is likely that a large area of pristine wetland may be lost. As such, the stabilisation of this system is strongly recommended.

Wetland Name	Wetland Label	Priority	Motivation
Wetland 16	S32E-04	1	Although formal landowner permissions have not been granted for this wetland, the system was prioritised as the most critical for rehabilitation. This is due to the actively eroding headcut and unstable slopes at the toe of the wetland. Upstream of this active erosion is fairly pristine wetland habitat that, should the erosion continue, may be lost. As such, the stabilisation of the toe of this HGM unit is crucial.

6.8 Monitoring and Evaluation

This section provides an overview of the data collected and a summary of the study results from which future monitoring and evaluation can be based.

6.8.1 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland systems provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes three years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the Amathole wetlands (**Table 6.6** and **Table 6.7**).

Table 6.6 Summary of present wetland health of the Amathole wetlands identified for rehabilitation based on the WET-Health assessment

HGM Unit	Hectares	Hydrology		Geomorphology		Vegetation	
		Impact Score	Trajectory Symbol	Impact Score	Trajectory Symbol	Impact Score	Trajectory Symbol
S32E-01	54.7 ha	5.0	→	2.4	→	4.1	↓
	PES Category	D		C		D	
	Overall Impact Score	4.0					
	Overall PES Category	D					
S32E-02	Hectares	Hydrology		Geomorphology		Vegetation	
		Impact Score	Trajectory Symbol	Impact Score	Trajectory Symbol	Impact Score	Trajectory Symbol
	24.4 ha	3.0	→	0.8	→	2.3	→
	PES Category	C		A		C	
	Overall Impact Score	2.2					
	Overall PES Category	C					
S32E-03	Hectares	Hydrology		Geomorphology		Vegetation	
		Impact Score	Trajectory Symbol	Impact Score	Trajectory Symbol	Impact Score	Trajectory Symbol
	43.3 ha	1.0	→	0.5	↓	1.8	
	PES Category	B		A		B	
	Overall Impact Score	1.1					
	Overall PES Category	B					
S32E-04	Hectares	Hydrology		Geomorphology		Vegetation	
		Impact Score	Trajectory Symbol	Impact Score	Trajectory Symbol	Impact Score	Trajectory Symbol
	18.5	3.0	↓	1.9	↓↓	4.1	↓
	PES Category	C		B		D	
	Overall Impact Score	3.0					
	Overall PES Category	C					

Trajectory Class	Description	Trajectory Symbol
Improve	Hydrological condition is likely to improve over the next 5 years	↑
Remain stable	Hydrological condition is likely to remain stable over the next 5 years	→
Slight deterioration	Hydrological condition is likely to deteriorate slightly over the next 5 years	↓
Substantial deterioration	Substantial deterioration of hydrological condition is expected over the next 5 years.	↓↓

6.8.2 Summary of the wetlands

Table 6.7 provides a detailed overview of the wetland systems identified for rehabilitation (refer to Appendix 2 for the corresponding photographs).

Table 6.7 Summary of monitoring and evaluation data collected for the wetland systems identified for rehabilitation

HGM unit	Overall hectares	Area influenced (ha)	Type of influence	Hectare equivalents gained	Hectare equivalents secured	FPP details			
						Yes/No	Label	Latitude	Longitude
S32E-01	54.7 ha	39.1 ha	Improved diffuse flows, encouraging the improvement in the vegetation and hydrology components of the wetland.	13.9 ha equivalents	N/A	Yes	FPP_W1	32° 26' 26.88" S	26° 46' 43.27" E
S32E-02	24.4 ha	14.4 ha	Removal of historical cultivation impacts to improve hydrology and vegetation of the wetland HGM unit.	3.0 ha equivalents	N/A	No	N/A	N/A	N/A
S32E-03	43.3 ha	10.1 ha	Secure erosion and remove historical cultivation to improve overall ecosystem functioning and integrity.	0.6 ha equivalents	N/A	Yes	FPP_W2	32° 26' 26.88" S	26° 46' 43.27" E
S32E-04	18.5 ha	0.3 ha	Secure erosion to protect the upstream reaches of the HGM unit and avoid further loss of wetland habitat.	0.3 ha equivalents	1.2 ha equivalents	No	N/A	N/A	N/A

7. REFERENCES

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8. APPENDIX

8.1 Appendix 1: Phase 1 Wetland Rehabilitation Planning Report

8.2 Appendix 2: Fixed Point Photographs

Wetland	Photograph
<p>S32E-01: FPP1</p> <p>Latitude: 32° 26' 26.88" S</p> <p>Longitude: 26° 46' 43.27" E</p>	<div>  <p>Upstream</p> </div> <div>  <p>Middle</p> </div> <div>  <p>Downstream</p> </div>

Wetland	Photograph
Wetland	Photograph
<p>S32E-03: FPP2</p> <p>Latitude: 32° 24' 34.24" S</p> <p>Longitude: 26° 45' 47.40" E</p>	<div>  </div> <p>Upstream</p> <div>  </div> <p>Middle</p> <div>  </div> <p>Downstream</p>

APPENDIX B
GENERAL CONSTRUCTION NOTES

(Ignore notes which are inapplicable)

1. **Occupational health and safety is a priority!** All necessary precautionary measures must be undertaken to ensure safety of the team. Particular attention must be given to deep excavations where gentle sloping back of soil or shoring must be applied to prevent possible soil collapse. Where risks are foreseen, these must be reported to the Occupational Health and Safety Agent employed by SANBI, who may need to seek further advice. In addition, no excavated earth or other materials should be stockpiled within a distance of one metre from the edge of any excavation. The one metre wide strip along the edges of all sides of an excavation should at all times be kept clear of objects such as lumps of clay, rocks or tools that could injure workers in the excavation if they were to fall in.
2. Check all dimensions on site to determine if any amendments to the designs are necessary. Note the required final height of the structure relative to the original ground level. The responsible engineer must be consulted before any changes are made to dimensions.
3. Excavation must be carried out to the final levels. Soil must be placed in areas best suited for re-use, for example, when building an earthen diversion embankment, the soil excavated should be used immediately in building up the embankment (on condition the excavated soil is of suitable quality). The excavated soil should alternatively be stockpiled immediately upstream of the site of the proposed wall. The topsoil must be stockpiled separately from the subsoil.
4. Where soil is to be the foundation for non-soil structures (for example, gabions and rafted weirs), all sand deposits must be removed and the floor well compacted while the soil is at optimum moisture content.
5. In instances where the addition of Gypsum (CaSO_4) has been specified for the amelioration of a dispersive soil, mixing must be carried out off site, after which it must be transported to the construction site.
6. When the final level of the soil construction has been reached the previously stockpiled topsoil must be added as an extra height and planted to suitable vegetation (unless other provision for protection of the structure has been specified).
7. When backfilling soil against concrete or gabion work, extra care must be taken to ensure that a waterproof joint with the structure is, as far as possible, achieved. Compaction must be carried out in layers as specified by the engineer. Material containing organic matter must not be used for this backfilling purpose.
8. Ensure that the correct steel reinforcing, as specified, has been delivered to site. Ensure that the minimum cover, as specified by the engineer, is achieved at all times. All welded steel mesh joints must have an overlap of at least 200mm and must be securely tied with 2mm building wire. At least three rings at 150mm spacing are required. Where reinforcing bars are used, bars at joints must be overlapped as per the distance specified

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

9. Before placing concrete on a rock foundation, carefully chip away any loose surface layers and wash away all debris. New surfaces must be painted with a cement slurry prior to the placing of the concrete.
10. Ensure that all shuttering is strong and well supported. It is recommended that the concrete be placed in layers no greater than one metre per day. The shuttering must be well oiled on the inside to prevent the concrete from sticking. Spacers between shuttering must be placed every one metre, both vertically and horizontally, with a minimum of two in both directions.
11. Note that when mixing concrete it is preferable to use a full pocket of cement with each mix. The specified cement water ratio must be maintained at all times.
12. The poured concrete must be "rodded" to ensure proper compaction. Never add more than one metre height of concrete in any one day, and attempt to lay the concrete in even, horizontal layers throughout the length of any section. Check the specifications for any requirement of expansion joints. The shuttering should be left for at least two days before stripping. Wetting the concrete while it is curing will make for a strong construction. Backfilling of soil against the completed structure may only be done after a period of at least seven days.
13. The use of "plums" in concrete: in some instances it may be feasible and economic to reduce the amount of concrete in mass gravity structures, by replacing up to 33% of the volume of concrete by the judicious use of suitable hand sized quarried rock. Where this is specified the rocks (purchased as handstone) must be so placed that there is always a minimum cover of 50mm between the rock and the shuttering, as well as between any two adjacent rocks. This should only be done where it is stated on the drawings that is permissible.
14. The standard procedures for the opening up and wiring together of gabion baskets and mattresses are well documented, and supplied with every delivery of the products. They must be strictly adhered to in all respects. Ensure that the lids of the final (top) baskets are always folded down and wired in a downstream direction.
15. Where rock-filled gabion baskets are used for the construction of keywalls, the trenches must be dug wide enough so that sufficient access is available to properly backfill and compact all the way around them. Making the trench only wide enough to receive the baskets is not acceptable, as water will eventually find its way around the structures and cause problems.
16. Where structures are to be built in dispersive soils, the following should be noted:
 - Impermeable cut off wall (at least 500mm deep) to be constructed under spillway section of the structure
 - Key walls to be impermeable

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

17. Sloping and vegetating gully banks where specified:

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

18. The orientation of all wetlands and interventions is to be taken facing downstream i.e. left bank and right bank are to be identified **facing downstream**.
19. The Bill of Quantities for the various rehabilitation interventions only included revegetation in those instances where the engineer considered the re-vegetation of the denuded area as important due to the size of the area affected or due to the risk associated with scouring and erosion.

APPENDIX C
INTERVENTION BOOKLET

Intervention Summary

Amathole - Eastern Cape

Intervention Number	Description	Type	Reference Document	Design Revision
S32E-01-201-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-202-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-203-00	Earthen berm with base flow pipe and skimming of berm	New	Amathole Rehabilitation Plan 2019	A
S32E-01-204-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-205-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-206-00	Earthen berm with base flow pipe and skimming of berm	New	Amathole Rehabilitation Plan 2019	A
S32E-01-207-00	Earthen berm with a geocell covered crest (3m wide) with base flow pipe and skimming of berm. TriAx for cattle	New	Amathole Rehabilitation Plan 2019	A
S32E-01-208-00	Excavation of berm and backfilling drain.	New	Amathole Rehabilitation Plan 2019	A
S32E-01-209-00	Slope banks. Geocell covered earthen berm	New	Amathole Rehabilitation Plan 2019	A
S32E-01-210-00	Slope banks. Construct earthen berm @ every 25m (start of intervention).	New	Amathole Rehabilitation Plan 2019	A
S32E-01-210-00	Slope banks. Construct earthen berm @ every 25m (end of intervention).	New	Amathole Rehabilitation Plan 2019	A
S32E-01-211-00	Excavation of berm and backfilling drain (start of intervention)	New	Amathole Rehabilitation Plan 2019	A
S32E-01-211-00	Excavation of berm and backfilling drain (end of intervention)	New	Amathole Rehabilitation Plan 2019	A
S32E-01-212-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-213-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-214-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-215-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-216-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-217-00	Geocell covered earthen berm with base flow pipe and deactivation of plough lines	New	Amathole Rehabilitation Plan 2019	A
S32E-01-218-00-A	Concrete buttress weir	New	Amathole Rehabilitation Plan 2019	A
S32E-01-218-00-B	3x Pole barriers	New	Amathole Rehabilitation Plan 2019	A

S32E-01-219-00	Earthen berm with base flow pipe and debris removal	New	Amathole Rehabilitation Plan 2019	A
S32E-01-220-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-221-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-222-00	Earthen berm with a geocell covered crest (3m wide) with base flow pipe.	New	Amathole Rehabilitation Plan 2019	A
S32E-01-223-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-224-00	Earthen berm with base flow pipe and skim side bank down to wetland level	New	Amathole Rehabilitation Plan 2019	A
S32E-01-225-00	Deactivation of ridge and furrow	New	Amathole Rehabilitation Plan 2019	A
S32E-01-226-00	Earthen berm with base flow pipe and skim side bank down to wetland level	New	Amathole Rehabilitation Plan 2019	A
S32E-01-227-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-01-228-00-A	Earthen berm with base flow pipe and additional berm downstream in wetland.	New	Amathole Rehabilitation Plan 2019	A
S32E-01-228-00-B	Earthen berm with base flow pipe and additional berm downstream in wetland.	New	Amathole Rehabilitation Plan 2019	A
S32E-01-229-00	Earthen berm with base flow pipe and skim levy to wetland level	New	Amathole Rehabilitation Plan 2019	A
S32E-01-230-00	Earthen berm with base flow pipe and skim levy to wetland level	New	Amathole Rehabilitation Plan 2019	A
S32E-01-231-00-A	Earthen berm with base flow pipe and skim levy to wetland level	New	Amathole Rehabilitation Plan 2019	A
S32E-01-231-00-B	Pole barrier upstream of berm	New	Amathole Rehabilitation Plan 2019	A
S32E-01-232-00	Geocell covered earthen berm with base flow pipe and skim levy to wetland level	New	Amathole Rehabilitation Plan 2019	A
S32E-01-233-00	Geocell covered earthen berm with base flow pipe and skim levy to wetland level. 33m concrete sill at ground level.	New	Amathole Rehabilitation Plan 2019	A
S32E-01-234-00	Geocell covered earthen berm with base flow pipe. 16m concrete sill at ground level.	New	Amathole Rehabilitation Plan 2019	A
S32E-01-235-00	Concrete buttress weir	New	Amathole Rehabilitation Plan 2019	A
S32E-01-236-00	Concrete buttress weir	New	Amathole Rehabilitation Plan 2019	A
S32E-01-237-00	Concrete buttress weir	New	Amathole Rehabilitation Plan 2019	A
S32E-01-238-00	Alien Vegetation Removal	New	Amathole Rehabilitation Plan 2019	A

S32E-02-201-00	Deactivation of ridge and furrows	New	Amathole Rehabilitation Plan 2019	A
S32E-02-202-00	Ecologs every 25m along parallel drains	New	Amathole Rehabilitation Plan 2019	A
S32E-02-203-00	Deactivate berm and construct earth plug in drain	New	Amathole Rehabilitation Plan 2019	A
S32E-02-204-00	Deactivate berm and backfill channel	New	Amathole Rehabilitation Plan 2019	A
S32E-02-205-00	Geocell covered earthen berm. Removal of existing berms. Earthen plug. Rock masonry walkway.	New	Amathole Rehabilitation Plan 2019	A
S32E-02-206-00	Earthen berm removal and construction of diversion plug	New	Amathole Rehabilitation Plan 2019	A
S32E-02-207-00	Construction of diversion plug	New	Amathole Rehabilitation Plan 2019	A
S32E-03-201-00	Concrete splash through	New	Amathole Rehabilitation Plan 2019	A
S32E-03-202-00	Rock masonry chute	New	Amathole Rehabilitation Plan 2019	A
S32E-03-203-00	Concrete spillway across channel and trickle pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-03-204-00	Concrete drop inlet weir	New	Amathole Rehabilitation Plan 2019	A
S32E-03-205-00	Earthen berm with base flow pipe	New	Amathole Rehabilitation Plan 2019	A
S32E-03-206-00	Concrete buttress weir	New	Amathole Rehabilitation Plan 2019	A
S32E-04-201-00	Concrete drop inlet weir and backfilling with ecologs at gradient changes and Ecolog stack upstream	New	Amathole Rehabilitation Plan 2019	A

Details

Intervention	S32E-01-201-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'22.41"S
Longitude (D°M'S")	26°46'52.95"E

Location Photograph: S32E-01-201-00



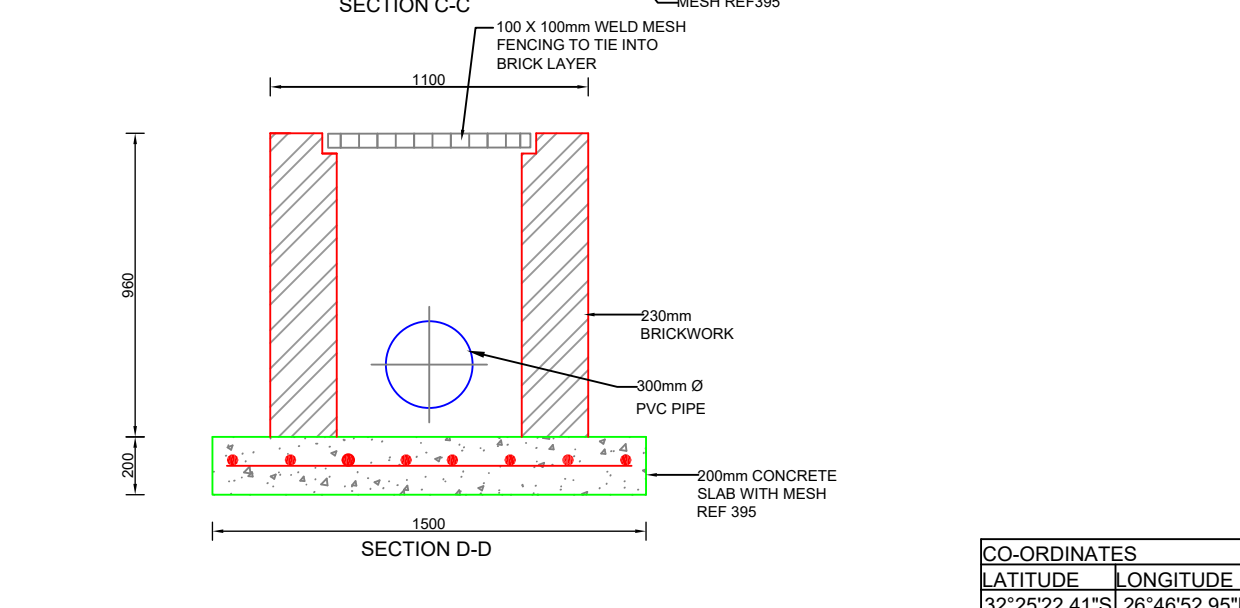
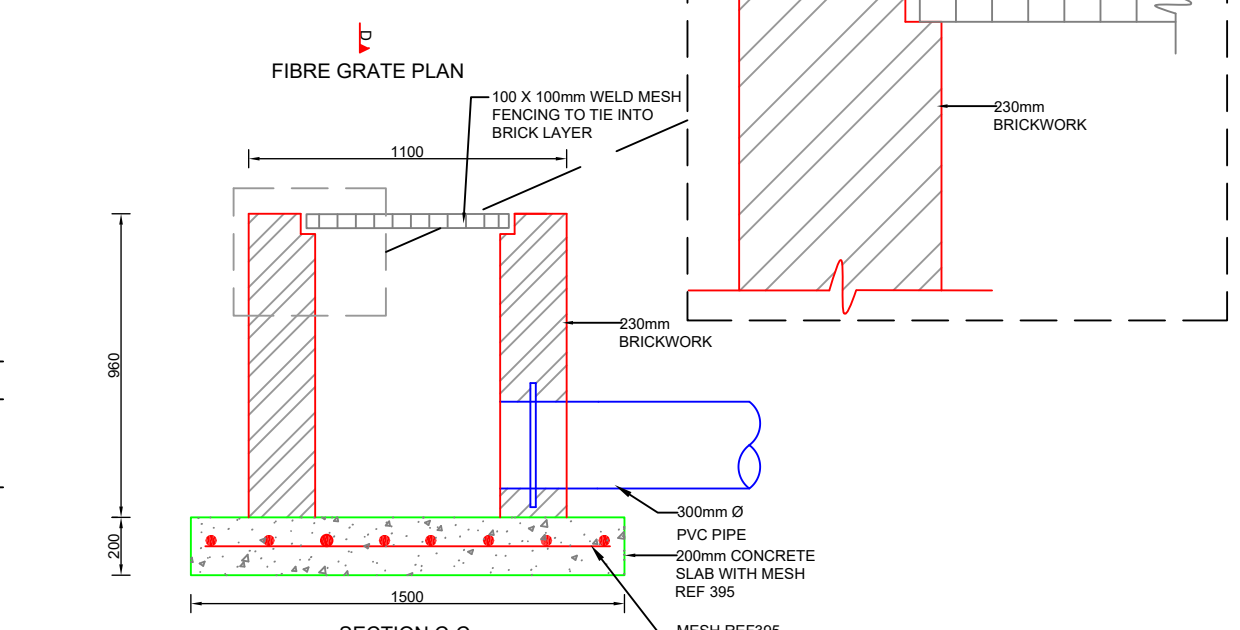
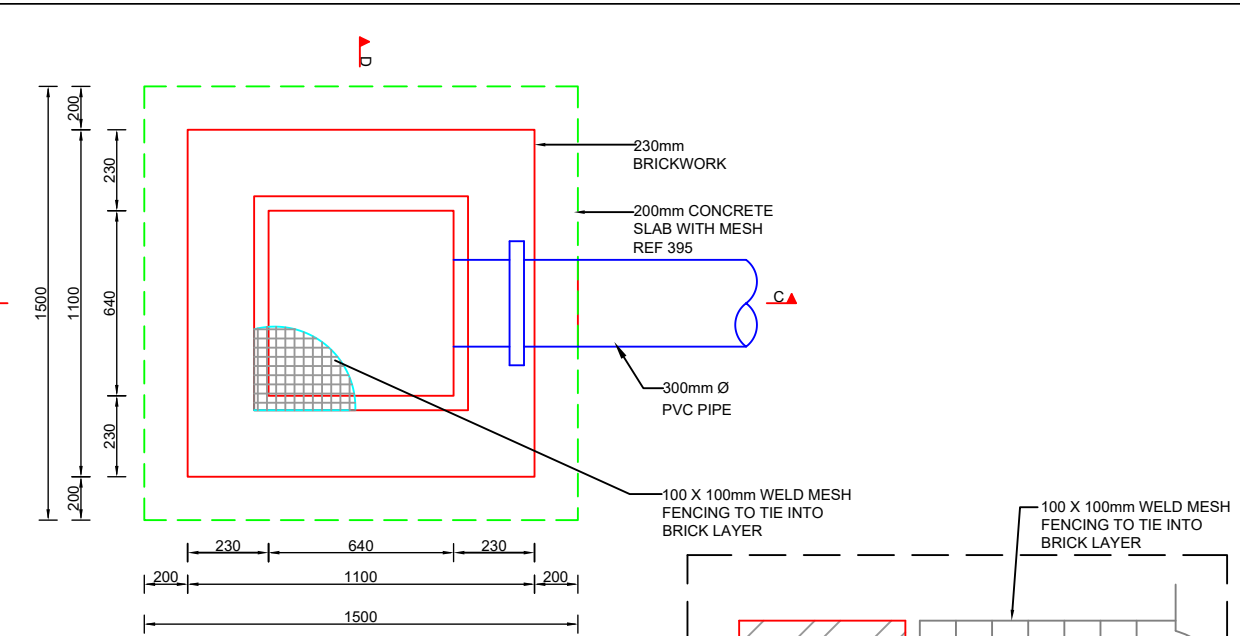
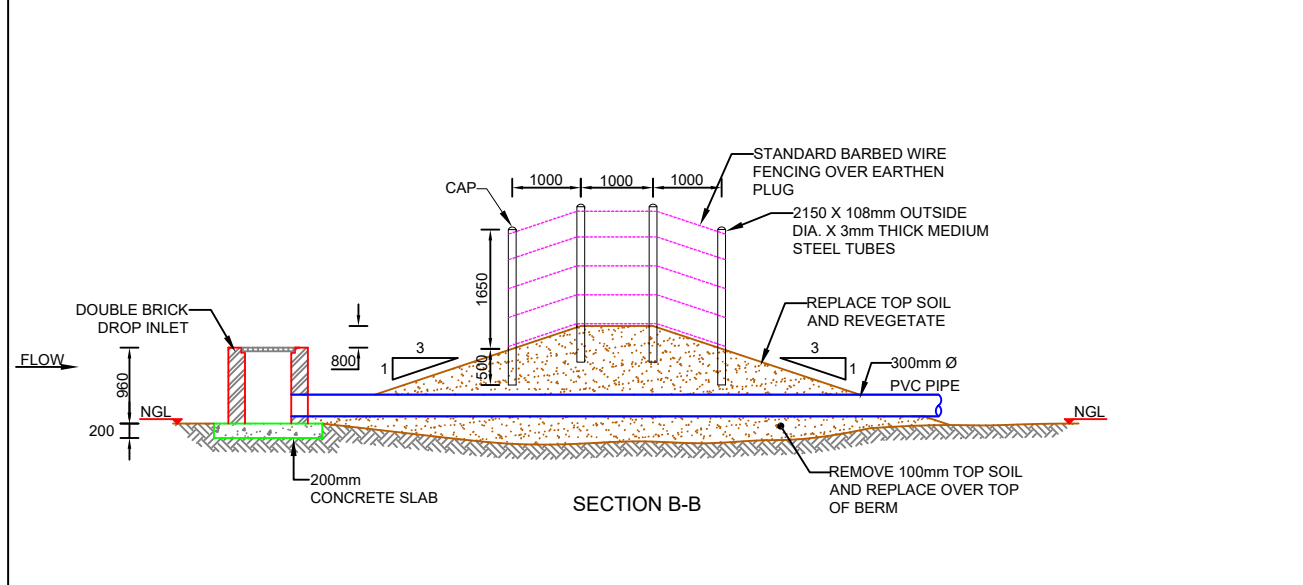
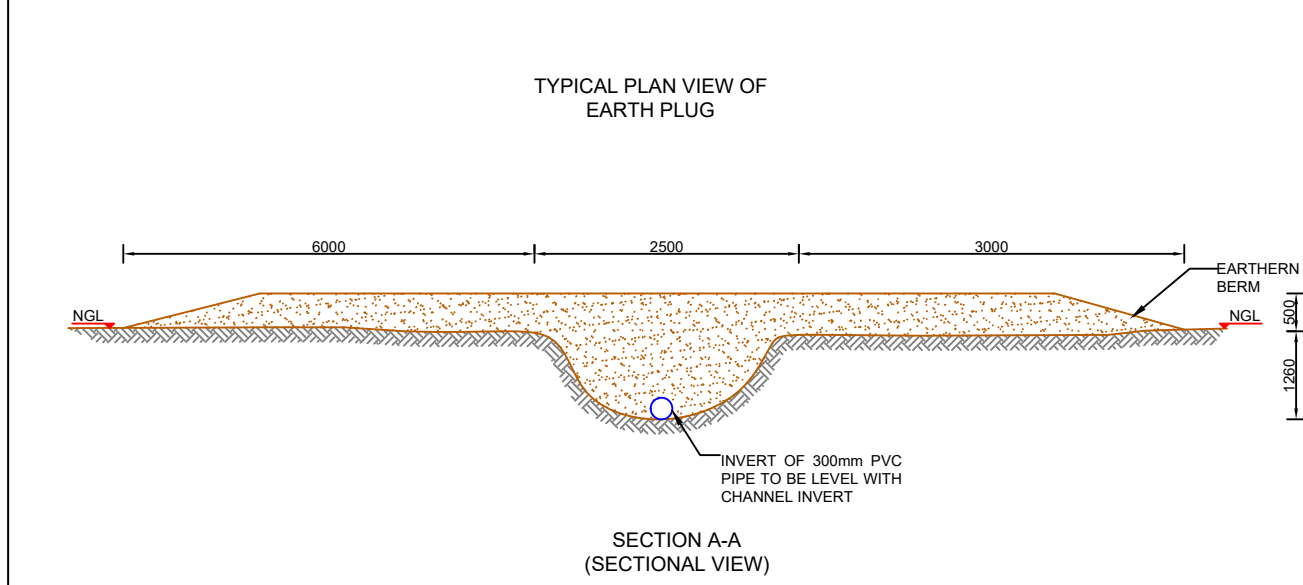
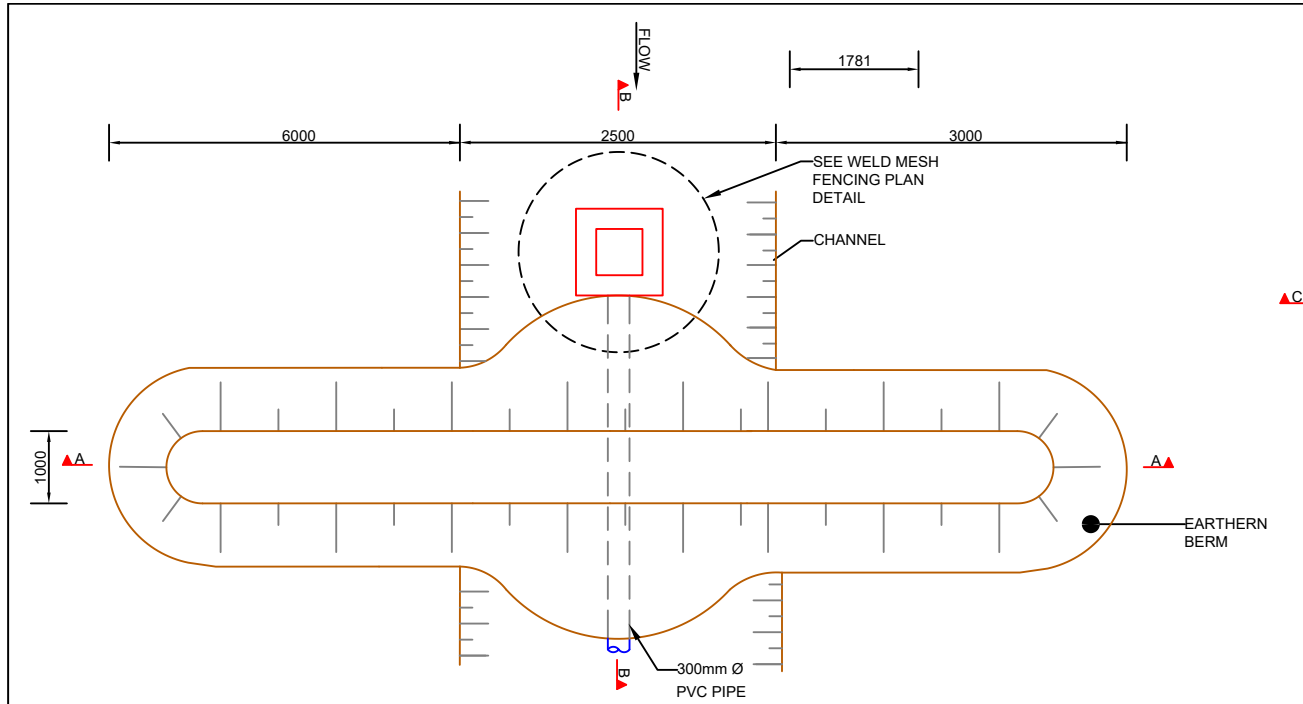
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	38.88
Excavation for sloping	m ³	107.96
Standard double skin brick	m ³	0.97
Concrete	m ³	0.45
Revegetation	m ²	30.33
Class4 300 mm PVC pipe	m	11.56
100 mm x 100 mm weld mesh fencing	m ²	0.80
Standard barbed wire	m	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'22.41"S	26°46'52.95"E

NOTES

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

ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.



REV	DATE	REVISION DETAILS	APPROVED
1	12/11/2018	DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No.	
20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 201 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-202-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'23.33"S
Longitude (D°M'S")	26°46'50.59"E

Location Photograph: S32E-01-202-00



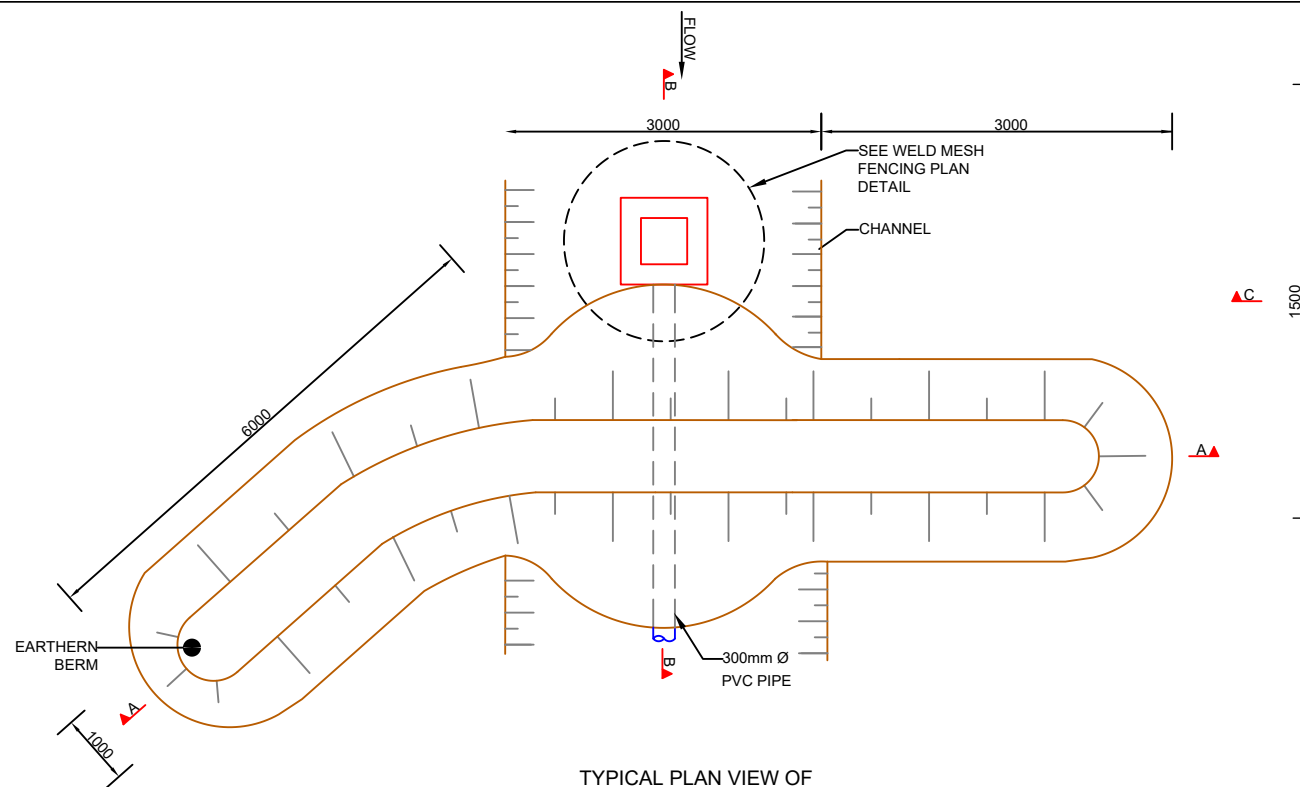
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	48.33
Excavation for sloping	m ³	229.98
Standard double skin brick	m ³	1.08
Concrete	m ³	0.45
Revegetation	m ²	38.48
Class4 300 mm PVC pipe	m	12.22
100 mm x 100 mm weld mesh fencing	m ²	0.80
Standard barbed wire	m	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no	4.00

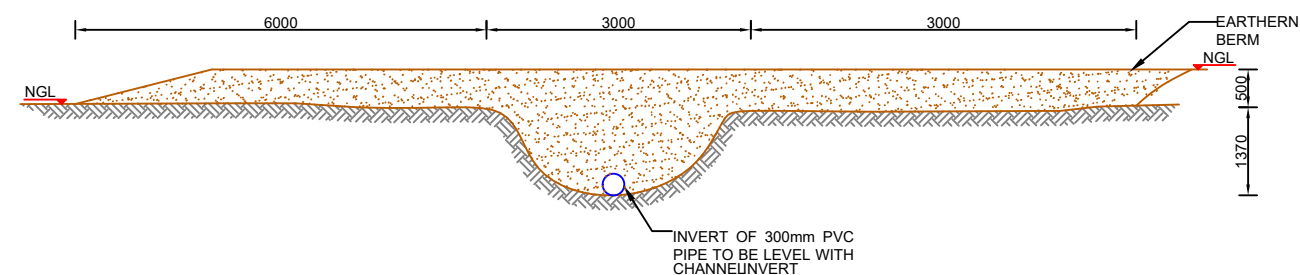
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

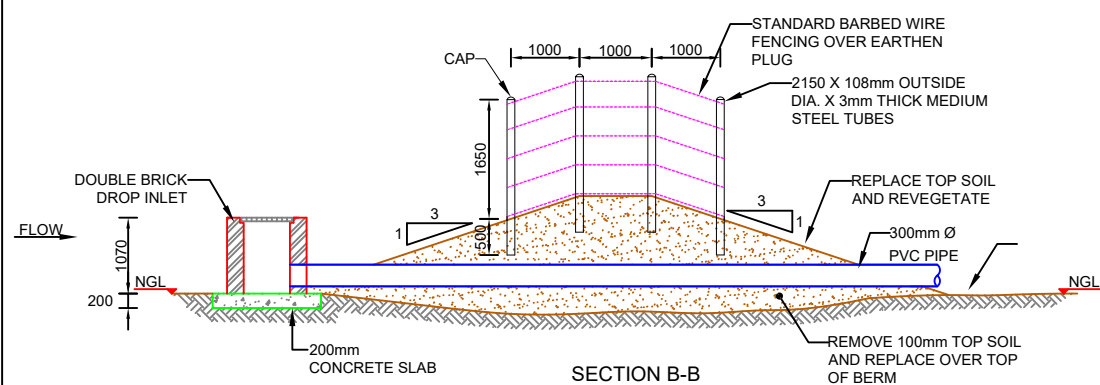
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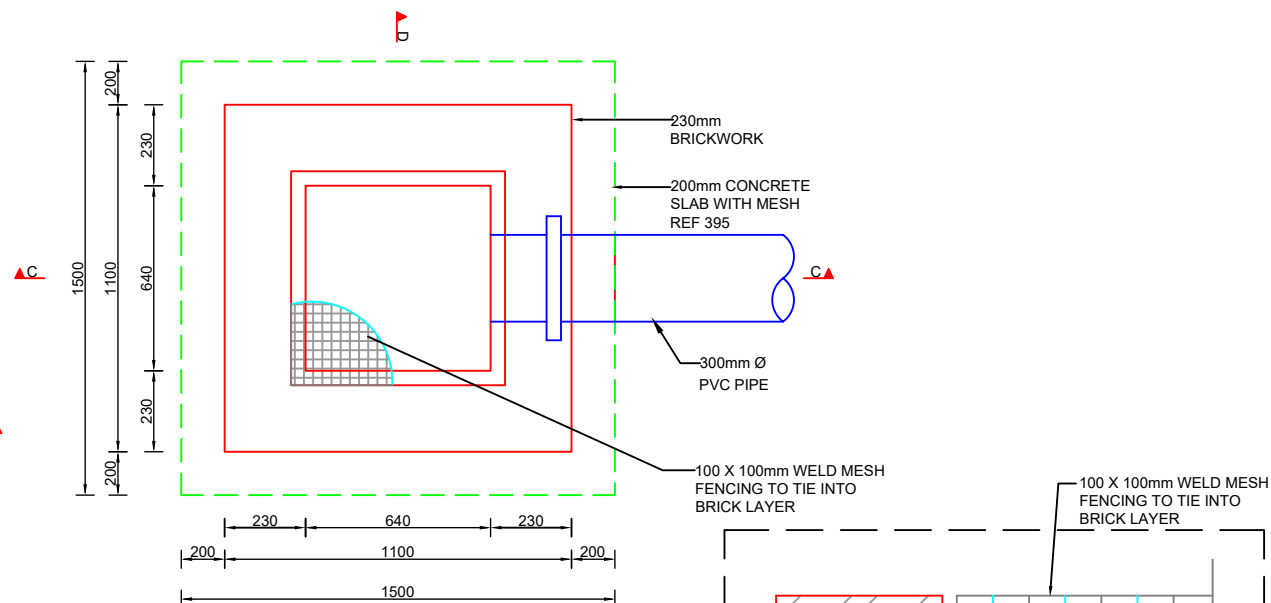
TYPICAL PLAN VIEW OF EARTH PLUG



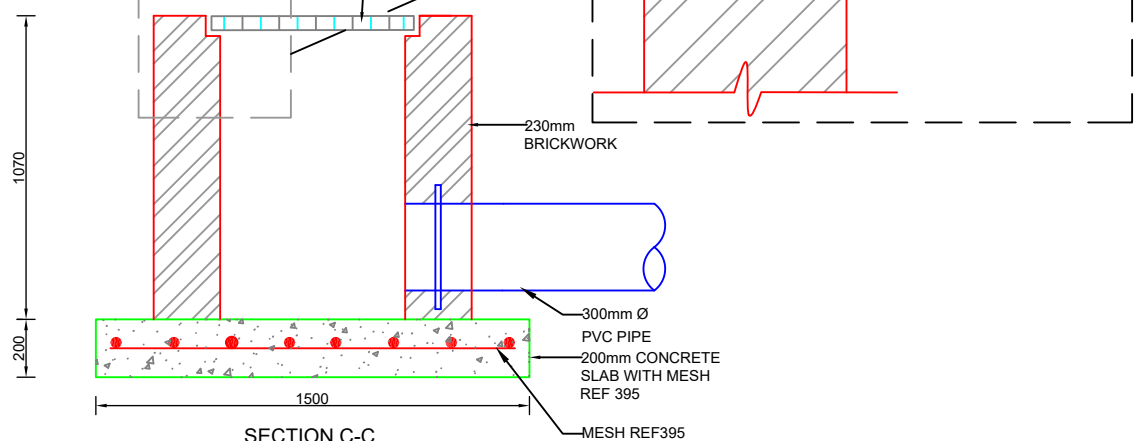
SECTION A-A
(SECTIONAL VIEW)



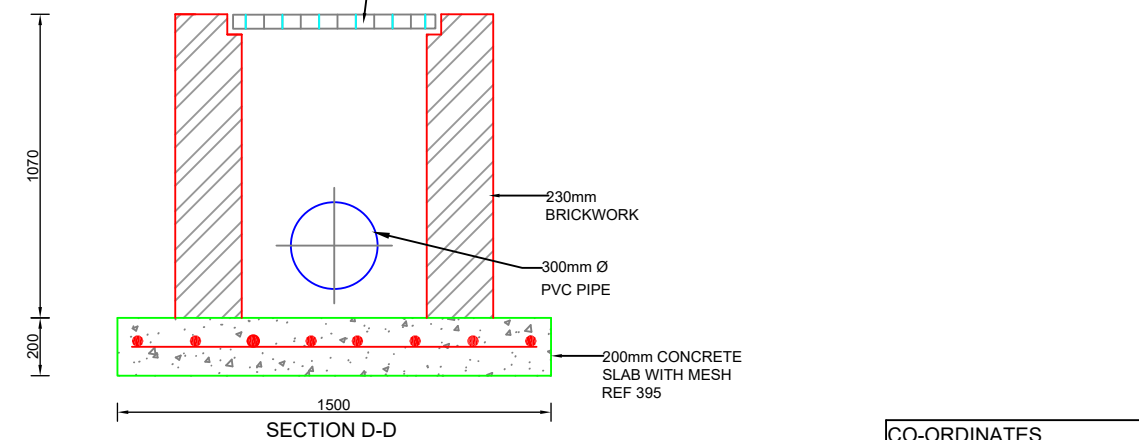
SECTION B-B



FIBRE GRATE PLAN



SECTION C-C



SECTION D-D

CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'23.33"S	26°46'50.59"E

NOTES

- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.

- AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED AGAINST ANY ASSOCIATED DAMAGES AND ACCEPT NO LIABILITY ASSOCIATED WITH THE CONSTRUCTION AND IMPLEMENTATION OF ENGINEERING INTERVENTIONS DUE TO THE ENGINEERS HAVING LIMITED CONTACT WITH THE IMPLEMENTER DURING THE CONSTRUCTION PHASE RESULTING IN OUR INABILITY TO DILIGENTLY SUPERVISE AND ASSESS ANY PROGRESS.

ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN

APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 202 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-203-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and skimming of berm
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Skimming of berm to allow water to flood to wetland level.
Latitude (D°M'S")	32°25'24.78"S
Longitude (D°M'S")	26°46'48.16"E

Location Photograph: S32E-01-203-00



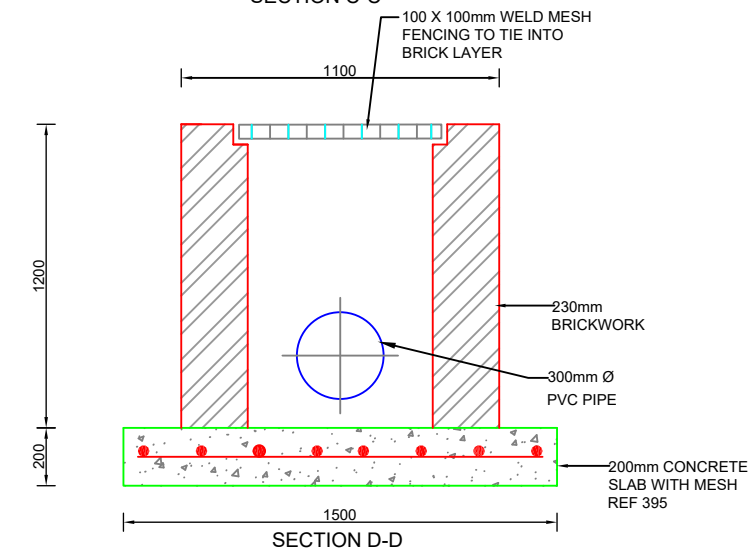
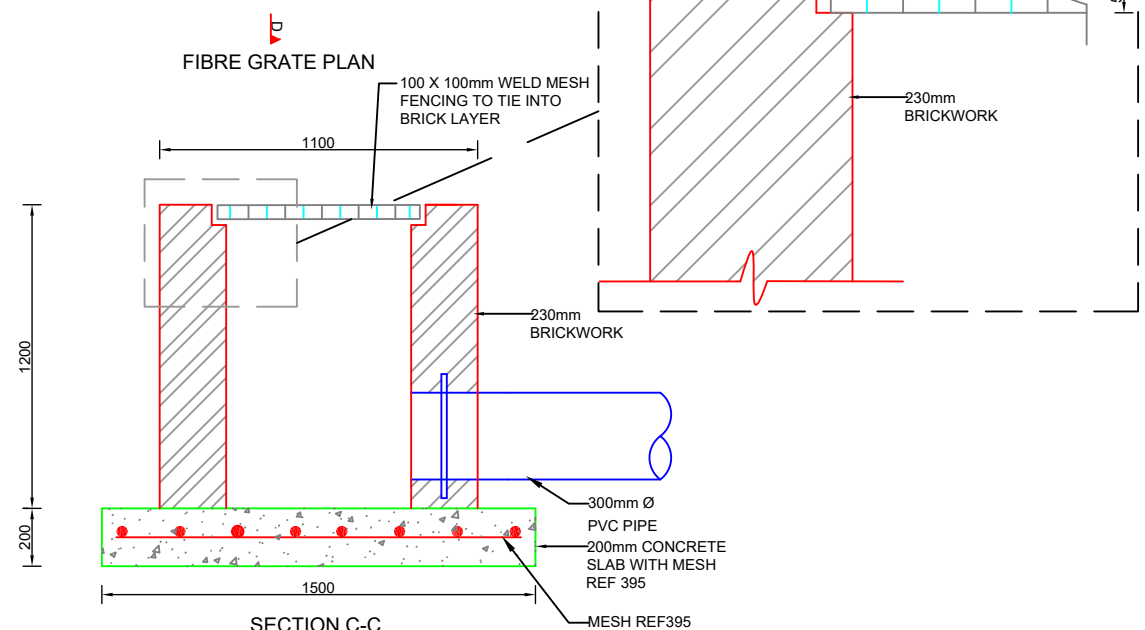
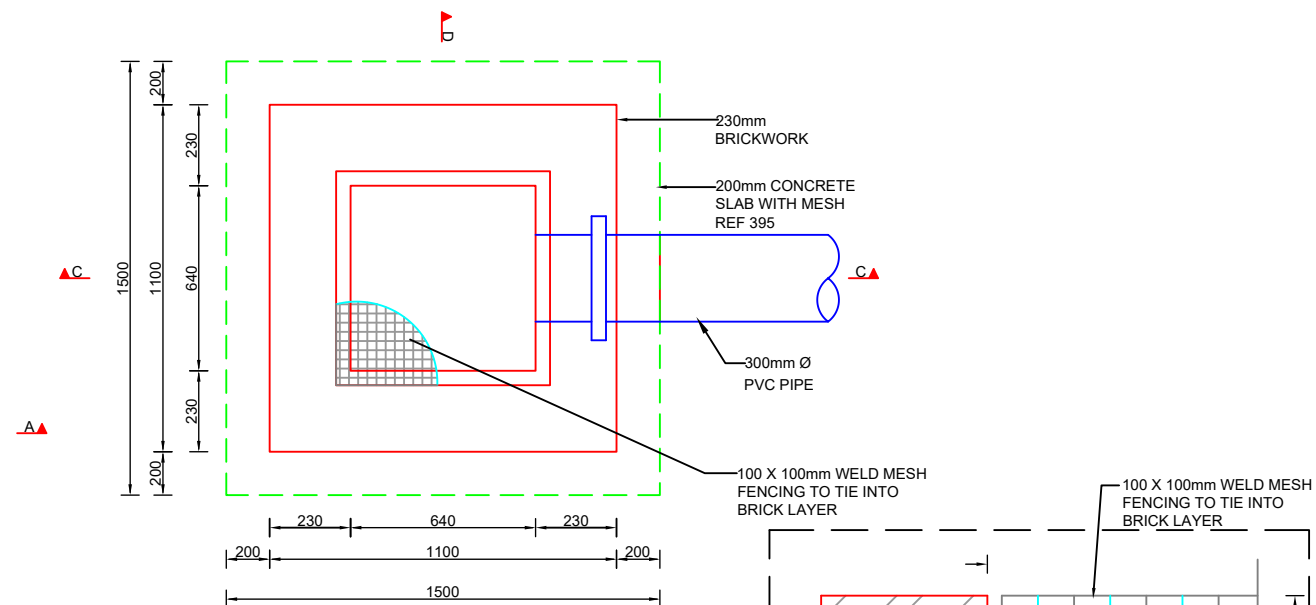
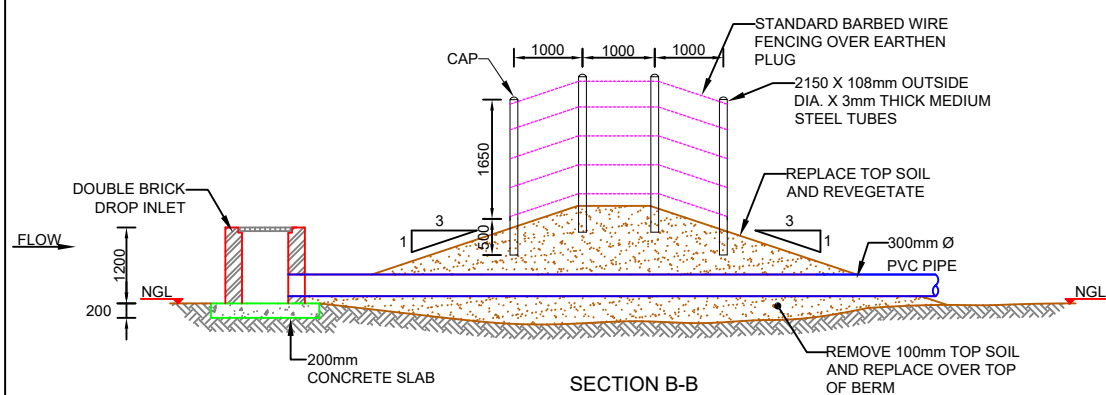
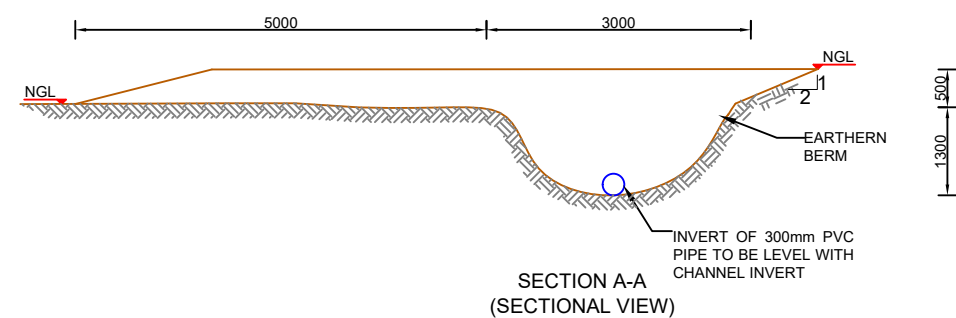
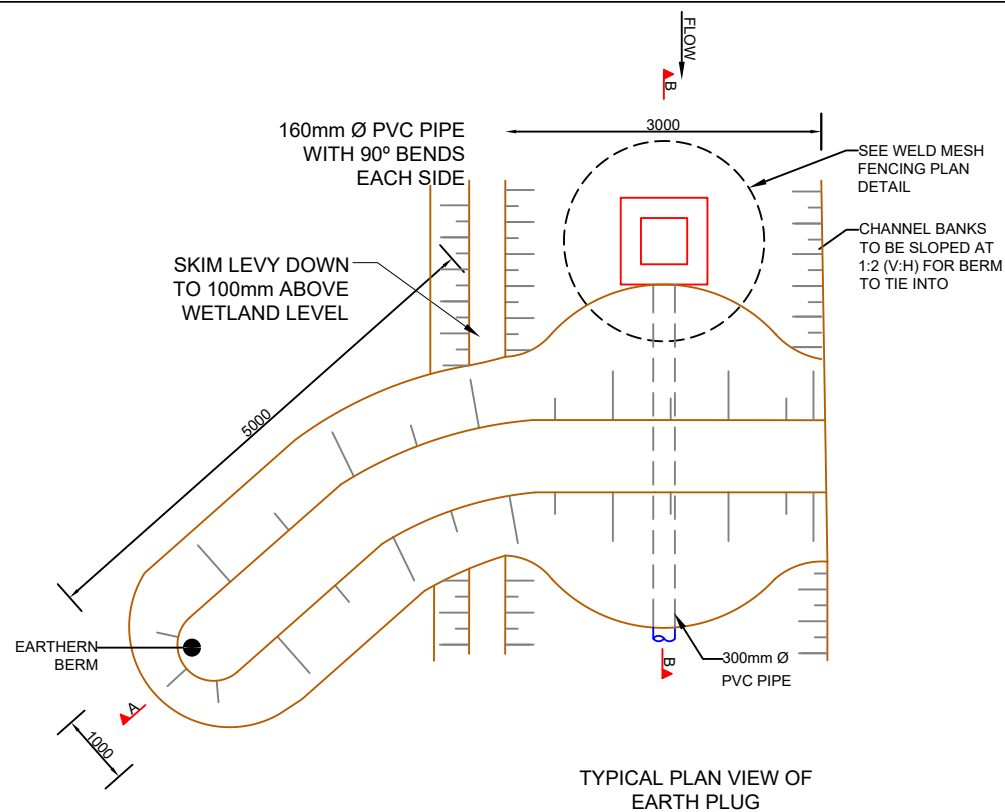
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	44.44
Excavation for sloping	m ³	296.06
Standard double skin brick	m ³	1.21
Concrete	m ³	0.45
Revegetation	m ²	39.05
Class4 300 mm PVC pipe	m	12.40
100 mm x 100 mm weld mesh fencing	m ²	0.80
Standard barbed wire	m	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'24.78"S	26°46'48.16"E

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

ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

Details

Intervention	S32E-01-204-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'26.29"S
Longitude (D°M'S")	26°46'46.64"E

Location Photograph: S32E-01-204-00



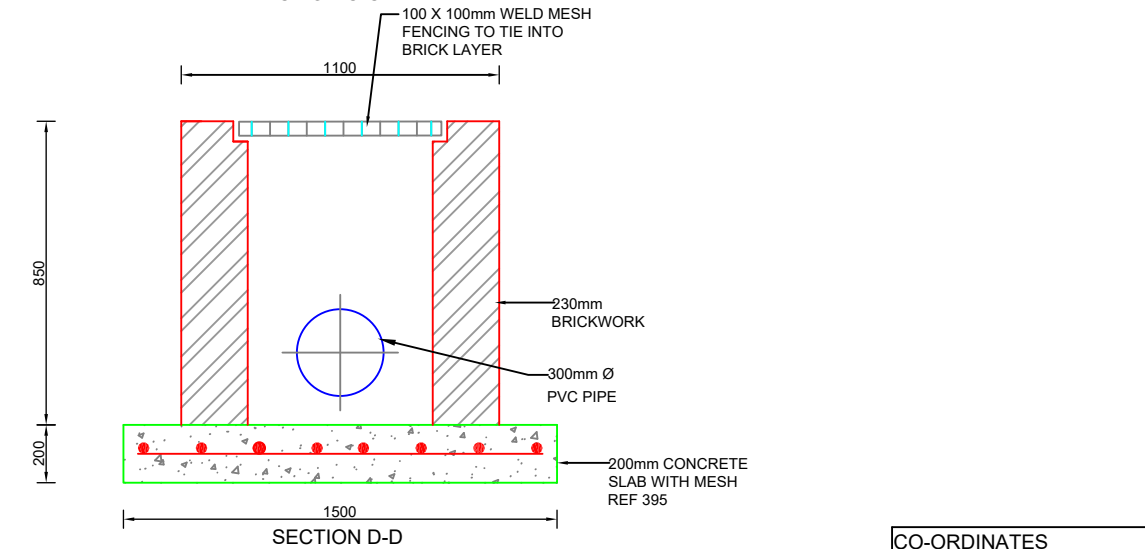
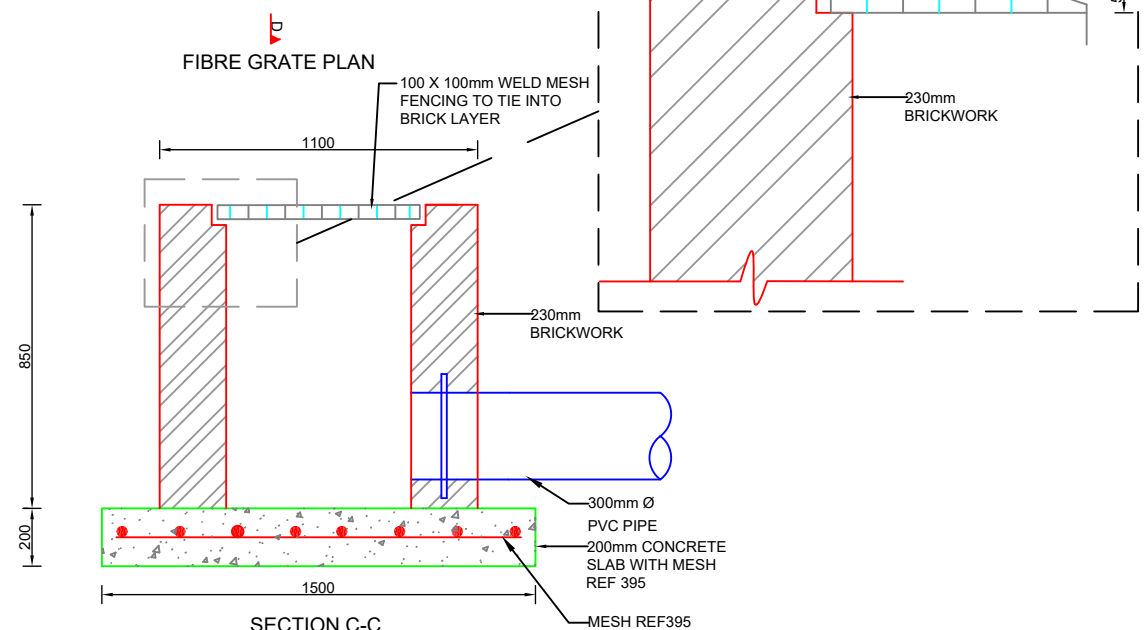
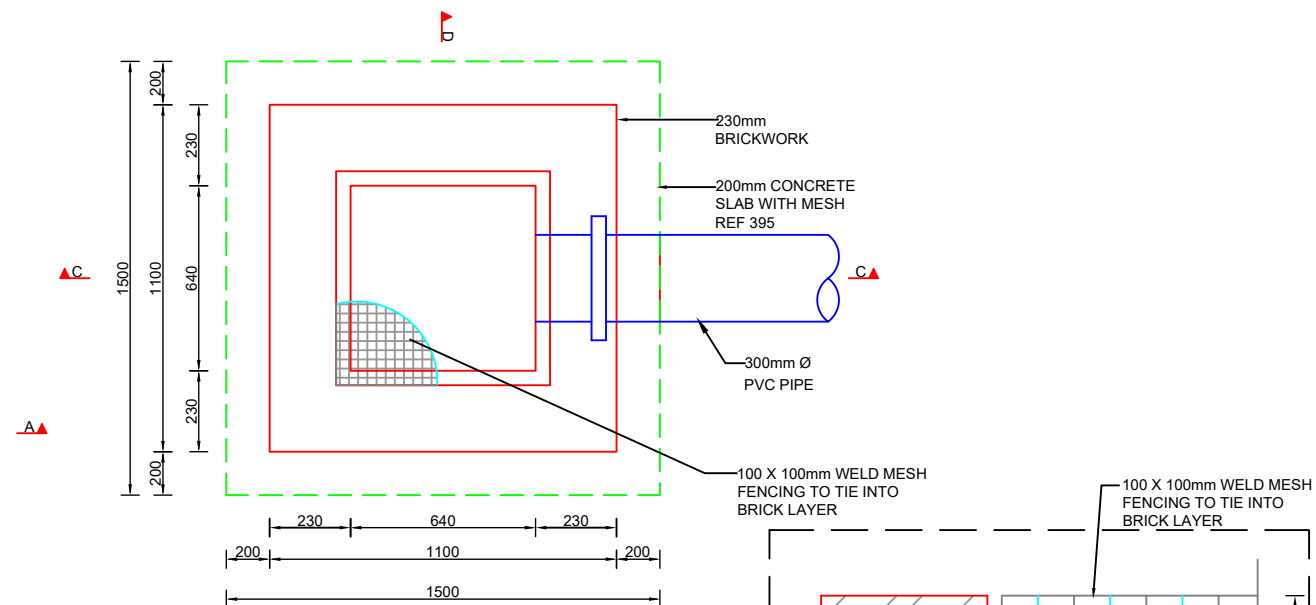
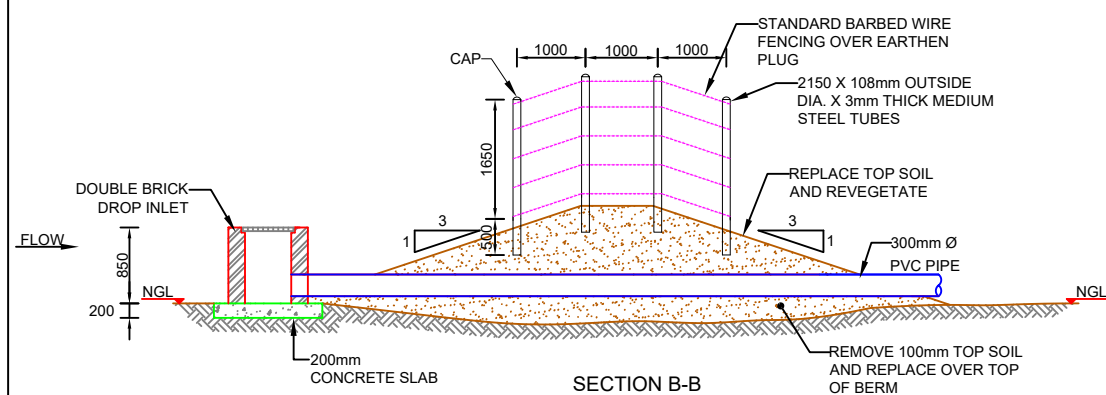
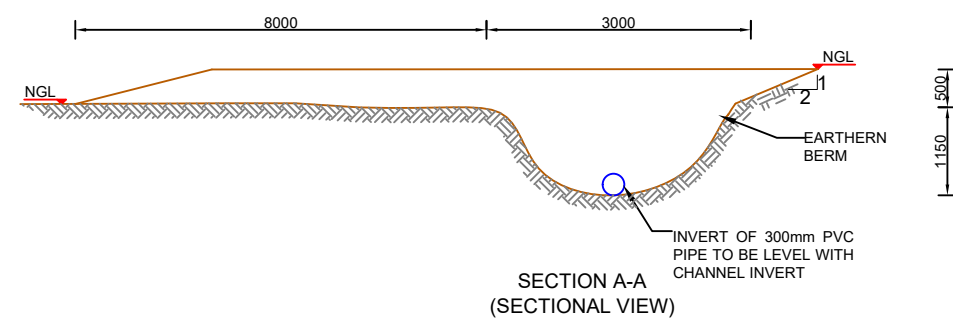
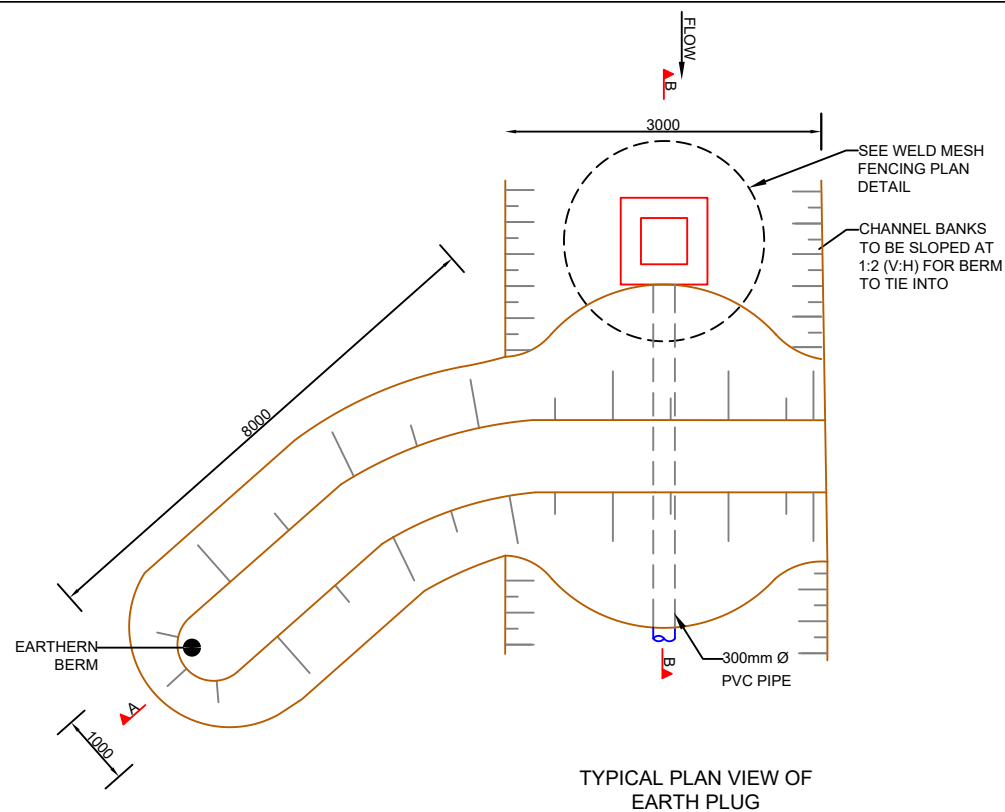
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	39.45
Excavation for sloping	m ³	182.51
Standard double skin brick	m ³	0.86
Concrete	m ³	0.45
Revegetation	m ²	34.31
Class4 300 mm PVC pipe	m	10.90
100 mm x 100 mm weld mesh fencing	m ²	0.80
Standard barbed wire	m	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'26.29"S	26°46'46.64"E

- NOTES**
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
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 - µm - MICRO METER

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

- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

Details

Intervention	S32E-01-205-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'27.45"S
Longitude (D°M'S")	26°46'45.55"E

Location Photograph: S32E-01-205-00



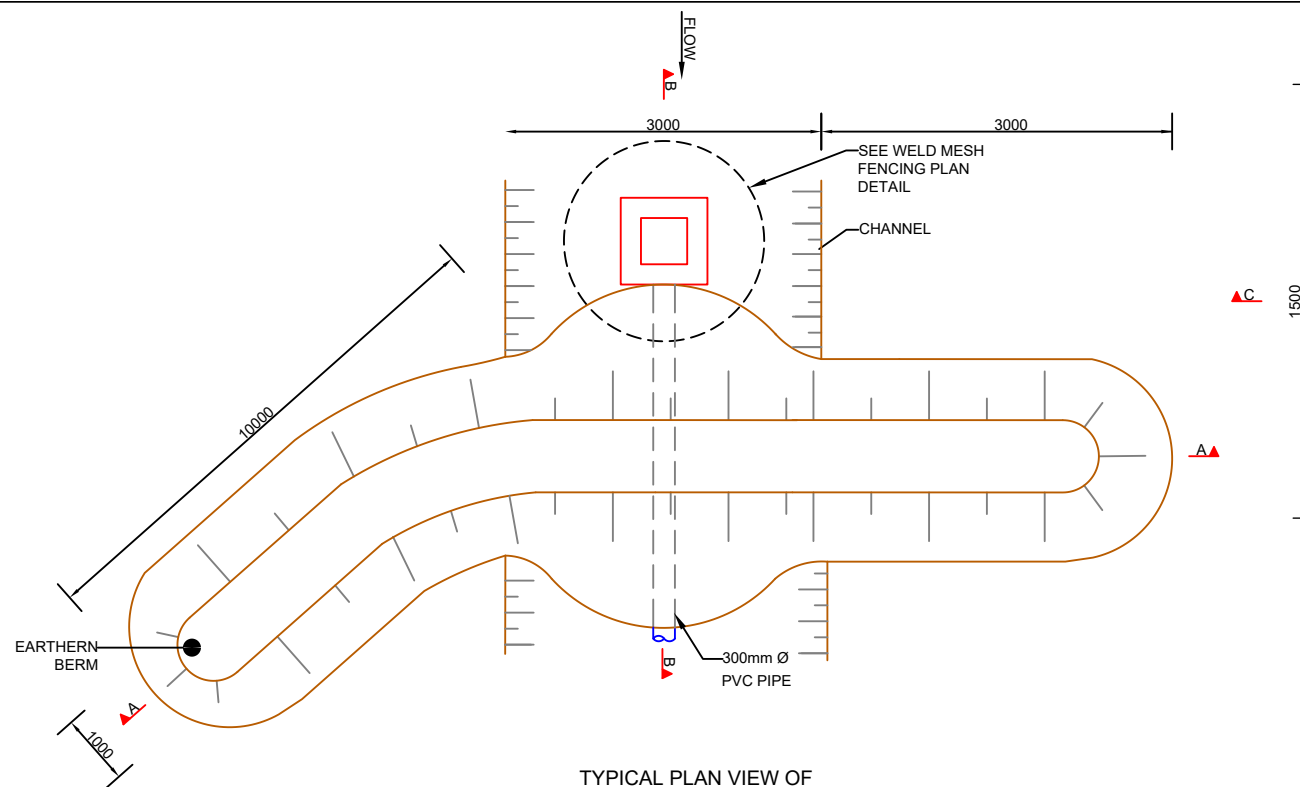
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	45.70
Excavation for sloping	m ³	137.54
Standard double skin brick	m ³	0.86
Concrete	m ³	0.45
Revegetation	m ²	34.31
Class4 300 mm PVC pipe	m	10.90
100 mm x 100 mm weld mesh fencing	m ²	0.80
Standard barbed wire	m	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

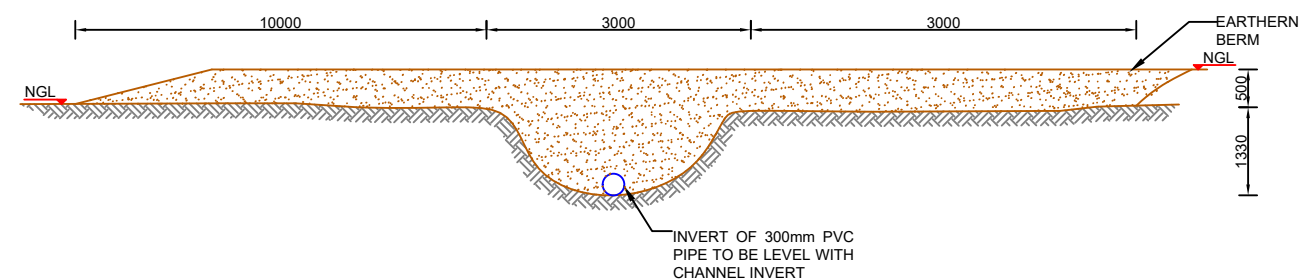
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

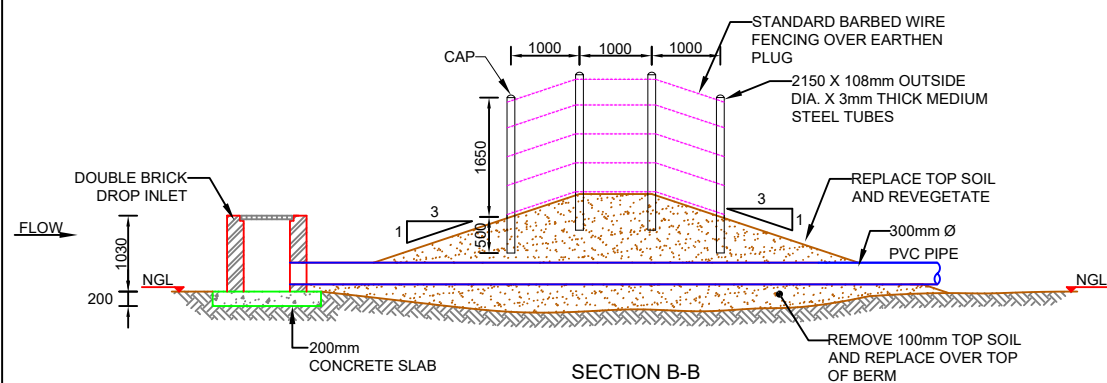
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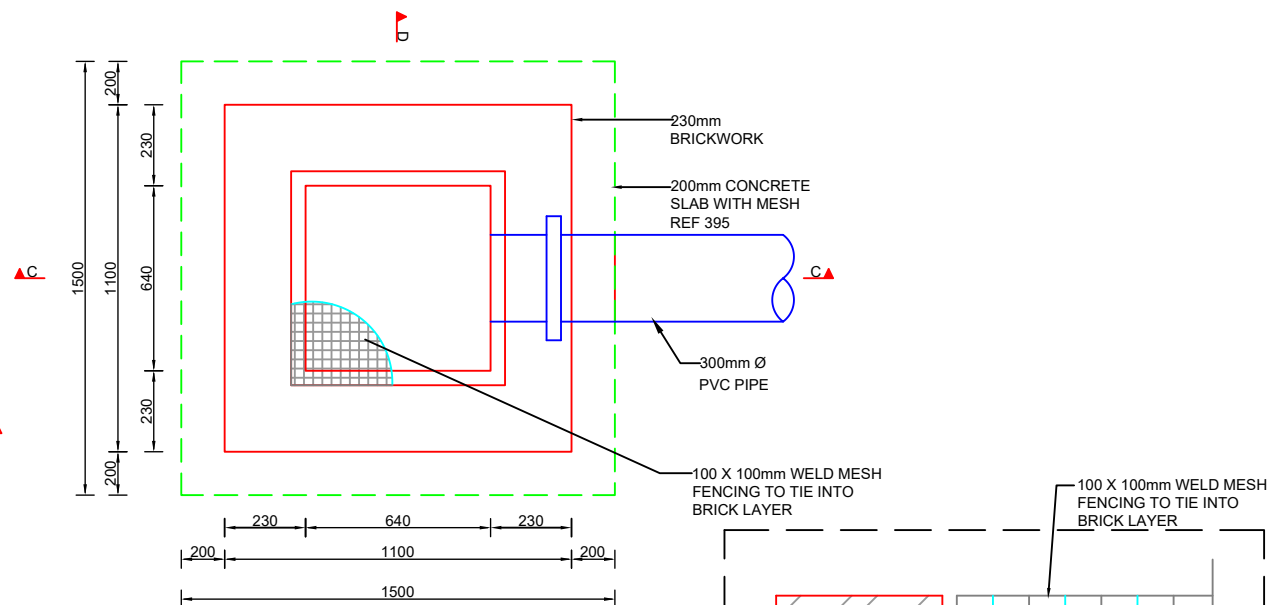
TYPICAL PLAN VIEW OF EARTH PLUG



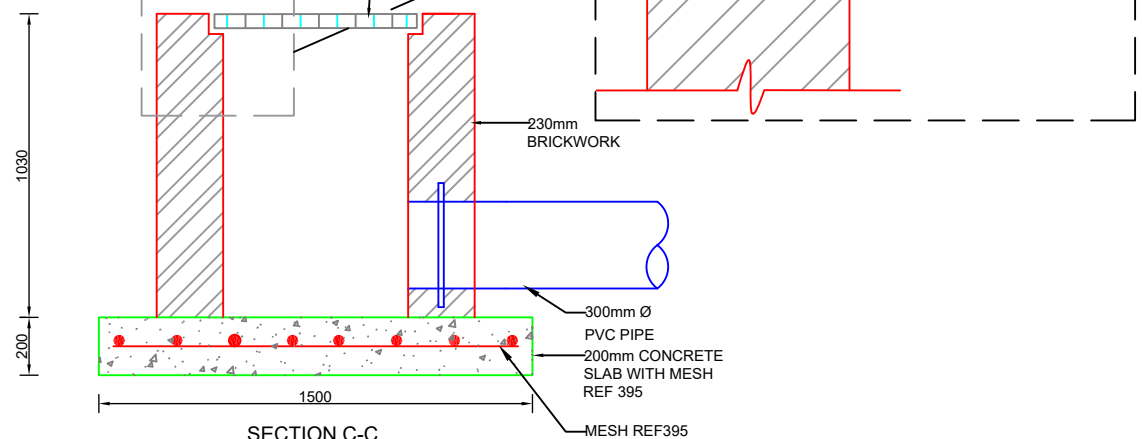
SECTION A-A
(SECTIONAL VIEW)



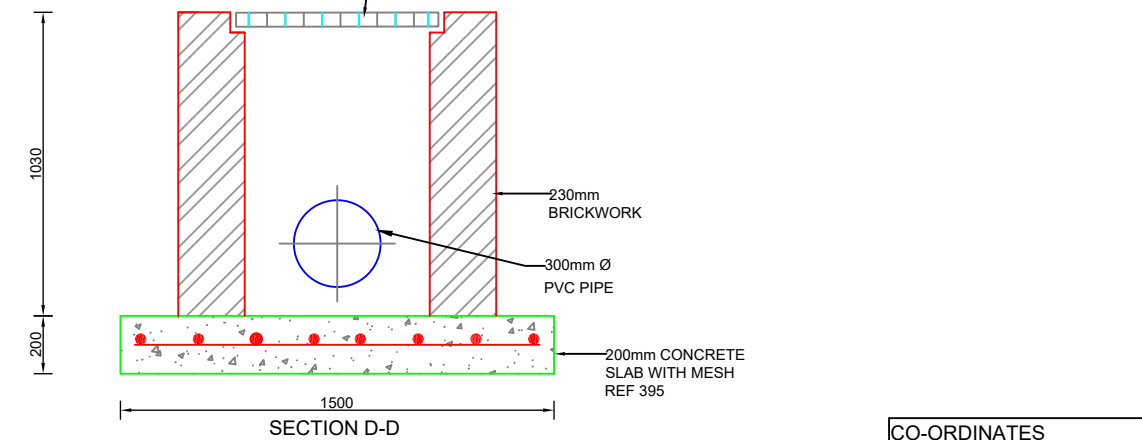
SECTION B-B



FIBRE GRATE PLAN



SECTION C-C



SECTION D-D

CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'27.45"S	26°46'45.55"E

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

- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

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

- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 205 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-206-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and skimming of berm
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Skimming of berm to allow water to flood to wetland level.
Latitude (D°M'S")	32°25'28.76"S
Longitude (D°M'S")	26°46'44.38"E

Location Photograph: S32E-01-206-00



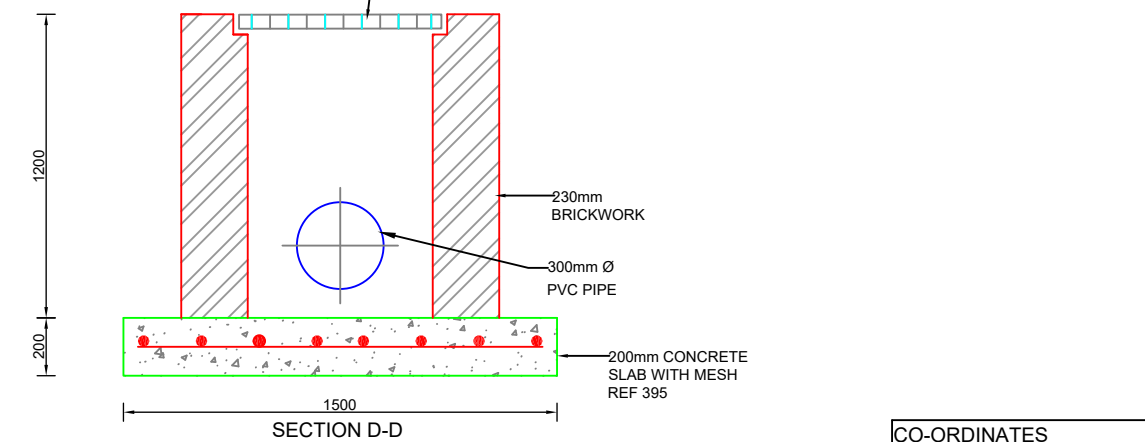
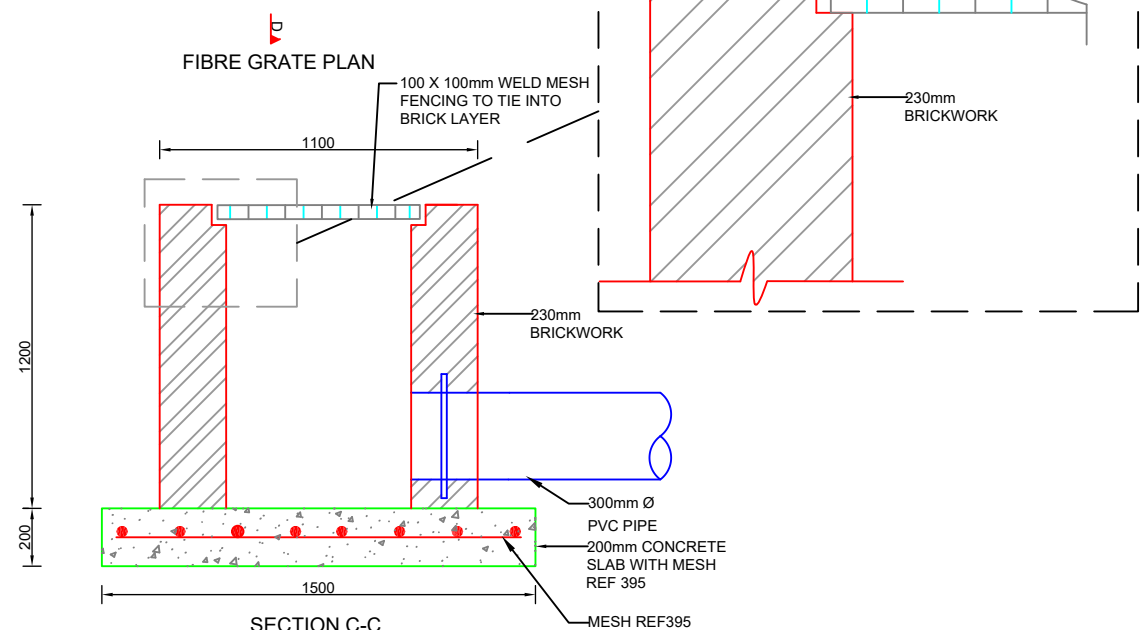
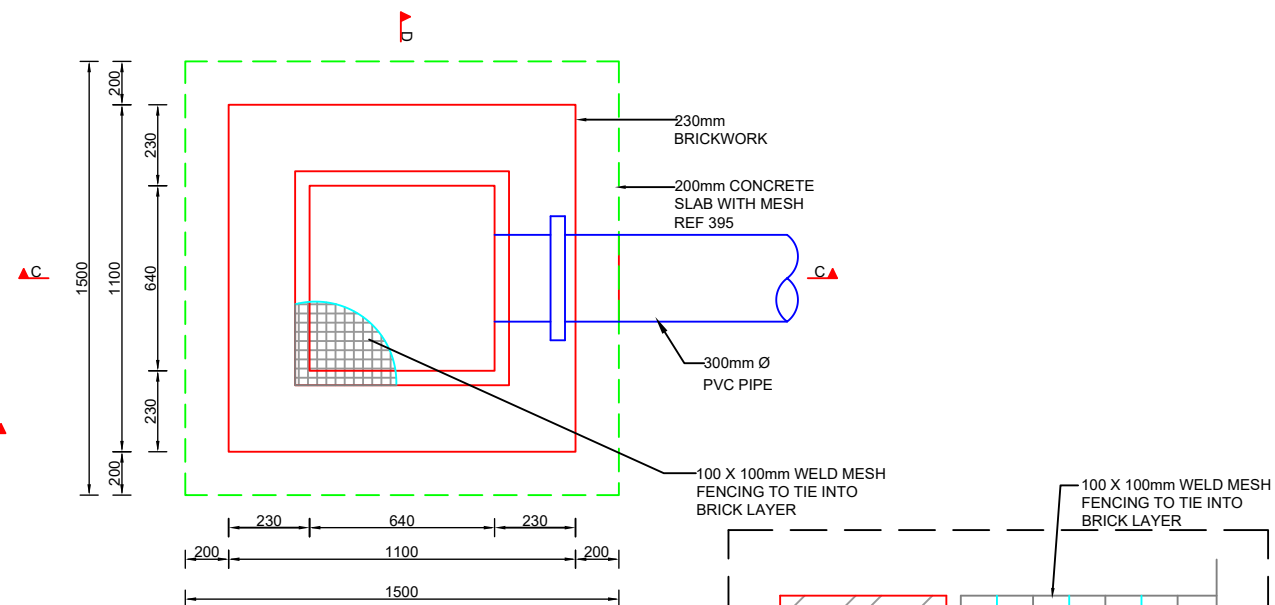
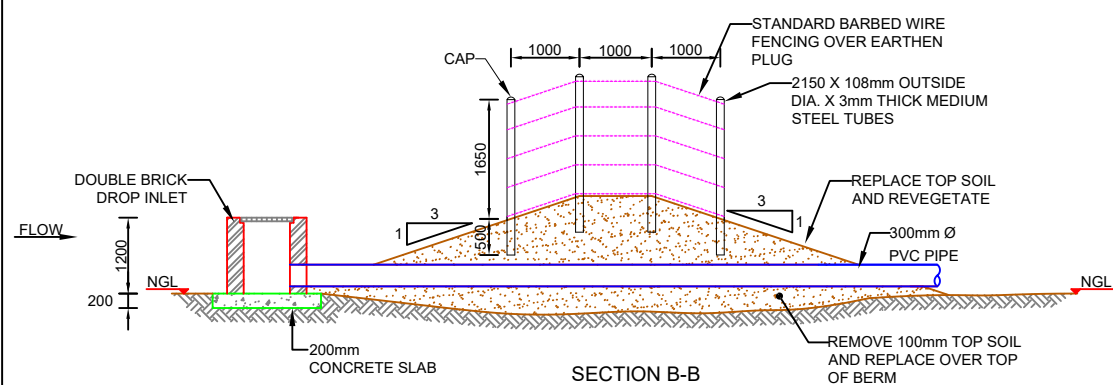
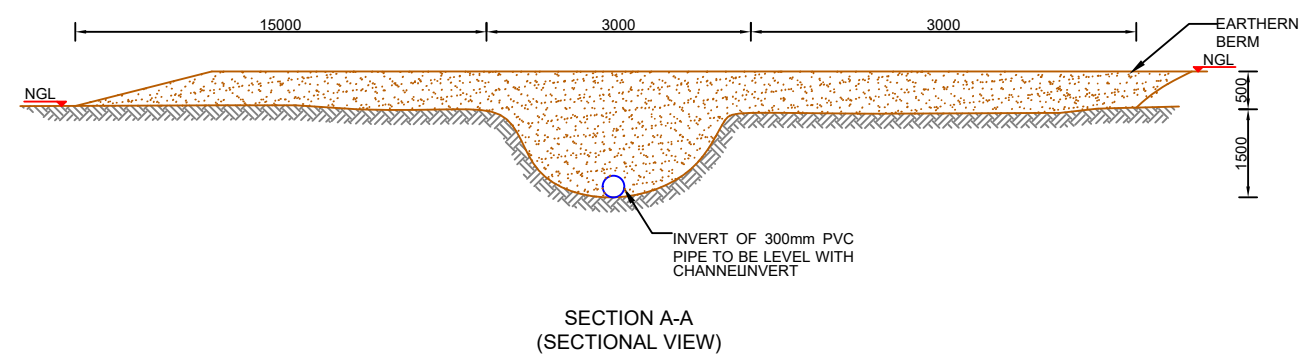
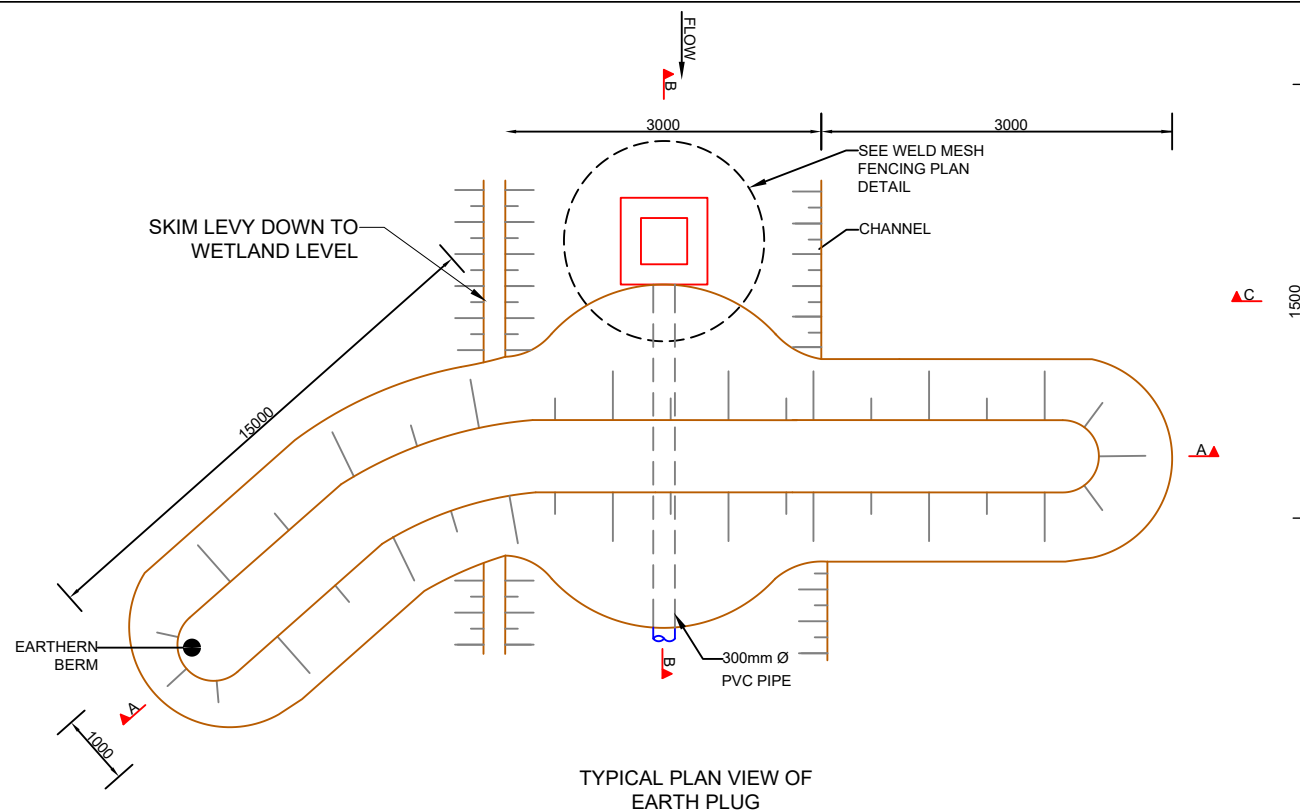
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	64.50
Excavation for sloping	m ³	216.00
Standard double skin brick	m ³	1.21
Concrete	m ³	0.45
Revegetation	m ²	40.95
Class4 300 mm PVC pipe	m	13.00
100 mm x 100 mm weld mesh fencing	m ²	0.80
Standard barbed wire	m	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'28.76"S	26°46'44.38"E

- NOTES**
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

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

- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.



REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
1		DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3	PRELIMINARY DESIGN	
				DRAWN		APPROVED	
				T. HARVEY		ENGINEER	DATE
				T. PIKE			08/02/2019
				CHECKED		REGISTRATION No.	
				T.PIKE		20130774	
DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV		
S32E	-	01	-	206	-	01 OF 01	1

Details

Intervention	S32E-01-207-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with a geocell covered crest (3m wide) with base flow pipe and skimming of berm. TriAx for cattle
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Skimming of berm to allow water to flood to wetland level. Geocell covered berm is to allow cattle to cross the channel and the TriAx to prevent the cattle damaging the wetland.
Latitude (D°M'S")	32°25'29.85"S
Longitude (D°M'S")	26°46'43.37"E

Location Photograph: S32E-01-207-00



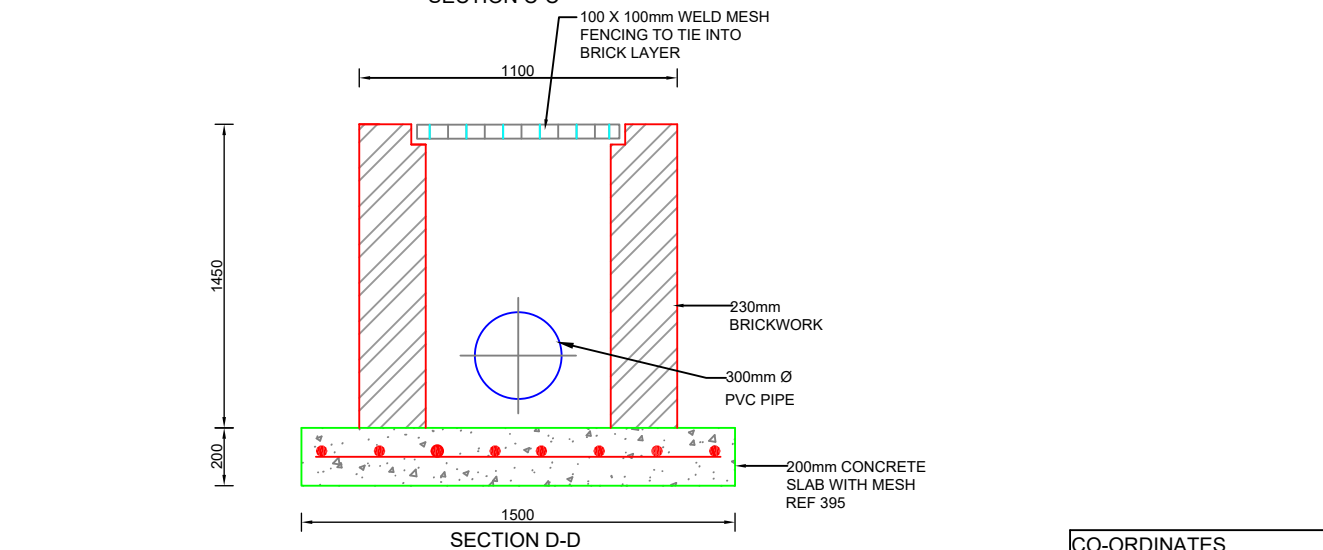
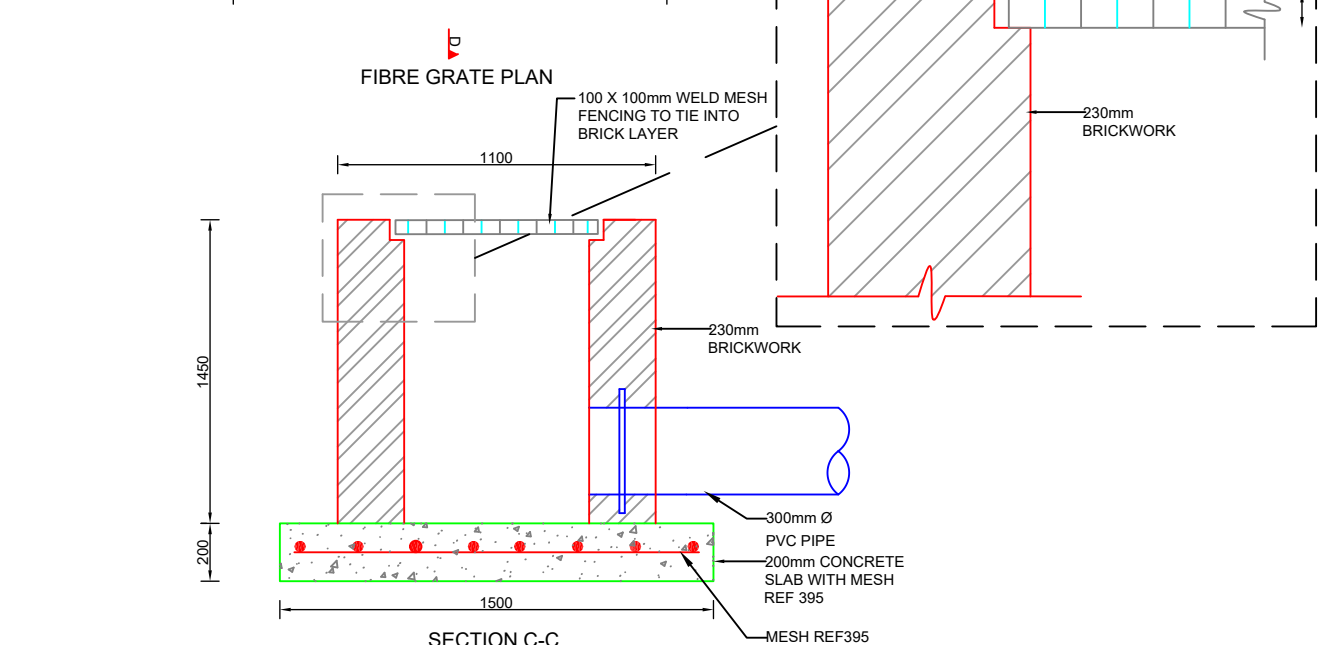
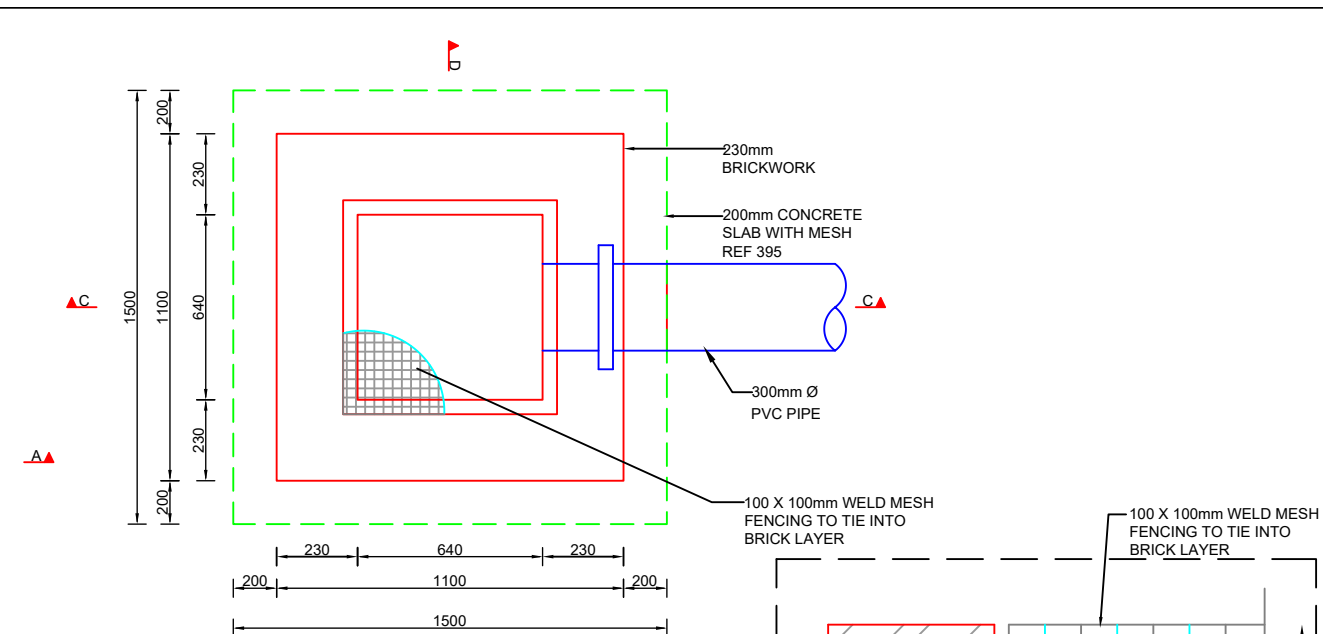
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	253.13
Excavation for sloping	m ³	312.20
Standard double skin brick	m ³	1.47
Concrete	m ³	12.88
Revegetation	m ²	172.30
Class4 300 mm PVC pipe	m	16.50
100 mm x 100 mm weld mesh fencing	m ²	0.80
Standard barbed wire	m	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no	4.00
GeoCells	m ²	76.88
Geofabric	m ²	76.88
TriAx cattle crossing	m ²	180.00

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

The following site specific mitigation measures shall be implemented:

N/A



NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.

2. AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED AGAINST ANY ASSOCIATED DAMAGES AND ACCEPT NO LIABILITY ASSOCIATED WITH THE CONSTRUCTION AND IMPLEMENTATION OF ENGINEERING INTERVENTIONS DUE TO THE ENGINEERS HAVING LIMITED CONTACT WITH THE IMPLEMENTER DURING THE CONSTRUCTION PHASE RESULTING IN OUR INABILITY TO DILIGENTLY SUPERVISE AND ASSESS ANY PROGRESS.

ACRONYMS AND ABBREVIATIONS

1. NGL - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE
3. μm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 10% OF THE PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
3. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
4. ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
5. CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
7. CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
9. FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CONCRETE FILLED GEOCELLS:

1. FOOTPRINT AREA TO BE CLEARED PRIOR TO CONSTRUCTION.
2. SHAPE TO REQUIRED SLOPE.
3. FOR CONCRETE MIX, FOLLOW SUPPLIERS INSTRUCTIONS. CONCRETE WITH A HIGH SLUMP IS PREFERABLE FOR PLACING IN GEOCELL.
4. CONCRETE FOR GEOCELLS TO BE MINIMUM 15MPa & MIX:
1 BAG CEMENT
125L SAND
120L STONE
30L WATER
5. RIGGING AS SPECIFIED BY SUPPLIER AND ANCHORING TO BE DONE.
6. CONCRETE TO HAVE BROOMED FINISH.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'29.85"S	26°46'43.37

Details

Intervention	S32E-01-208-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Excavation of berm and backfilling drain.
Rehabilitation Objectives	To spread flow evenly through wetland and have no preferred flow path.
Latitude (D°M'S")	32°25'31.13"S
Longitude (D°M'S")	26°46'43.53"E

Location Photograph: S32E-01-208-00



Bill of Quantities

Item	Units	Quantity
Earthworks for backfilling drain	m ³	31.20

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

The following site specific mitigation measures shall be implemented:

N/A

Details

Intervention	S32E-01-209-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Slope banks. Geocell covered earthen berm
Rehabilitation Objectives	To deactivate the channel and flood wetland.
Latitude (D°M'S")	32°25'31.07"S
Longitude (D°M'S")	26°46'45.36"E

Location Photograph: S32E-01-209-00



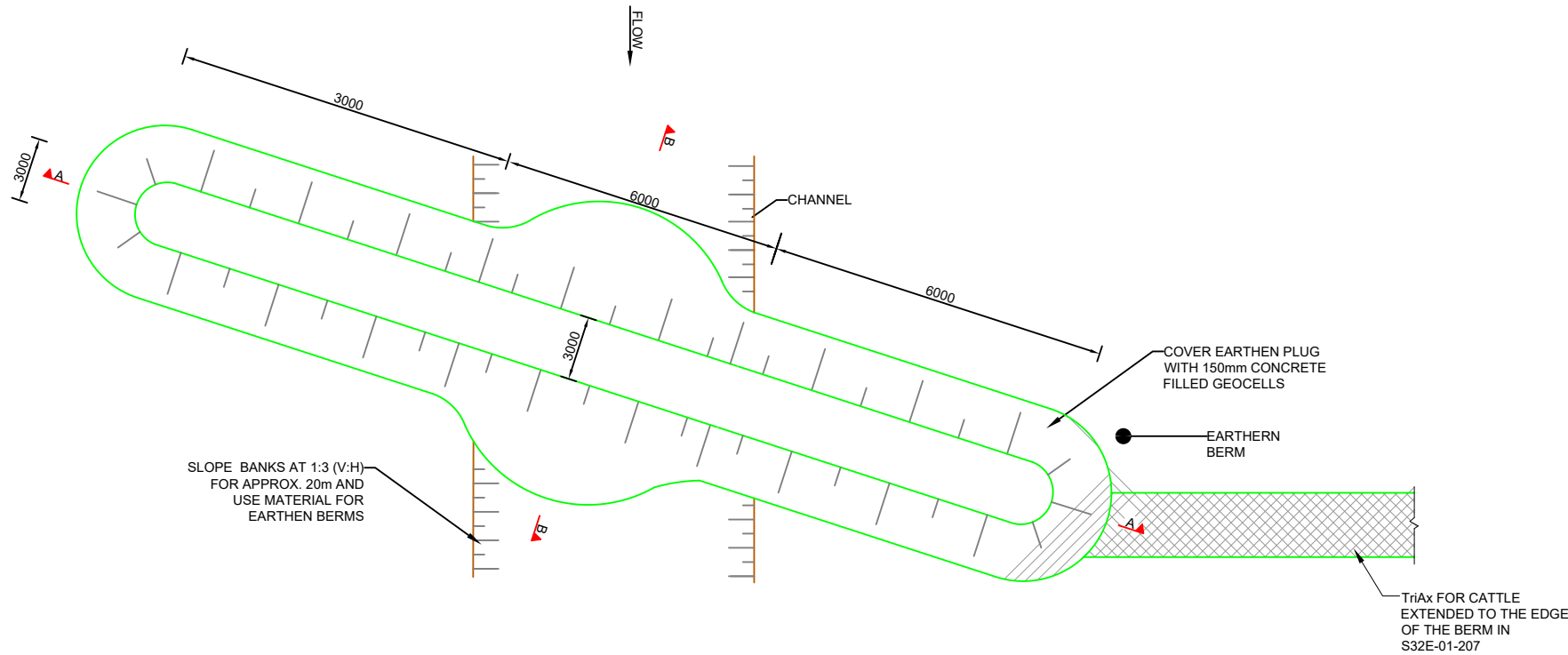
Bill of Quantities

Item	Units	Quantity
Excavation for sloping	m ³	13.50
Earthworks for earthen berm	m ³	52.32
Geocells	m ²	94.64
Concrete	m ³	16.90
Geofabric	m ²	94.64

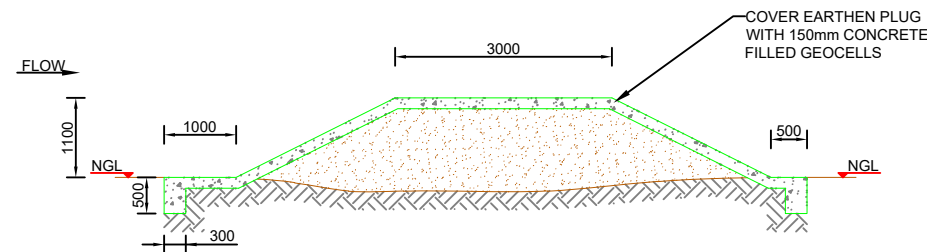
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

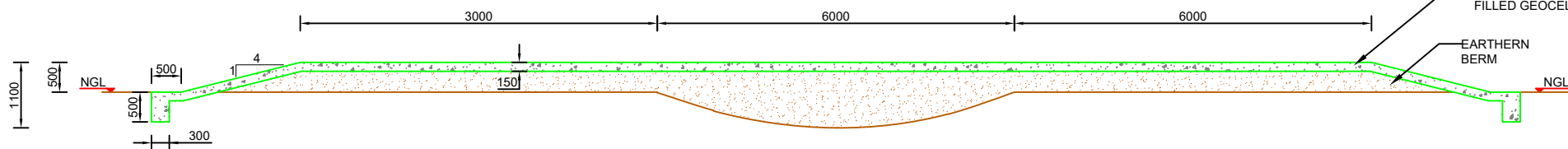
N/A



TYPICAL PLAN VIEW OF EARTH PLUG



SECTION B-B



SECTION A-A

CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'31.07"S	26°46'45.36"E

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

ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

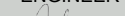
- ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
- ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100MM OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
- SOIL FOR BERMS AND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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDED SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE FILLED GEOCELLS:

- FOOTPRINT AREA TO BE CLEARED PRIOR TO CONSTRUCTION.
- SHAPE TO REQUIRED SLOPE.
- FOR CONCRETE MIX, FOLLOW SUPPLIERS INSTRUCTIONS. CONCRETE WITH A HIGH SLUMP IS PREFERABLE FOR PLACING IN GEOCELL.
- CONCRETE FOR GEOCELLS TO BE MINIMUM 15MPa & MIX:
1 BAG CEMENT
125L SAND
120L STONE
30L WATER
- RIGGING AS SPECIFIED BY SUPPLIER AND ANCHORING TO BE DONE.
- CONCRETE TO HAVE BROOMED FINISH.

REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN	PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020								
1	14/11/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3											
				DRAWN		APPROVED	PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE								
				T. HARVEY		ENGINEER	DATE									
				DESIGNED			08/02/2019	INTERVENTION DESCRIPTION	GEOCELL COVERED EARTHEN BERM							
				CHECKED		REGISTRATION No.										
				T.PIKE		20130774		DRAWING No.	QUATERNARY No.		WETLAND No.		INTERVENTION No.		PAGE NUMBER	REV
								S32E	-	01	-	209	-	01 OF 01	-	1

Details

Intervention	S32E-01-210-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Slope banks. Construct earthen berm @ every 25m (start of intervention).
Rehabilitation Objectives	To deactivate the channel and flood wetland.
Latitude (D°M'S")	Start: 32°25'30.99"S Start: 32°25'21.85"S
Longitude (D°M'S")	End: 26°46'45.57"E End: 26°46'56.04"E

Location Photograph: S32E-01-210-00



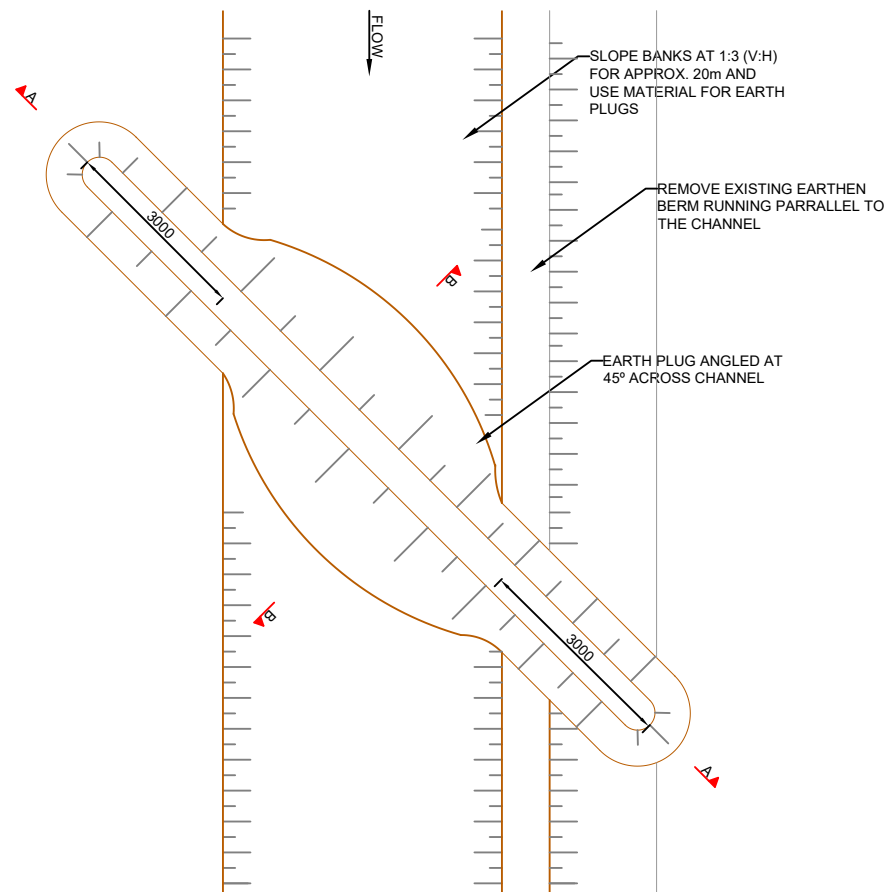
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m³	306.18
Excavation for sloping	m³	367.75

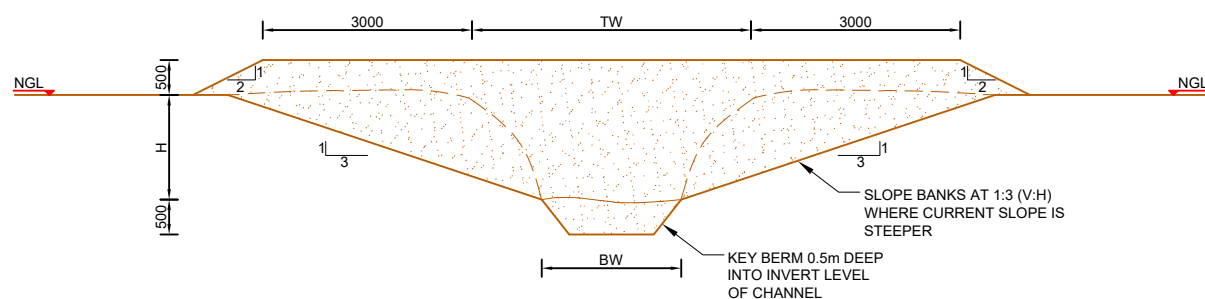
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

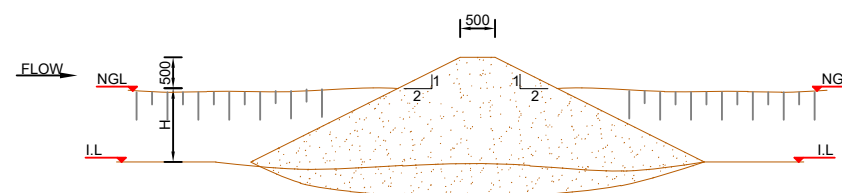
N/A



TYPICAL PLAN VIEW OF EARTH PLUG



SECTION A-A



SECTION B-B

Latitude	Longitude	H (m)	TW (m)	BW (m)
32°25'30.99"S	26°46'45.57"E	1.5	4	2
32°25'30.51"S	26°46'45.99"E	0.4	3.5	2
32°25'29.78"S	26°46'46.53"E	0.36	5	3
32°25'29.25"S	26°46'47.01"E	0.3	4	2
32°25'28.61"S	26°46'47.58"E	1	4	2
32°25'28.04"S	26°46'48.13"E	0.9	4	2
32°25'27.41"S	26°46'48.61"E	1	4	2
32°25'26.75"S	26°46'49.22"E	0.5	4	2
32°25'26.16"S	26°46'49.78"E	0.6	4	1.5
32°25'25.51"S	26°46'50.33"E	0.5	4	2
32°25'24.91"S	26°46'50.85"E	0.6	4	1.5
32°25'24.22"S	26°46'51.49"E	0.5	3	1.5
32°25'23.79"S	26°46'52.24"E	1	4	2
32°25'23.35"S	26°46'53.07"E	0.3	3	1.5
32°25'22.96"S	26°46'53.81"E	0.3	4	2
32°25'22.65"S	26°46'54.54"E	0.5	3.5	1.5
32°25'22.26"S	26°46'55.32"E	0.4	3	1
32°25'21.85"S	26°46'56.04"E	0.4	3	1.5

NOTES

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

ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

DISPERSIVE SOILS:

(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CO-ORDINATES

LATITUDE	LONGITUDE
32°24'29.16"S	26°45'51.12"E

REV	DATE	REVISION DETAILS
1	14/11/2018	DRAFT FOR REHAB PLAN

APPROVED
T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN
APPROVED
ENGINEER
DATE
REGISTRATION No.

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	SERIES OF EARTHEN BERMS
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 210 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-211-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Excavation of berm and backfilling drain (start of intervention)
Rehabilitation Objectives	To allow for a more diffuse movement of water through wetland.
Latitude (D°M'S")	Start: 32°26'26.72"S
Longitude (D°M'S")	26°46'42.50"E

Location Photograph: S32E-01-211-00



Bill of Quantities

Item	Units	Quantity
Earthworks for backfilling drain	m ³	2624.75
Excavation for removal of berm	m ³	2624.75

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

The following site specific mitigation measures shall be implemented:

N/A

Details

Intervention	S32E-01-212-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'31.12"S
Longitude (D°M'S")	26°46'42.36"E

Location Photograph: S32E-01-212-00



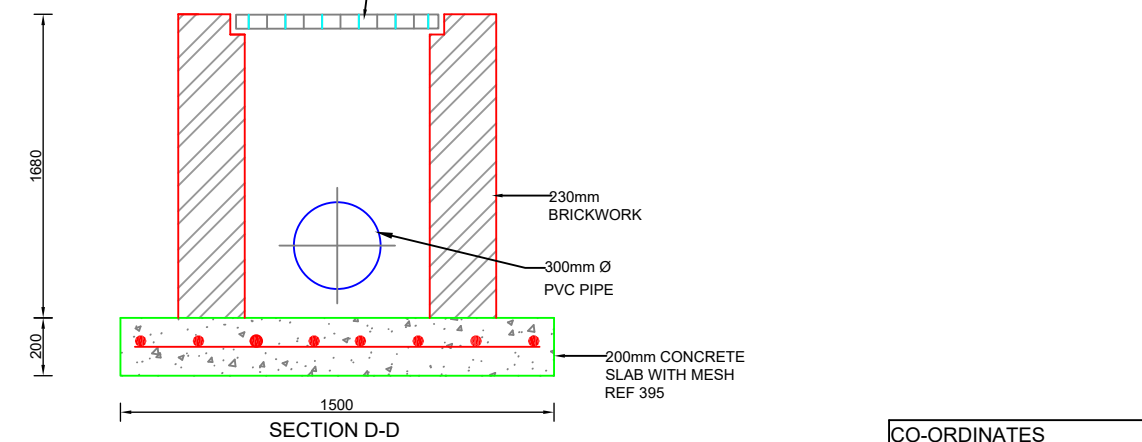
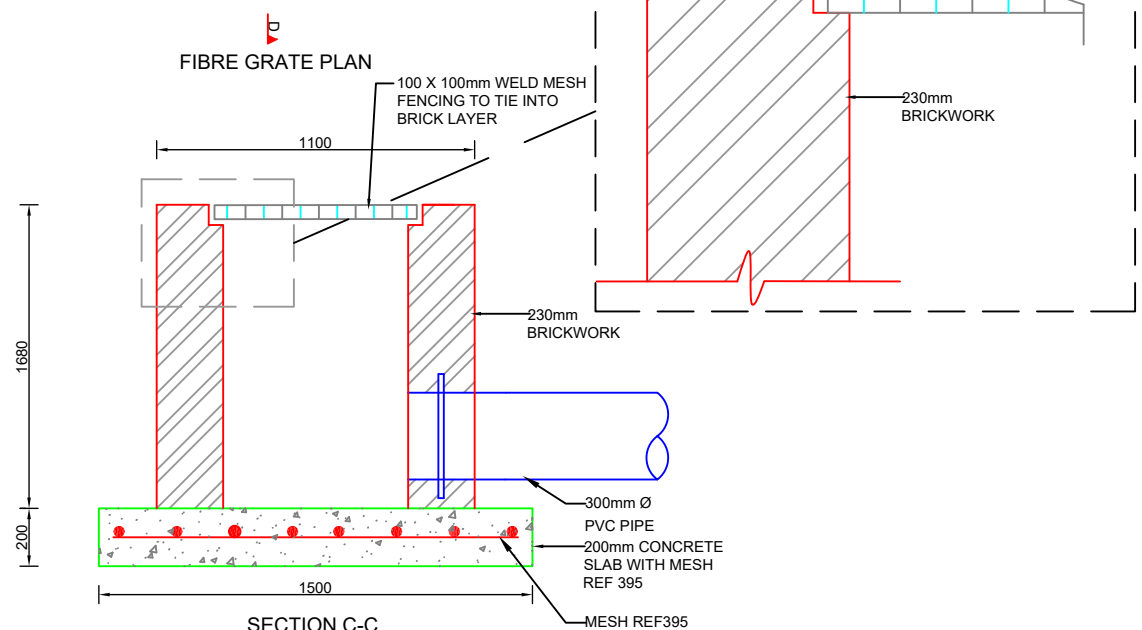
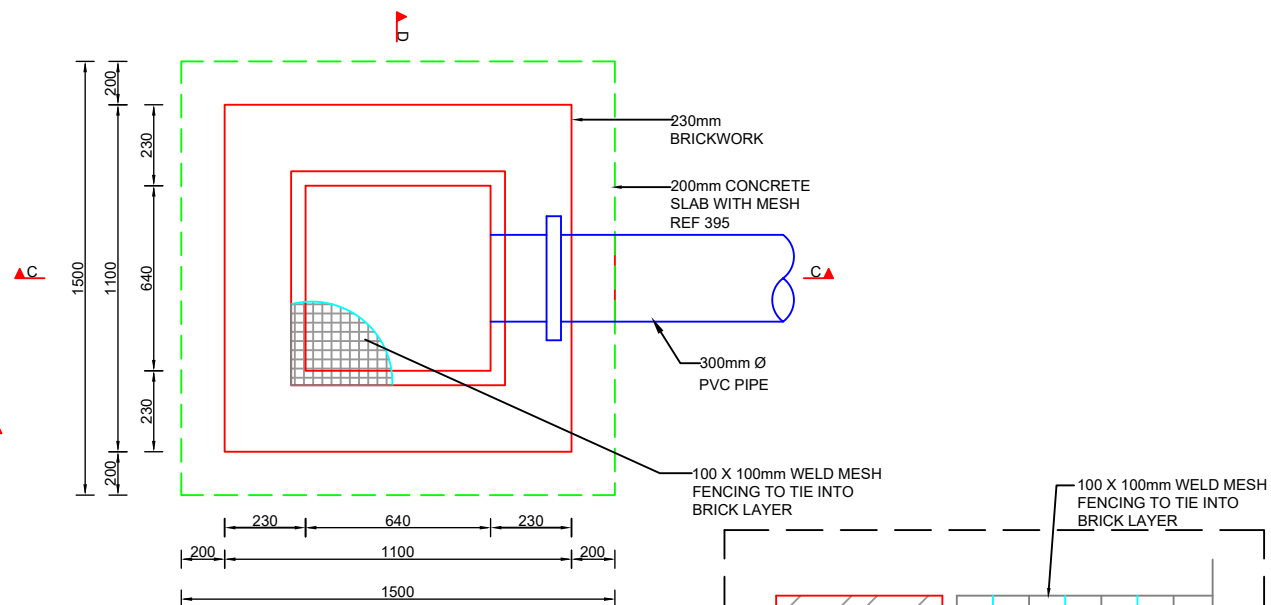
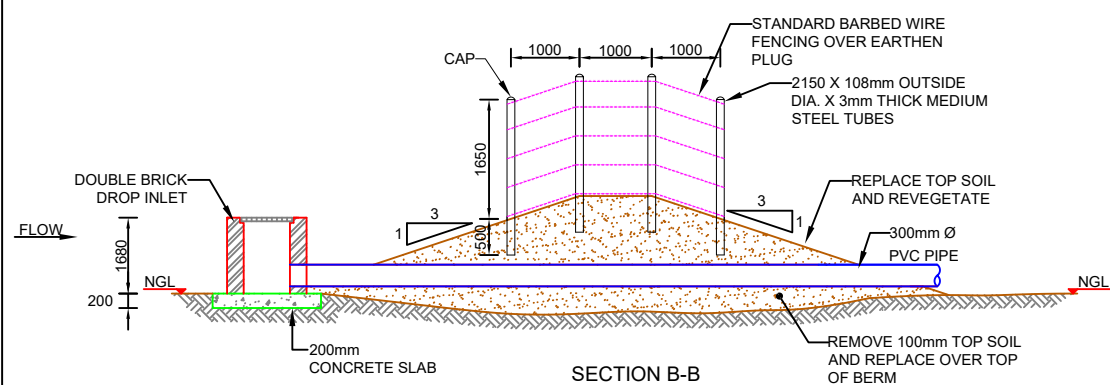
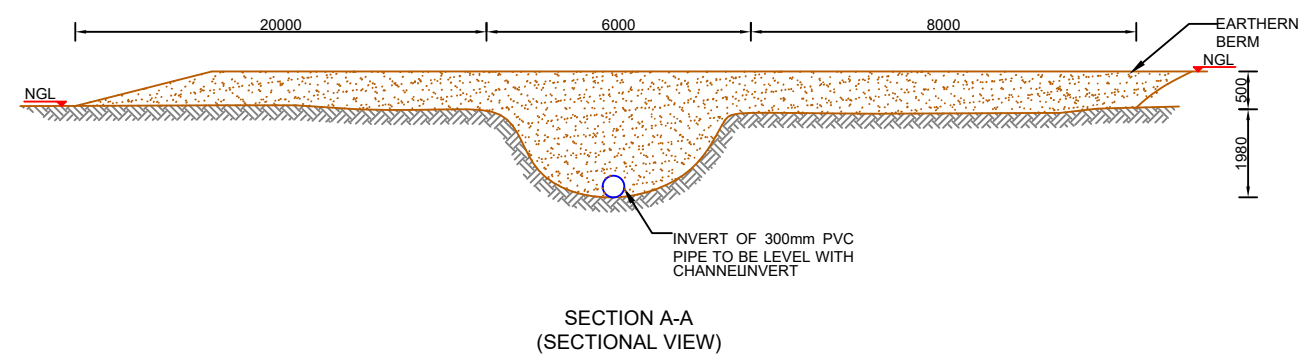
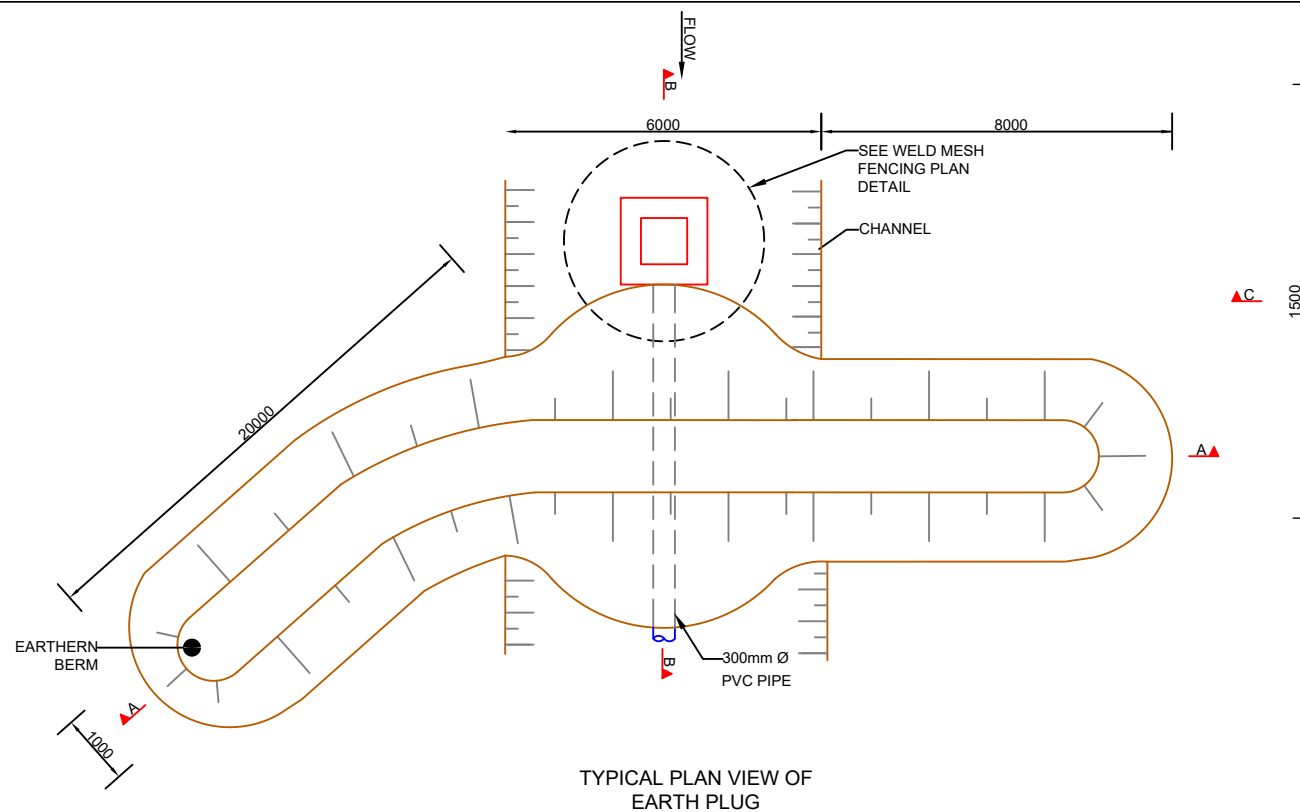
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	160.59
Excavation for sloping	m ³	345.00
Standard double skin brick	m ³	1.70
Concrete	m ³	0.45
Revegetation	m ²	100.11
Class4 300 mm PVC pipe	m	15.88
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'31.12"S	26°46'42.36"E

- NOTES**
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

- EARTHWORKS/ EARTH STRUCTURES:**
- ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
 - ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100MM OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
 - SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100MM LAYERS AT OPTIMUM WATER CONTENT.
- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
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- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 212 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-213-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'33.58"S
Longitude (D°M'S")	26°46'40.10"E

Location Photograph: S32E-01-213-00



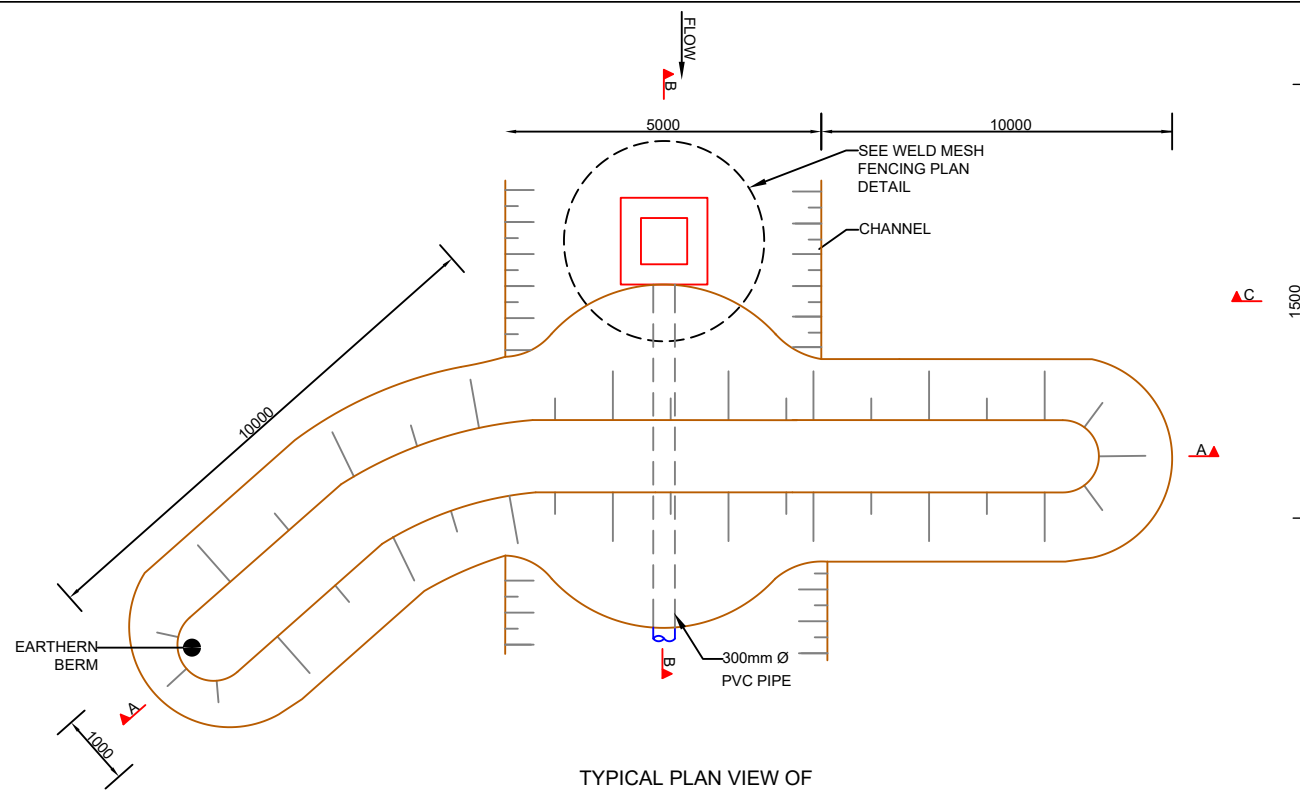
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	105.78
Excavation for sloping	m ³	388.54
Standard double skin brick	m ³	1.38
Concrete	m ³	0.45
Revegetation	m ²	73.31
Class4 300 mm PVC pipe	m	13.96
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

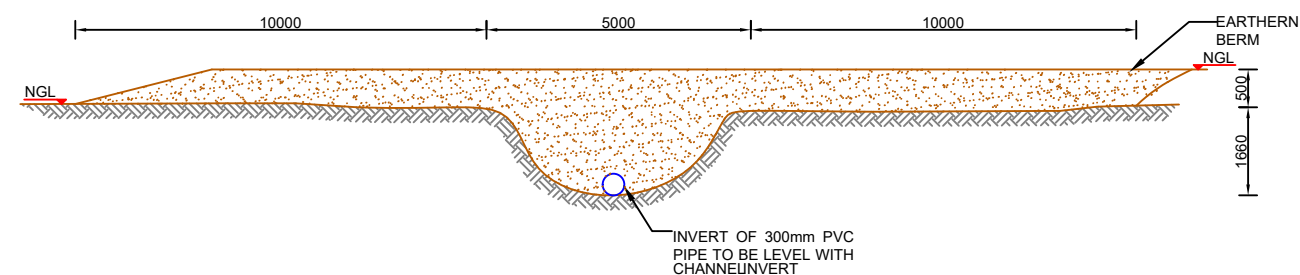
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

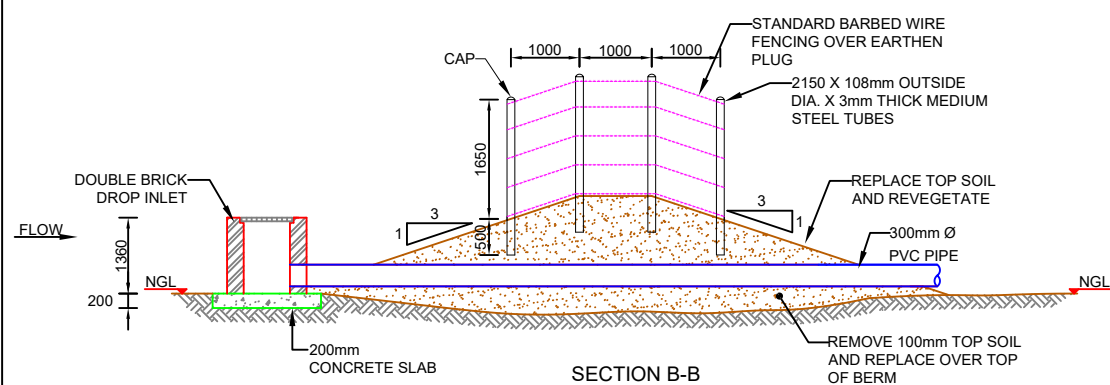
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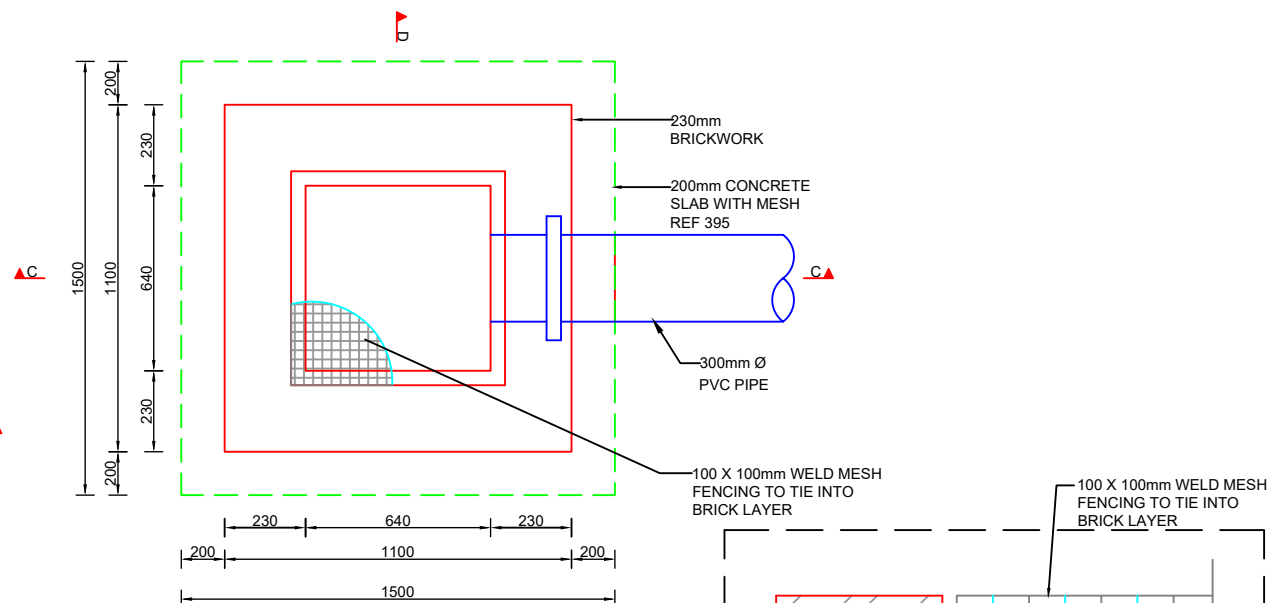
TYPICAL PLAN VIEW OF EARTH PLUG



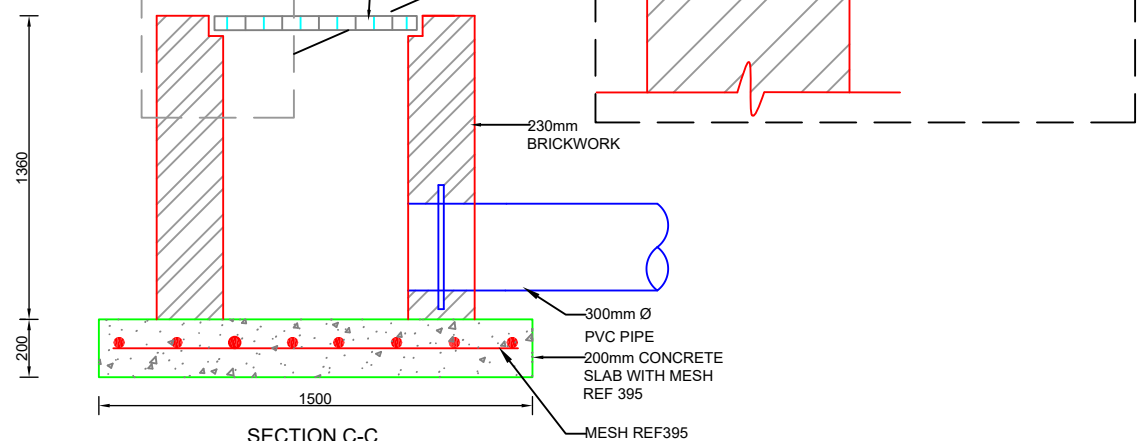
SECTION A-A
(SECTIONAL VIEW)



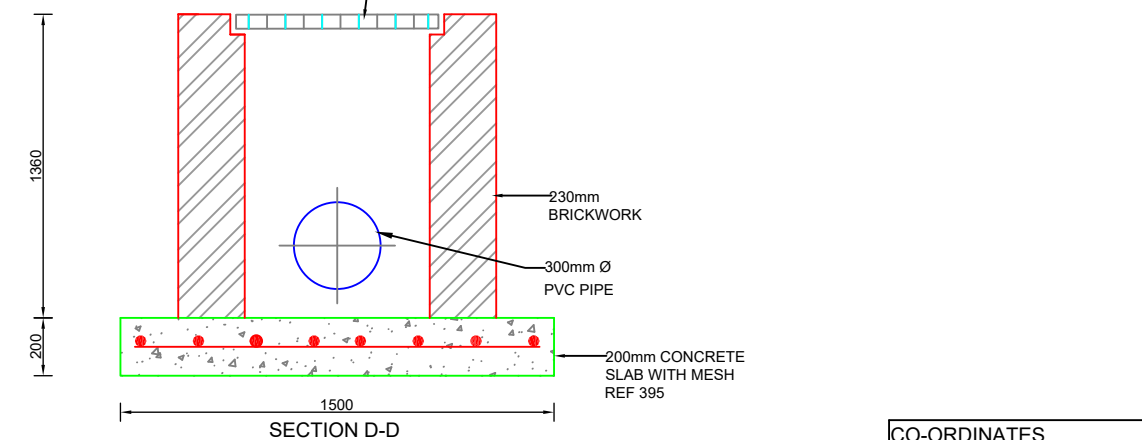
SECTION B-B



FIBRE GRATE PLAN



SECTION C-C



SECTION D-D

CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'33.58"S	26°46'40.10"E

- NOTES**
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- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

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

- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

REV	DATE	REVISION DETAILS
1		DRAFT FOR REHAB PLAN

APPROVED
T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	T. HARVEY
DESIGNED	T. PIKE
CHECKED	T. PIKE

PRELIMINARY DESIGN	
APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 213 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-214-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'34.65"S
Longitude (D°M'S")	26°46'39.35"E

Location Photograph: S32E-01-214-00



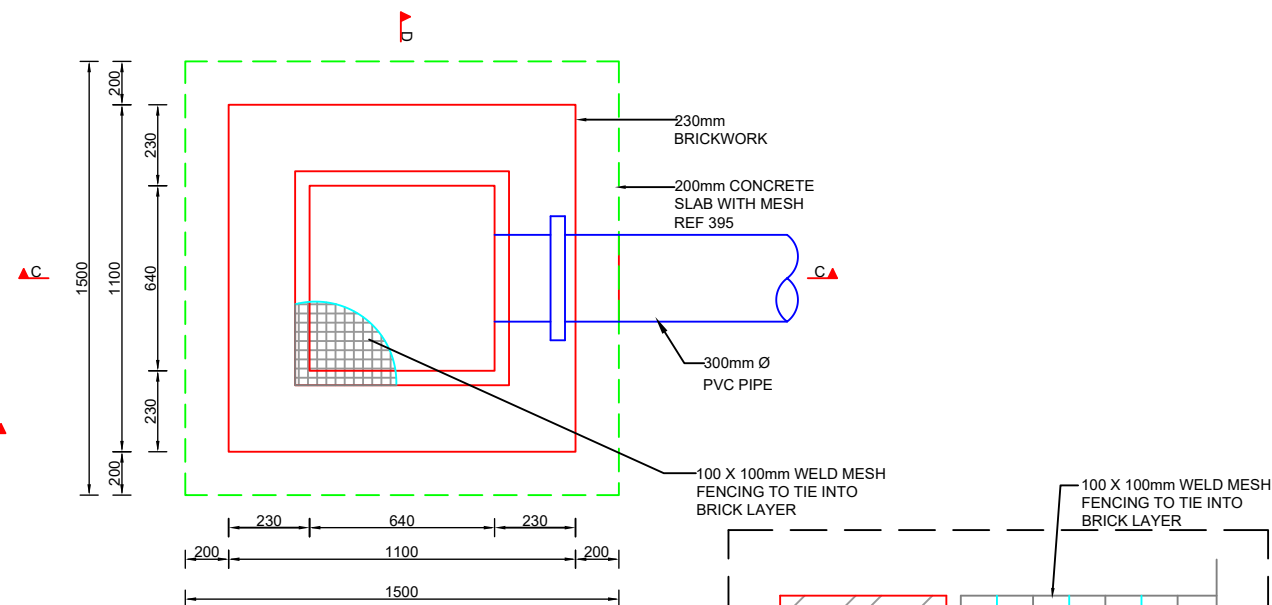
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	185.86
Excavation for sloping	m ³	568.30
Standard double skin brick	m ³	1.66
Concrete	m ³	0.45
Revegetation	m ²	115.02
Class4 300 mm PVC pipe	m	15.64
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

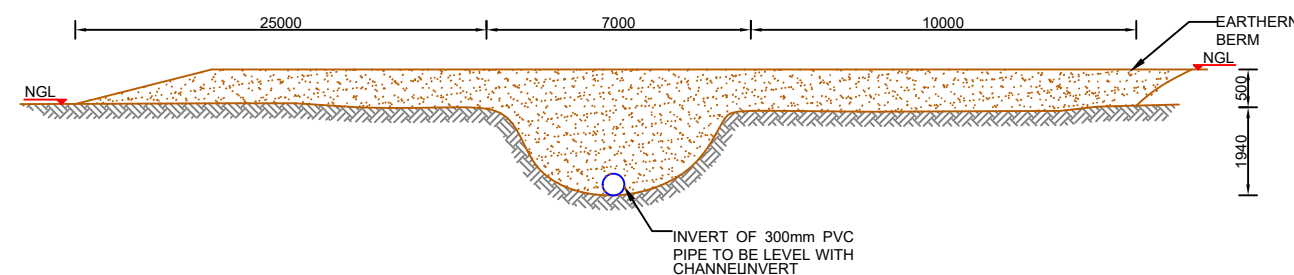
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

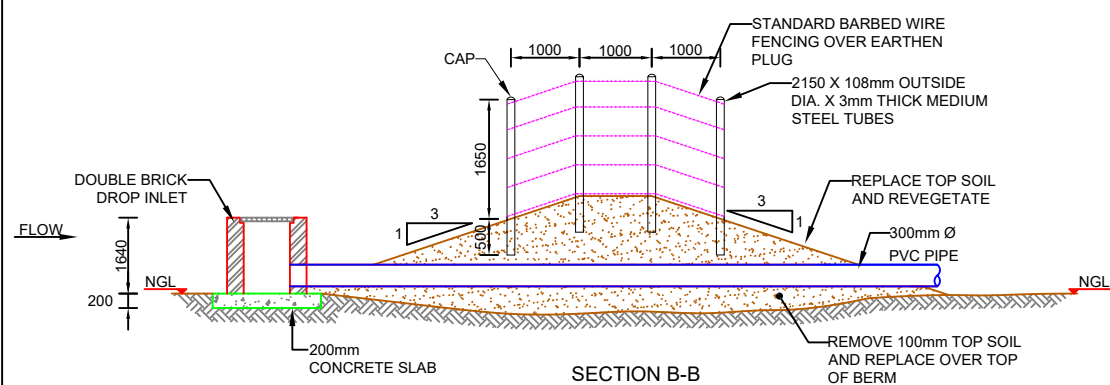
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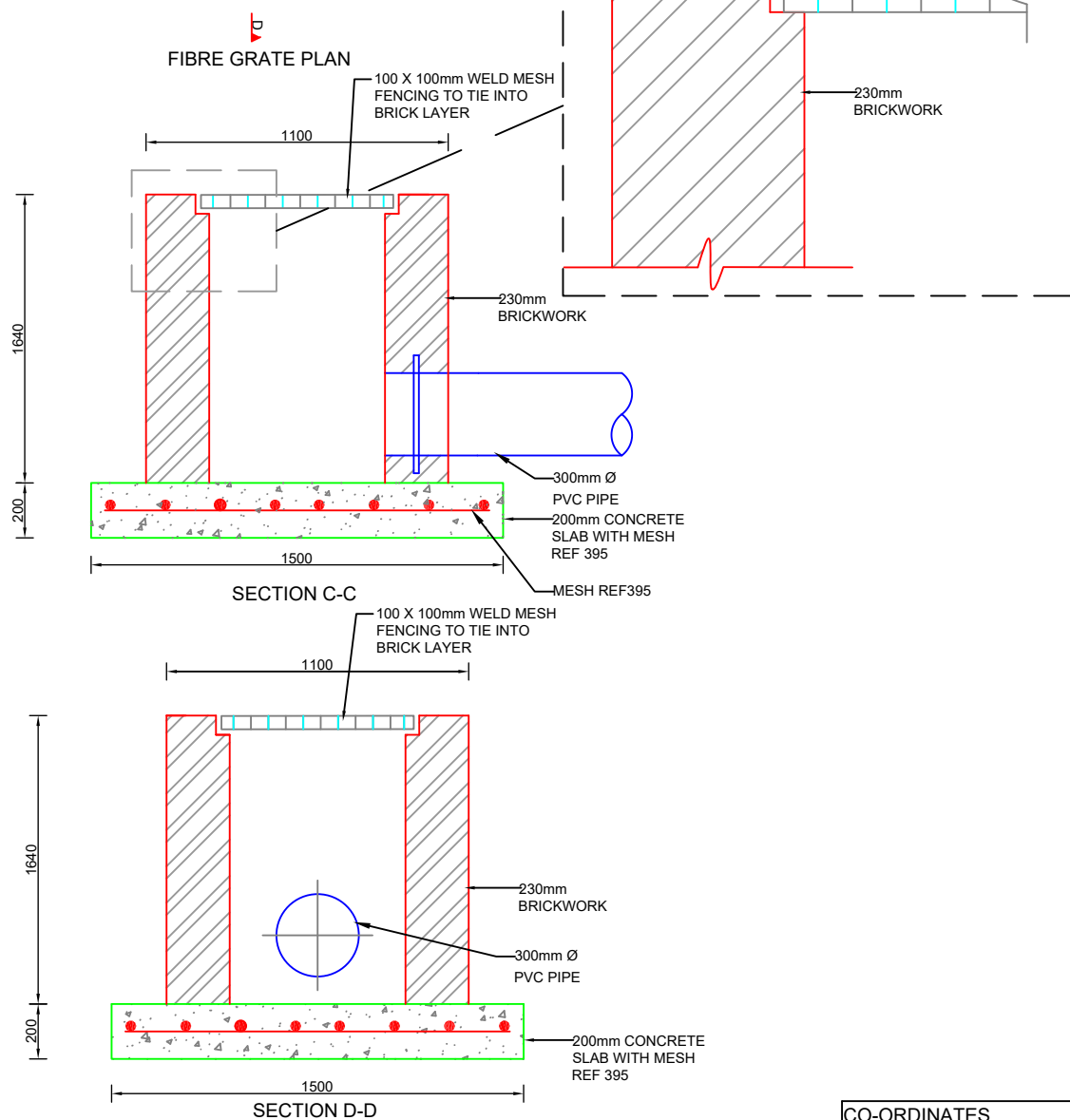
TYPICAL PLAN VIEW OF
EARTH PLUG



SECTION A-A
(SECTIONAL VIEW)



SECTION B-B



SECTION D-D

CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'34.65"S	26°46'39.35

NOTES
<p>1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.</p>
<p>2. AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED AGAINST ANY ASSOCIATED DAMAGES AND ACCEPT NO LIABILITY ASSOCIATED WITH THE CONSTRUCTION AND IMPLEMENTATION OF ENGINEERING INTERVENTIONS DUE TO THE ENGINEERS HAVING LIMITED CONTACT WITH THE IMPLEMENTER DURING THE CONSTRUCTION PHASE RESULTING IN OUR INABILITY TO DILIGENTLY SUPERVISE AND ASSESS ANY PROGRESS.</p>

ACRONYMS AND ABBREVIATIONS

1. NGL - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE
3. μ m - MICRO METER

EARTHWORKS/ EARTH STRUCTURES

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

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

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
3. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
4. ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
5. CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
7. CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
9. FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

Details

Intervention	S32E-01-215-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'36.08"S
Longitude (D°M'S")	26°46'37.50"E

Location Photograph: S32E-01-215-00



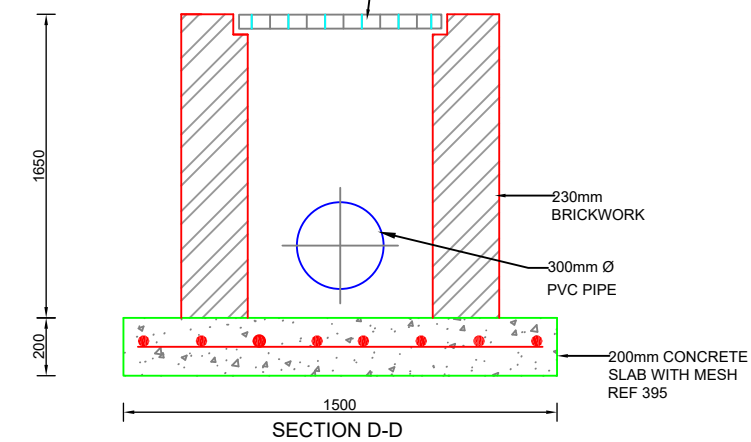
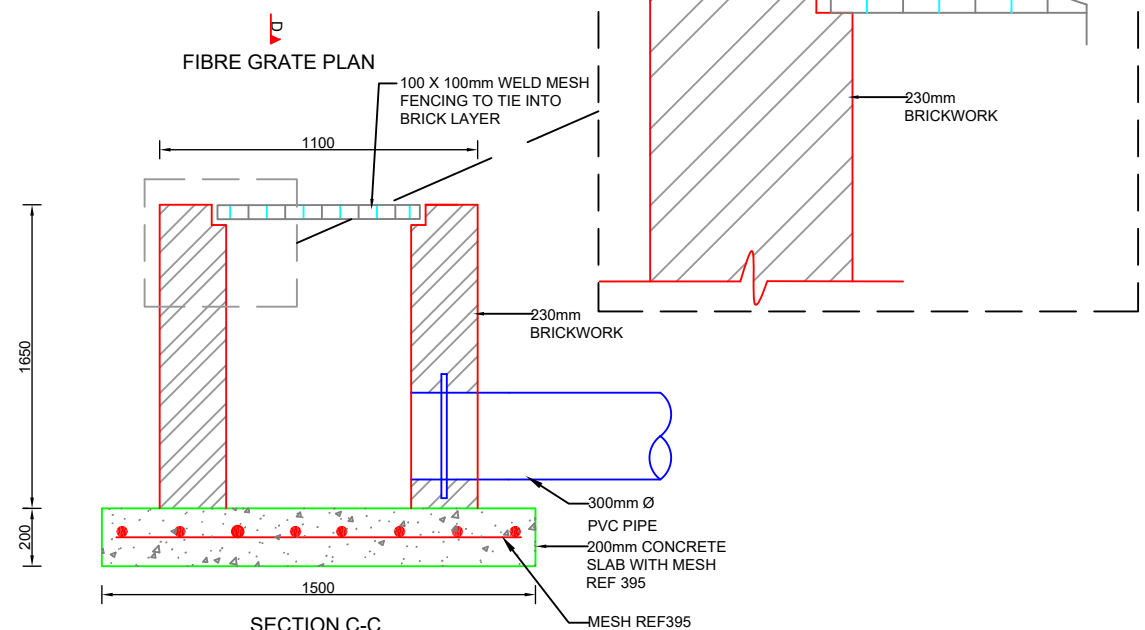
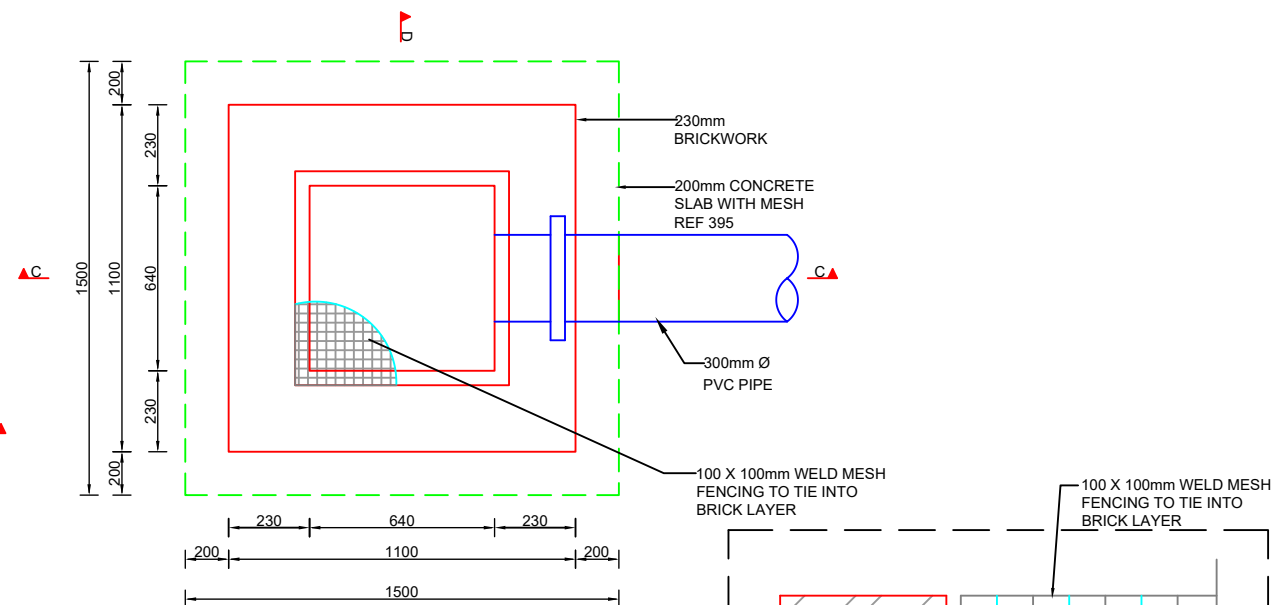
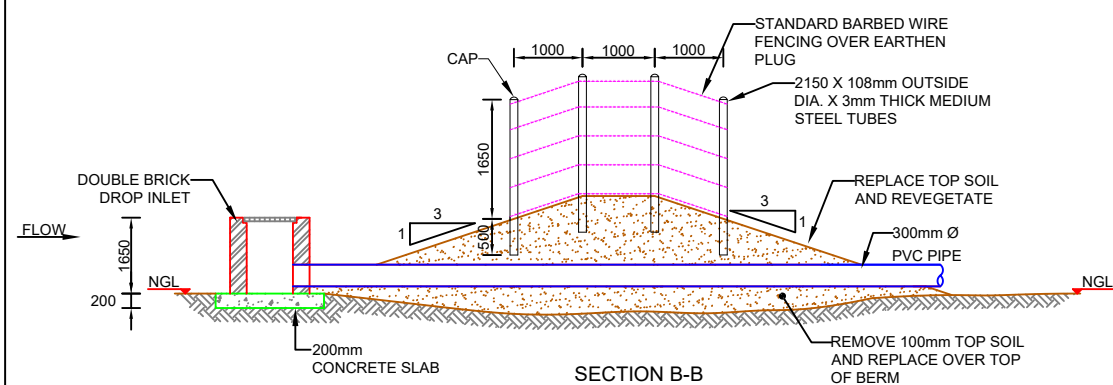
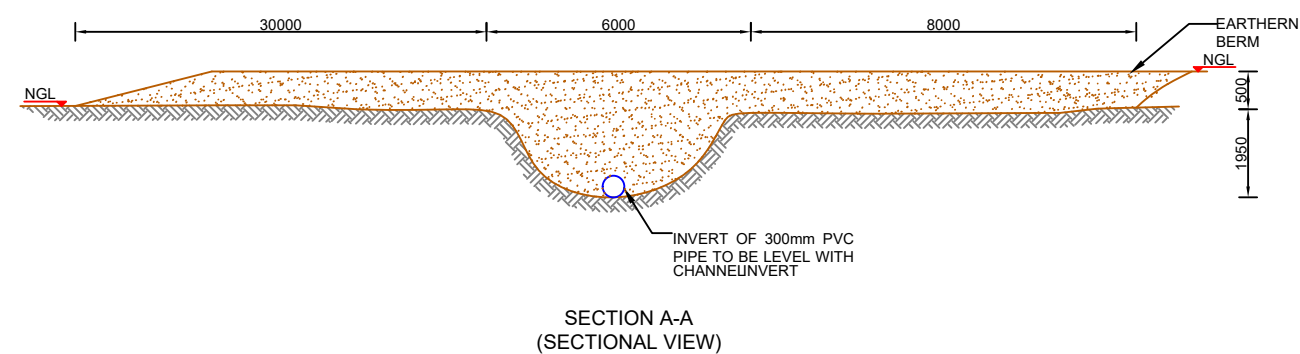
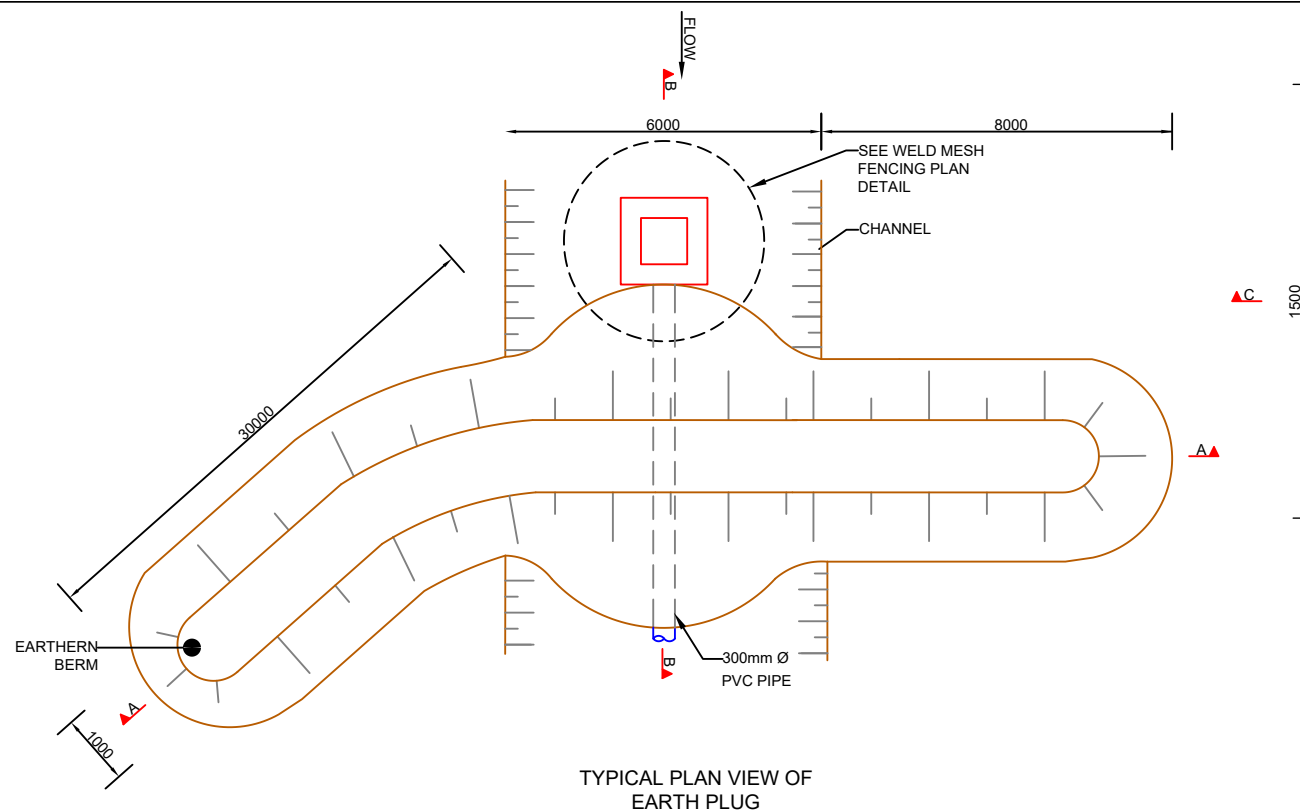
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	170.25
Excavation for sloping	m ³	536.15
Standard double skin brick	m ³	1.67
Concrete	m ³	0.45
Revegetation	m ²	98.87
Class4 300 mm PVC pipe	m	15.70
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'36.08"S	26°46'37.50"E

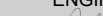
- NOTES**
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. NO GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON-STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN		PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020						
1		DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3										
				DRAWN		APPROVED		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE						
				T. HARVEY		ENGINEER		DATE							
				DESIGNED				08/02/2019	INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE					
				T. PIKE											
				CHECKED		REGISTRATION No.									
				T.PIKE		20130774			DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV	
									S32E	-	01	-	215	-	01 OF 01 - 1

Details

Intervention	S32E-01-216-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'37.53"S
Longitude (D°M'S")	26°46'35.80"E

Location Photograph: S32E-01-216-00



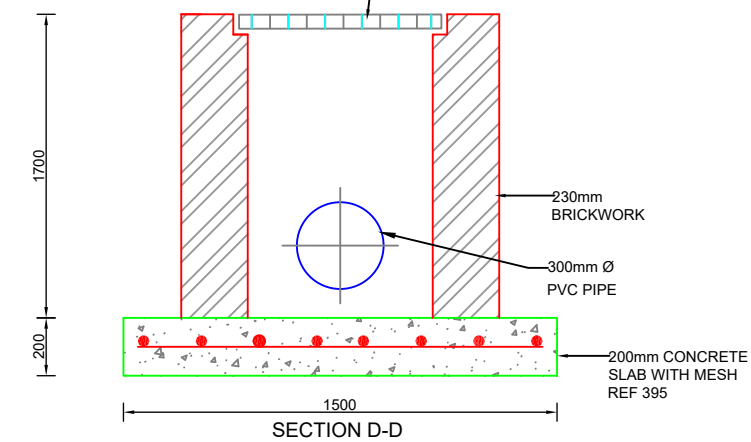
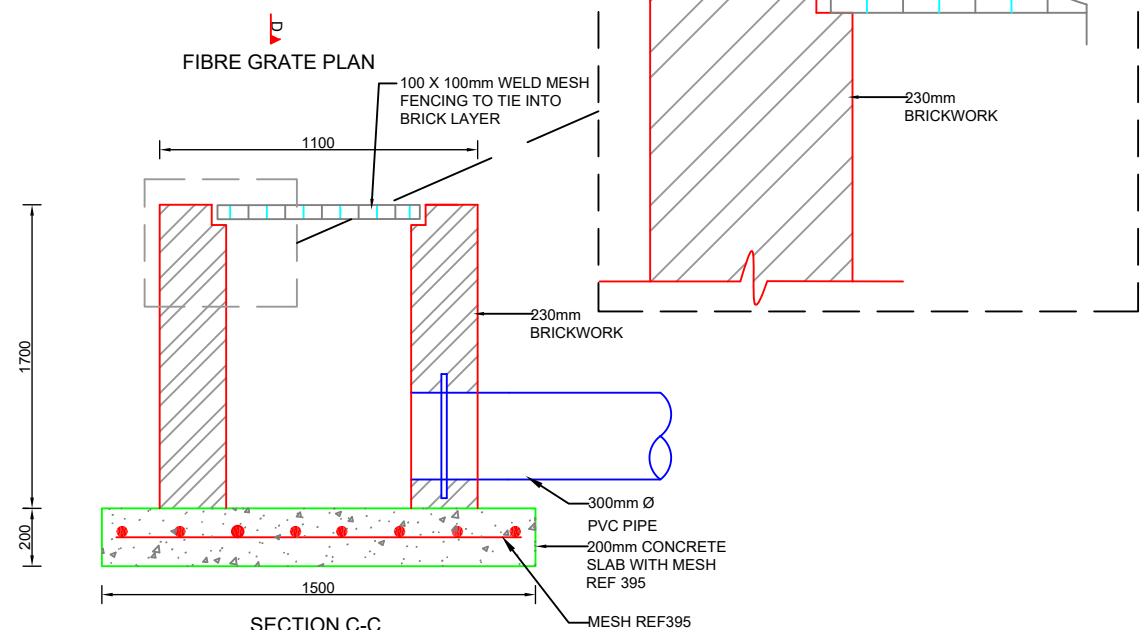
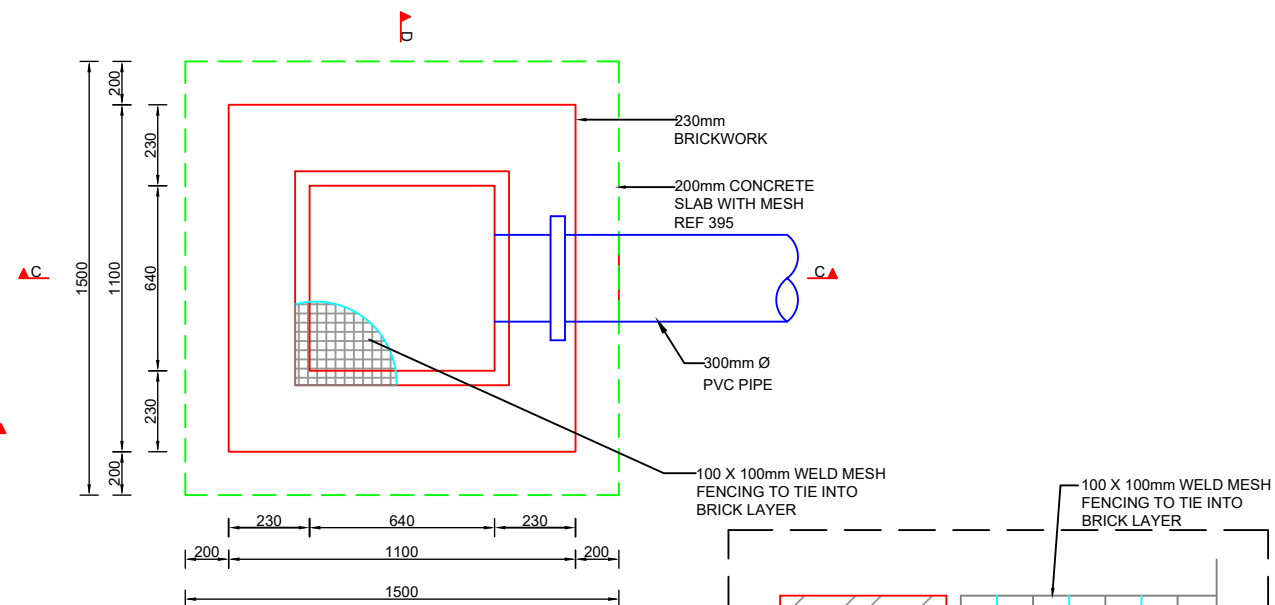
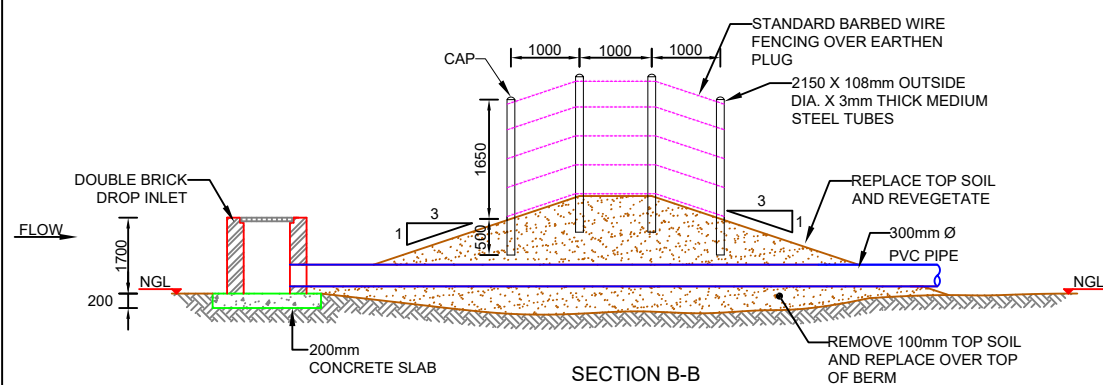
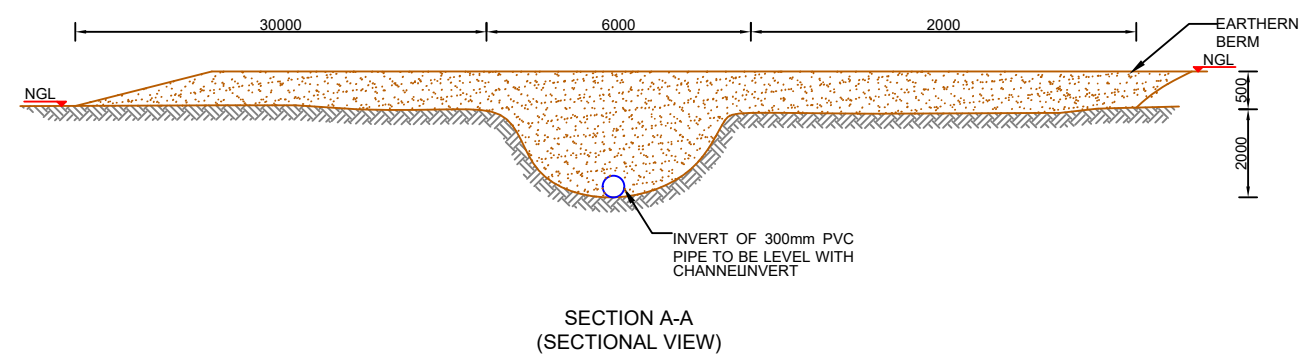
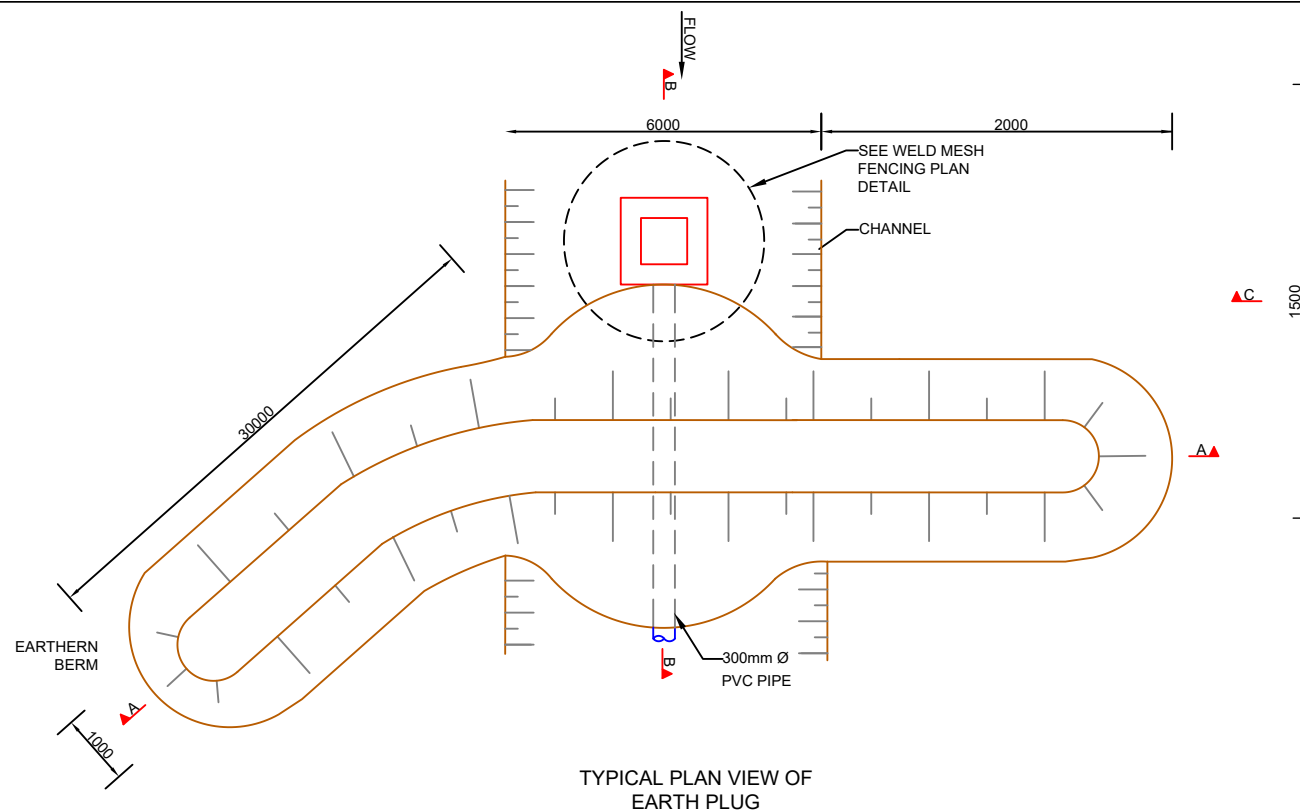
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	167.50
Excavation for sloping	m ³	624.00
Standard double skin brick	m ³	1.72
Concrete	m ³	0.45
Revegetation	m ²	100.87
Class4 300 mm PVC pipe	m	16.00
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'37.53"S	26°46'35.80"E

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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
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21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
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REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 216 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-217-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Geocell covered earthen berm with base flow pipe and deactivation of plough lines
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Geocell covered berm is for structural stability as it is a control structure. Deactivation of plough lines for even flow through wetland.
Latitude (D°M'S")	32°25'38.72"S
Longitude (D°M'S")	26°46'34.13"E

Location Photograph: S32E-01-217-00



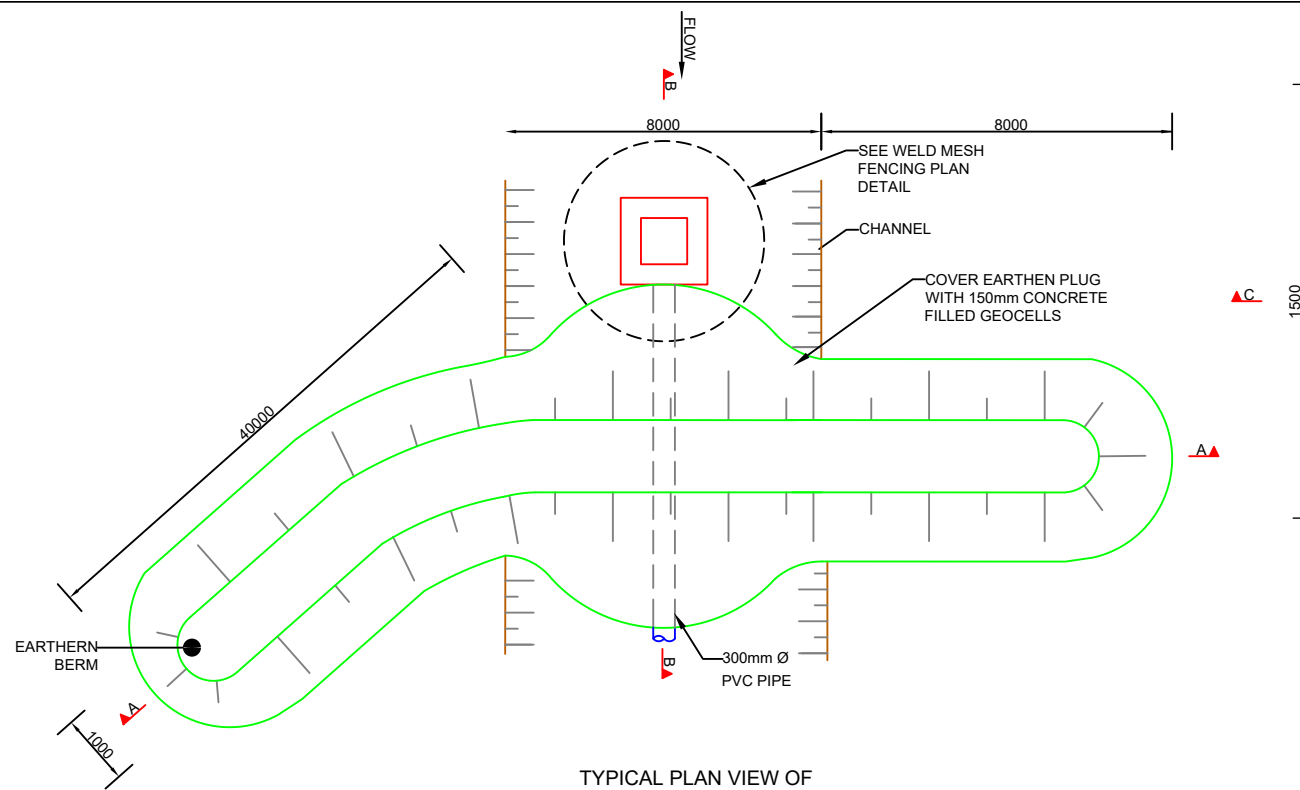
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	99.98
Excavation for sloping	m ³	438.27
Standard double skin brick	m ³	1.60
Concrete	m ³	23.46
Revegetation	m ²	151.39
Class4 300 mm PVC pipe	m	12.28
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00
Geocells	m ²	151.39
Geofabric	m ²	151.39

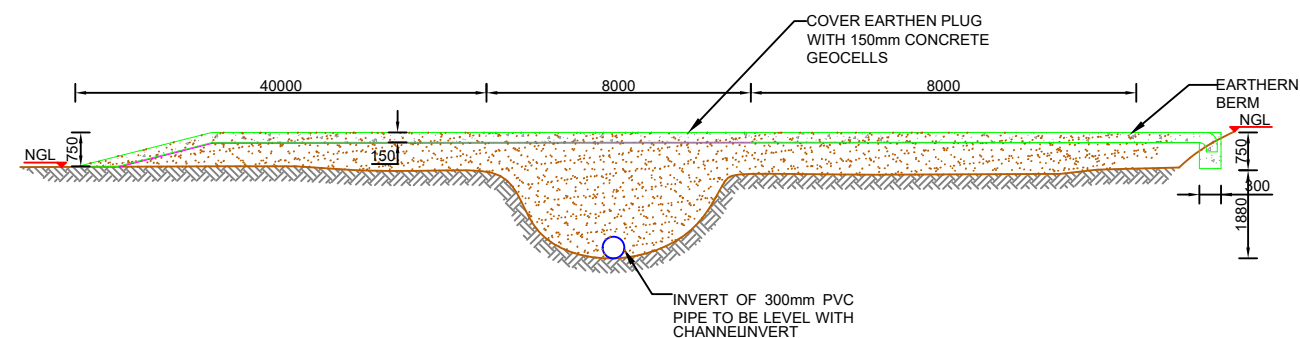
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The following site specific mitigation measures shall be implemented:

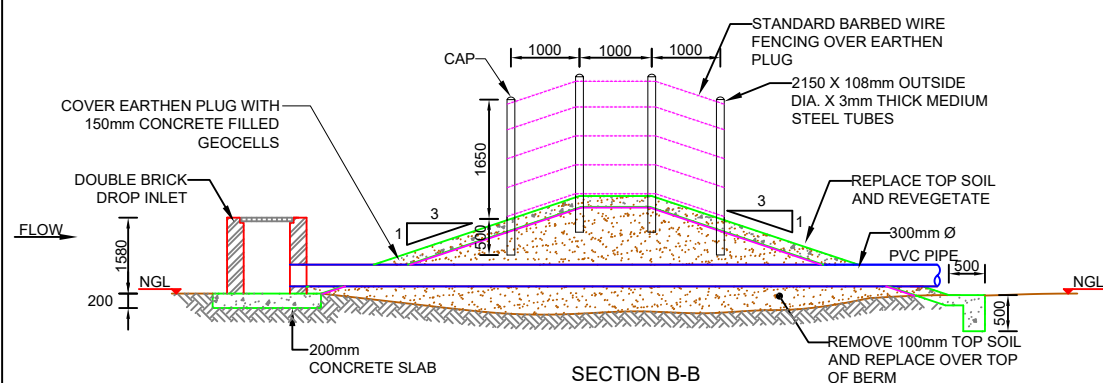
N/A



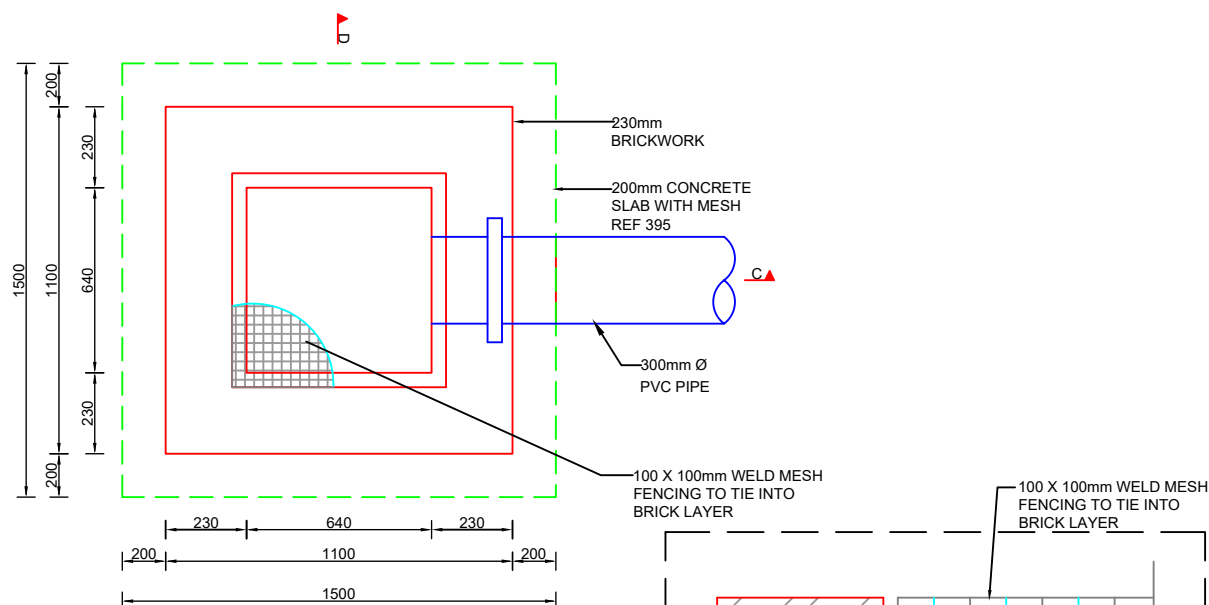
TYPICAL PLAN VIEW OF EARTH PLUG



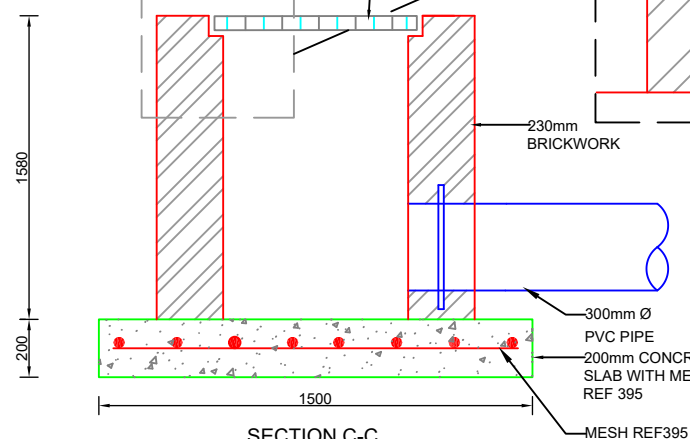
SECTION A-A
(SECTIONAL VIEW)



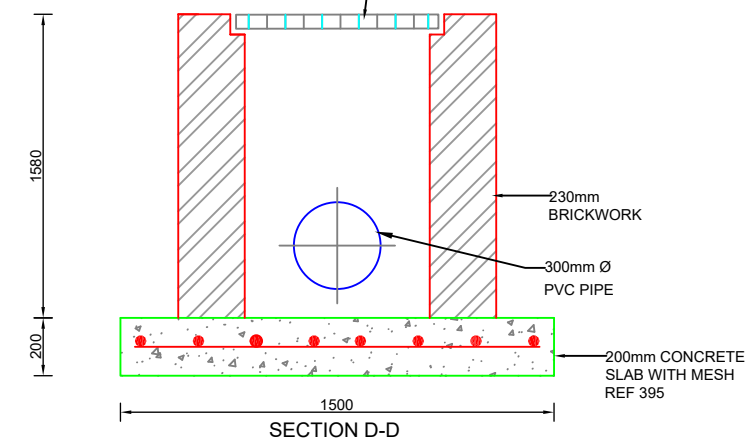
SECTION B-B



FIBRE GRATE PLAN



SECTION C-C



SECTION D-D

NOTES

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CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
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1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
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- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CONCRETE FILLED GEOCELLS:

- FOOTPRINT AREA TO BE CLEARED PRIOR TO CONSTRUCTION.
- SHAPE TO REQUIRED SLOPE.
- FOR CONCRETE MIX, FOLLOW SUPPLIERS INSTRUCTIONS. CONCRETE WITH A HIGH SLUMP IS PREFERABLE FOR PLACING IN GEOCELL.
- CONCRETE FOR GEOCELLS TO BE MINIMUM 15MPa & MIX:
1 BAG CEMENT
125L SAND
120L STONE
30L WATER
- RIGGING AS SPECIFIED BY SUPPLIER AND ANCHORING TO BE DONE.
- CONCRETE TO HAVE BROOMED FINISH.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'38.72"S	26°46'34.13"E

Details

Intervention	S32E-01-218-00A
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Concrete buttress weir
Rehabilitation Objectives	To rais water levels within the channel and flood adjacent wetland. Water levels have been determined to backflood to upstream heacuts.
Latitude (D°M'S")	32°25'39.95"S
Longitude (D°M'S")	26°46'33.49"E

Location Photograph: S32E-01-218-00A



Bill of Quantities

Item	Units	Quantity
Excavation for structure	m ³	41.08
concrete	m ³	37.05
Mesh ref 888 (6m x 2.4 m sheets)	m ²	43.20
Mesh ref 655 (6m x 2.4 m sheets)	m ²	43.20

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

The following site specific mitigation measures shall be implemented:

N/A

Details

Intervention	S32E-01-218-00B
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	3x Pole barriers
Rehabilitation Objectives	To deactivate headcuts and trap sediment
Latitude (D°M'S")	32°25'43.13"S
Longitude (D°M'S")	26°46'32.77"E

Location Photograph: S32E-01-218-00B



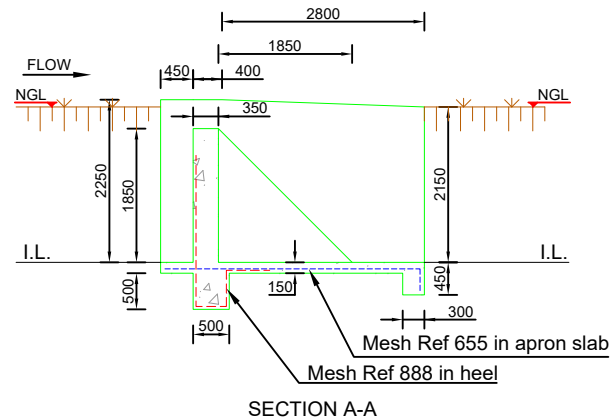
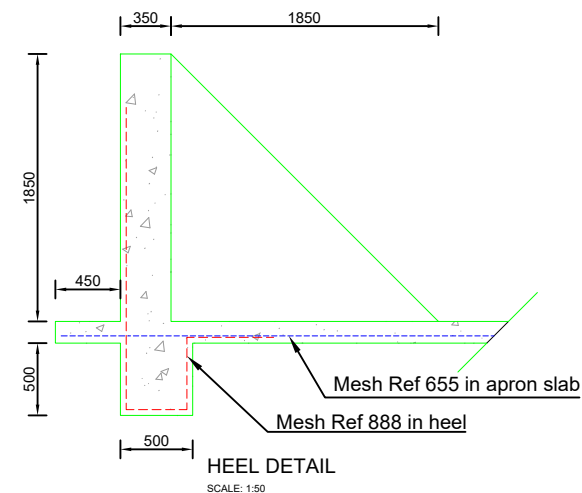
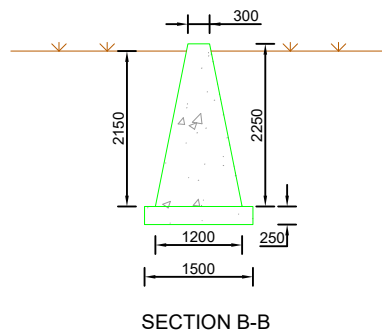
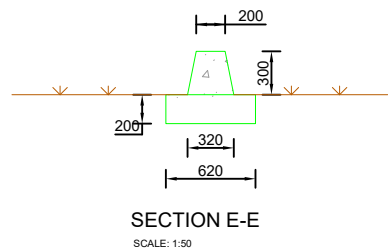
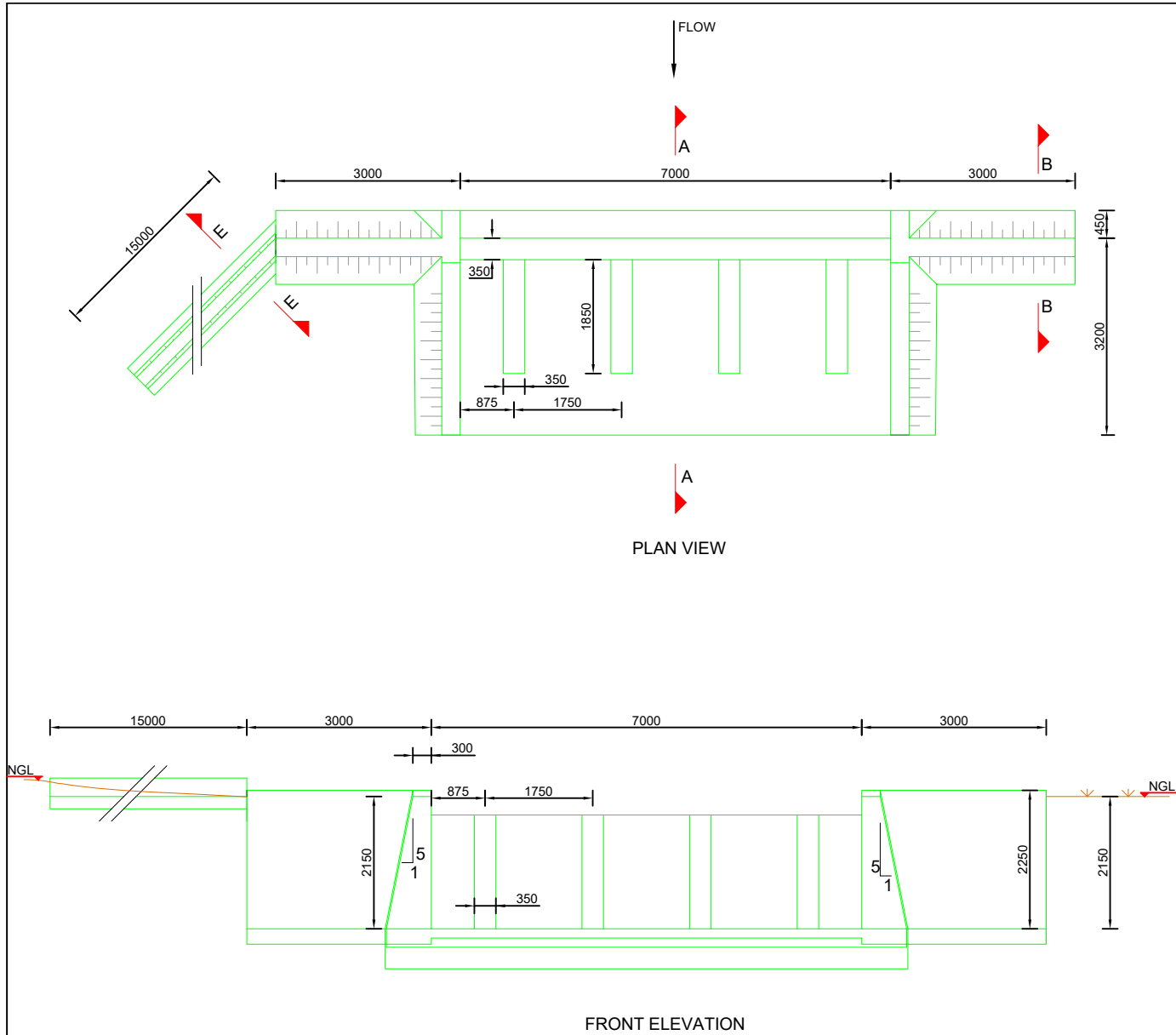
Bill of Quantities

Item	Units	Quantity
Earthworks for backfilling	m ³	56.00
Excavation of banks	m	22.00
Timber poles(1.8m lengths)	m	608.00
3.4mm wire	m	60.32
Geofabric	m ²	57.60

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

The following site specific mitigation measures shall be implemented:

N/A



NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.

2. AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED AGAINST ANY ASSOCIATED DAMAGES AND ACCEPT NO LIABILITY ASSOCIATED WITH THE CONSTRUCTION AND IMPLEMENTATION OF ENGINEERING INTERVENTIONS DUE TO THE ENGINEERS HAVING LIMITED CONTACT WITH THE IMPLEMENTER DURING THE CONSTRUCTION PHASE RESULTING IN OUR INABILITY TO DILIGENTLY SUPERVISE AND ASSESS ANY PROGRESS.

ACRONYMS AND ABBREVIATIONS:

1. NGL - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE
3. µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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





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

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
3. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
4. ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
5. CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
7. CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
9. FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'39.95"S	26°46'33.49"E

 www.aurecongroup.com		CLIENT	REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN	PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020								
		 Water, Wetlands and Environmental Engineering	1	17/09/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3		ENGINEER  DATE 08/02/2019 REGISTRATION No. 20130774	PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE							
							DRAWN				INTERVENTION DESCRIPTION	CONCRETE BUTTRESS WEIR							
							T. HARVEY				DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV			
							DESIGNED					S32E	-	01	-	218	-	01 OF 02	-	1
						T. PIKE													
							CHECKED												
							T.PIKE												

NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.

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ACRONYMS AND ABBREVIATIONS:

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

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

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

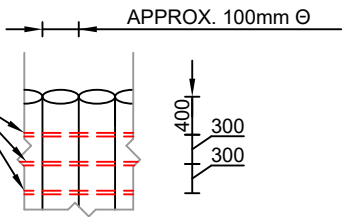
TIMBER POLES:

1. BRACE THE TIMBER POLES AS INDICATED WHILE PLACING IN POSITION WITH PVC COATED GALVANISED WIRE OF O/D NO LESS THAN 3.4mm THROUGH THE CENTRE.
2. TIMBER POLES ARE TO BE PLACED IN AN UPRIGHT POSITION ON THE TOP OF CONCRETE FOUNDATION OF 150 x 250 STRIP (20MPa).
3. BRACE POLES WITH 4.0mm SANS 675: 2009 GRADE A (HEAVY) GALVANISED WIRE USING D-SHAPE BRACING AROUND POLES.
4. ALL ENDS TO BE FITTED WITH THE MAXIMUM SIZED END CAPS TO PREVENT SPLITTING.

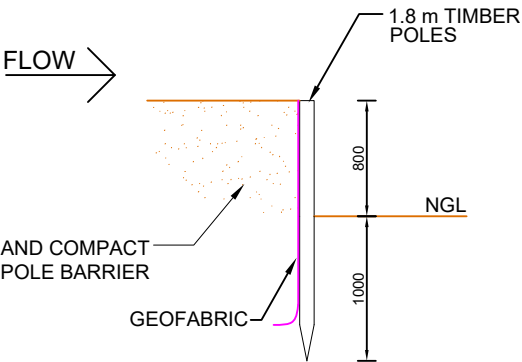
CO-ORDINATES

LATITUDE	LONGITUDE
32°25'43.13"S	26°46'32.77"E

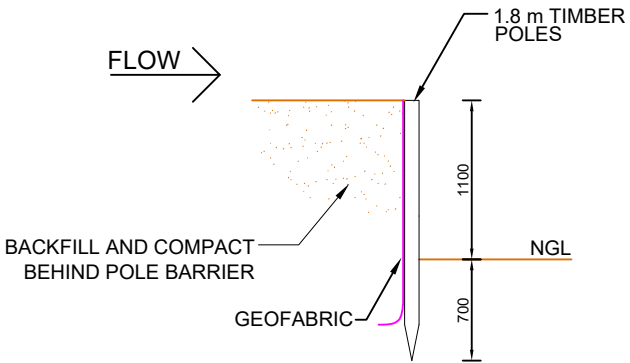
TIMBER POLES TIED TOGETHER WITH 3.4mm WIRE AT MIN. 300mm SPACINGS



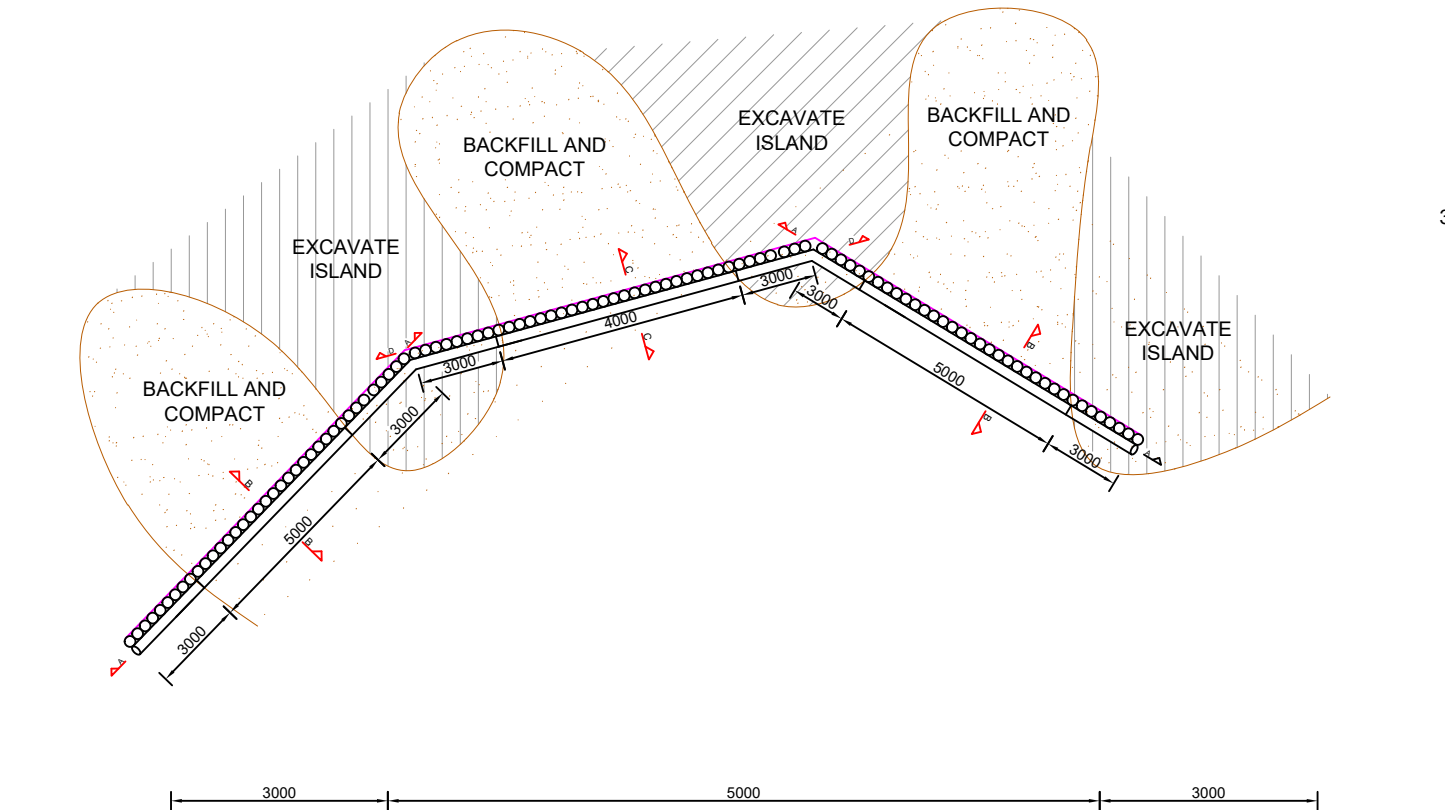
DETAIL A



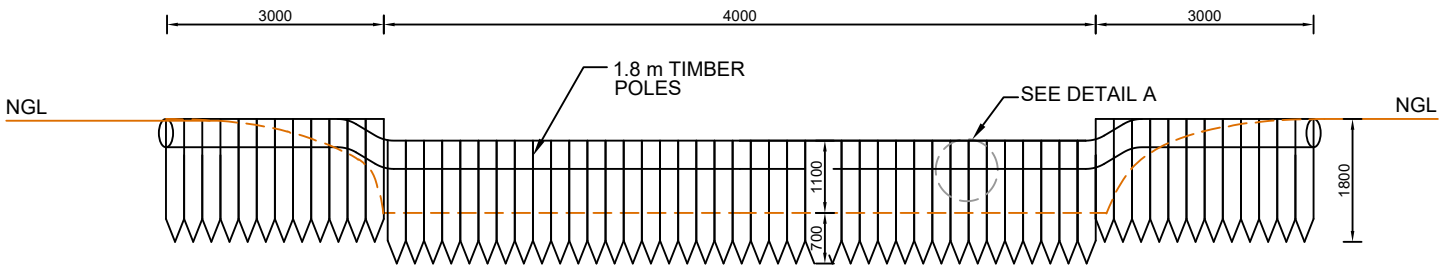
SECTION B-B
NTS



SECTION C-C
NTS



SECTION A-A
NTS



SECTION D-D
NTS

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GroundTruth
Water, Wetlands and
Environmental Engineering



REV	DATE	REVISION DETAILS	APPROVED
1	20/11/2018	DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	
ENGINEER	DATE
	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020				
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE				
INTERVENTION DESCRIPTION	POLE BARRIERS				
DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
S32E	-	01	-	218	-
				02 OF 02	1

Details

Intervention	S32E-01-219-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and debris removal
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'46.44"S
Longitude (D°M'S")	26°46'33.42"E

Location Photograph: S32E-01-219-00



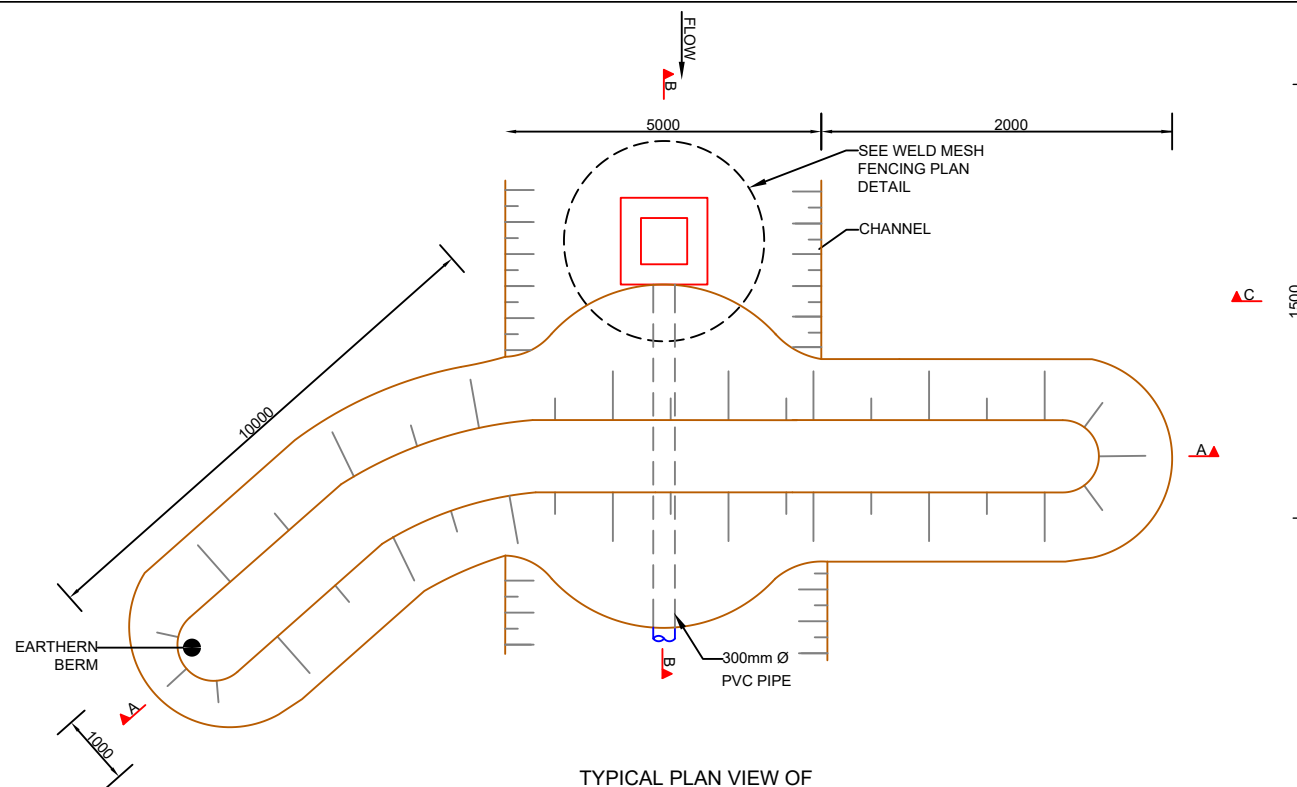
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	64.09
Excavation for sloping	m ³	290.95
Standard double skin brick	m ³	0.86
Concrete	m ³	0.45
Revegetation	m ²	57.18
Class4 300 mm PVC pipe	m	10.90
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

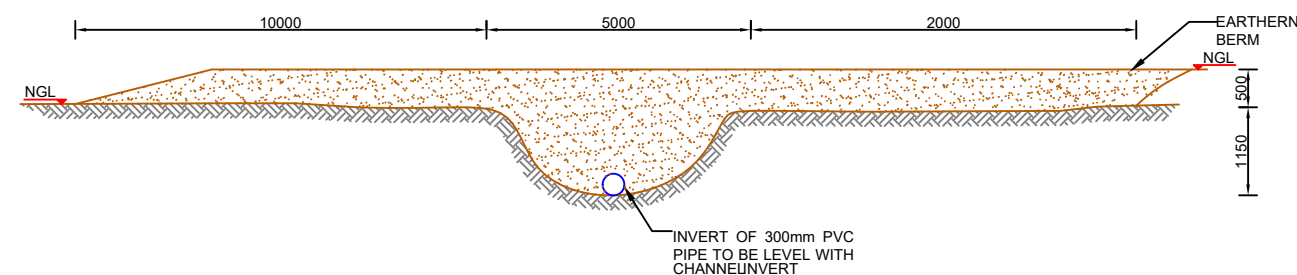
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

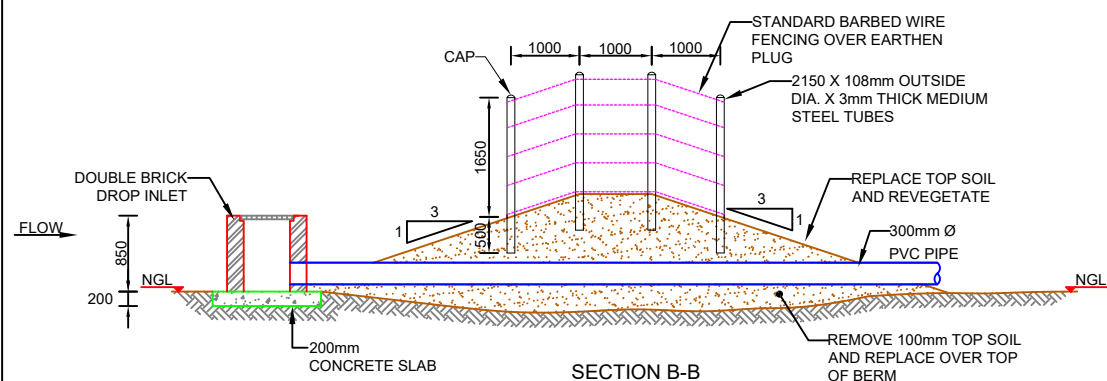
N/A



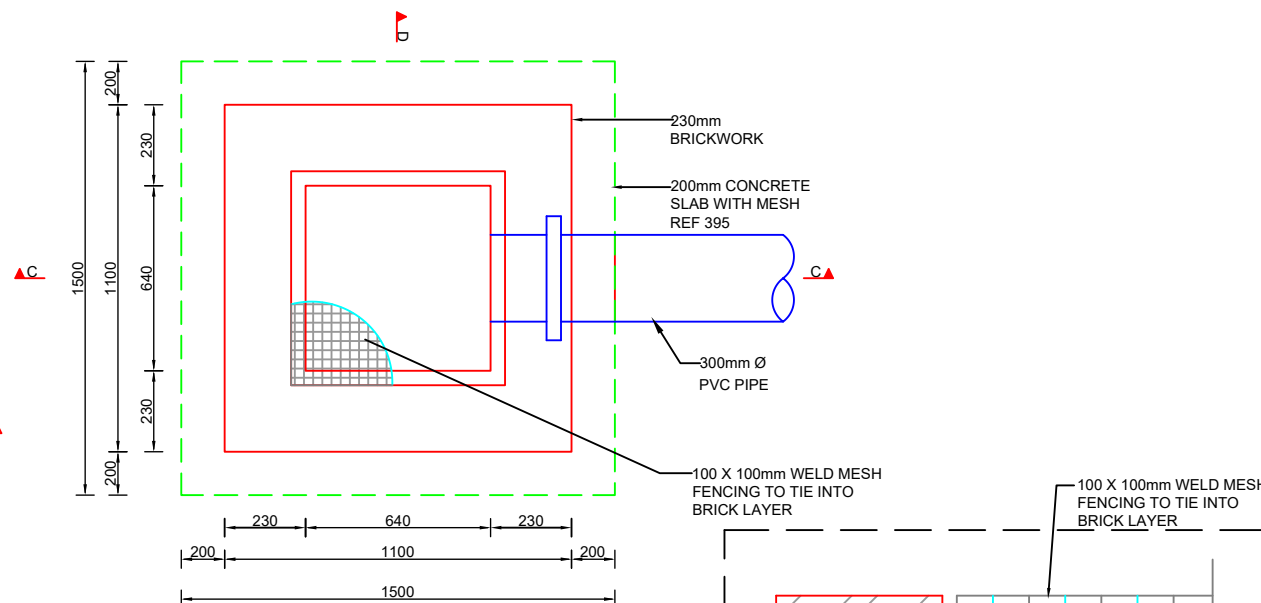
TYPICAL PLAN VIEW OF EARTH PLUG



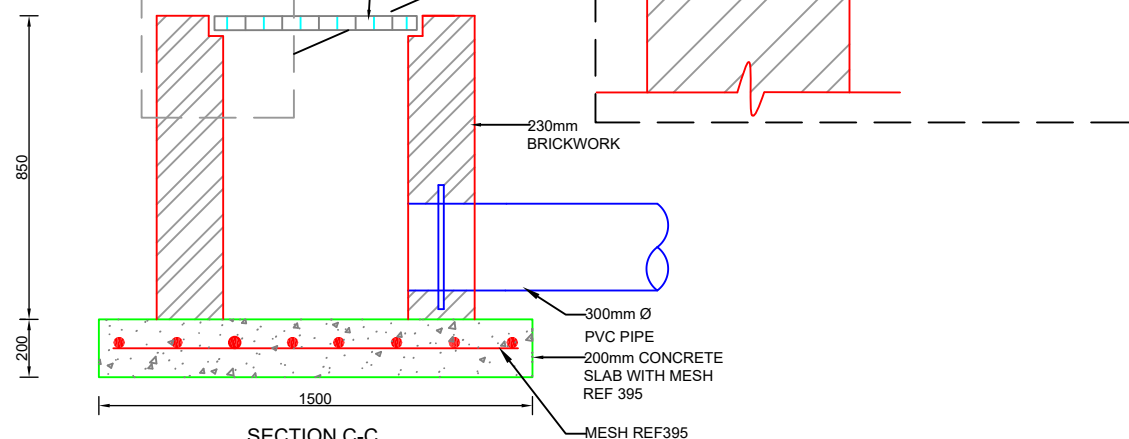
SECTION A-A
(SECTIONAL VIEW)



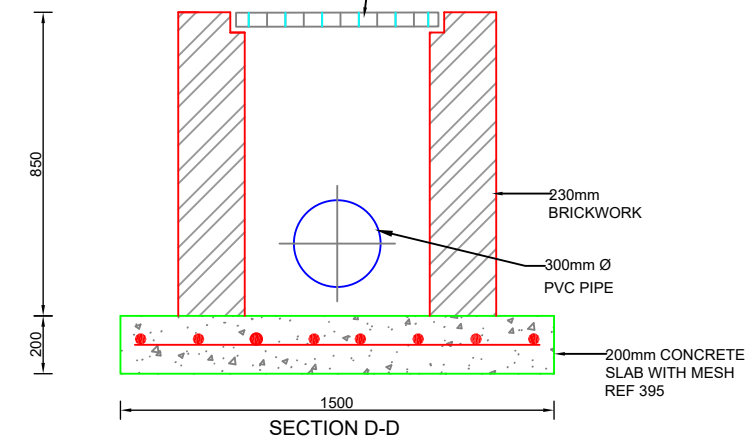
SECTION B-B



FIBRE GRATE PLAN



SECTION C-C



SECTION D-D

CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'46.44"S	26°46'33.42"E

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

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- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

Details

Intervention	S32E-01-220-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'48.56"S
Longitude (D°M'S")	26°46'33.24"E

Location Photograph: S32E-01-220-00



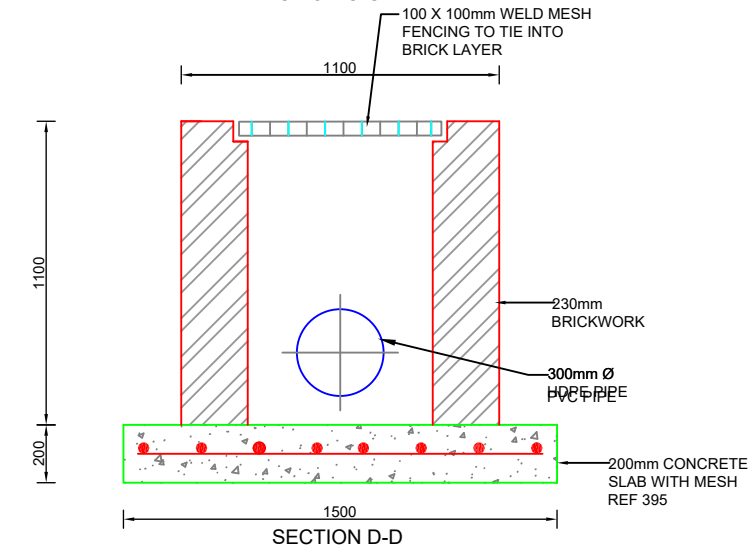
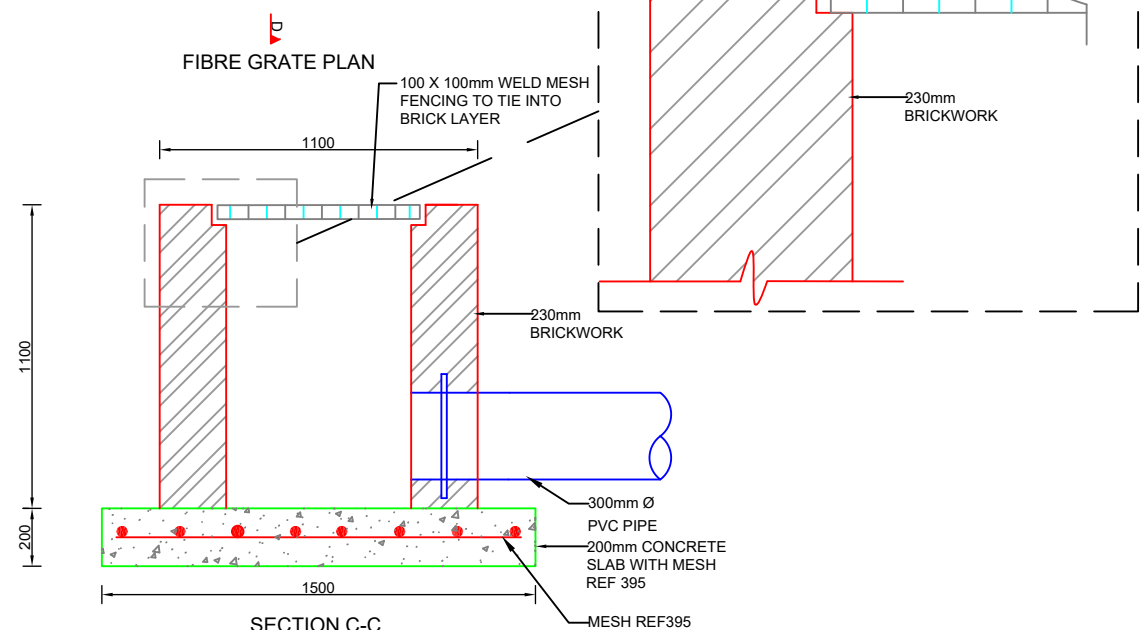
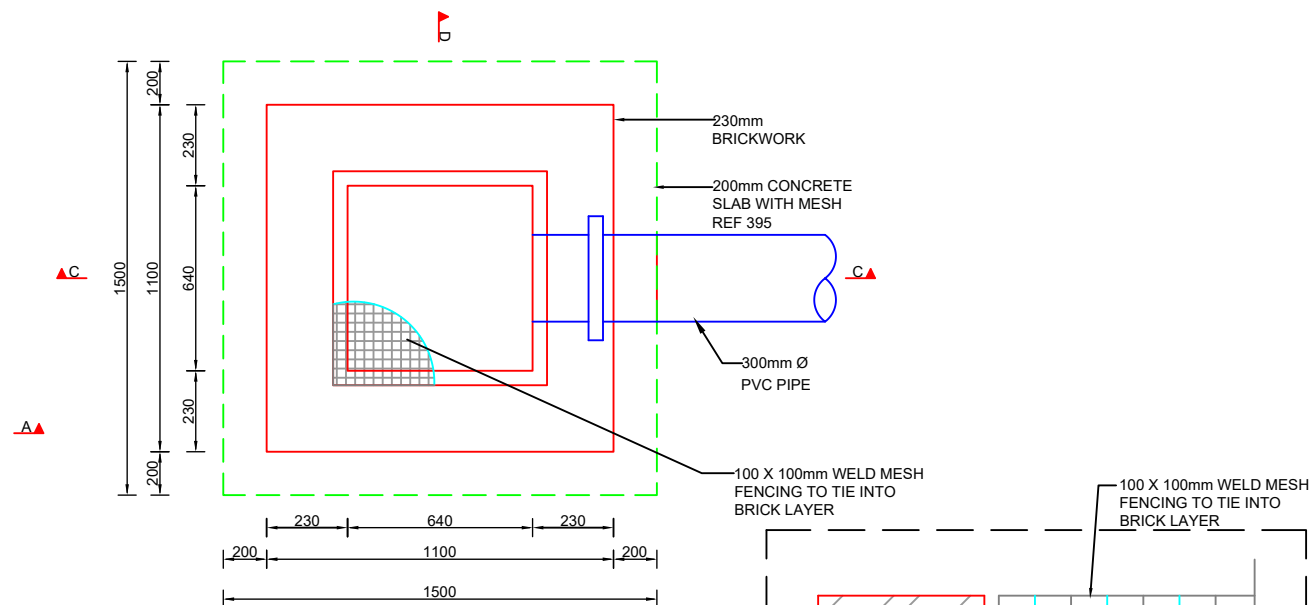
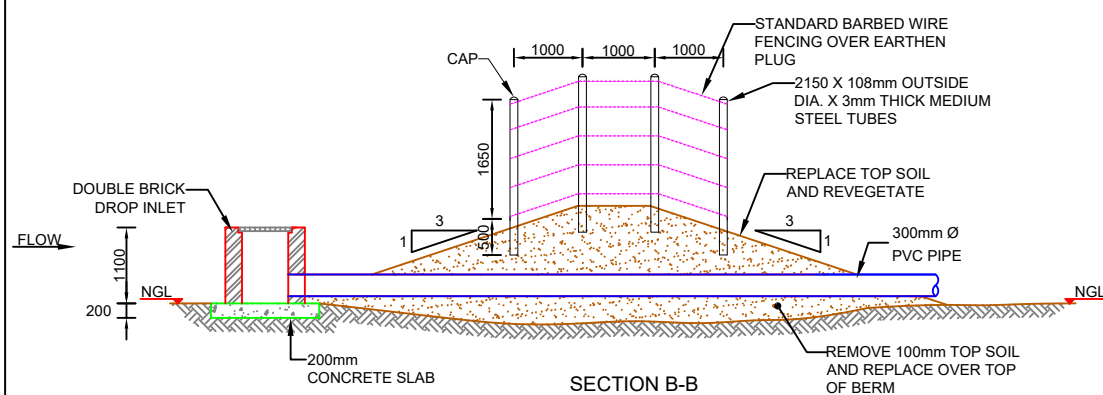
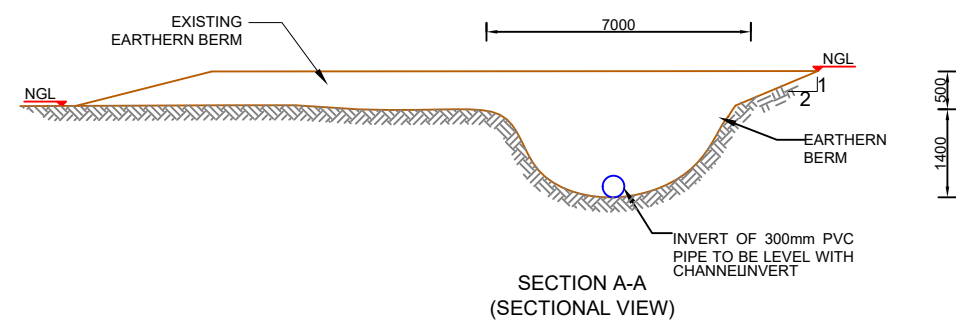
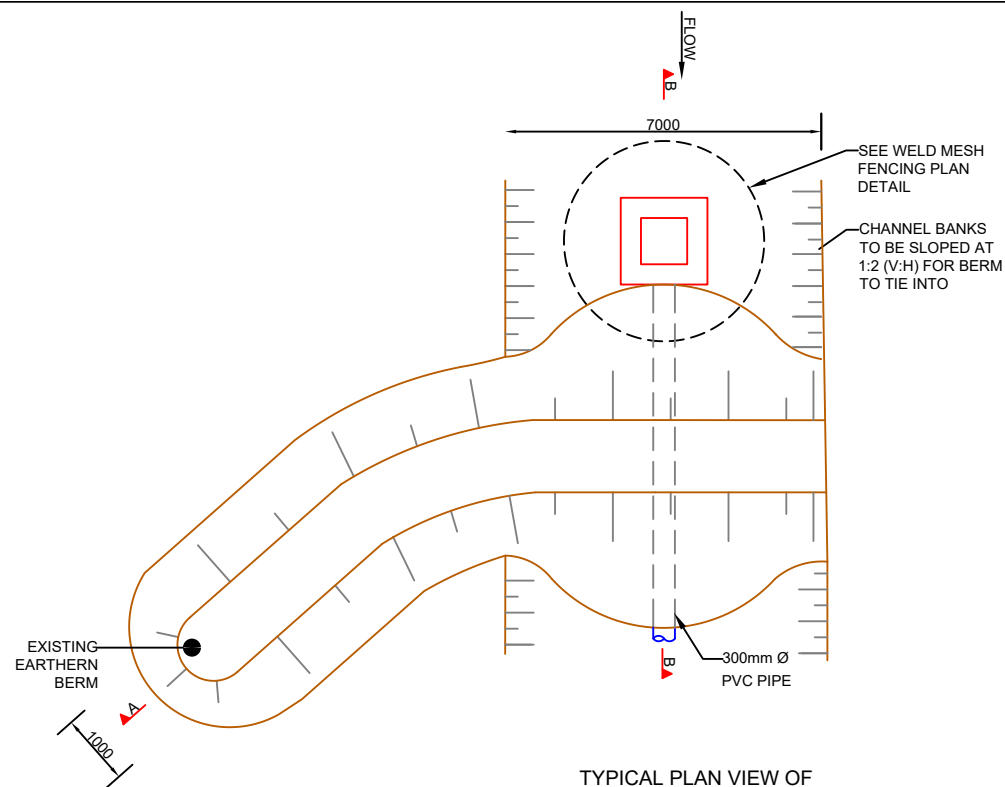
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	89.11
Excavation for sloping	m ³	562.52
Standard double skin brick	m ³	1.11
Concrete	m ³	0.45
Revegetation	m ²	91.12
Class4 300 mm PVC pipe	m	12.40
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'48.56"S	26°46'33.24"E

- NOTES**
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 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
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REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN		PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020				
1		DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3	APPROVED		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE				
				DRAWN		DATE		INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE				
				T. HARVEY		08/02/2019							
				T. PIKE		REGISTRATION No.							
				T.PIKE		20130774							
								DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV
								S32E	-	01	-	220	-
												01 OF 01	1

Details

Intervention	S32E-01-221-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'52.20"S
Longitude (D°M'S")	26°46'33.43"E

Location Photograph: S32E-01-221-00



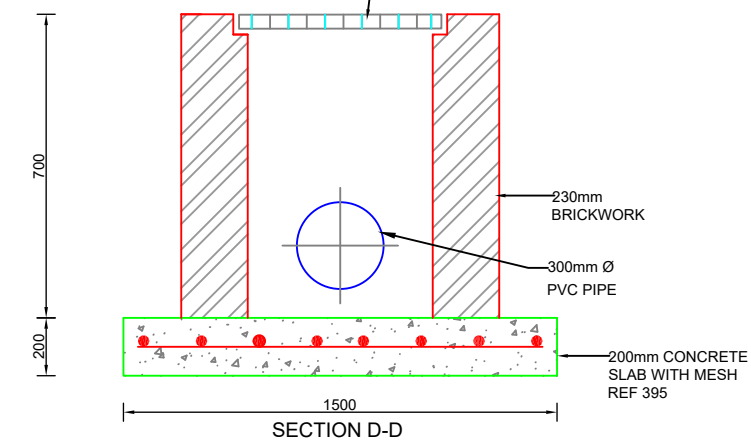
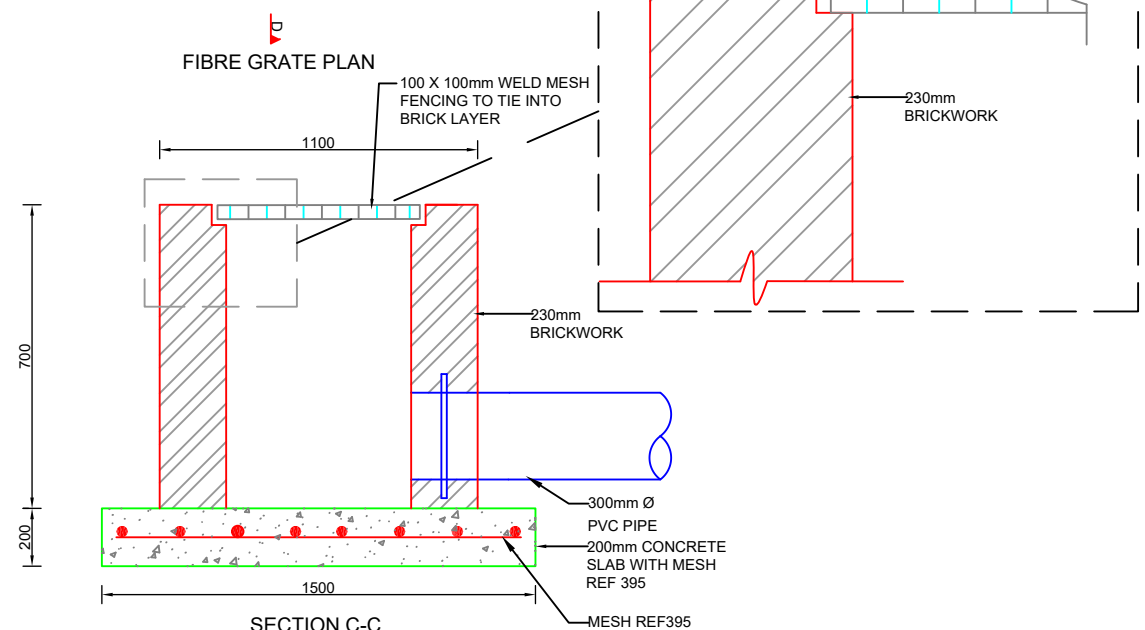
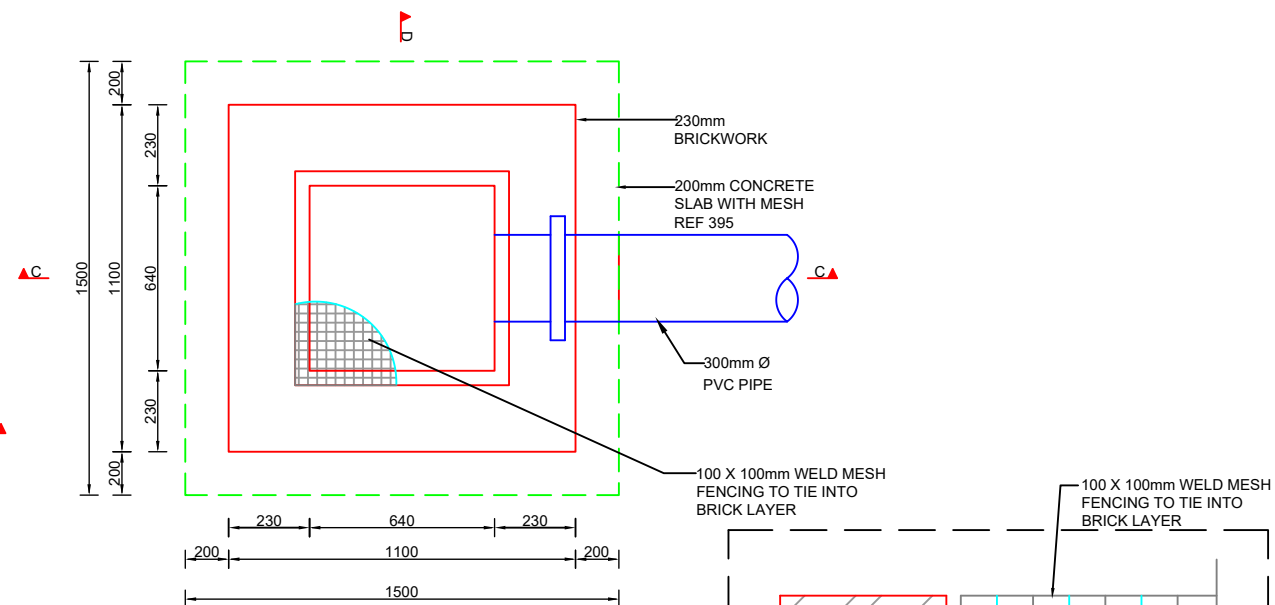
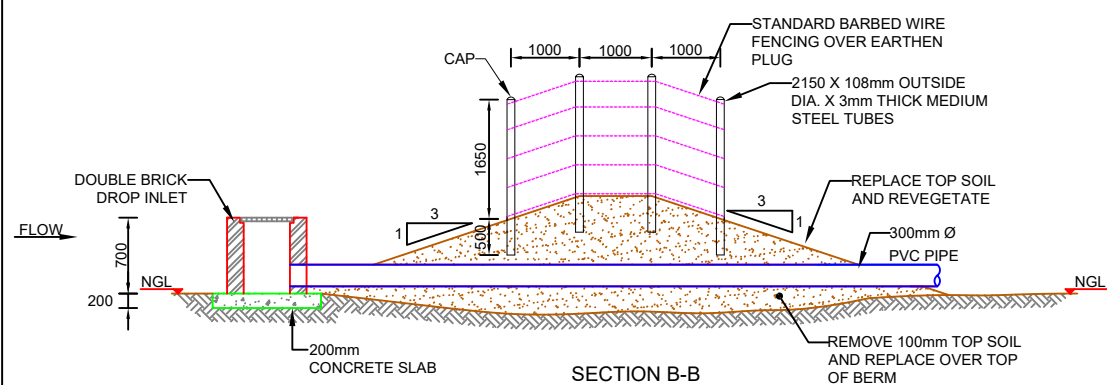
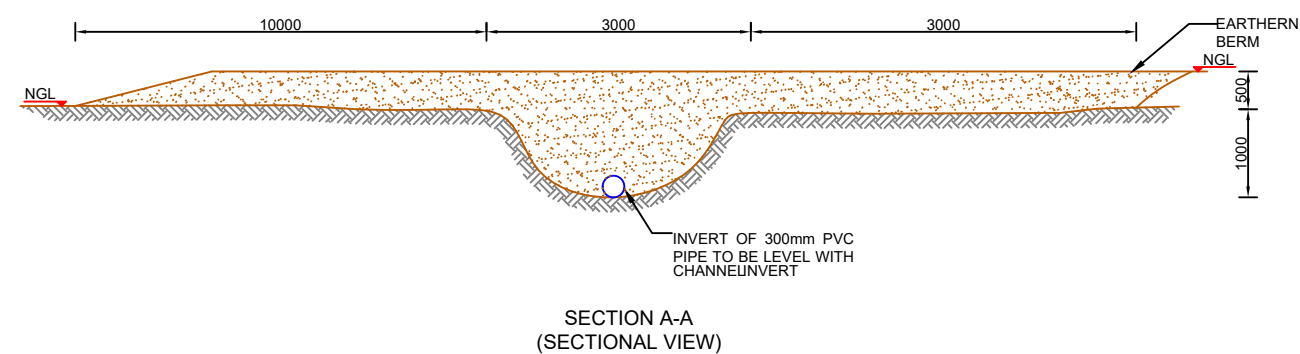
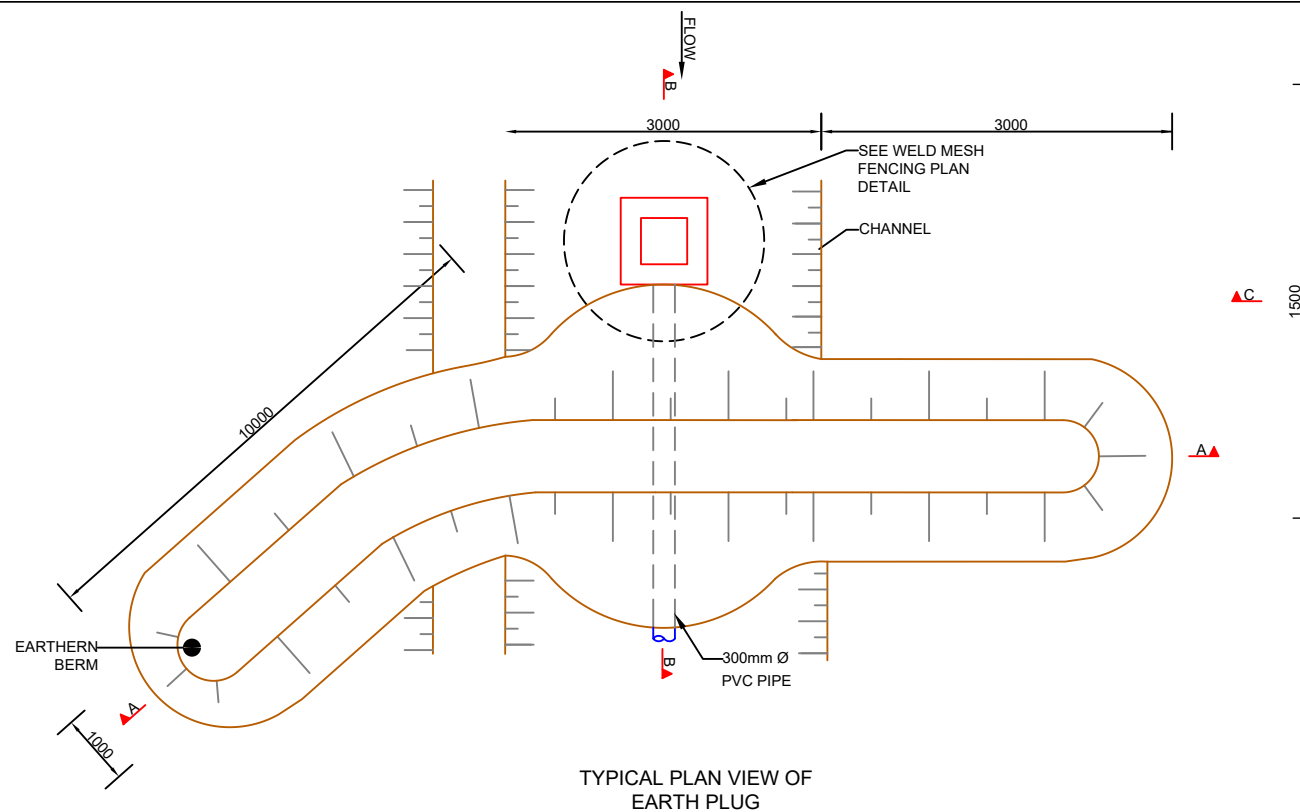
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	56.32
Excavation for sloping	m ³	439.42
Standard double skin brick	m ³	1.16
Concrete	m ³	0.45
Revegetation	m ²	40.00
Class4 300 mm PVC pipe	m	12.70
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'52.20"S	26°46'33.43"E

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

- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

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

- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 221 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-222-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with a geocell covered crest (3m wide) with base flow pipe.
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Geocell covered berm is to allow cattle to cross the channel.
Latitude (D°M'S")	32°25'55.11"S
Longitude (D°M'S")	26°46'33.70"E

Location Photograph: S32E-01-222-00



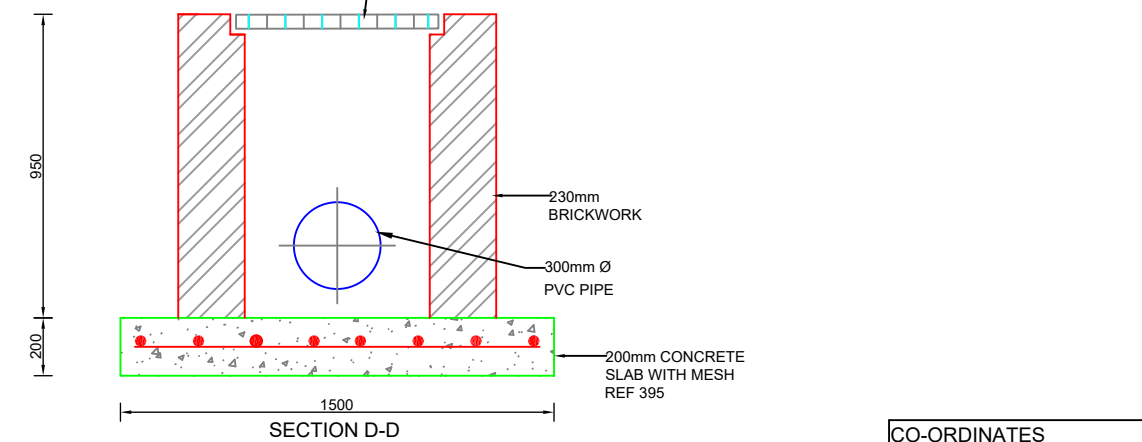
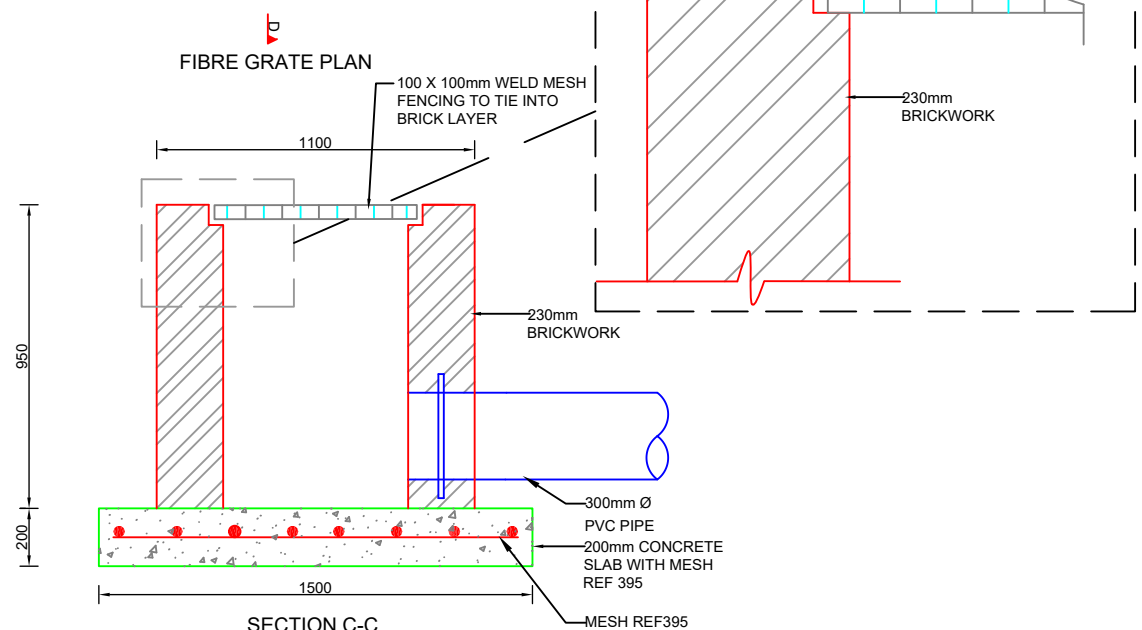
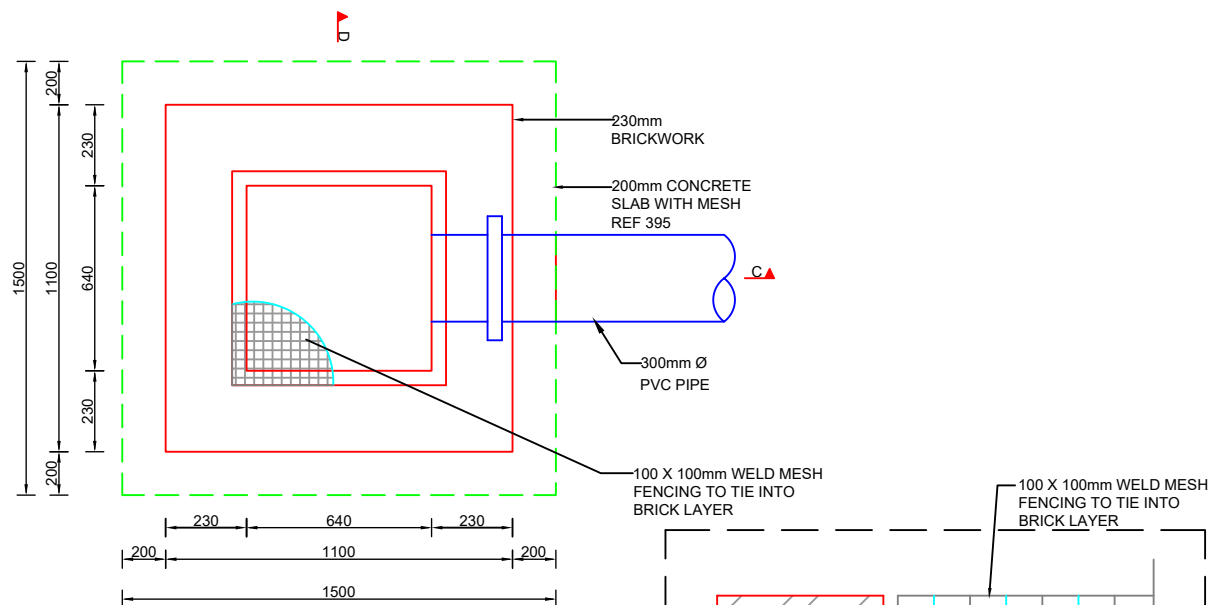
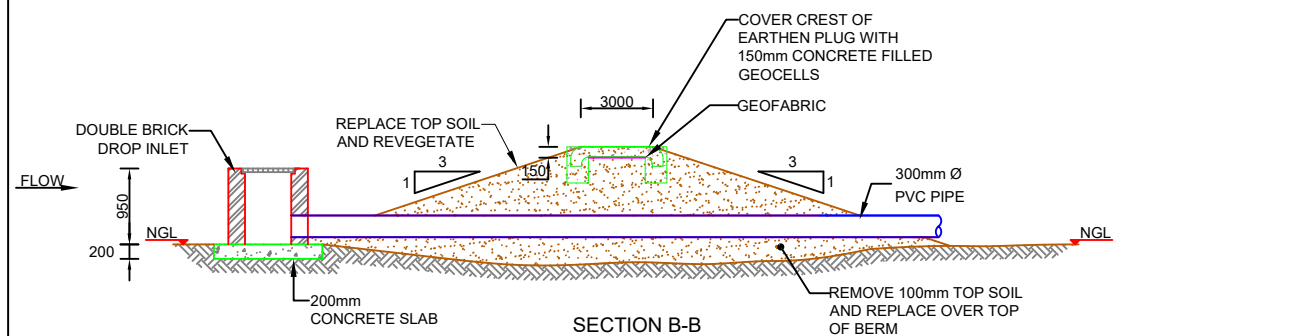
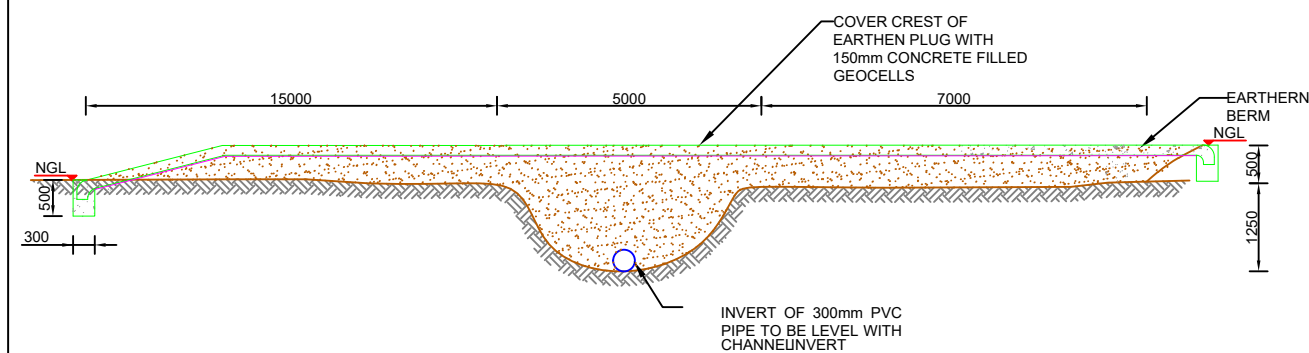
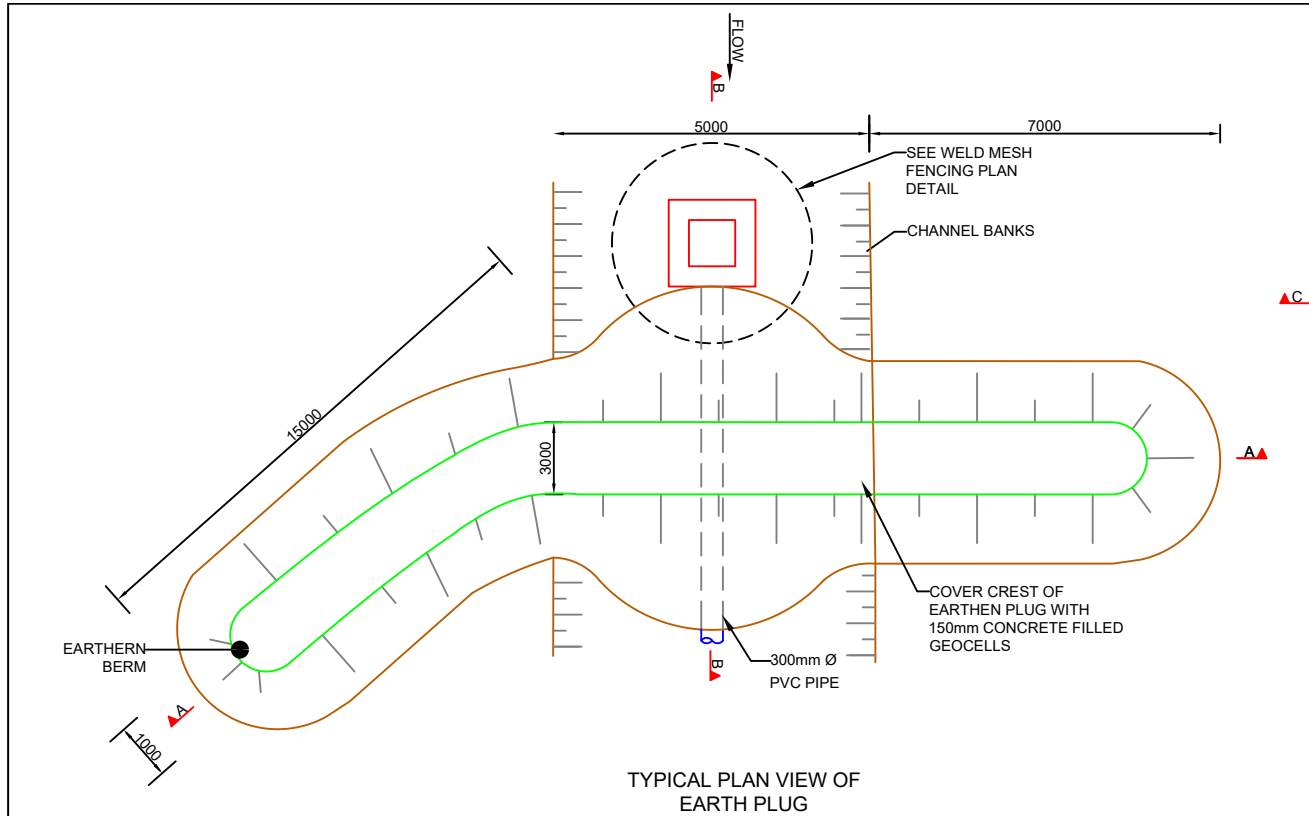
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	121.69
Excavation for sloping	m ³	295.31
Standard double skin brick	m ³	0.96
Concrete	m ³	14.06
Revegetation	m ²	70.34
Class4 300 mm PVC pipe	m	13.50
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00
Geocells	m ²	84.75
Gefabric	m ²	84.75

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'55.11"S	26°46'33.70"E

NOTES

- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.

- AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED AGAINST ANY ASSOCIATED DAMAGES AND ACCEPT NO LIABILITY ASSOCIATED WITH THE CONSTRUCTION AND IMPLEMENTATION OF ENGINEERING INTERVENTIONS DUE TO THE ENGINEERS HAVING LIMITED CONTACT WITH THE IMPLEMENTER DURING THE CONSTRUCTION PHASE RESULTING IN OUR INABILITY TO DILIGENTLY SUPERVISE AND ASSESS ANY PROGRESS.

ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CONCRETE FILLED GEOCELLS:

- FOOTPRINT AREA TO BE CLEARED PRIOR TO CONSTRUCTION.
- SHAPE TO REQUIRED SLOPE.
- FOR CONCRETE MIX, FOLLOW SUPPLIERS INSTRUCTIONS. CONCRETE WITH A HIGH SLUMP IS PREFERABLE FOR PLACING IN GEOCELL.
- CONCRETE FOR GEOCELLS TO BE MINIMUM 15MPa & MIX:
1 BAG CEMENT
125L SAND
120L STONE
30L WATER
- RIGGING AS SPECIFIED BY SUPPLIER AND ANCHORING TO BE DONE.
- CONCRETE TO HAVE BROOMED FINISH.

Details

Intervention	S32E-01-223-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°25'58.26"S
Longitude (D°M'S")	26°46'32.75"E

Location Photograph: S32E-01-223-00



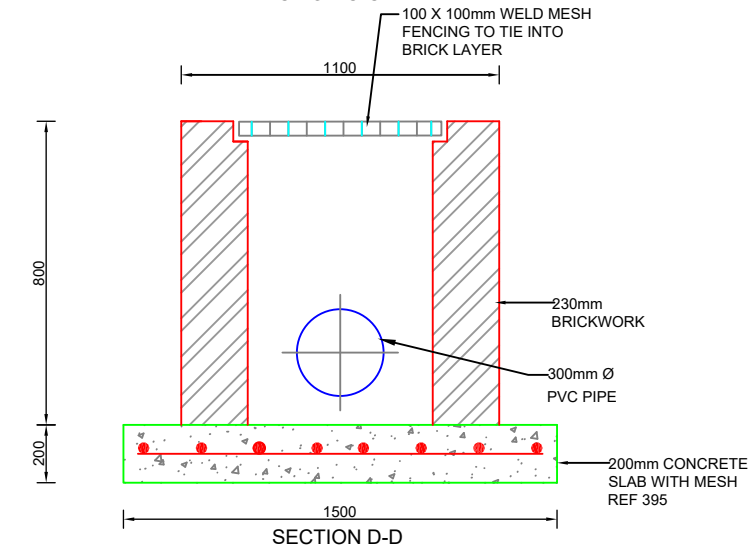
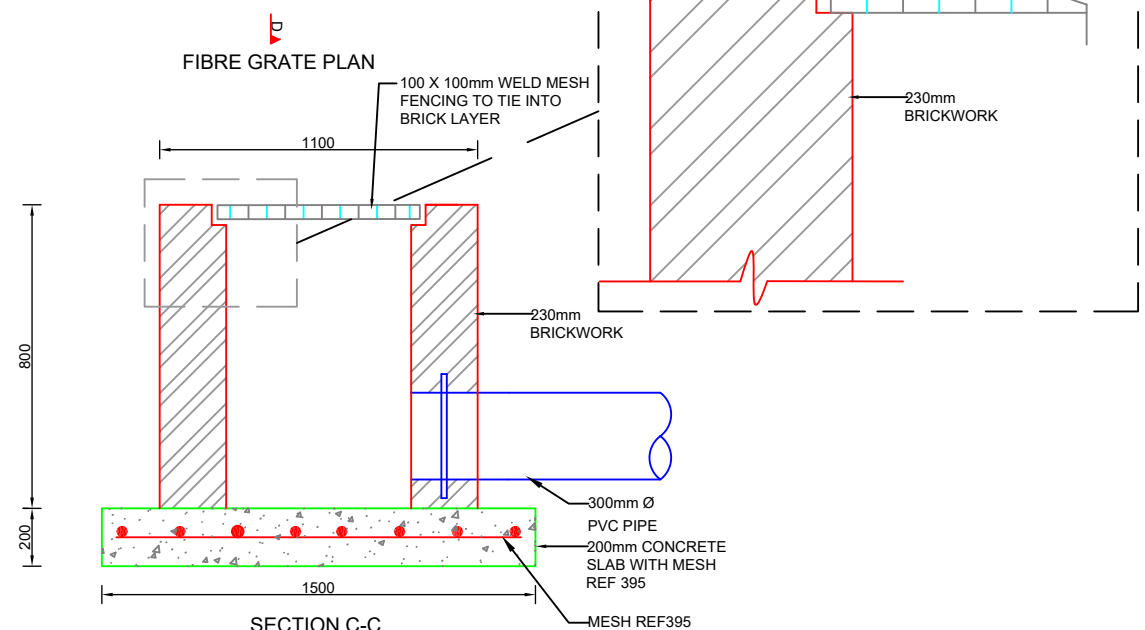
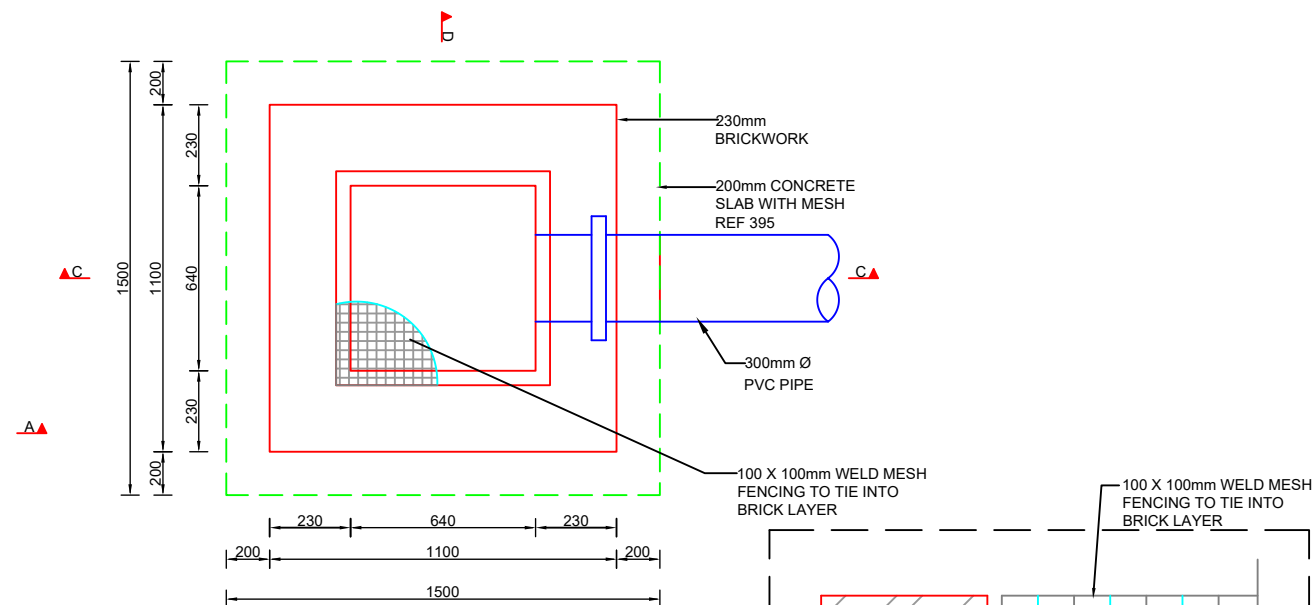
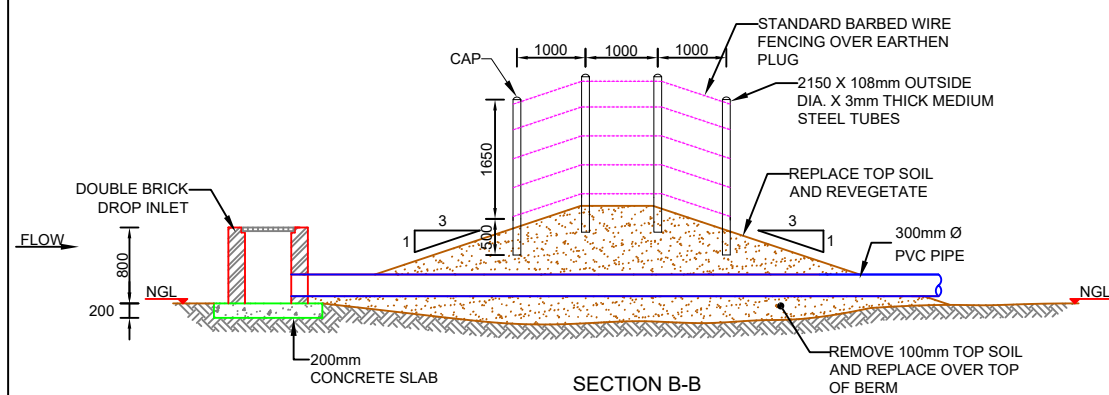
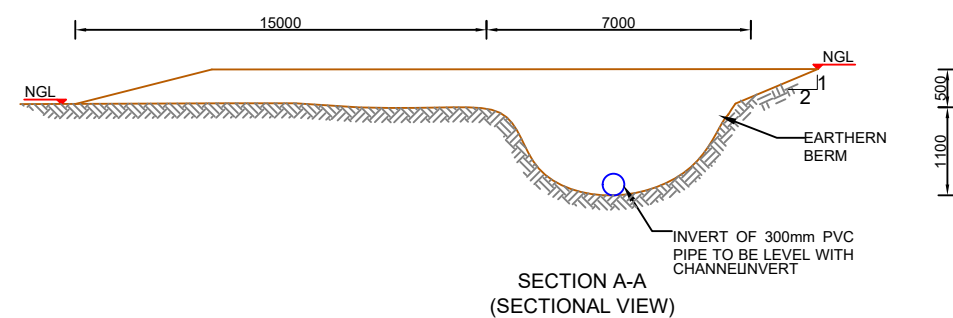
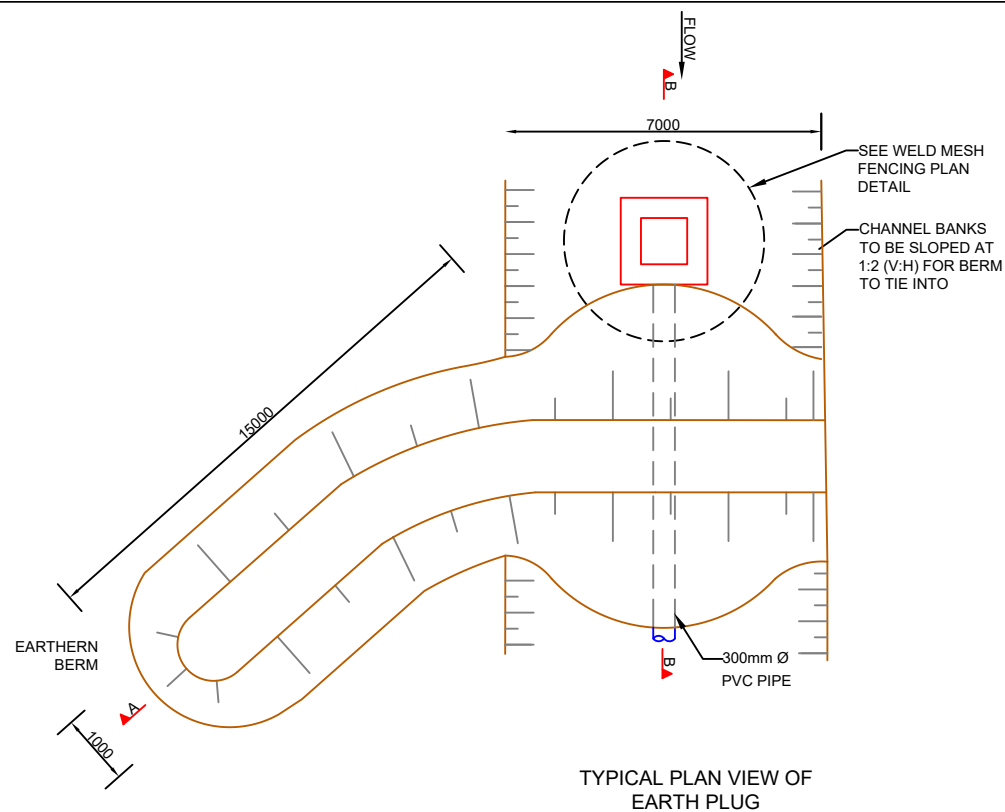
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	83.71
Excavation for sloping	m ³	199.65
Standard double skin brick	m ³	0.81
Concrete	m ³	0.45
Revegetation	m ²	77.84
Class4 300 mm PVC pipe	m	10.60
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°25'58.26"S	26°46'32.75"E

- NOTES**
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

Details

Intervention	S32E-01-224-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and skim side bank down to wetland level
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°26'0.36"S
Longitude (D°M'S")	26°46'32.33"E

Location Photograph: S32E-01-224-00



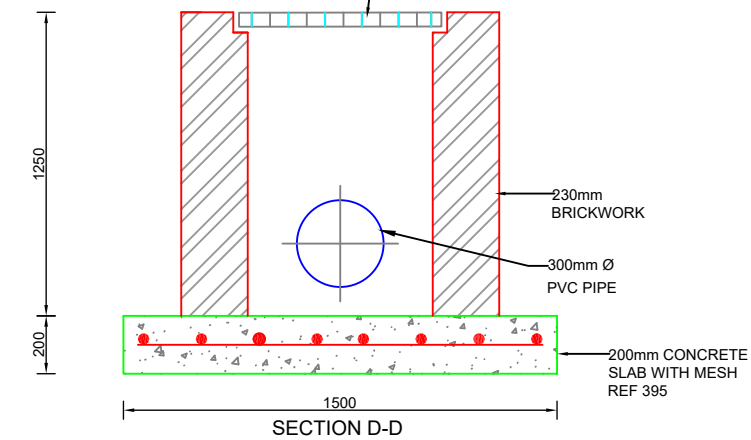
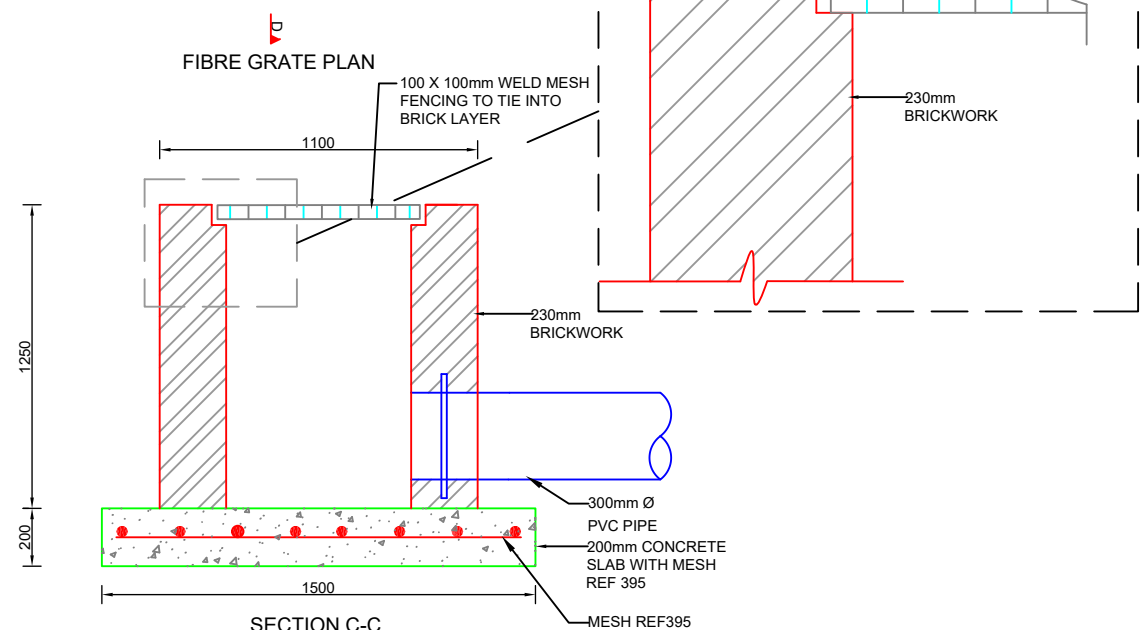
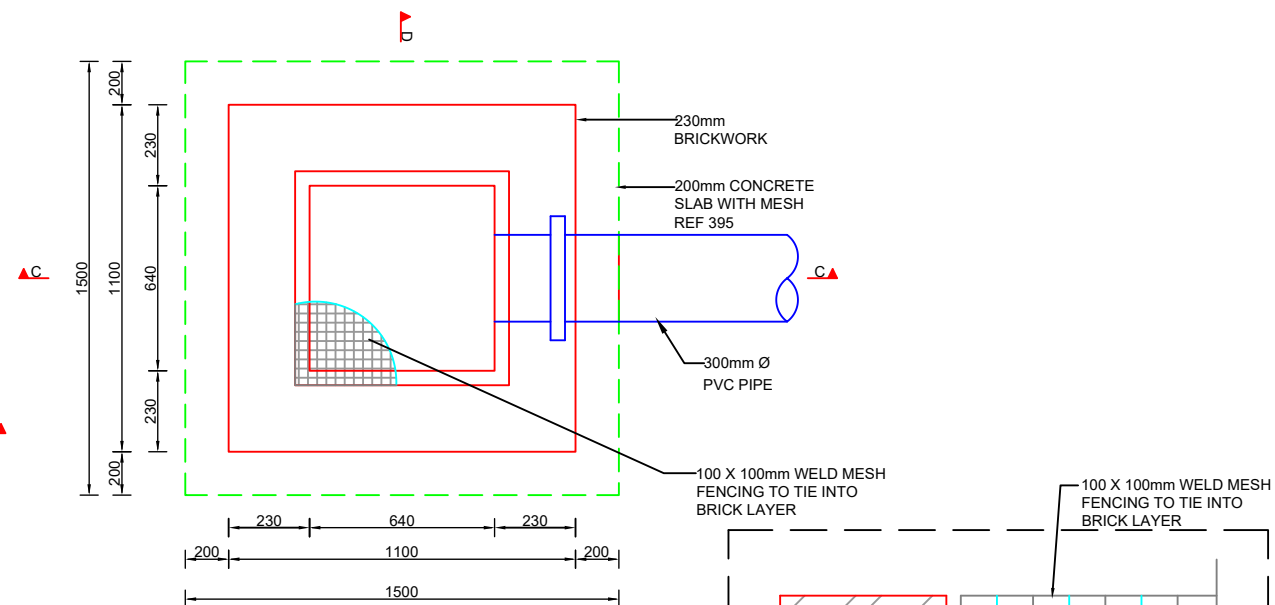
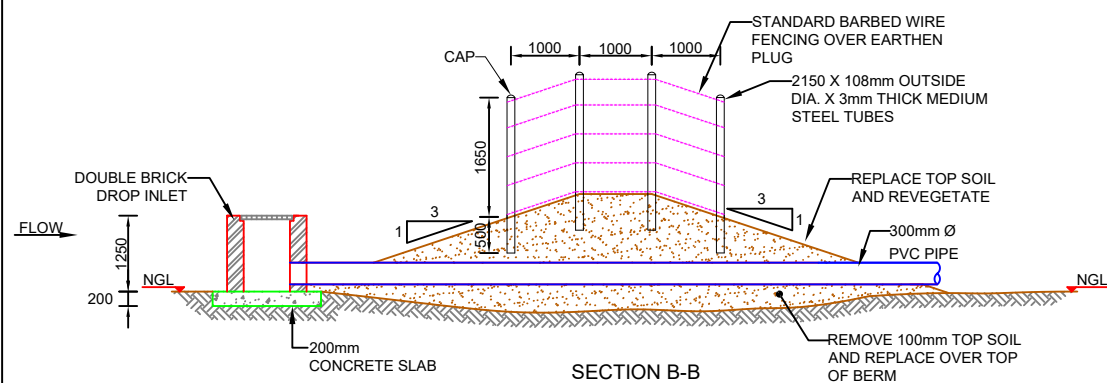
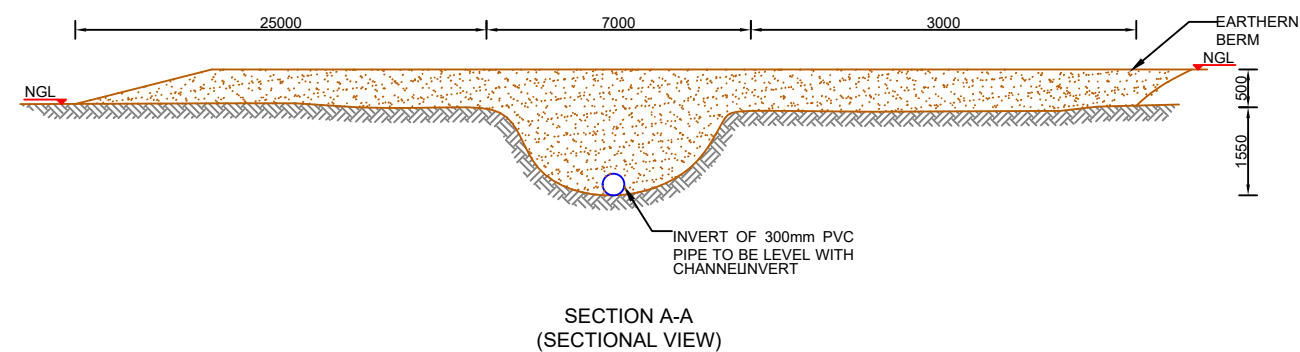
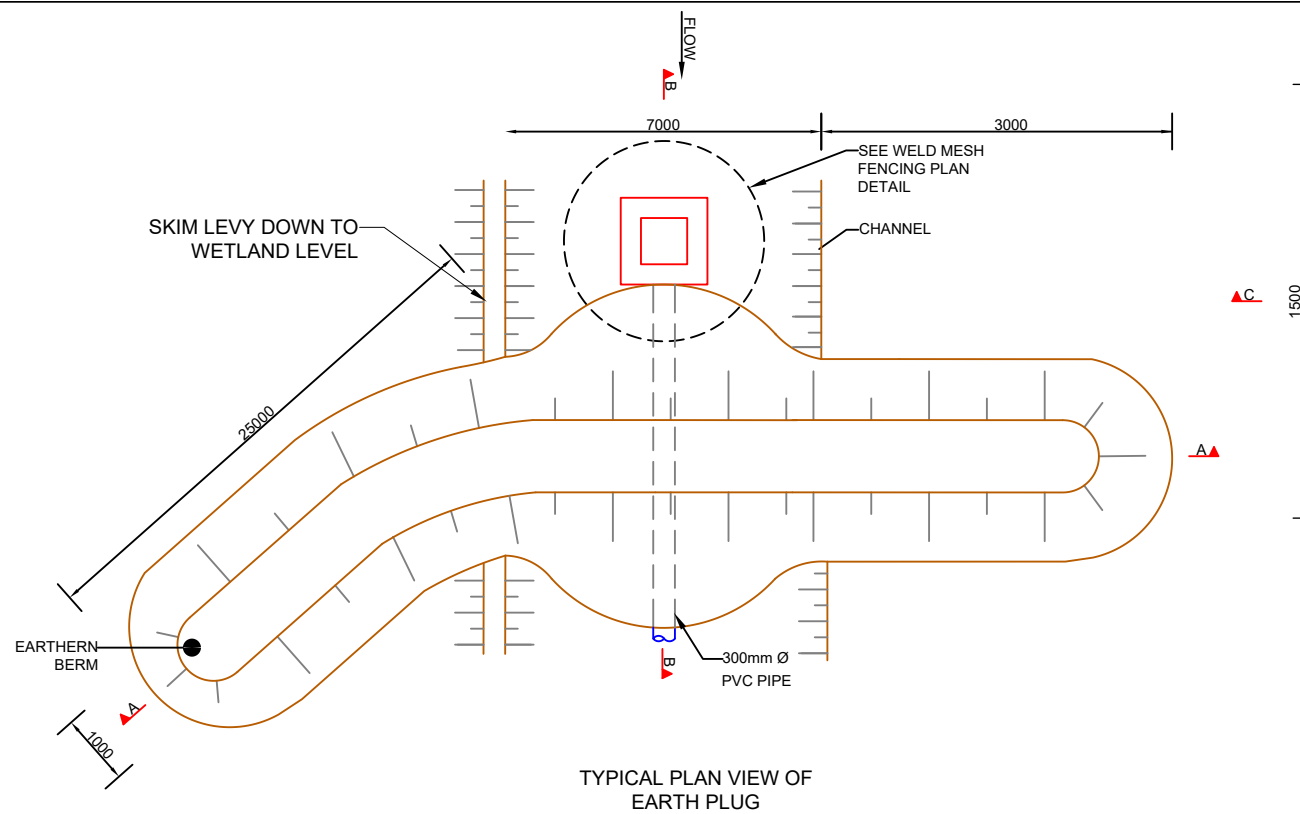
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	137.60
Excavation for sloping	m ³	363.66
Standard double skin brick	m ³	1.27
Concrete	m ³	0.45
Revegetation	m ²	97.76
Class4 300 mm PVC pipe	m	13.30
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'0.36"S	26°46'32.33"E

- NOTES**
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

- EARTHWORKS/ EARTH STRUCTURES:**
- ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
 - ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100mm OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
 - SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100MM LAYERS AT OPTIMUM WATER CONTENT.
- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 224 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-225-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Deactivation of ridge and furrow
Rehabilitation Objectives	To even out wetland to spread flow evenly.
Latitude (D°M'S")	32°26'0.65"S
Longitude (D°M'S")	26°46'33.18"E

Location Photograph: S32E-01-225-00



Bill of Quantities

Item	Units	Quantity
Earthworks for infilling drain	m ³	250.00
Excavation for removal of berm	m ³	250.00

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

The following site specific mitigation measures shall be implemented:

Ensure the invasive bramble plants (*Rubus* spp) near this intervention are completely removed and correctly disposed of outside the wetland to avoid spreading seed

Details

Intervention	S32E-01-226-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and skim side bank down to wetland level
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°26'2.77"S
Longitude (D°M'S")	26°46'31.85"E

Location Photograph: S32E-01-226-00



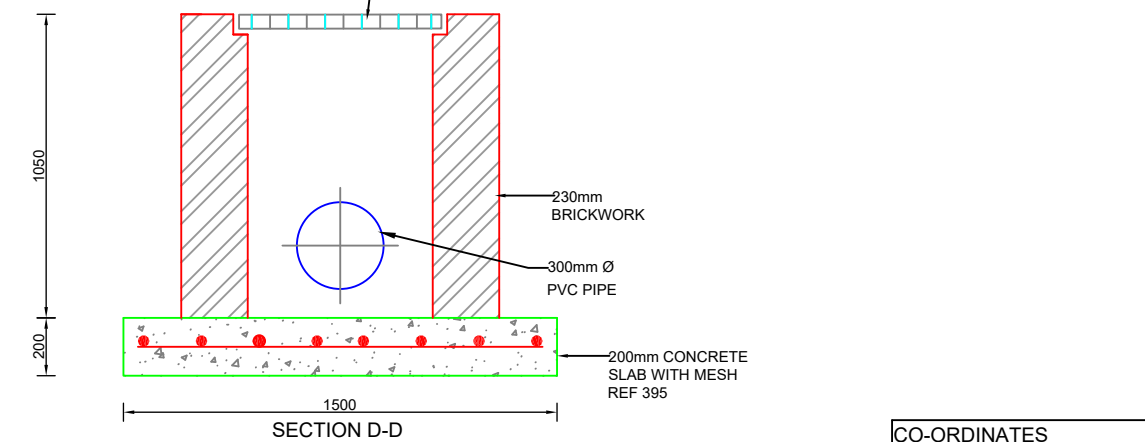
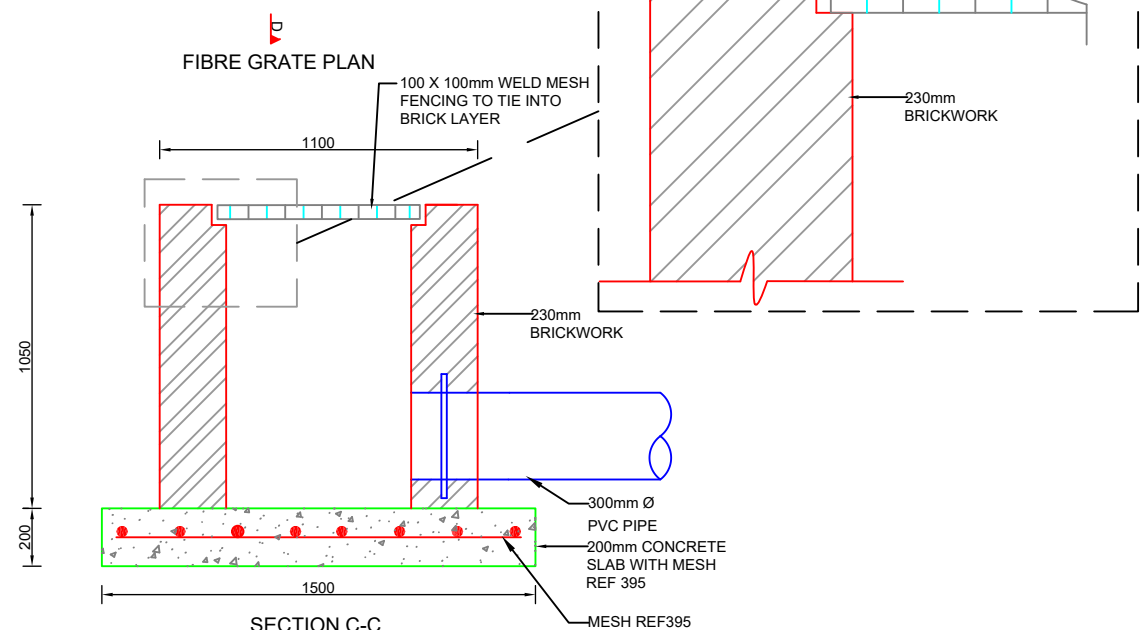
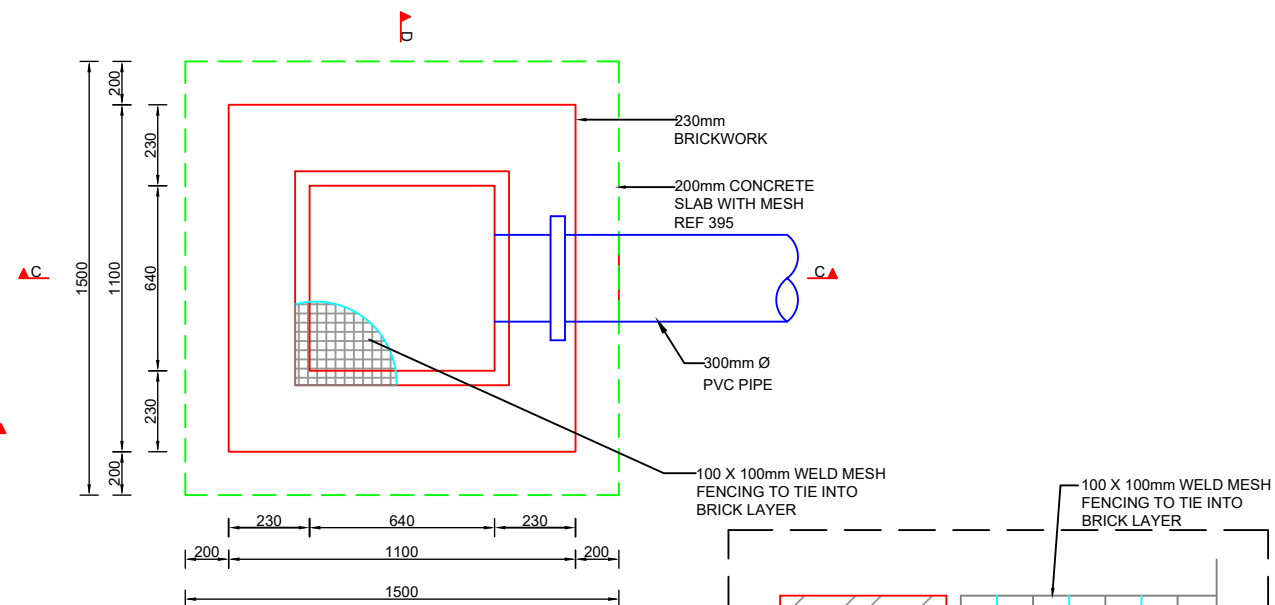
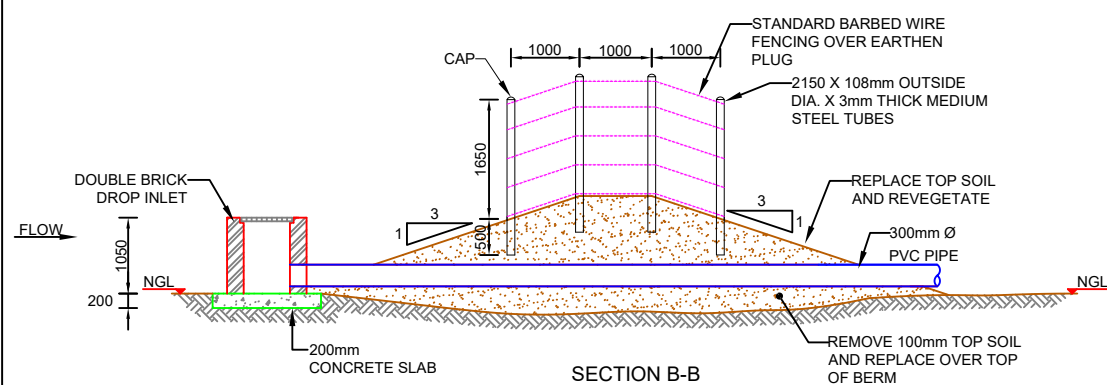
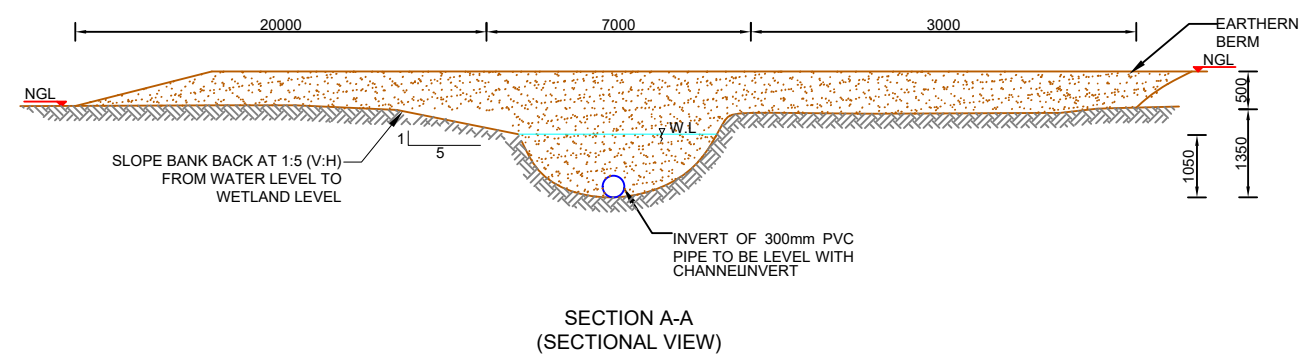
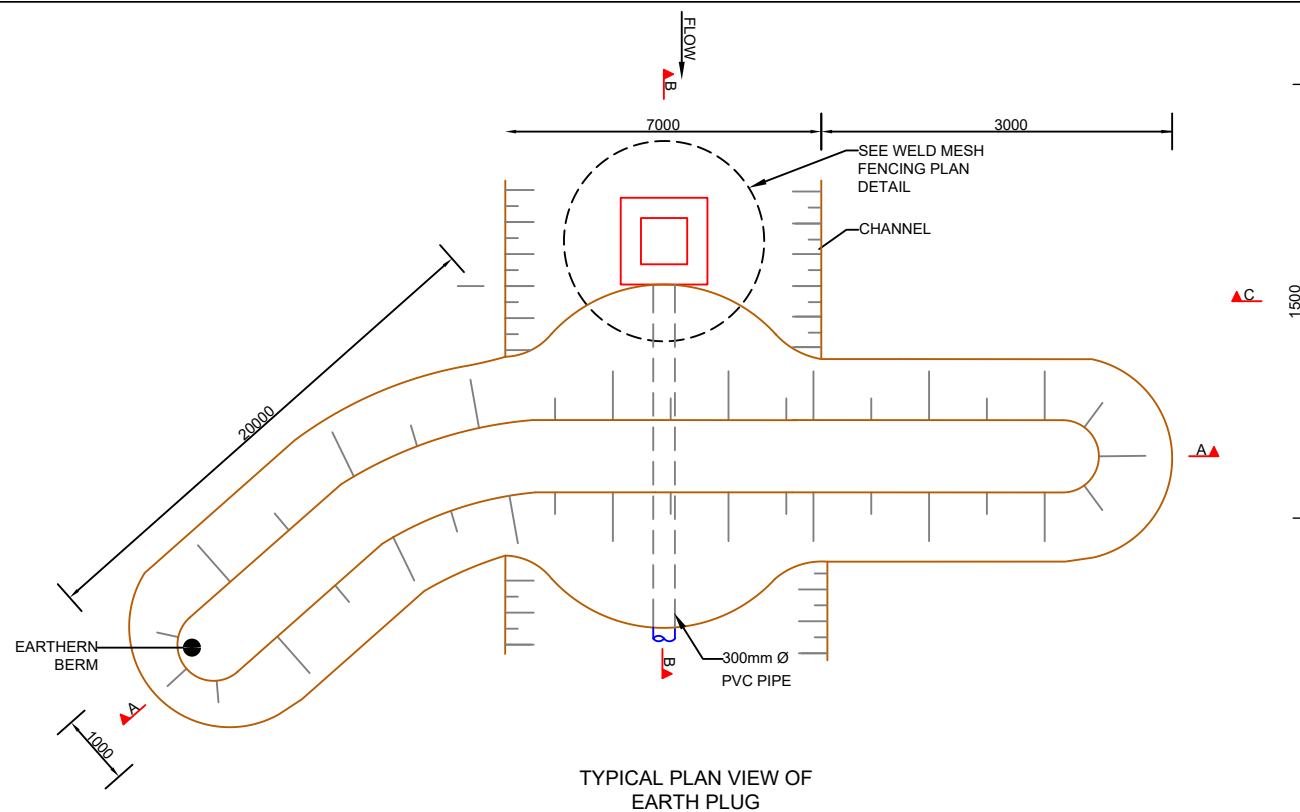
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	113.57
Excavation for sloping	m ³	185.30
Standard double skin brick	m ³	1.06
Concrete	m ³	0.45
Revegetation	m ²	88.90
Class4 300 mm PVC pipe	m	12.10
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'2.77"S	26°46'31.85"E

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

- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

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

- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 226 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-227-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°26'6.09"S
Longitude (D°M'S")	26°46'31.71"E

Location Photograph: S32E-01-227-00



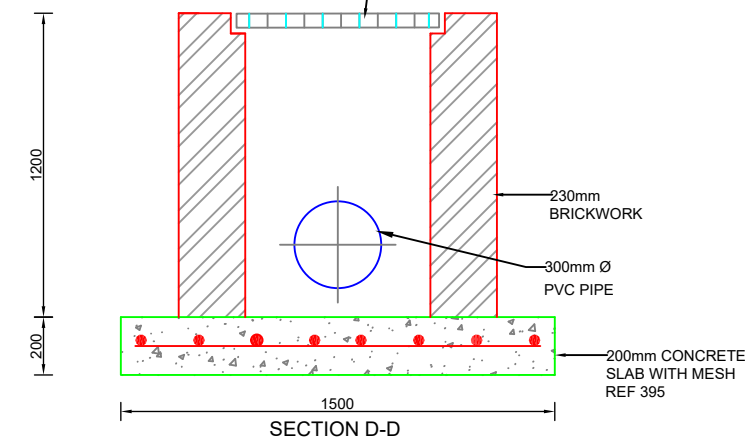
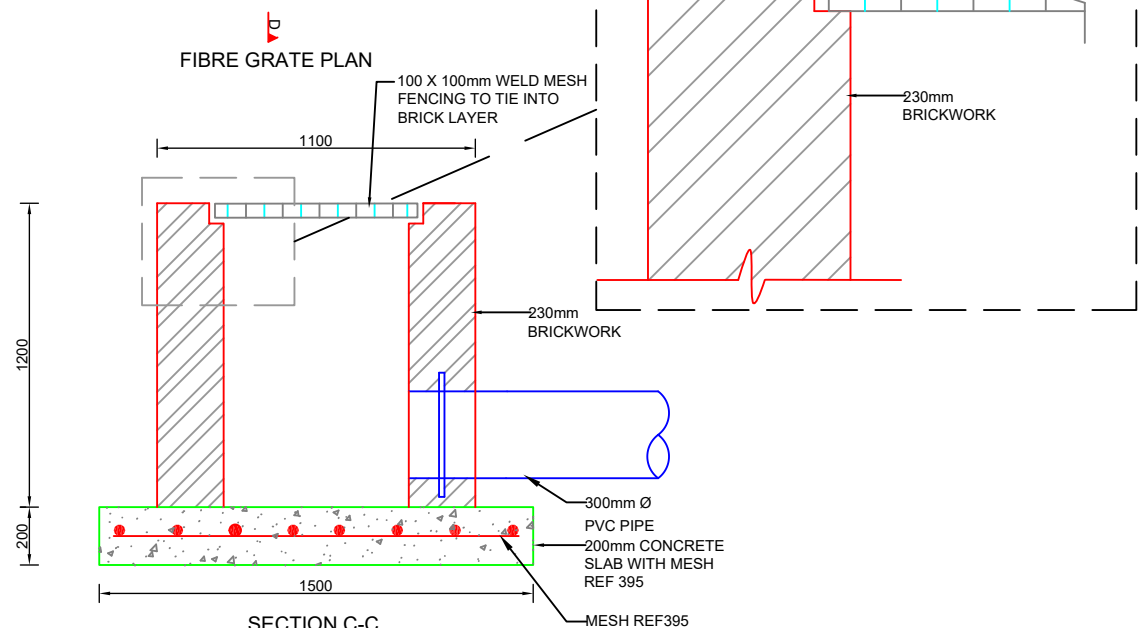
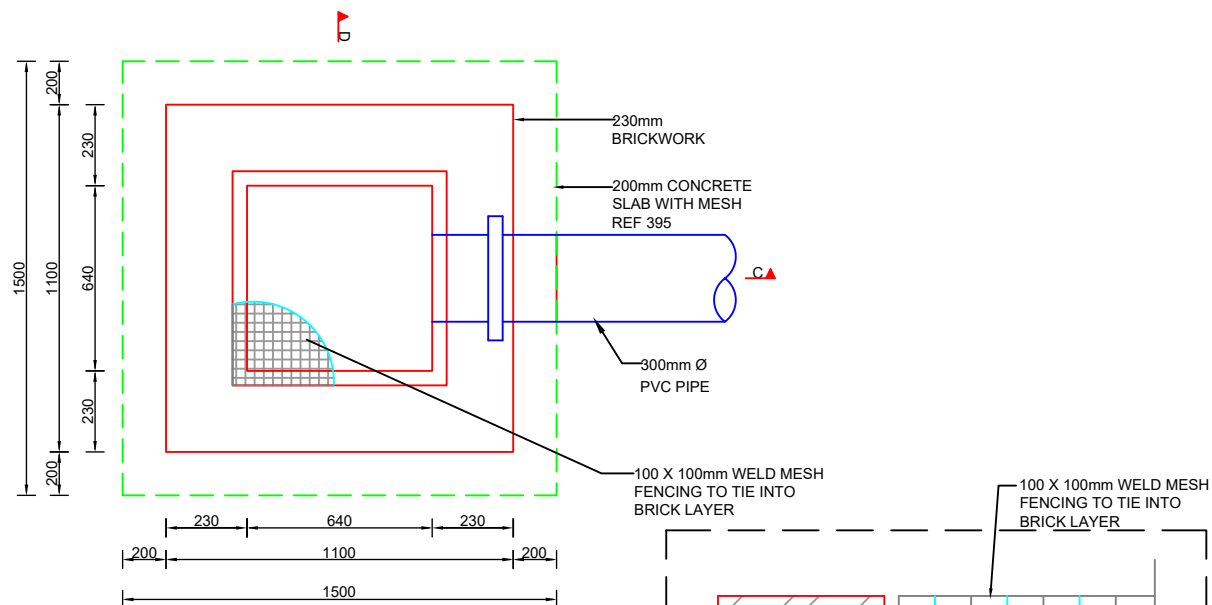
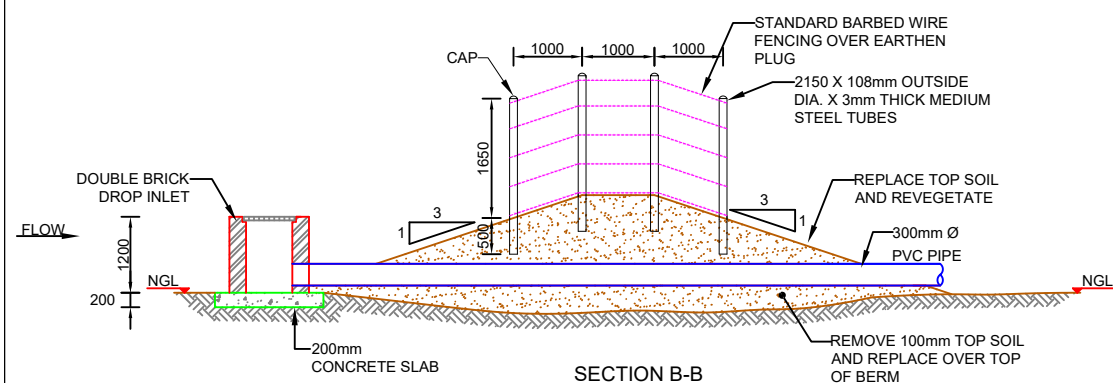
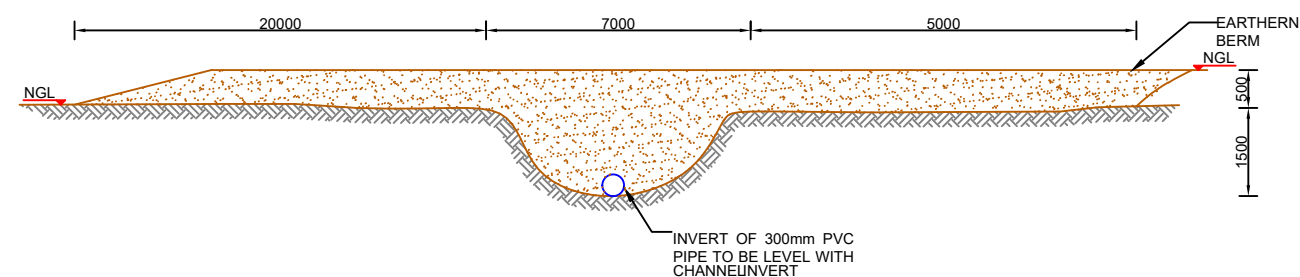
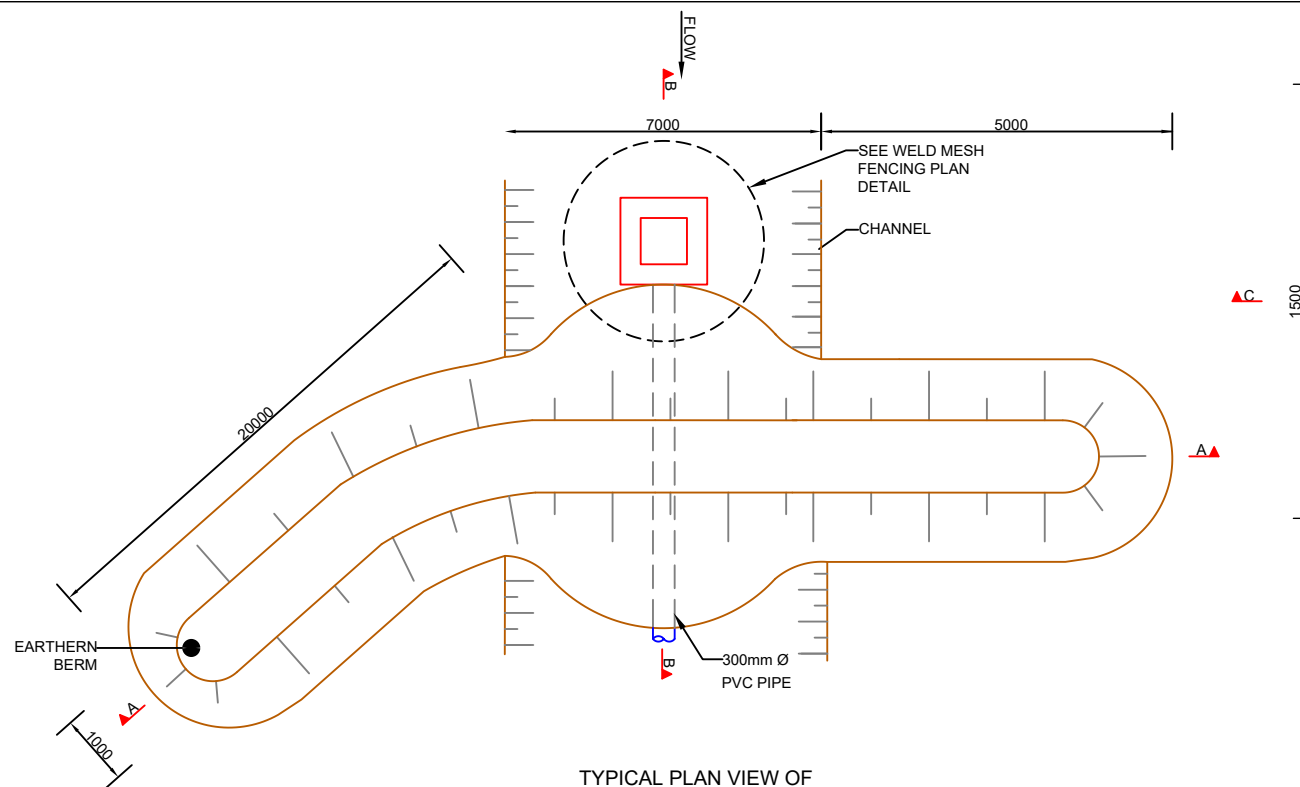
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	129.25
Excavation for sloping	m ³	654.75
Standard double skin brick	m ³	1.21
Concrete	m ³	0.45
Revegetation	m ²	95.54
Class4 300 mm PVC pipe	m	13.00
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'6.09"S	26°46'31.71"E

- NOTES
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	
ENGINEER	DATE
	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 227 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-228-00A
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and additional berm downstream in wetland.
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Additional berm to prevent flows re-entering the channel.
Latitude (D°M'S")	32°26'12.01"S
Longitude (D°M'S")	26°46'33.52"E

Location Photograph: S32E-01-228-00A



Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	122.90
Excavation for sloping	m ³	901.15
Standard double skin brick	m ³	1.37
Concrete	m ³	0.45
Revegetation	m ²	87.59

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

The following site specific mitigation measures shall be implemented:

N/A

Details

Intervention	S32E-01-228-00B
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and additional berm downstream in wetland.
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Additional berm to prevent flows re-entering the channel.
Latitude (D°M'S")	32°26'12.01"S
Longitude (D°M'S")	26°46'33.52"E

Location Photograph: S32E-01-228-00-B



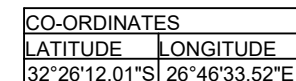
Bill of Quantities

Item	Units		Quantity
Class4 300 mm PVC pipe	m		13.90
100 mm x 100 mm weld mesh fencing	m ²		0.80
standard Barbed wire	m		15.00
2150 mm (l) x 106 mm (ø) x 3mm(t) medium steel tubes	no.		4.00
Earth Works for earthen berm	m ³		8.04





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

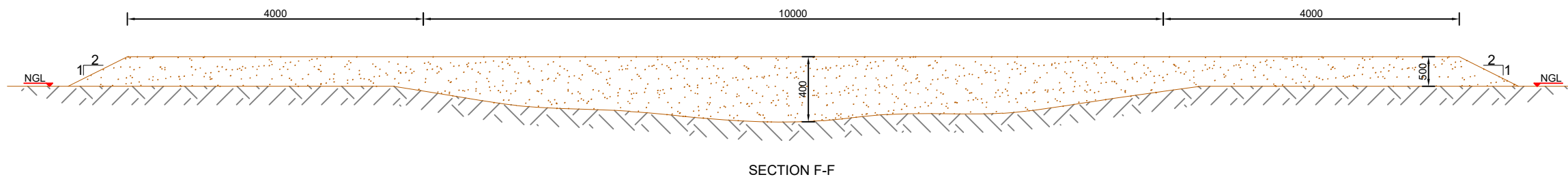
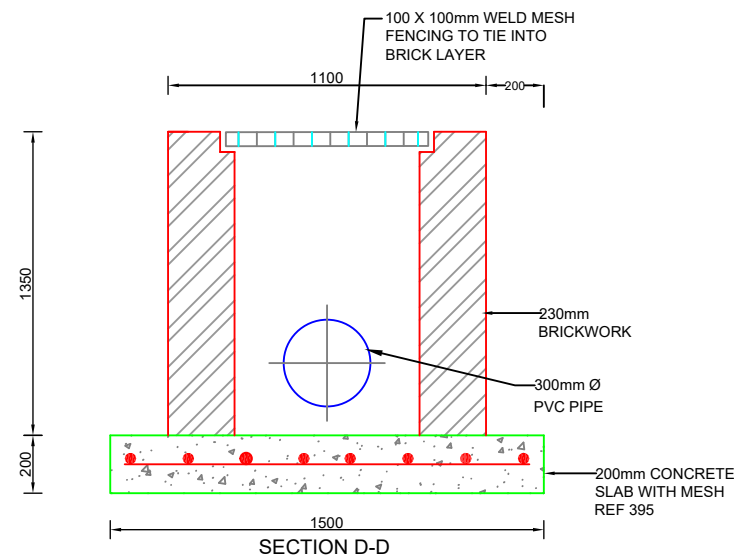
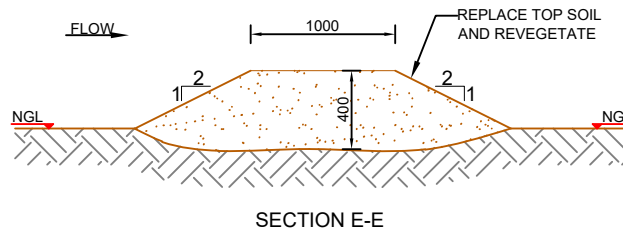
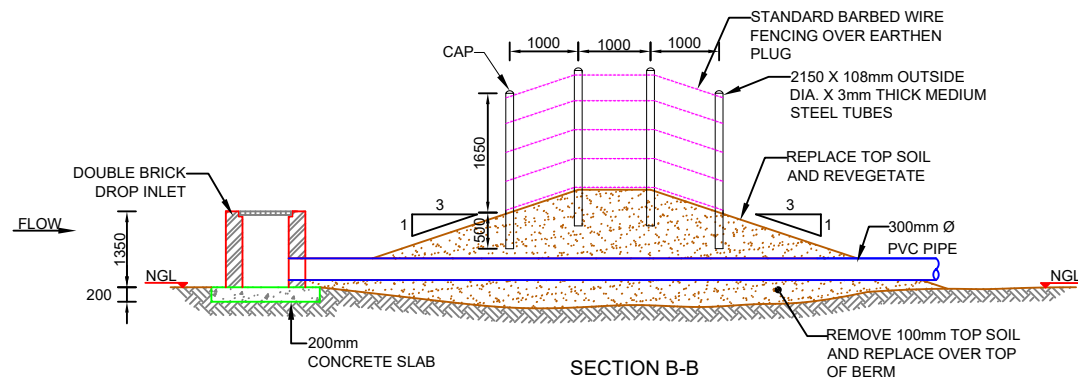
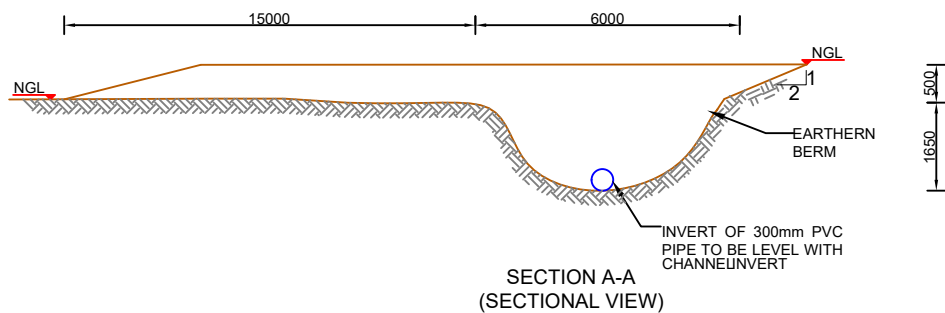
The following site specific mitigation measures shall be implemented:

N/A



1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
3. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
4. ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
5. CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
7. CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
9. FOUNDATION IMPROVMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

<div> www.aurecongroup.com</div> <div> Water, Wetlands and Environmental Engineering</div>	<div></div>	CLIENT	REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN		PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020				
			1		DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3								
							DRAWN		APPROVED		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE				
							T. HARVEY		ENGINEER DATE		INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE				
							DESIGNED		 08/02/2019							
							T. PIKE		REGISTRATION No. 20130774							
						CHECKED				DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV	
						T.PIKE				S32E	-	01	-	228	-	01 OF 02 - 1



- NOTES**
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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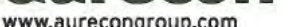
- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

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

- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'12.01"S	26°46'33.52"E

 www.aurecongroup.com		CLIENT	REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN	PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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Details

Intervention	S32E-01-229-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and skim levy to wetland level
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°26'16.34"S
Longitude (D°M'S")	26°46'34.78"E

Location Photograph: S32E-01-229-00



Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	58.79
Excavation for sloping	m ³	234.92
Standard double skin brick	m ³	0.76
Concrete	m ³	0.45
Revegetation	m ²	54.02
Class4 300 mm PVC pipe	m	10.30
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A

Details

Intervention	S32E-01-230-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and skim levy to wetland level
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°26'18.37"S
Longitude (D°M'S")	26°46'35.76"E

Location Photograph: S32E-01-230-00



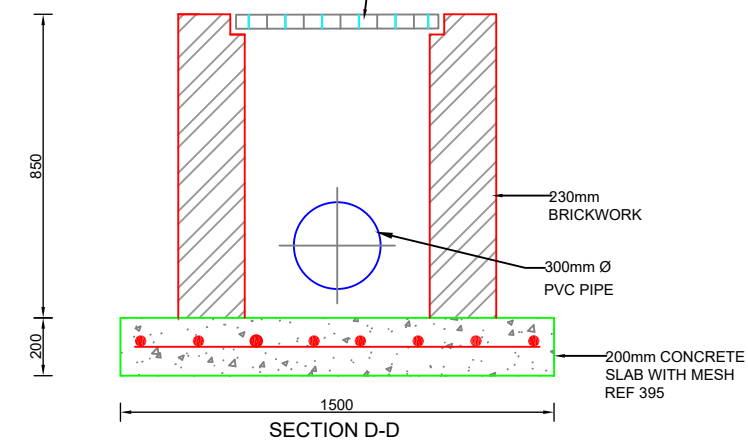
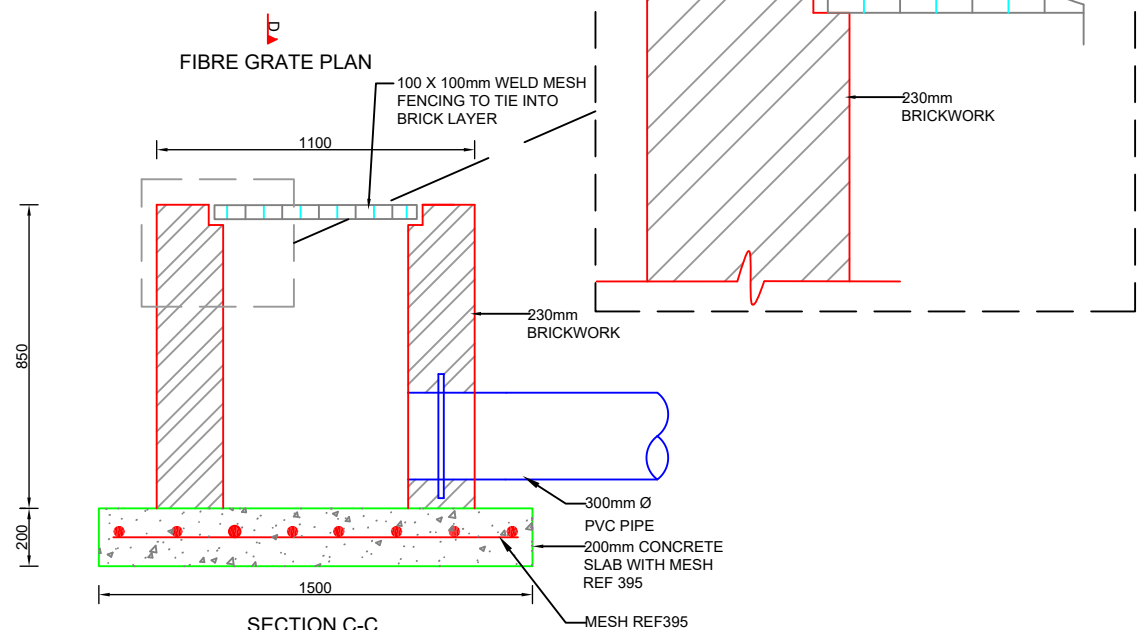
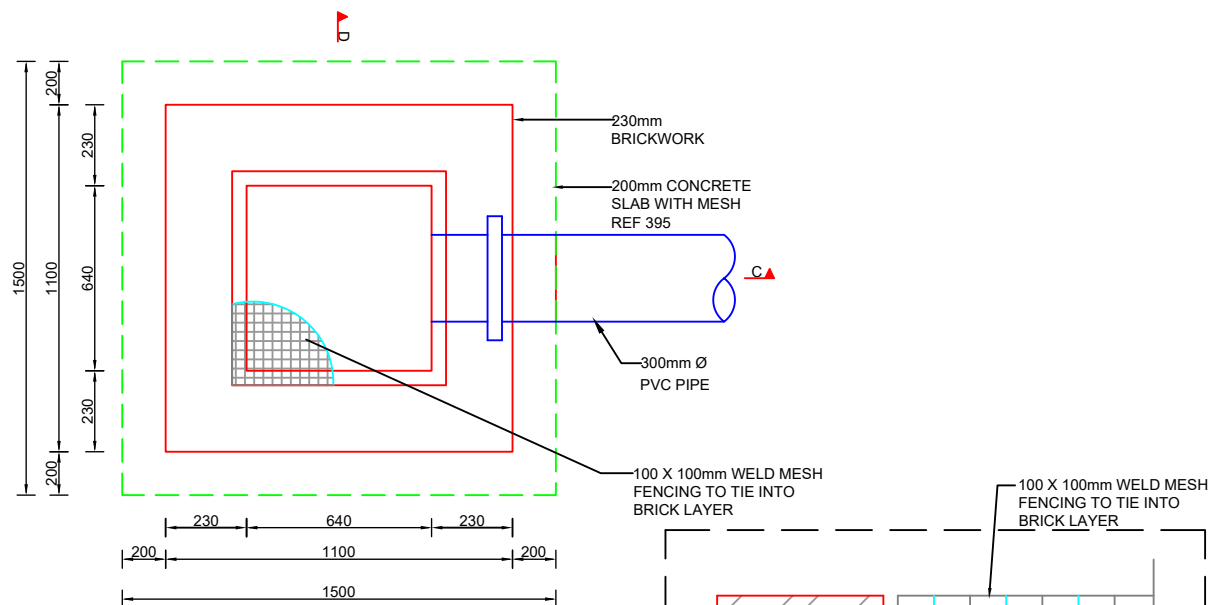
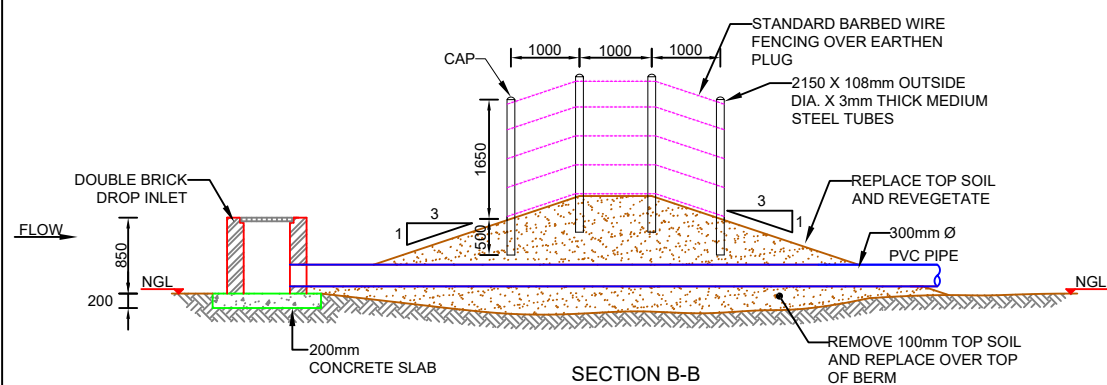
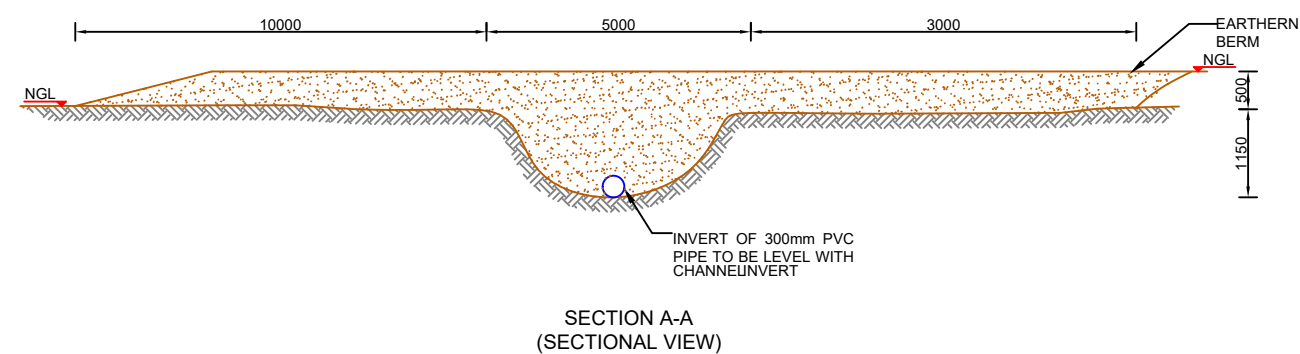
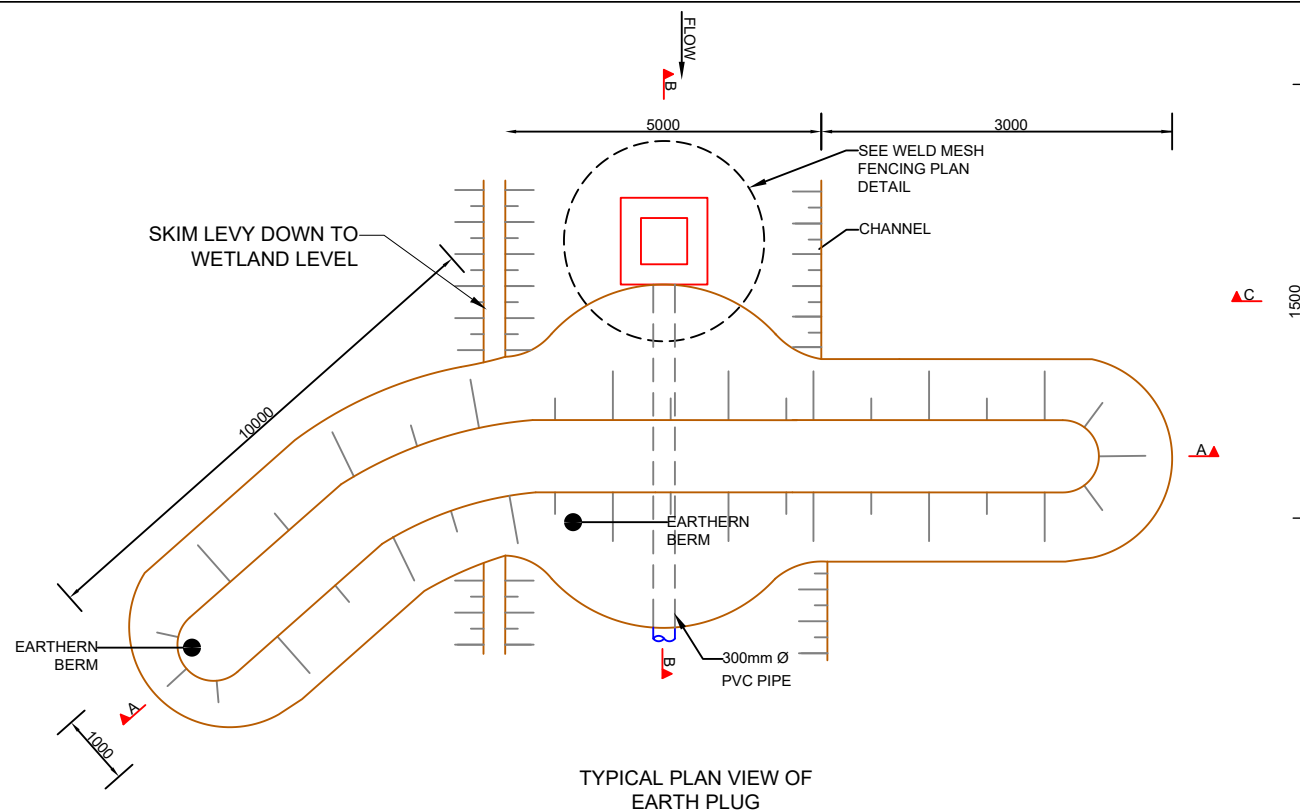
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	65.34
Excavation for sloping	m ³	156.15
Standard double skin brick	m ³	0.86
Concrete	m ³	0.45
Revegetation	m ²	57.18
Class4 300 mm PVC pipe	m	10.90
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	1.50
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'18.37"S	26°46'35.76"E

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

ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

REV	DATE	REVISION DETAILS
1		DRAFT FOR REHAB PLAN

APPROVED
T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	T. HARVEY
DESIGNED	T. PIKE
CHECKED	T. PIKE

PRELIMINARY DESIGN	
APPROVED	DATE
ENGINEER	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 230 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-231-00A
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe and skim levy to wetland level
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°26'19.79"S
Longitude (D°M'S")	26°46'36.22"E

Location Photograph: S32E-01-231-00A



Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	122.86
Excavation for sloping	m ³	311.76
Standard double skin brick	m ³	1.11
Concrete	m ³	0.45
Revegetation	m ²	91.12
Class4 300 mm PVC pipe	m	12.40
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

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

The following site specific mitigation measures shall be implemented:

N/A

Details

Intervention	S32E-01-231-00B
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Pole barrier upstream of berm
Rehabilitation Objectives	To deactivate headcuts
Latitude (D°M'S")	32°26'20.92"S
Longitude (D°M'S")	26°46'36.06"E

Location Photograph: S32E-01-231-00B



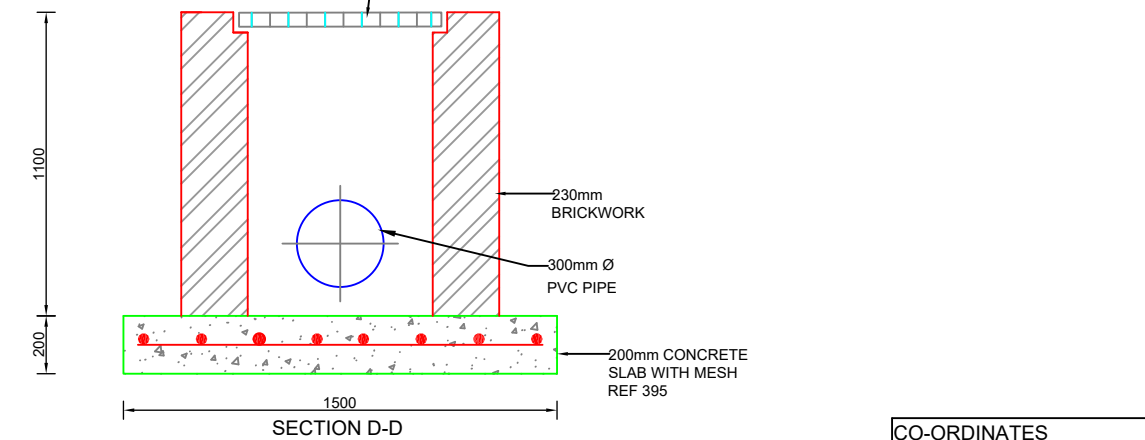
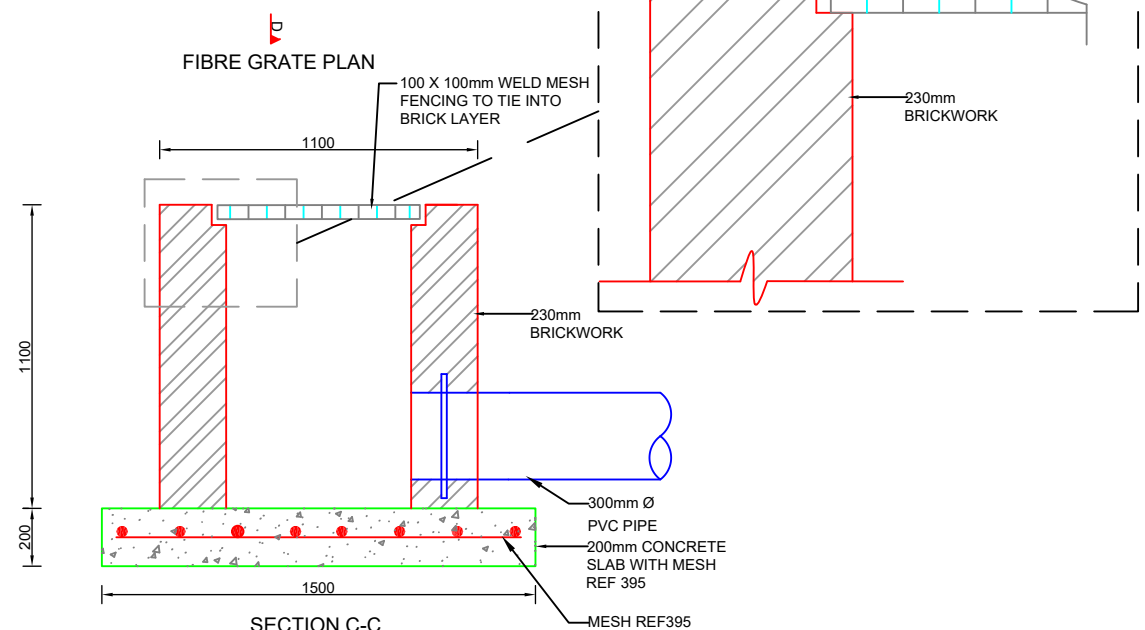
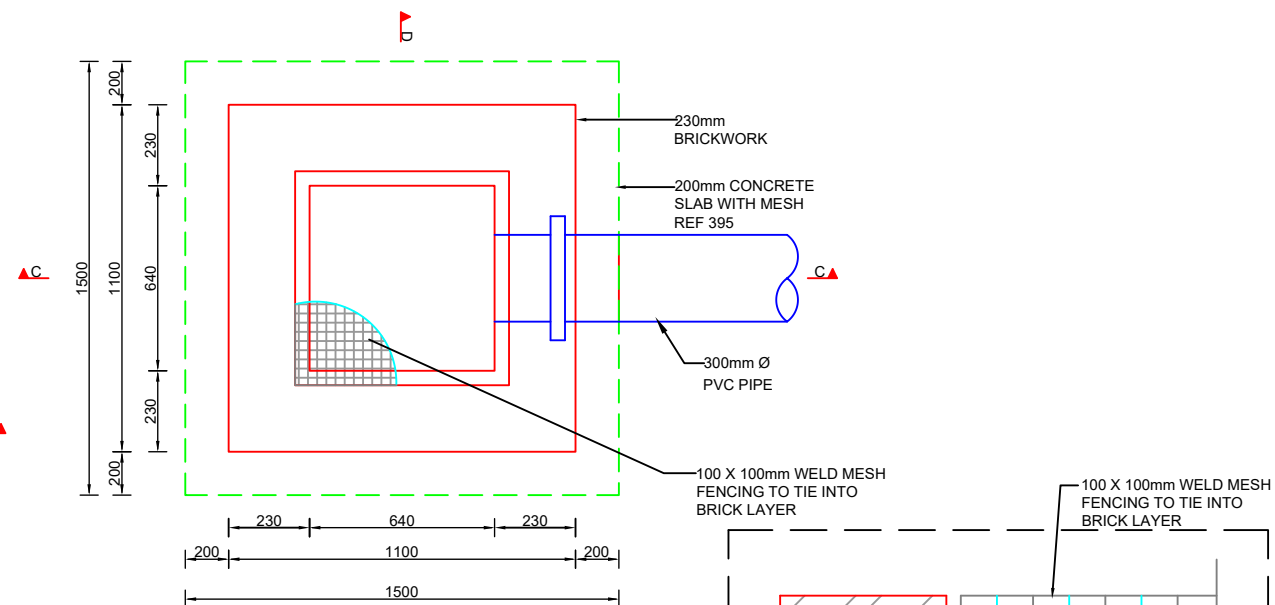
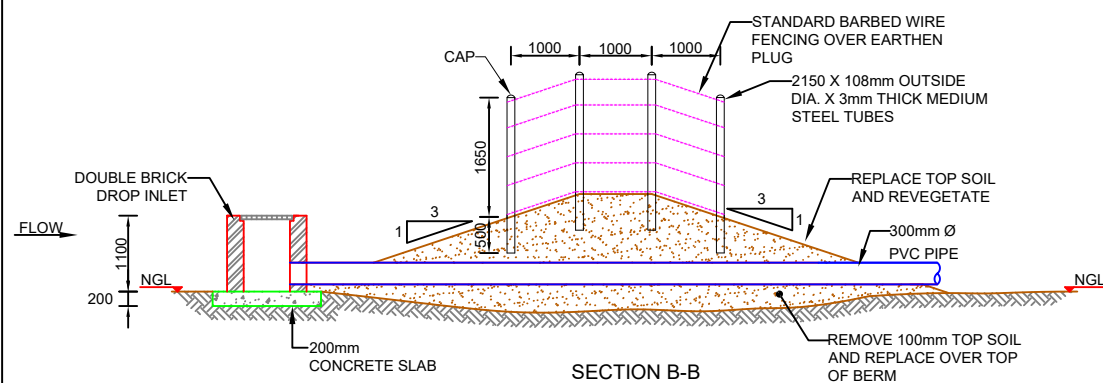
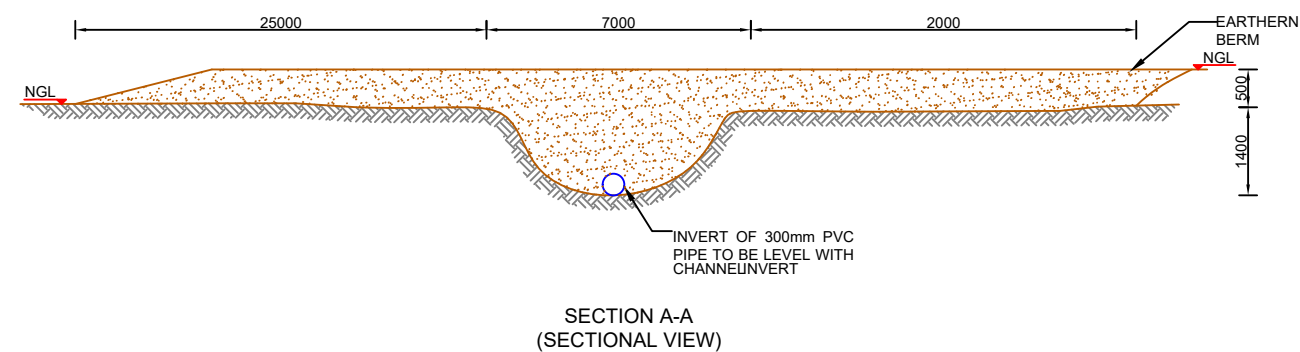
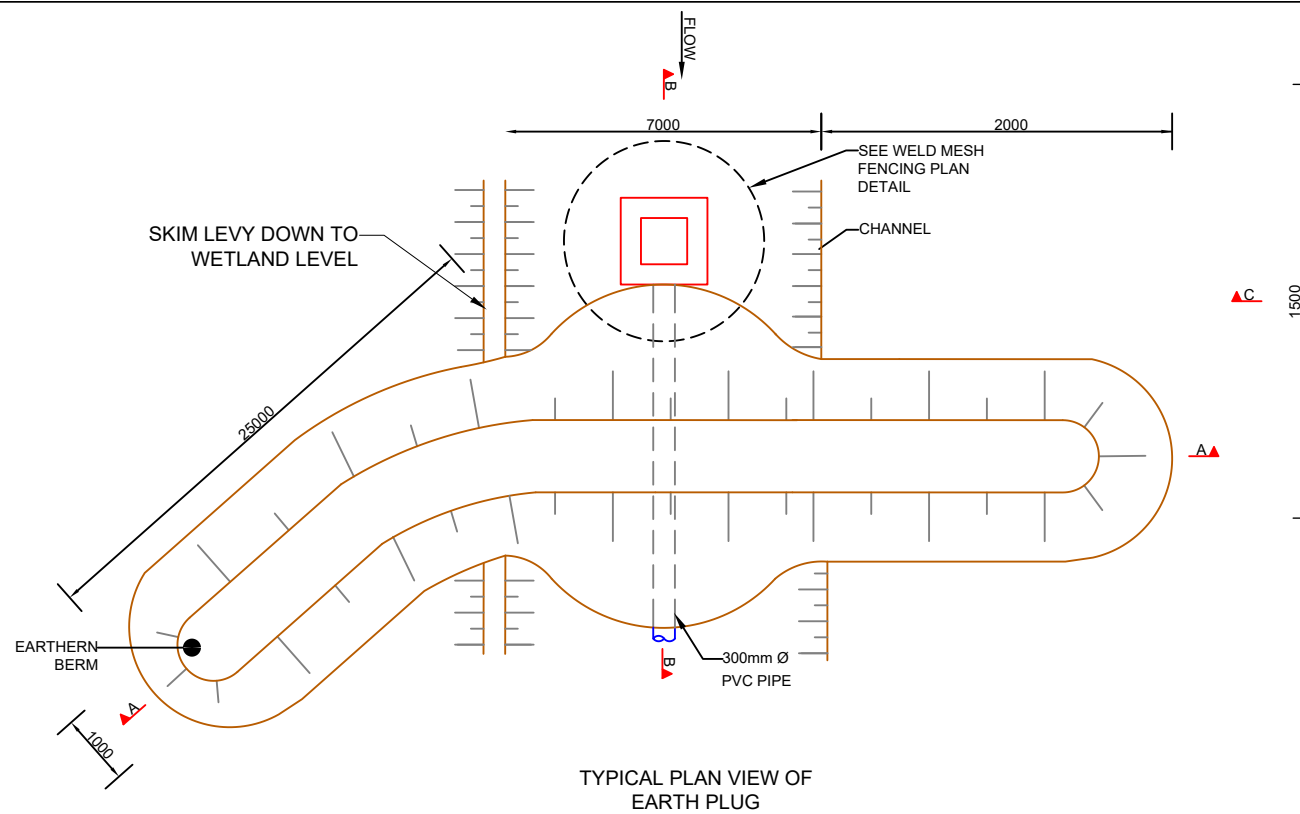
Bill of Quantities

Item	Units	Quantity
Earthworks for backfilling	m ³	2.00
Timber poles (1.2m lengths)	m	78.00
3.4 mm wire	m	7.54
Geofabric	m ²	7.20

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'19.79"S	26°46'36.22"E

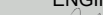
- NOTES**
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. NO GEOTECHNICAL, TOPOGRAPHICAL,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

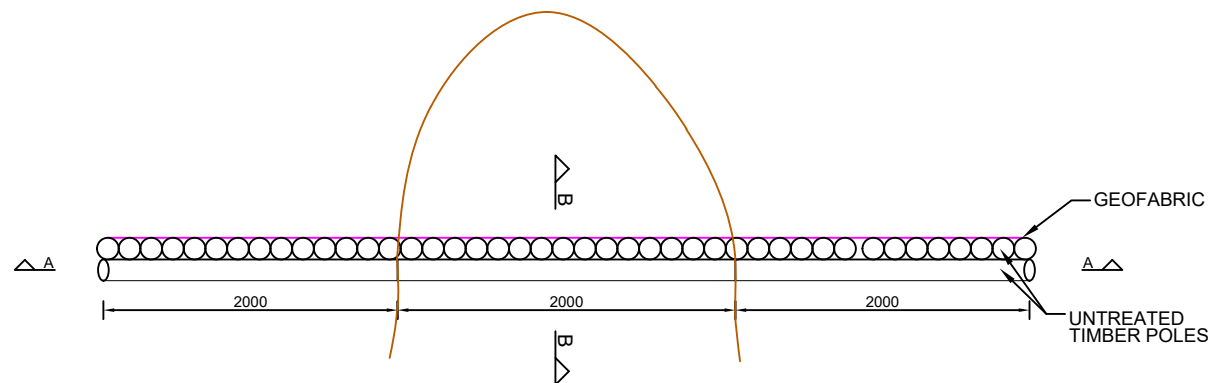
- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

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

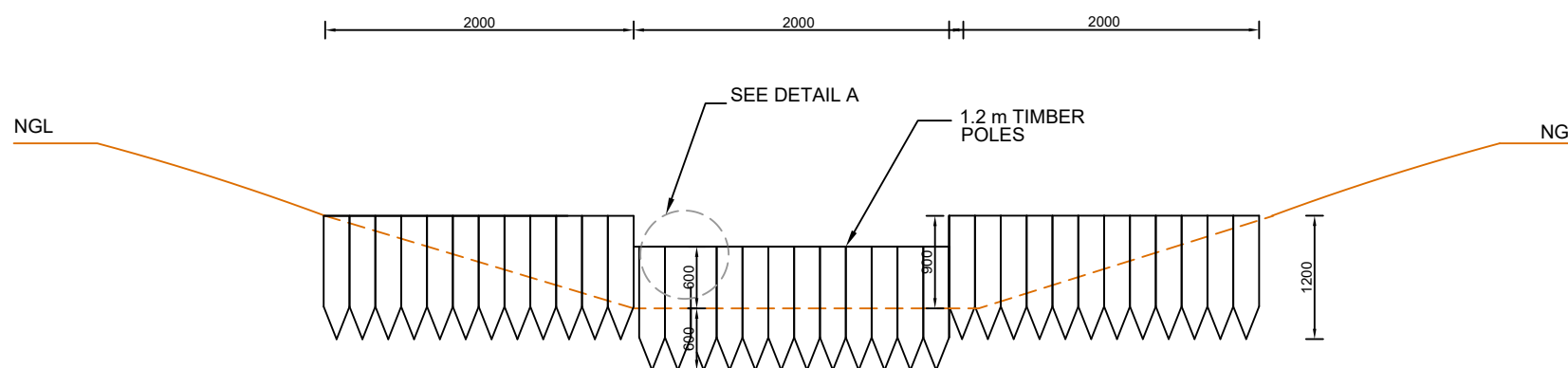
- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
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 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

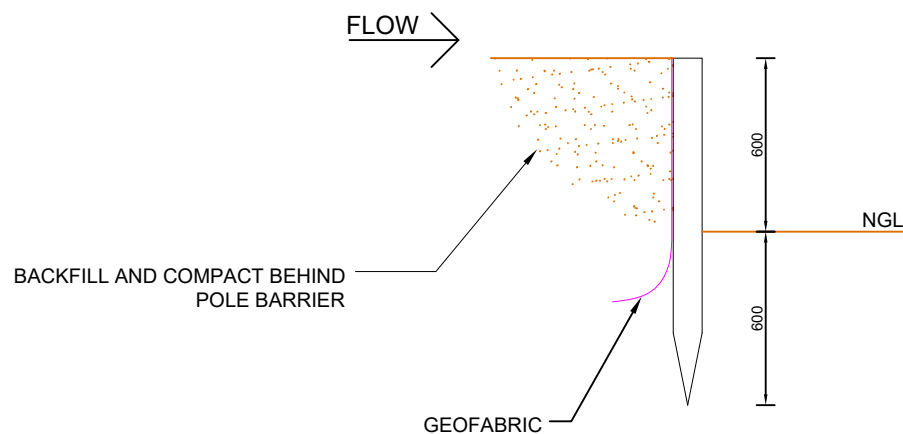
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				DRAWN		APPROVED		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE						
				T. HARVEY		ENGINEER		DATE							
				DESIGNED				08/02/2019	INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE					
				T. PIKE											
				CHECKED		REGISTRATION No.									
				T PIKE		20130774			DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV	
									S32E	- 01	- 231	- 01 OF 02	- 1		



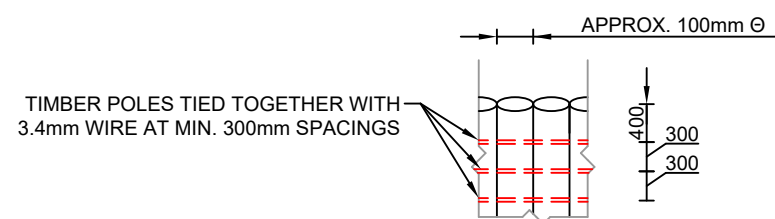
LAYOUT
NTS



SECTION A-A
NTS



SECTION B-B
NTS



DETAIL A

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

ACRONYMS AND ABBREVIATIONS:

1. NGL - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE
3. μ m - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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




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

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTER CONTENT.

TIMBER POLES:

1. BRACE THE TIMBER POLES AS INDICATED WHILE PLACING IN POSITION WITH PVC COATED GALVANISED WIRE OF O/D NO LESS THAN 3.4mm THROUGH THE CENTRE.
2. TIMBER POLES ARE TO BE PLACED IN AN UPRIGHT POSISSION ON THE TOP OF CONCRETE FOUNDATION OF 150 x 250 STRIP (20MPa).
3. BRACE POLES WITH 4.0mm SANS 675: 2009 GRADE A (HEAVY) GALVANISED WIRE USING D-SHAPE BRACING AROUND POLES.
4. ALL ENDS TO BE FITTED WITH THE MAXIMUM SIZED END CAPS TO PREVENT SPLITTING.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'20.92"S	26°46'36.06"E

 www.aurecongroup.com		CLIENT	REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN	PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020						
		 Water, Wetlands and Environmental Engineering	1	20/11/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3									
							DRAWN										
							T. HARVEY										
							DESIGNED										
				T. PIKE		ENGINEER	DATE	08/02/2019	PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE							
									INTERVENTION DESCRIPTION	POLE BARRIERS							
									REGISTRATION No. 20130774								
										DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV		
											S32E	-	01	-	02 OF 02	-	1

Details

Intervention	S32E-01-232-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Geocell covered earthen berm with base flow pipe and skim levy to wetland level
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Skimming of berm to allow water to flood to wetland level.
Latitude (D°M'S")	32°26'22.83"S
Longitude (D°M'S")	26°46'38.73"E

Location Photograph: S32E-01-232-00



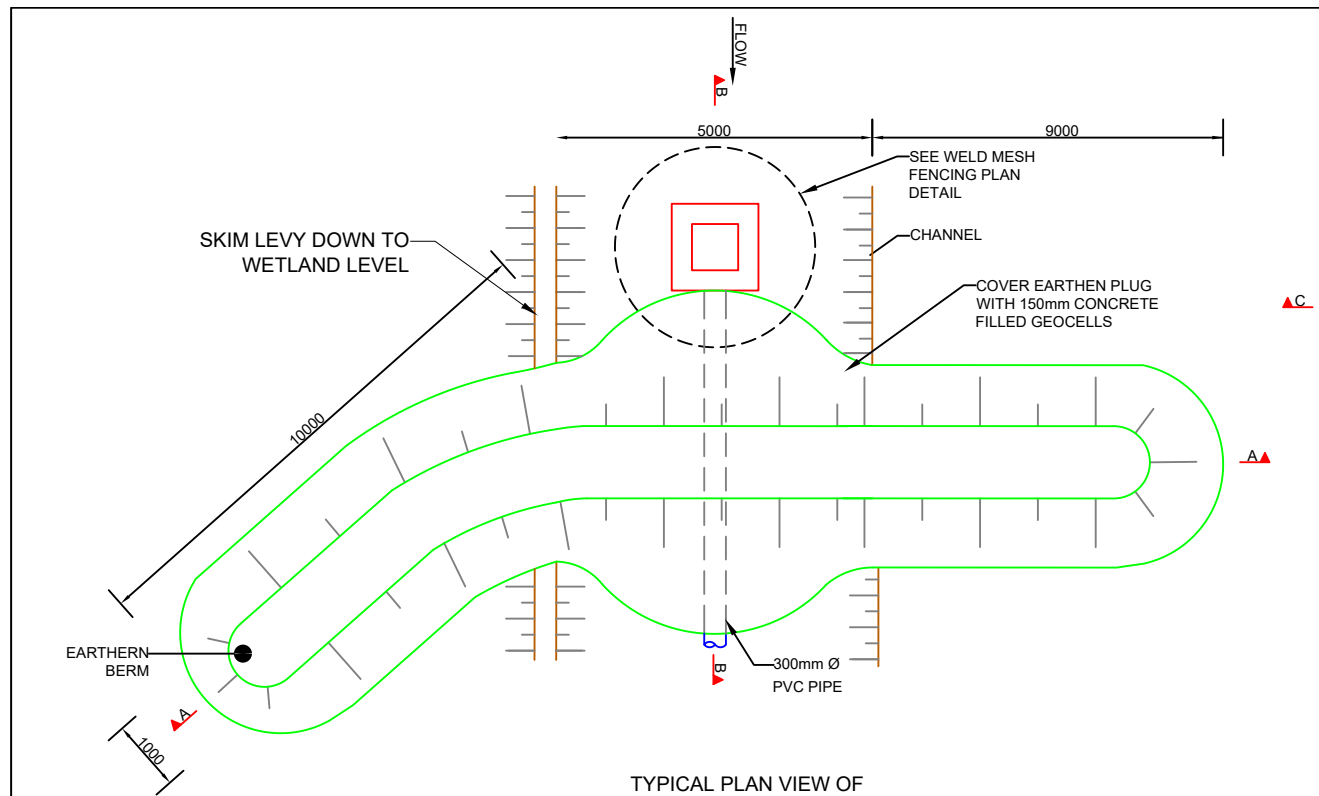
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	113.10
Excavation for sloping	m ³	323.06
Standard double skin brick	m ³	0.91
Concrete	m ³	27.12
Revegetation	m ²	175.79
Class4 300 mm PVC pipe	m	12.70
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00
Geocells	m ²	175.79
Geofabric	m ²	175.79

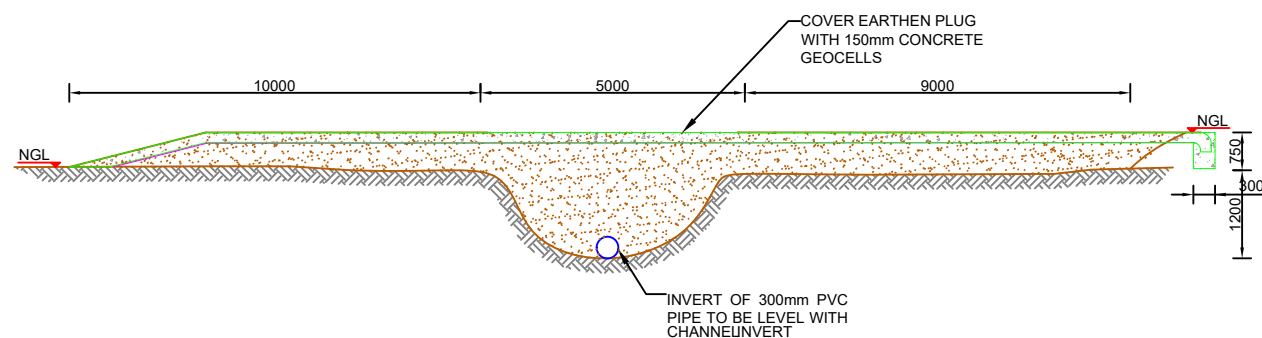
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

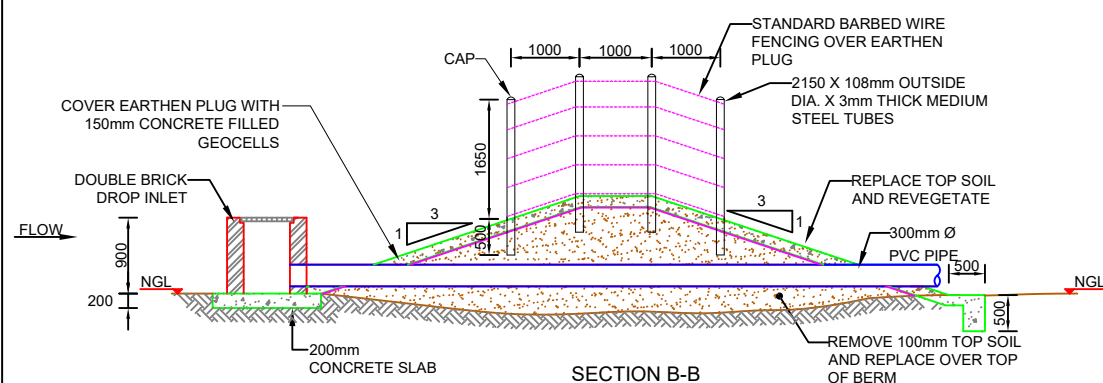
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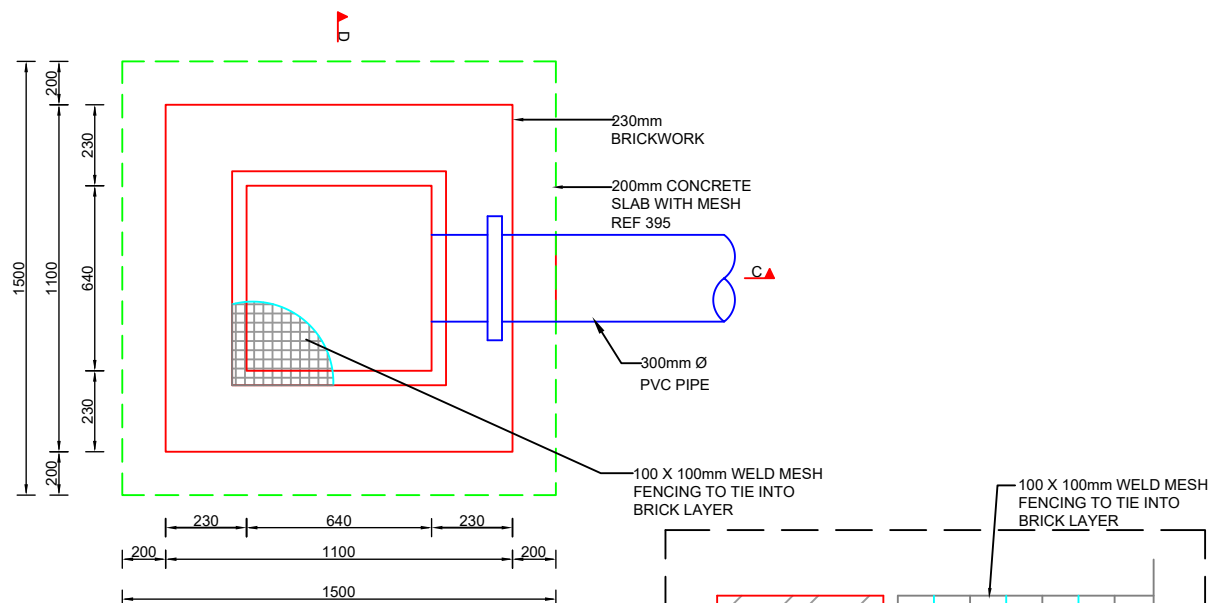
TYPICAL PLAN VIEW OF EARTH PLUG



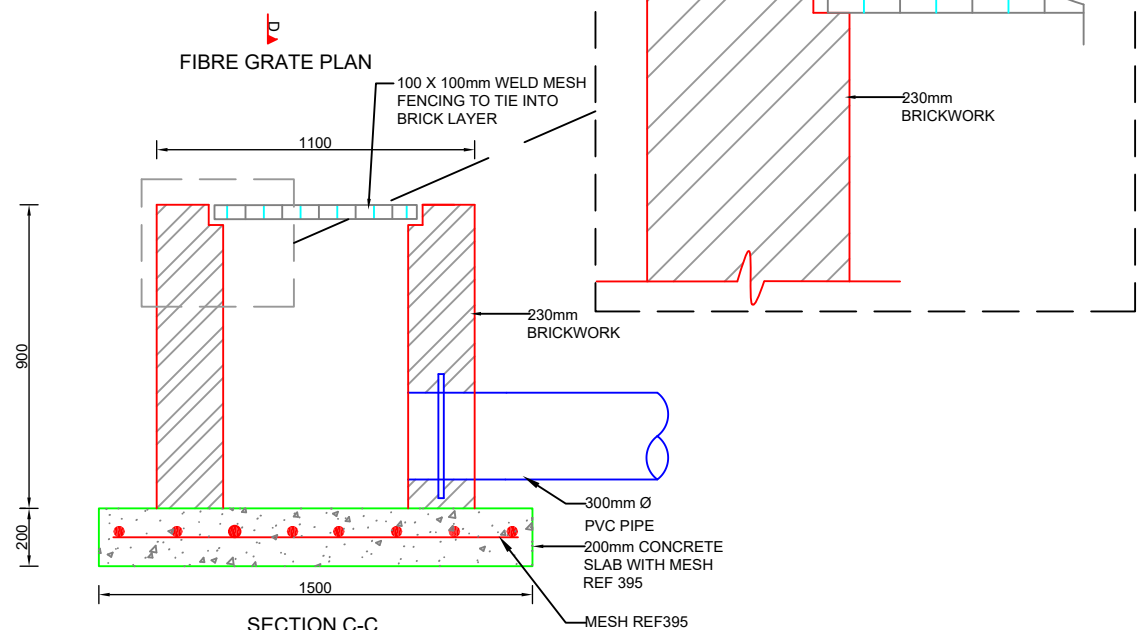
SECTION A-A
(SECTIONAL VIEW)



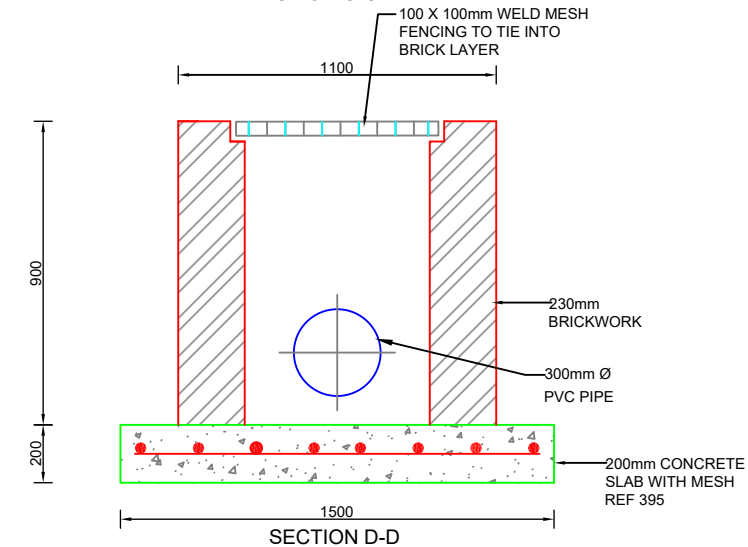
SECTION B-B



FIBRE GRATE PLAN



SECTION C-C



SECTION D-D

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'22.83"S	26°46'38.73"E

NOTES

- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.

- AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED AGAINST ANY ASSOCIATED DAMAGES AND ACCEPT NO LIABILITY ASSOCIATED WITH THE CONSTRUCTION AND IMPLEMENTATION OF ENGINEERING INTERVENTIONS DUE TO THE ENGINEERS HAVING LIMITED CONTACT WITH THE IMPLEMENTER DURING THE CONSTRUCTION PHASE RESULTING IN OUR INABILITY TO DILIGENTLY SUPERVISE AND ASSESS ANY PROGRESS.

ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CONCRETE FILLED GEOCELLS:

- FOOTPRINT AREA TO BE CLEARED PRIOR TO CONSTRUCTION.
- SHAPE TO REQUIRED SLOPE.
- FOR CONCRETE MIX, FOLLOW SUPPLIERS INSTRUCTIONS. CONCRETE WITH A HIGH SLUMP IS PREFERABLE FOR PLACING IN GEOCELL.
- CONCRETE FOR GEOCELLS TO BE MINIMUM 15MPa & MIX:
1 BAG CEMENT
125L SAND
120L STONE
30L WATER
- RIGGING AS SPECIFIED BY SUPPLIER AND ANCHORING TO BE DONE.
- CONCRETE TO HAVE BROOMED FINISH.

REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	
ENGINEER	DATE
	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 232 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-233-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Geocell covered earthen berm with base flow pipe and skim levy to wetland level. 33m concrete sill at ground level.
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Skimming of berm to allow water to flood to wetland level.
Latitude (D°M'S")	32°26'24.42"S
Longitude (D°M'S")	26°46'40.22"E

Location Photograph: S32E-01-233-00



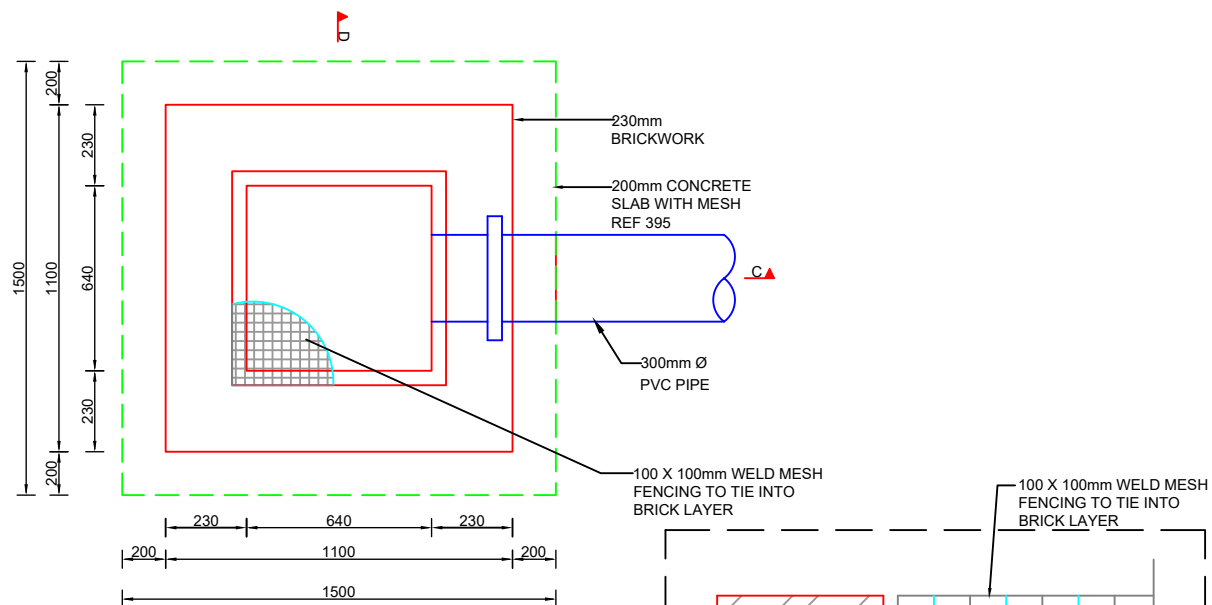
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	76.88
Excavation for sloping	m ³	92.12
Standard double skin brick	m ³	0.96
Concrete	m ³	20.17
Revegetation	m ²	129.50
Class4 300 mm PVC pipe	m	11.80
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00
Geocells	m ²	129.50
Geofabric	m ²	129.50

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

The following site specific mitigation measures shall be implemented:

N/A



FIBRE GRATE PLAN

100 X 100mm WELD MESH FENCING TO TIE INTO BRICK LAYER

1100

230mm BRICKWORK

230mm BRICKWORK

300mm Ø PVC PIPE

200mm CONCRETE SLAB WITH MESH REF 395

MESH REF395

1500

950

200

SECTION C-C

100 X 100mm WELD MESH
FENCING TO TIE INTO
BRICK LAYER

1100

950

200

230mm
BRICKWORK

300mm Ø
PVC PIPE

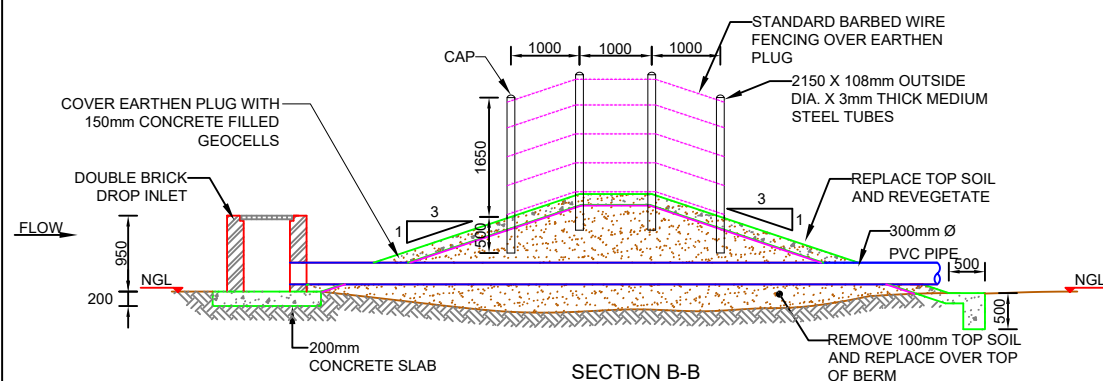
200mm CONCRETE
SLAB WITH MESH
REF 395

1500

SECTION D-D

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'24.42"S	26°46'40.22"E

1. FOOTPRINT AREA TO BE CLEARED PRIOR TO CONSTRUCTION.
2. SHAPE TO REQUIRED SLOPE.
3. FOR CONCRETE MIX, FOLLOW SUPPLIERS INSTRUCTIONS.
CONCRETE WITH A HIGH SLUMP IS PREFERABLE FOR PLACING IN GEOCELL.
4. CONCRETE FOR GEOCELLS TO BE MINIMUM 15MPa & MIX:
1 BAG CEMENT
125L SAND
120L STONE
30L WATER
5. RIGGING AS SPECIFIED BY SUPPLIER AND ANCHORING TO BE DONE.
6. CONCRETE TO HAVE BROOMED FINISH.



1500
SECTION D-D

Details

Intervention	S32E-01-234-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Geocell covered earthen berm with base flow pipe. 16m concrete sill at ground level.
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel. Skimming of berm to allow water to flood to wetland level.
Latitude (D°M'S")	32°26'25.76"S
Longitude (D°M'S")	26°46'41.33"E

Location Photograph: S32E-01-234-00



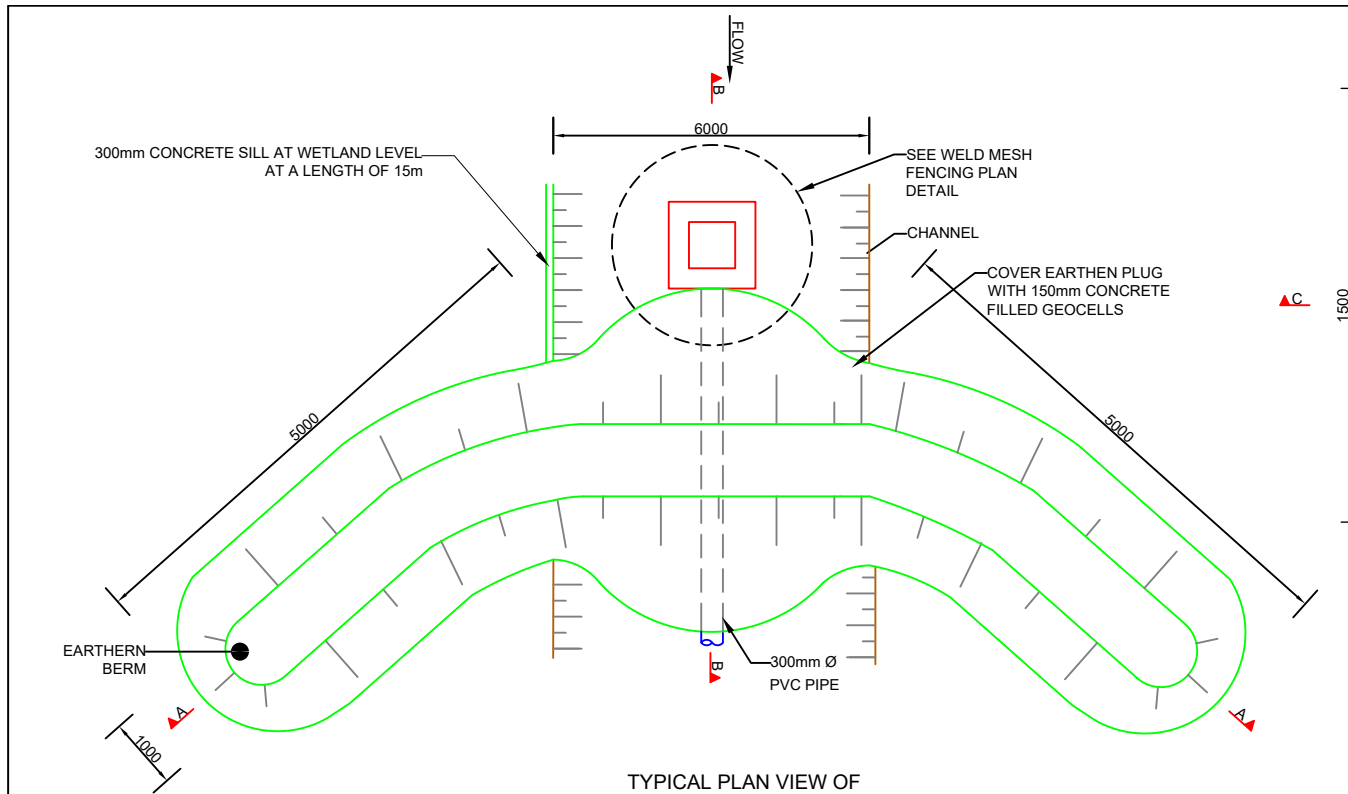
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	92.65
Excavation for sloping	m ³	101.07
Standard double skin brick	m ³	1.21
Concrete	m ³	18.99
Revegetation	m ²	121.62
Class4 300 mm PVC pipe	m	12.70
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00
Geocells	m ²	121.62
Geofabric	m ²	121.62

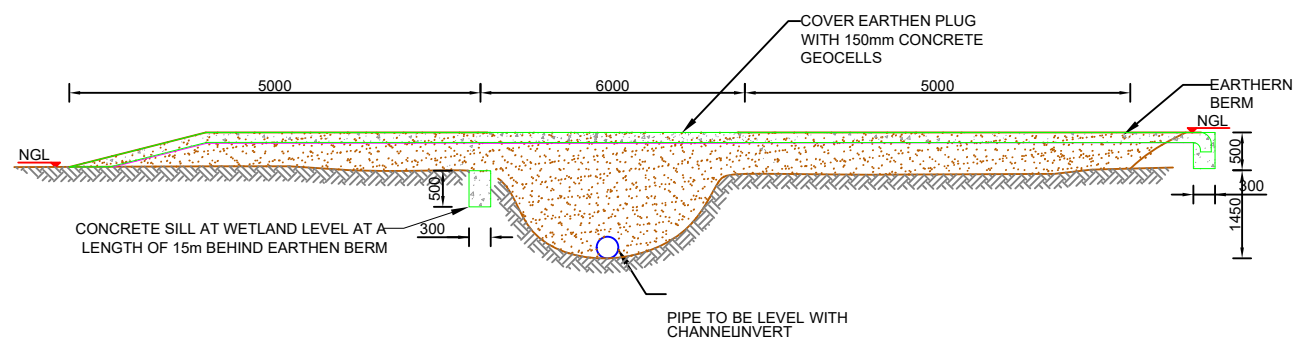
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

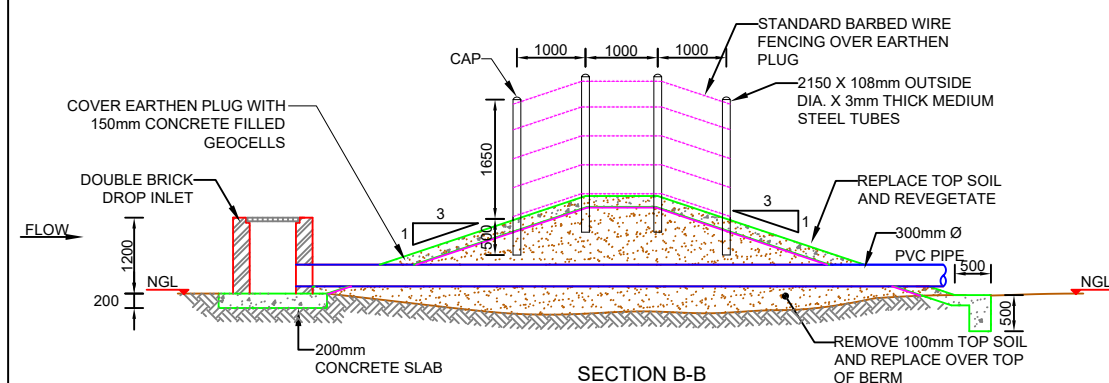
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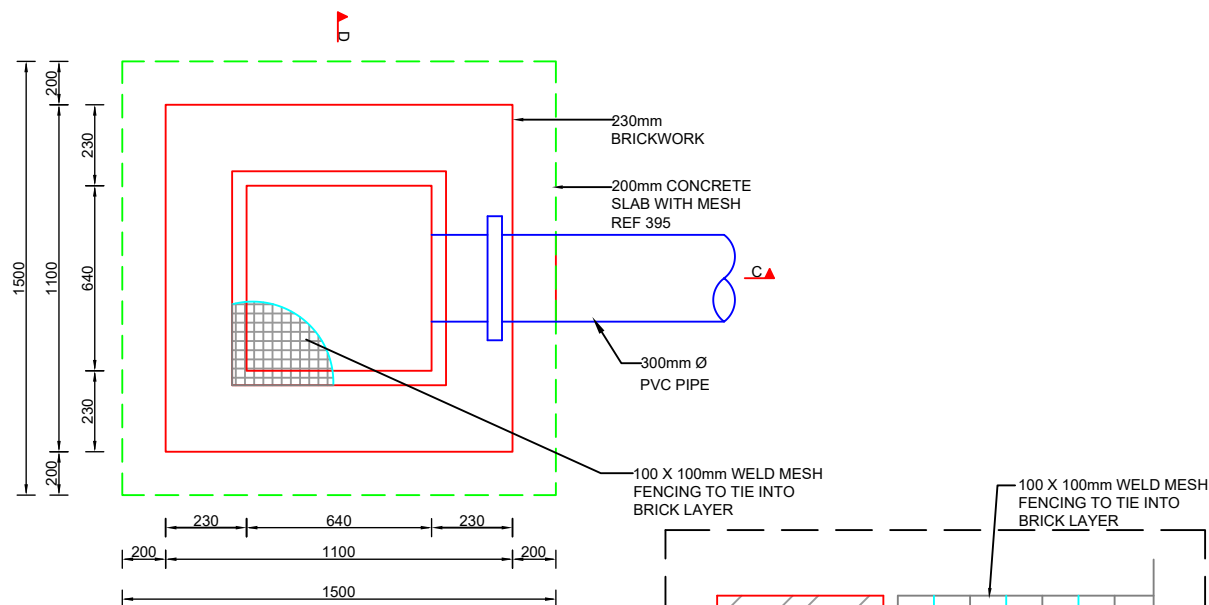
TYPICAL PLAN VIEW OF EARTH PLUG



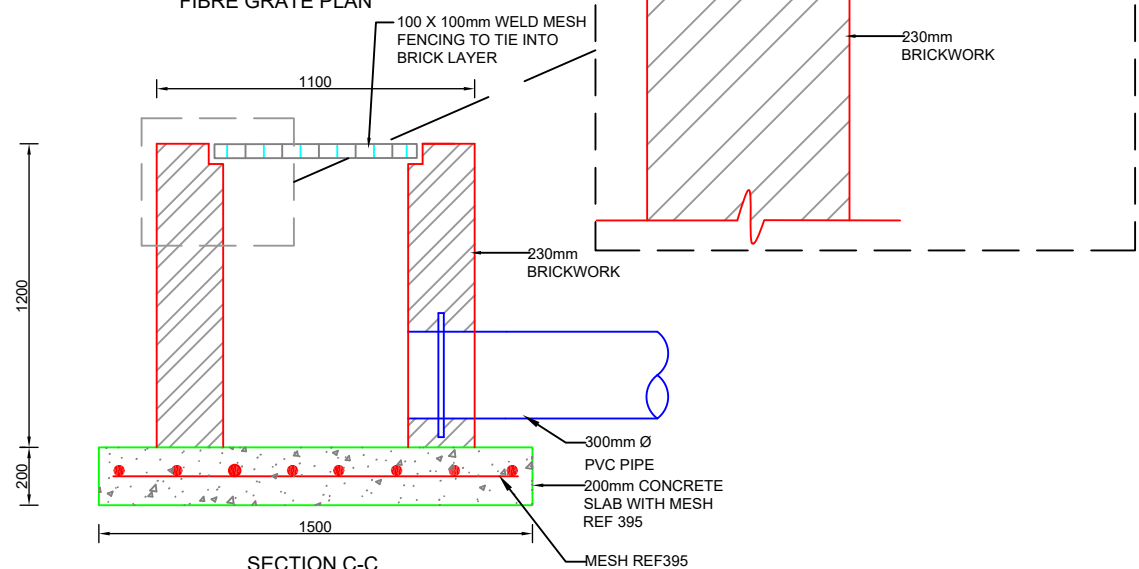
SECTION A-A
(SECTIONAL VIEW)



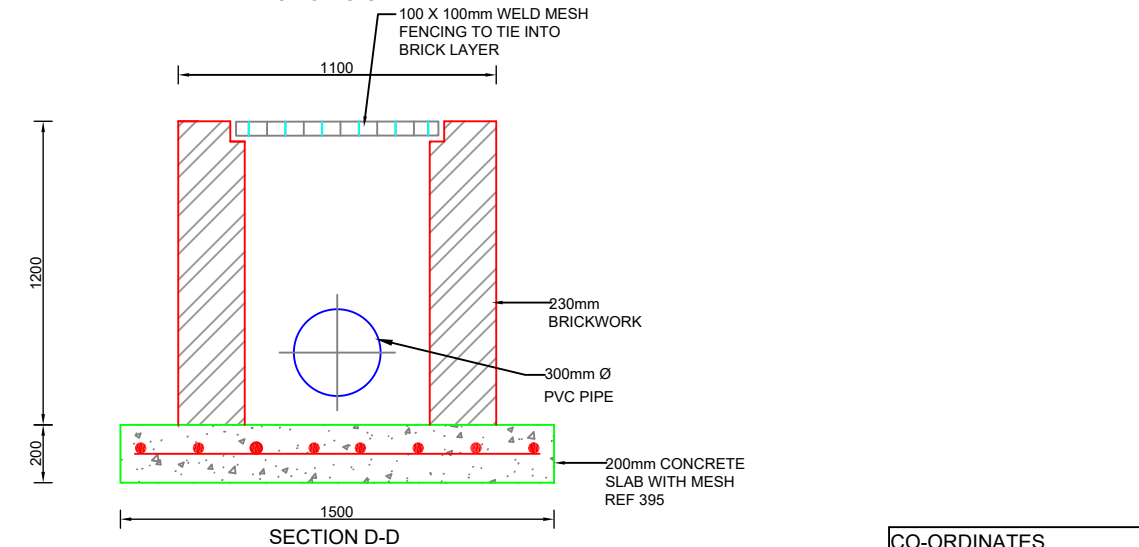
SECTION B-B



FIBRE GRATE PLAN



SECTION C-C



SECTION D-D

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'25.76"S	26°46'41.33"E

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

- ACRONYMS AND ABBREVIATIONS:**
- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

- EARTHWORKS/ EARTH STRUCTURES:**
- ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
 - ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100MM OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
 - SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100MM LAYERS AT OPTIMUM WATER CONTENT.
- DISPERSIVE SOILS:**
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:**
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
 - IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
 - CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
 - ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

- CONCRETE FILLED GEOCELLS:**
- FOOTPRINT AREA TO BE CLEARED PRIOR TO CONSTRUCTION.
 - SHAPE TO REQUIRED SLOPE.
 - FOR CONCRETE MIX, FOLLOW SUPPLIERS INSTRUCTIONS. CONCRETE WITH A HIGH SLUMP IS PREFERABLE FOR PLACING IN GEOCELL.
 - CONCRETE FOR GEOCELLS TO BE MINIMUM 15MPa & MIX:
1 BAG CEMENT
125L SAND
120L STONE
30L WATER
 - RIGGING AS SPECIFIED BY SUPPLIER AND ANCHORING TO BE DONE.
 - CONCRETE TO HAVE BROOMED FINISH.

REV	DATE	REVISION DETAILS	APPROVED
1		DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	
ENGINEER	DATE
	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	EARTHEN BERM WITH BASE FLOW PIPE
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 234 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	Amathole
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Concrete buttress weir
Rehabilitation Objectives	Control structure to raise water level in the channel and backflood to upstream weir.
Latitude (D°M'S")	32°26'26.99"S
Longitude (D°M'S")	26°46'42.34"E

Location Photograph: S32E-01-235-00

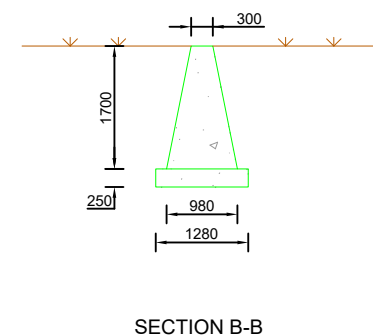
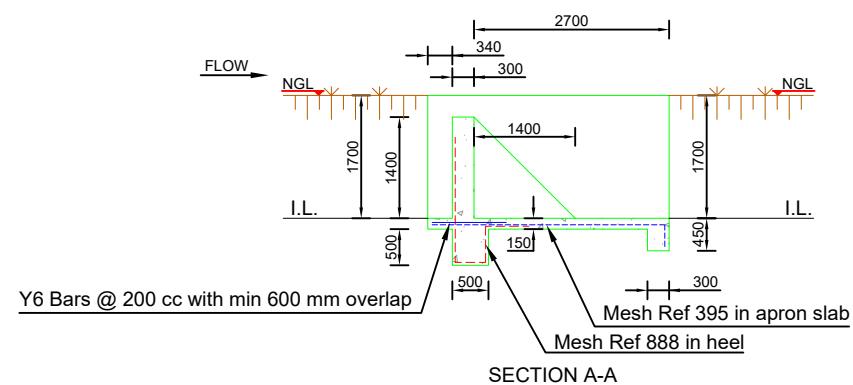
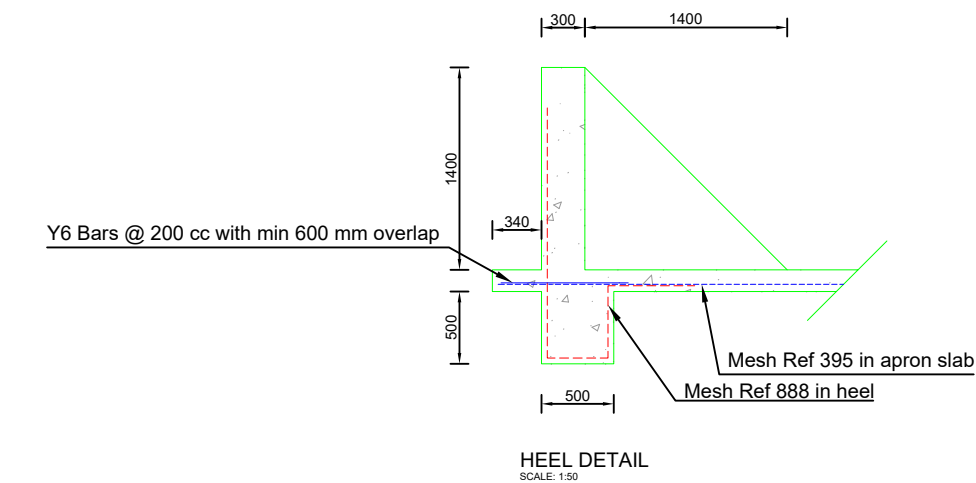
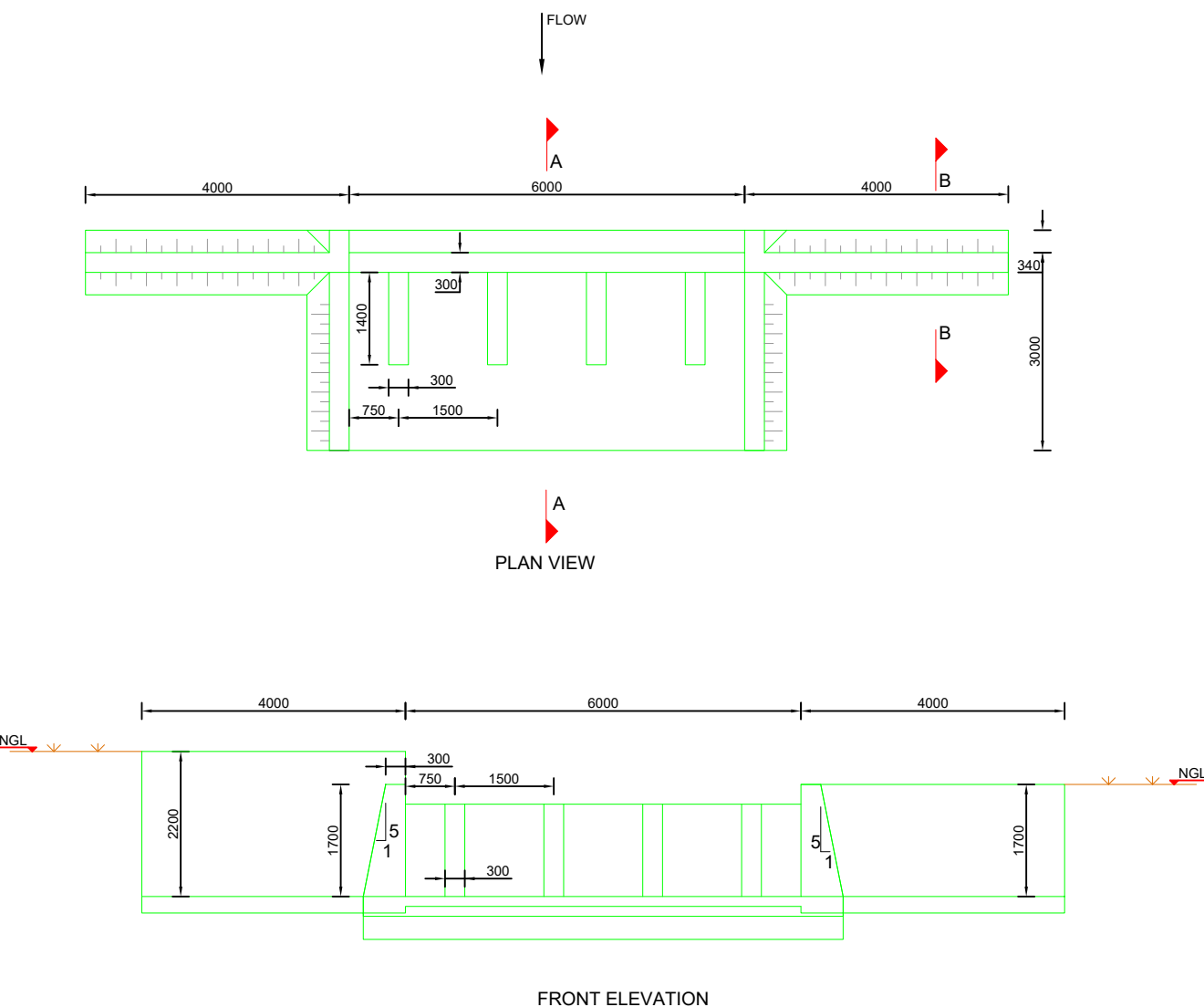


Bill of Quantities

Item	Units	Quantity
Excavation for structure	m ³	37.85
Concrete	m ³	28.59
Mesh ref 888 (6m x 2.4m sheets)	m ²	28.80
Mesh ref 395 (6m x 2.4m sheets)	m ²	28.80

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

The following site specific mitigation measures shall be implemented:



NOTES

1. AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.

2. AURECON, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED AGAINST ANY ASSOCIATED DAMAGES AND ACCEPT NO LIABILITY ASSOCIATED WITH THE CONSTRUCTION AND IMPLEMENTATION OF ENGINEERING INTERVENTIONS DUE TO THE ENGINEERS HAVING LIMITED CONTACT WITH THE IMPLEMENTER DURING THE CONSTRUCTION PHASE RESULTING IN OUR INABILITY TO DILIGENTLY SUPERVISE AND ASSESS ANY PROGRESS.

ACRONYMS AND ABBREVIATIONS:

1. NGL - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE
3. μm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

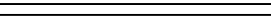

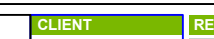
DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100% CLIMPER PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
6SL SAND
8SL STONE
21L WATER
3. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
4. ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
5. CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
7. CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
9. FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'26.99"S	26°46'42.34"E

 aurecon www.aurecongroup.com  GroundTruth <i>Water, Wetlands and Environmental Engineering</i>		CLIENT	REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN	PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020									
			1	17/09/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3		ENGINEER	DATE	PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE							
							DRAWN					INTERVENTION DESCRIPTION	CONCRETE BUTTRESS WEIR							
							T. HARVEY													
							T. PIKE													
							T.PIKE													
										REGISTRATION No. 20130774		DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV			
												S32E	-	01	-	235	-	01 OF 01	-	1

Details

Intervention	S32E-01-236-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Concrete buttress weir
Rehabilitation Objectives	To raise water level in the channel and backflood to upstream weir.
Latitude (D°M'S")	32°26'34.62"S
Longitude (D°M'S")	26°46'46.59"E

Location Photograph: S32E-01-236-00



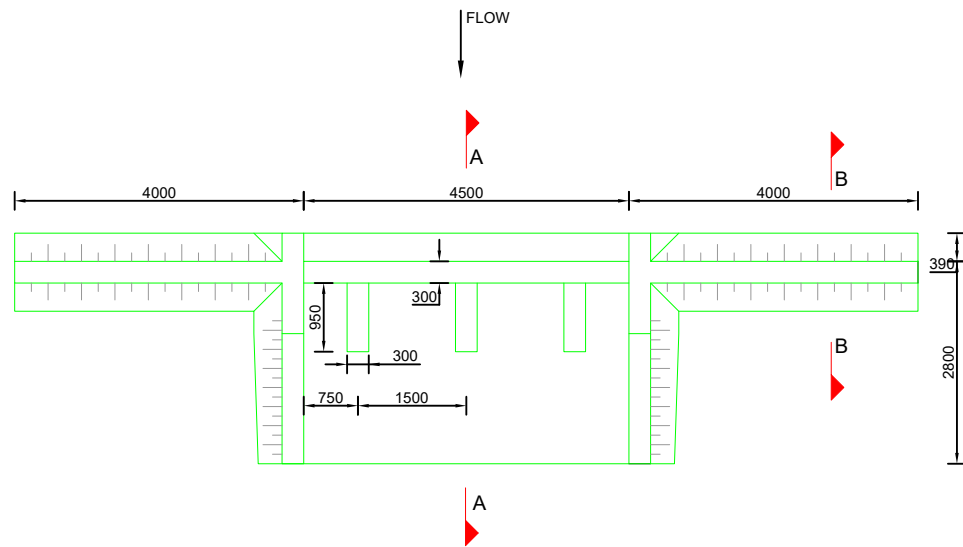
Bill of Quantities

Item	Units	Quantity
Excavation for structure	m ³	34.04
Concrete	m ³	24.80
Mesh ref 888 (6m x 2.4m sheets)	m ²	28.80
Mesh ref 395 (6m x 2.4m sheets)	m ²	28.80

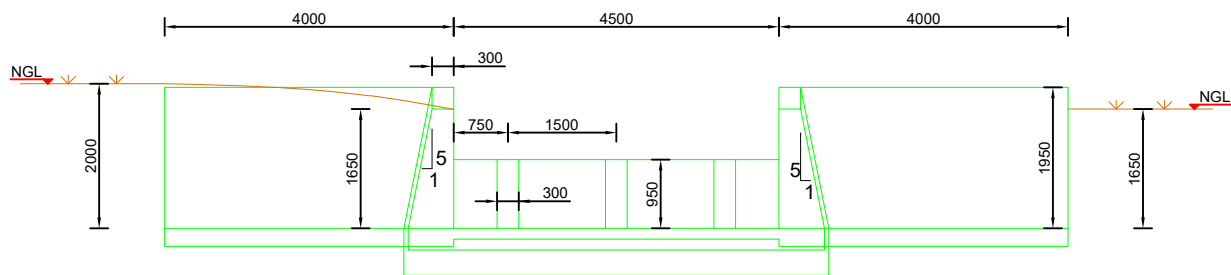
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

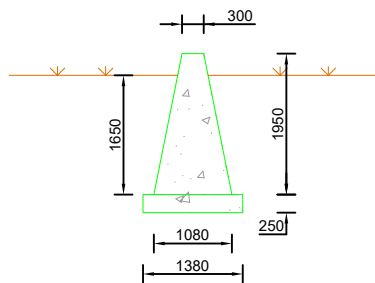
N/A



PLAN VIEW

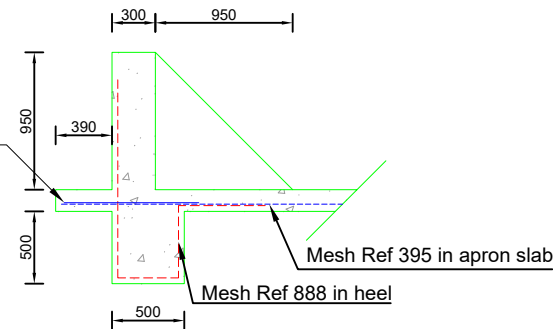


FRONT ELEVATION



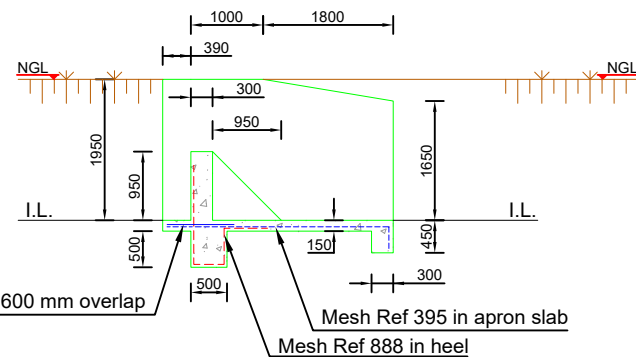
SECTION B-B

Y12 Bars @ 200 cc with min 600 mm overlap



HEEL DETAIL

SCALE: 1:50



SECTION A-A

- NOTES
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'34.62"S	26°46'46.59"E

REV	DATE	REVISION DETAILS	APPROVED
1	17/09/2018	DRAFT FOR REHAB PLAN	T. PIKE

SCALE	SIZE
AS SHOWN	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN	
APPROVED	
ENGINEER	DATE
	08/02/2019
REGISTRATION No. 20130774	

PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020
PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE
INTERVENTION DESCRIPTION	CONCRETE BUTTRESS WEIR
DRAWING No.	QUATERNARY No. S32E - WETLAND No. 01 - INTERVENTION No. 236 - PAGE NUMBER 01 OF 01 - REV 1

Details

Intervention	S32E-01-237-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Concrete buttress weir
Rehabilitation Objectives	To raise water level in the channel
Latitude (D°M'S")	32°26'32.15"S
Longitude (D°M'S")	26°46'46.07"E

Location Photograph: S32E-01-237-00



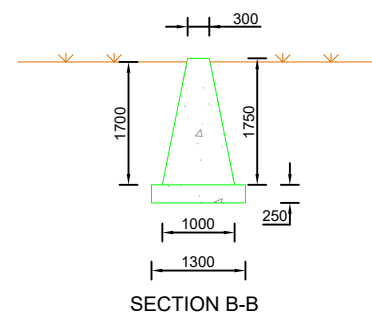
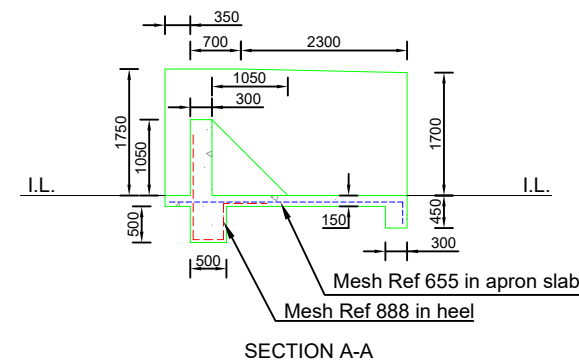
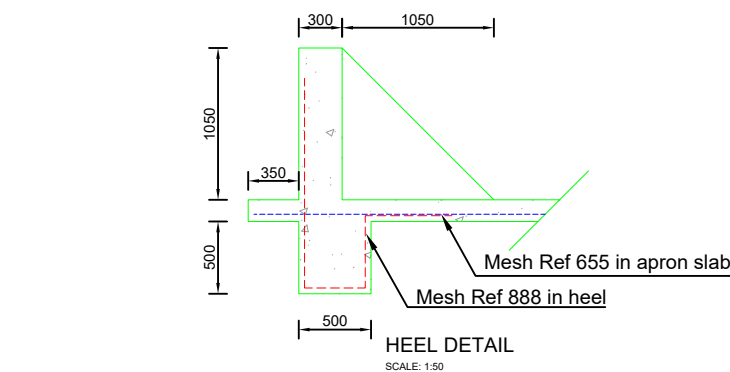
Bill of Quantities

Item	Units	Quantity
Excavation for structure	m ³	30.98
Concrete	m ³	22.54
Mesh ref 888 (6m x 2.4m sheets)	m ²	28.80
Mesh ref 655 (6m x 2.4m sheets)	m ²	28.80

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

The following site specific mitigation measures shall be implemented:

N/A



NOTES

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

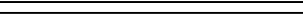


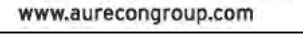
DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)

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2. FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-28mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
3. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
4. ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
5. CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
7. CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
9. FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER, REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'32.15"S	26°46'46.07"E

 www.aurecongroup.com		CLIENT	REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN		PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020					
			1	17/09/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3									
							DRAWN		APPROVED		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE					
							T. HARVEY		ENGINEER DATE		INTERVENTION DESCRIPTION	CONCRETE BUTTRESS WEIR					
							DESIGNED		 08/02/2019								
							T. PIKE		REGISTRATION No. 20130774								
 Water, Wetlands and Environmental Engineering						CHECKED				DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV		
						T.PIKE				S32E	-	01	-	237	-	01 OF 01	-	1

Details

Location Photograph: S32E-01-238-00

Intervention	S32E-01-238-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Alien Vegetation Removal
Rehabilitation Objectives	Removal of alien vegetation from the wetland
Latitude (D°M'S")	32°25'58.26"S
Longitude (D°M'S")	26°46'32.75"E



Bill of Quantities

Item	Units	Quantity
Alien plant clearing	no.	1400.00

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

The following site specific mitigation measures shall be implemented:

Vegetation removal to take place as per the Working for Water guidelines

Details

Intervention	S32E-02-201-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Deactivation of ridge and furrows
Rehabilitation Objectives	To allow for a more diffuse movement of water through wetland.
Latitude (D°M'S")	32°26'54.55"S
Longitude (D°M'S")	26°46'31.60"E

Location Photograph: S32E-02-201-00



Bill of Quantities

Item	Units	Quantity
Excavation for removal of berm	m ³	58.50
Earthworks for backfilling	m ³	58.50

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

The following site specific mitigation measures shall be implemented:

Ensure the invasive bramble plants (*Rubus* spp) near this intervention are completely removed and correctly disposed of outside the wetland to avoid spreading seed

Details

Intervention	S32E-02-202-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Ecologs every 25m along parallel drains
Rehabilitation Objectives	Deactivate drains
Latitude (D°M'S")	32°26'54.33"S
Longitude (D°M'S")	26°46'28.31"E

Location Photograph: S32E-02-202-00



Bill of Quantities

Item	Units	Quantity
NRM erosion control logs	m	216.00
NRM erosion control blanket	m ²	54.00

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

The following site specific mitigation measures shall be implemented:

N/A

[illegible]

Details

Intervention	S32E-02-203-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Deactivate berm and construct earth plug in drain
Rehabilitation Objectives	To raise water level in drain and flood adjacent wetland
Latitude (D°M'S")	32°26'52.94"S
Longitude (D°M'S")	26°46'27.12"E

Location Photograph: S32E-02-203-00



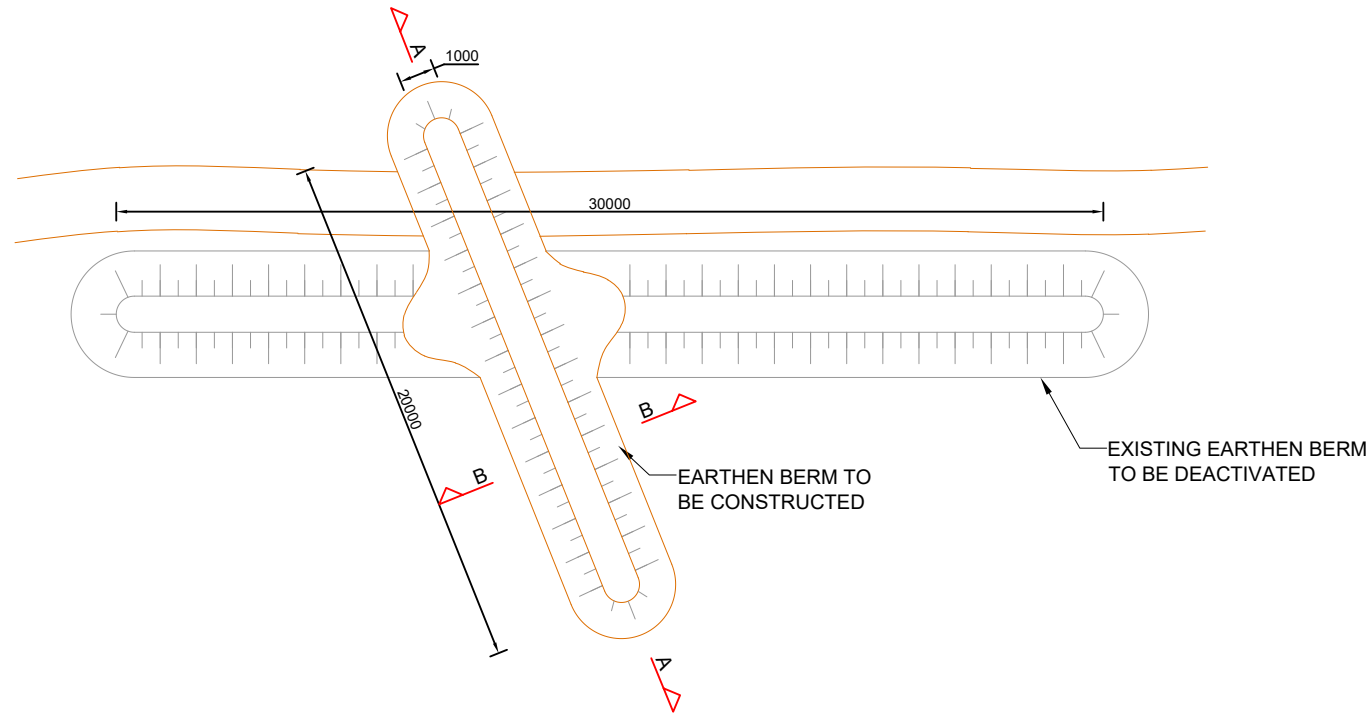
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	106.00
Excavation for removal of berm	m ³	40.50

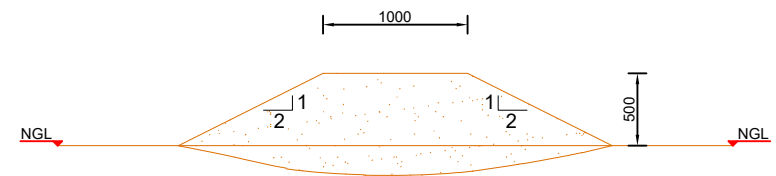
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

N/A



PLAN VIEW



SECTION B-B
SCALE 1:50



SECTION A-A





- NOTES**
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 - SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100MM LAYERS AT OPTIMUM WATER CONTENT.

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

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'52.94"S	26°46'27.12"E

 www.aurecongroup.com		CLIENT	REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN	PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020								
			1	28/11/2018	DRAFT FOR REHAB PLAN	T. PIKE	NTS	A3			PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE							
 Water, Wetlands and Environmental Engineering							DRAWN		ENGINEER  DATE 08/02/2019	INTERVENTION DESCRIPTION	EARTHEN BERM								
							DESIGNED												
							T. PIKE												
							CHECKED												
							T.PIKE												
										REGISTRATION No. 20130774	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV				
										DRAWING No.	S32E	-	02	-	203	-	01 OF 01	-	1

Details

Intervention	S32E-02-204-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Deactivate berm and backfill channel
Rehabilitation Objectives	To allow for a more diffuse movement of water through wetland.
Latitude (D°M'S")	32°26'53.85"S
Longitude (D°M'S")	26°46'25.31"E

Location Photograph: S32E-02-204-00



Bill of Quantities

Item	Units	Quantity
Earthworks for backfilling	m ³	275.10
Excavation for removal of berm	m ³	275.10

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

The following site specific mitigation measures shall be implemented:

N/A

Details

Intervention	S32E-02-205-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Geocell covered earthen berm. Removal of existing berms. Earthen plug. Rock masonry walkway.
Rehabilitation Objectives	To deactivate drain the drain yet allow access to cross the drain.
Latitude (D°M'S")	32°26'56.40"S
Longitude (D°M'S")	26°46'20.41"E

Location Photograph: S32E-02-205-00



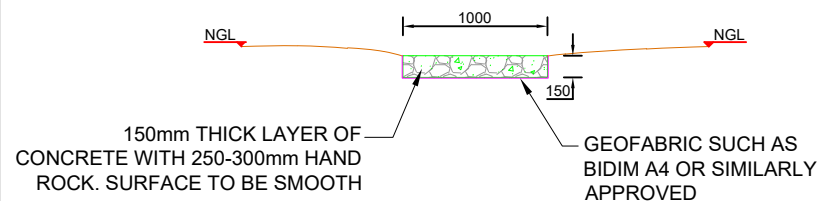
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berms	m ³	91.83
Excavation	m ³	22.78
Geocells	m ²	74.30
Concrete	m ³	15.00
Geofabric	m ²	86.90
250 mm - 300 mm handrock	m ³	0.68

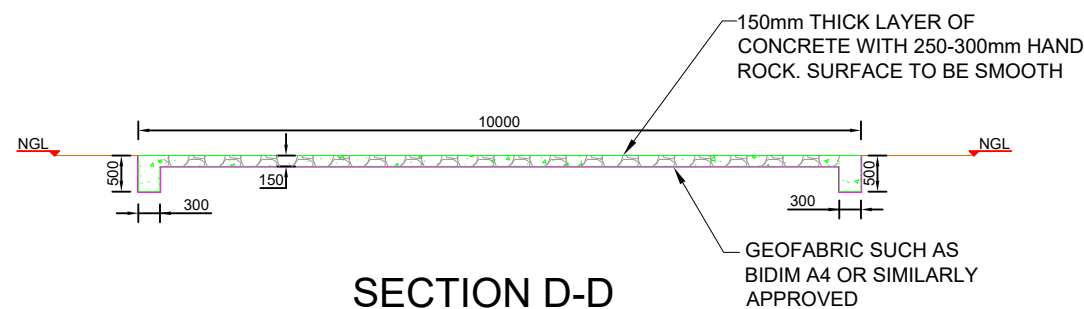
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

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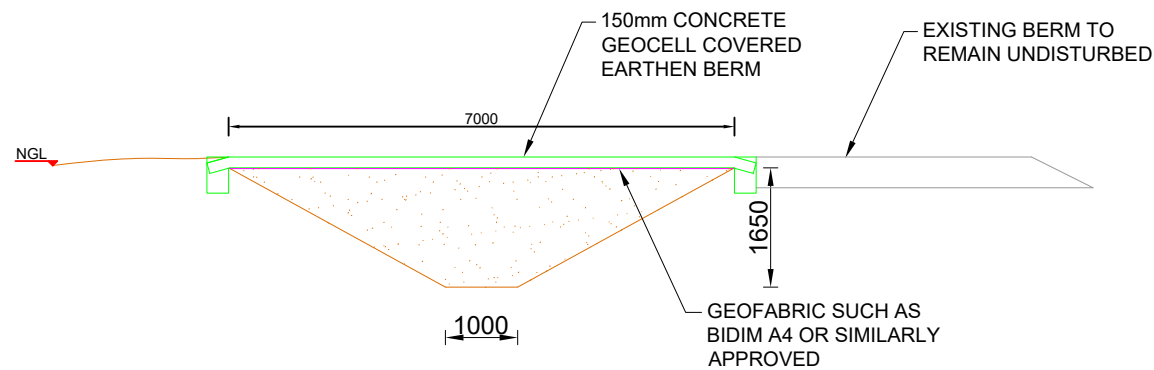
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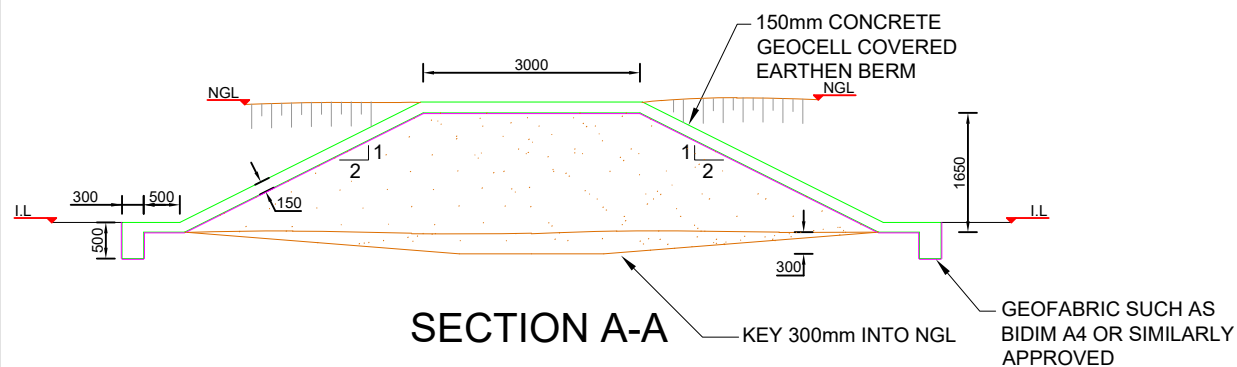
SECTION C-C
SCALE 1:50



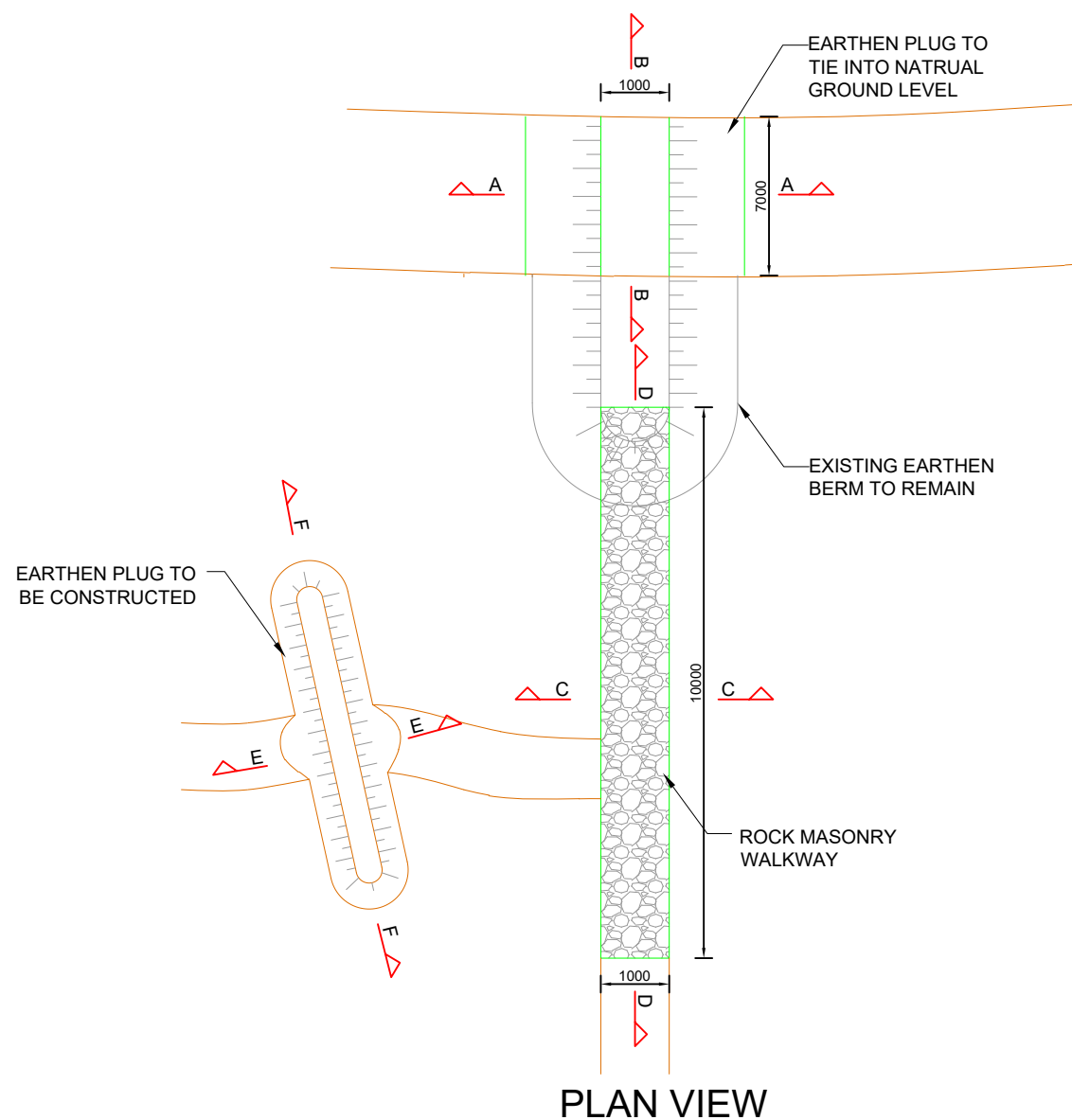
SECTION D-D



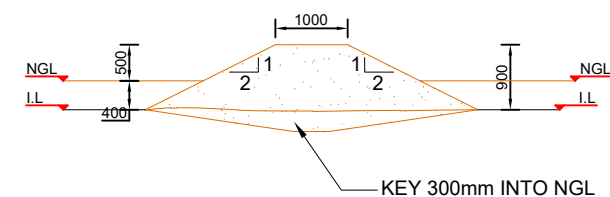
SECTION B-B



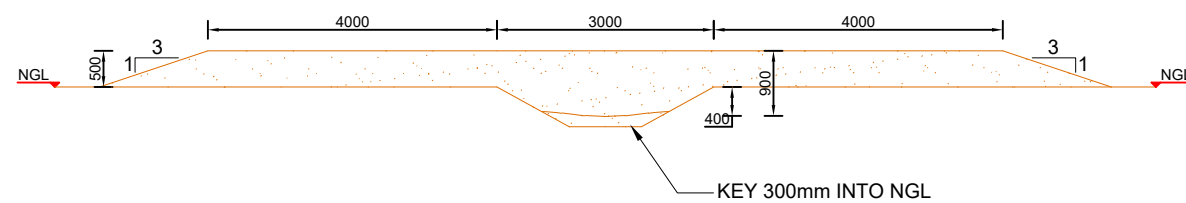
SECTION A-A



PLAN VIEW



SECTION E-E



SECTION F-F

CO-ORDINATES	
LATITUDE	LONGITUDE
32°26'56.40"S	26°46'20.41"E

NOTES

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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)

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

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CONCRETE FILLED GEOCELLS:

- FOOTPRINT AREA TO BE CLEARED PRIOR TO CONSTRUCTION.
- SHAPE TO REQUIRED SLOPE.
- FOR CONCRETE MIX, FOLLOW SUPPLIERS INSTRUCTIONS. CONCRETE WITH A HIGH SLUMP IS PREFERABLE FOR PLACING IN GEOCELL.
- CONCRETE FOR GEOCELLS TO BE MINIMUM 15MPa & MIX:
1 BAG CEMENT
125L SAND
120L STONE
30L WATER
- RIGGING AS SPECIFIED BY SUPPLIER AND ANCHORING TO BE DONE.
- CONCRETE TO HAVE BROOMED FINISH.

REV	DATE	REVISION DETAILS
1	03/12/2018	DRAFT FOR REHAB PLAN

APPROVED
T. PIKE

SCALE	SIZE
NTS	A3
DRAWN	
T. HARVEY	
DESIGNED	
T. PIKE	
CHECKED	
T.PIKE	

PRELIMINARY DESIGN

APPROVED

ENGINEER

DATE

08/02/2019

REGISTRATION No.
20130774

PROJECT

WORKING FOR WETLANDS PROGRAMME 2017-2020

PROVINCE - PROJECT AREA

EASTERN CAPE - AMATHOLE

INTERVENTION DESCRIPTION

EARTHEN BERM, GEOCELL, ROCK MASONRY

DRAWING No.

QUATERNARY No.

-

WETLAND No.

-

INTERVENTION No.

-

PAGE NUMBER

-

REV

S32E

02

205

01 OF 01

1

Details

Intervention	S32E-02-206-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm removal and construction of diversion plug
Rehabilitation Objectives	To raise water level and push water out to wetland level
Latitude (D°M'S")	32°26'57.23"S
Longitude (D°M'S")	26°46'23.08"E

Location Photograph: S32E-02-206-00



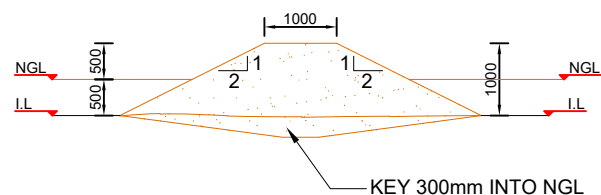
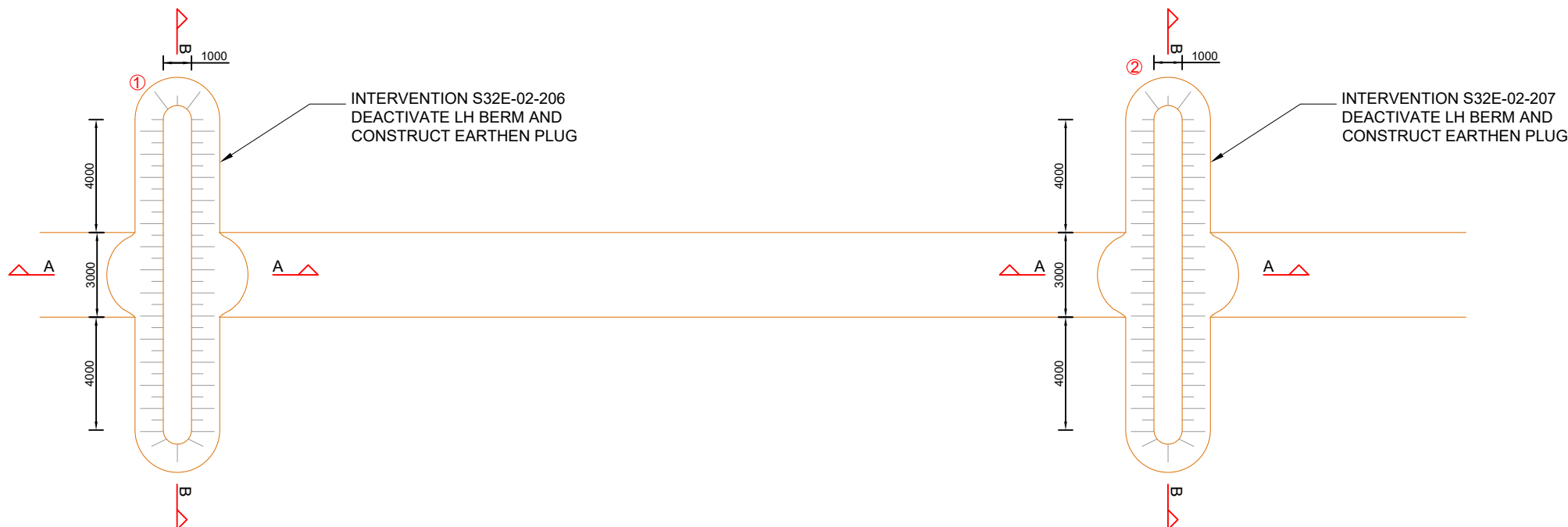
Bill of Quantities

Item	Units	Quantity
Earthworks for berm	m ³	20.50
Excavation for removal of berm	m ³	131.18

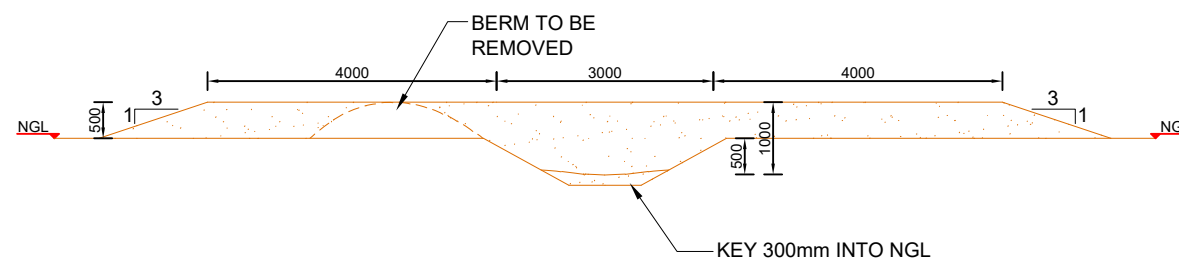
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

N/A



SECTION A-A



SECTION B-B

- NOTES
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- I.L. - INVERT LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER




EARTHWORKS/ EARTH STRUCTURES:

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

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

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- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILLING AND COMPACTION SHALL BE WELL MIXED WITH LIME OR GYPSUM DEPENDING ON THE SOIL PROPERTIES WHICH IS TO BE CONFIRMED BY SOIL TESTING AT THE TIME OF CONSTRUCTION.

CO-ORDINATES	
LATITUDE	LONGITUDE
① 32°26'57.23"S	26°46'23.08"E
② 32°26'56.40"S	26°46'27.36"E

 www.aurecongroup.com		CLIENT			REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN		PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020						
		APPROVED												PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE					
 Water, Wetlands and Environmental Engineering					1	28/11/2018	DRAFT FOR REHAB PLAN	T. PIKE	NTS	A3	ENGINEER	DATE	REGISTRATION No. 20130774	INTERVENTION DESCRIPTION	STD EARTHEN PLUG					
												08/02/2019								

Details

Intervention	S32E-02-207-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Construction of diversion plug
Rehabilitation Objectives	To raise water level and push water out to wetland level
Latitude (D°M'S")	32°26'56.40"S
Longitude (D°M'S")	26°46'27.36"E

Location Photograph: S32E-02-207-00



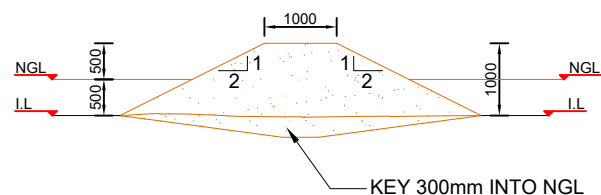
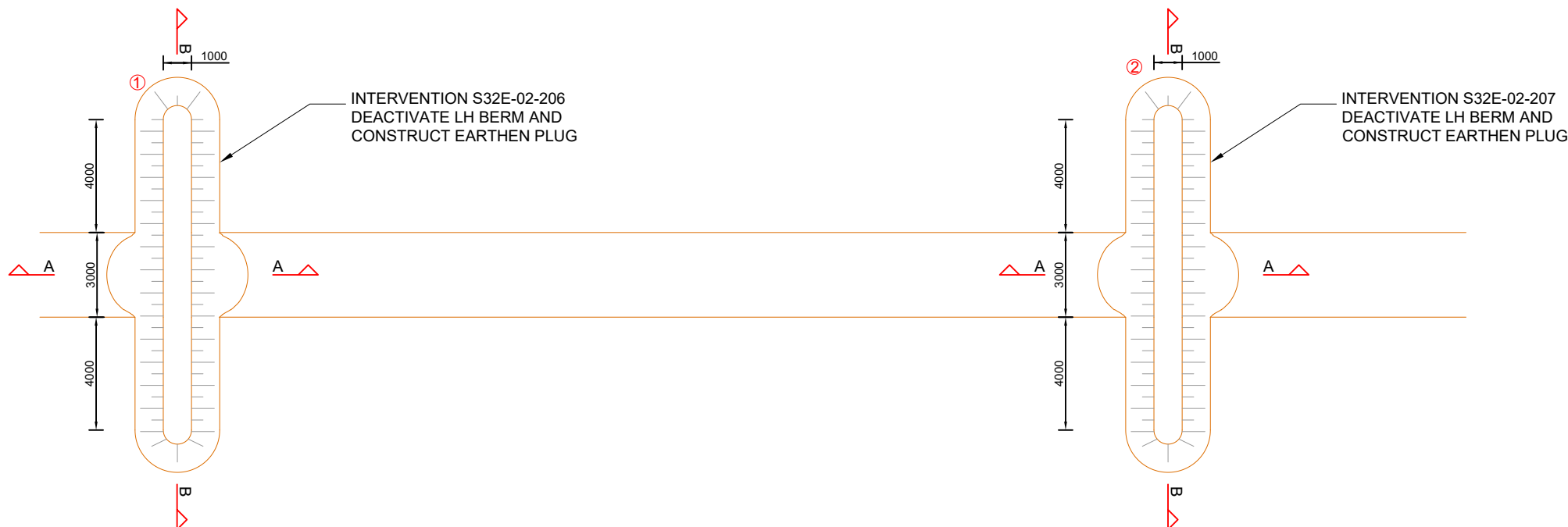
Bill of Quantities

Item	Units	Quantity
Earthworks for berm	m ³	20.50

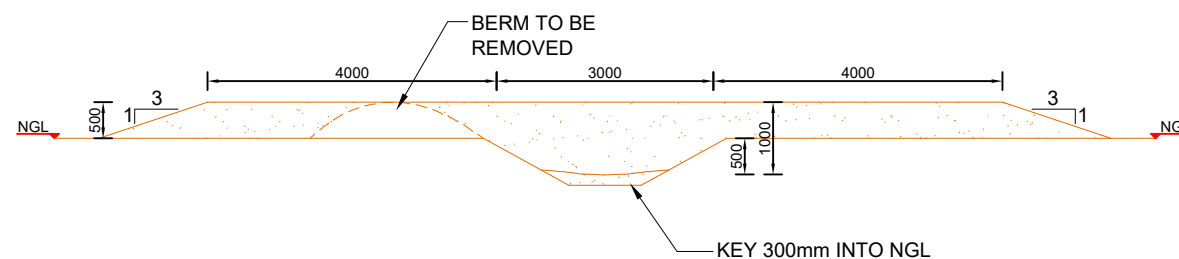
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

N/A



SECTION A-A



SECTION B-B

- NOTES
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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- ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100MM OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
- SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100MM LAYERS AT OPTIMUM WATER CONTENT.

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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)

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CO-ORDINATES	
LATITUDE	LONGITUDE
① 32°26'57.23"S	26°46'23.08"E
② 32°26'56.40"S	26°46'27.36"E

 www.aurecongroup.com		CLIENT		REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN	PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020				
		1	28/11/2018	DRAFT FOR REHAB PLAN	T. PIKE	NTS	A3	ENGINEER  DATE 08/02/2019 REGISTRATION No. 20130774	PROVINCE - PROJECT AREA		EASTERN CAPE - AMATHOLE					
						DRAWN	T. HARVEY		INTERVENTION DESCRIPTION		STD EARTHEN PLUG					
						DESIGNED	T. PIKE		DRAWING No.		QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV	
						CHECKED	T.PIKE				-	-	-	-	01 OF 01	- 1

Details

Intervention	S32E-03-201-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Concrete splash through
Rehabilitation Objectives	To allow access for channel crossing
Latitude (D°M'S")	32°24'40.01"S
Longitude (D°M'S")	26°45'31.08"E

Location Photograph: S32E-03-201-00



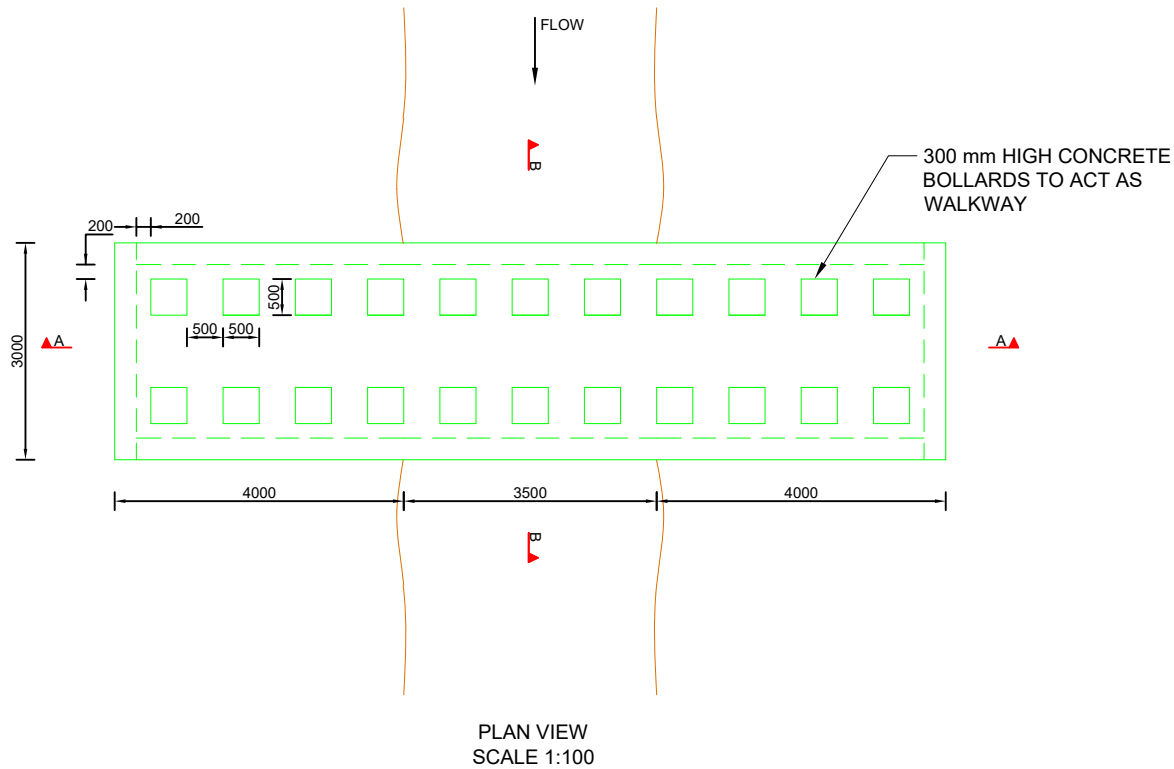
Bill of Quantities

Item	Units	Quantity
Excavation for structure	m ³	2.60
Concrete	m ³	12.90

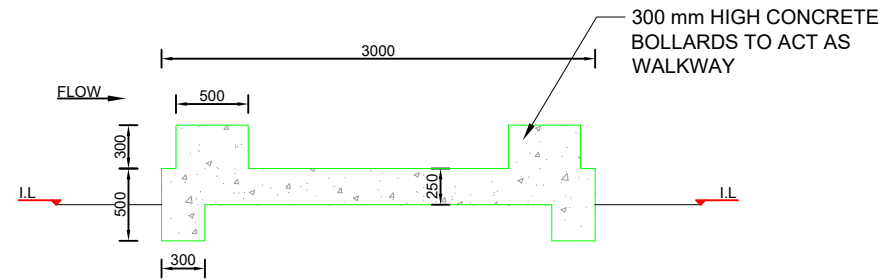
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

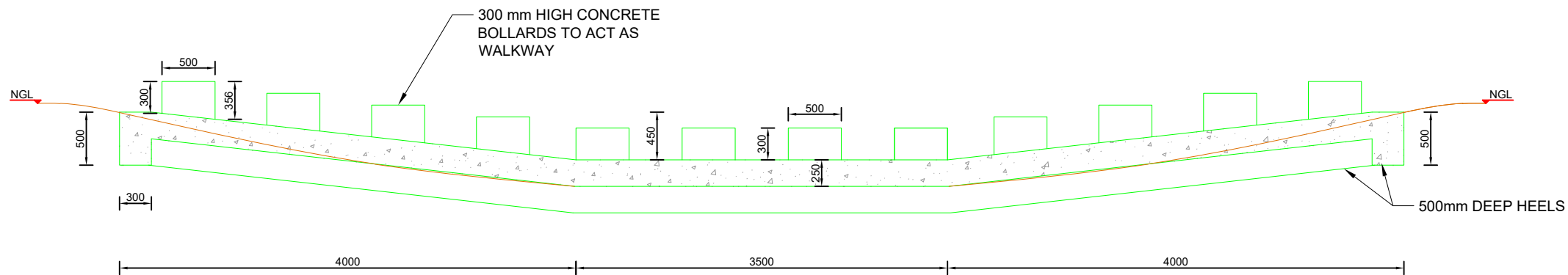
Ensure community still have safe crossing point over channel during construction of the replacement crossing



PLAN VIEW
SCALE 1:100



SECTION B-B
SCALE 1:50



SECTION A-A
SCALE 1:50

- NOTES
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- ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100MM OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
- SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 100MM LAYERS AT OPTIMUM WATER CONTENT.

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- FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
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- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

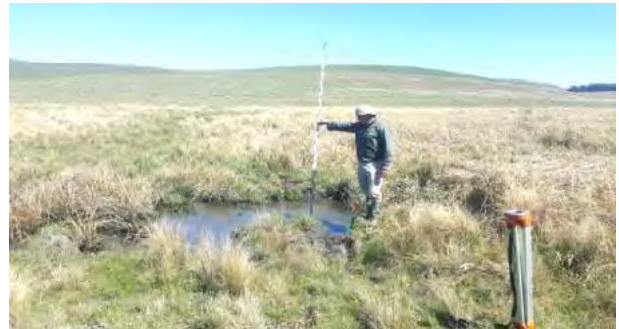
CO-ORDINATES	
LATITUDE	LONGITUDE
32°24'40.01"S	26°45'31.08"E

REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN		PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020					
1	14/12/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3	APPROVED		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE					
				DRAWN		DATE		INTERVENTION DESCRIPTION	CONCRETE SPLASH THROUGH					
				T. HARVEY		08/02/2019								
				T. PIKE		REGISTRATION No.								
				T.PIKE		20130774								
								QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV		
								S32E	03	201	01 OF 01	1		

Details

Intervention	S32E-03-202-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Rock masonry chute
Rehabilitation Objectives	Deactivate headcut
Latitude (D°M'S")	32°24'38.99"S
Longitude (D°M'S")	26°45'42.69"E

Location Photograph: S32E-03-202-00



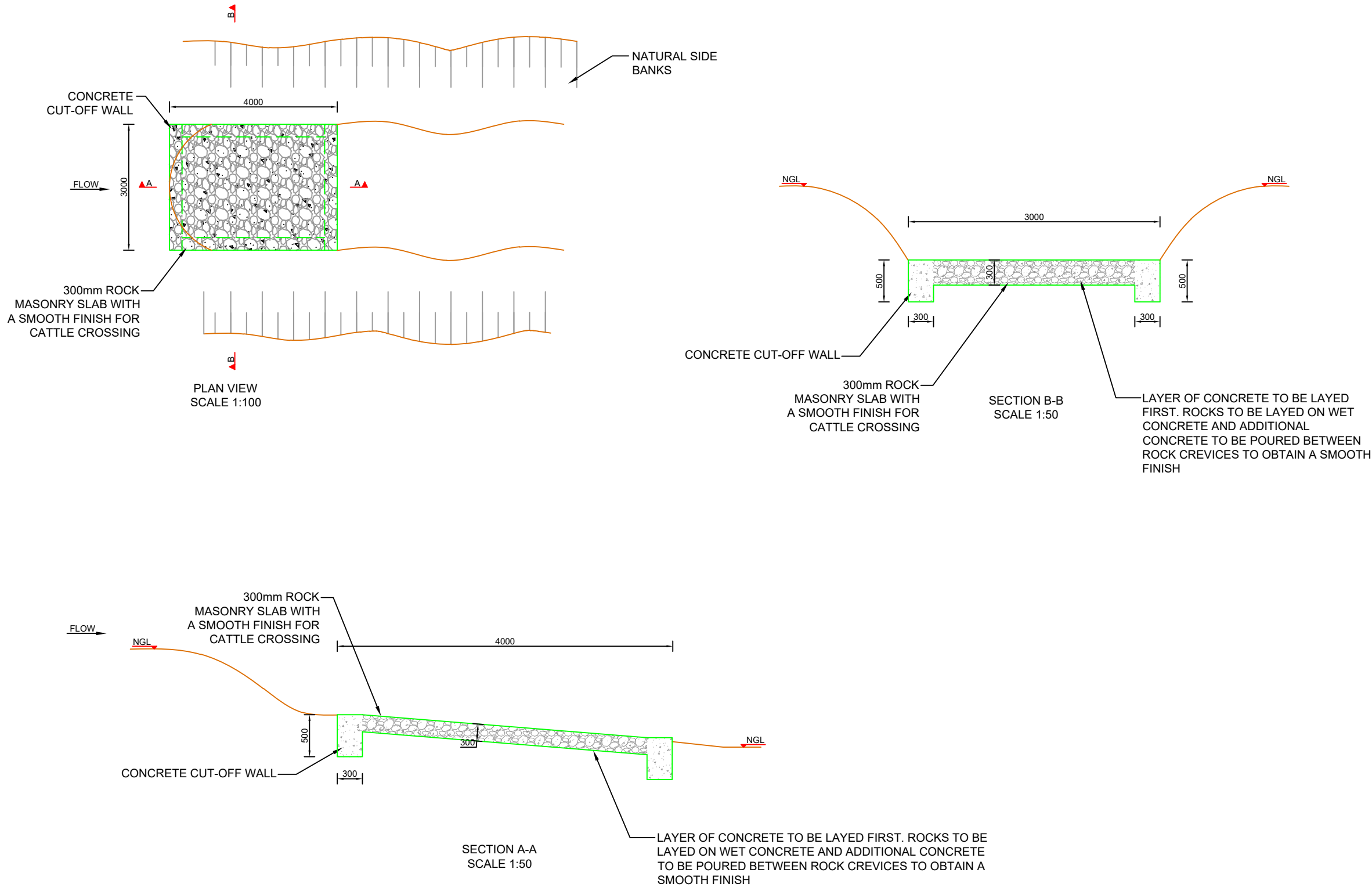
Bill of Quantities

Item	Units	Quantity
Excavation for structure	m ³	15.40
Concrete	m ³	4.08
250mm-300mm smooth handrock	m ³	2.00

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

The following site specific mitigation measures shall be implemented:

N/A



NOTES

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





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

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
3. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
4. ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
5. CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
7. CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
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9. FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°24'38.99"S	26°45'42.69"E

 www.aurecongroup.com		CLIENT		REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN	PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020				
				1	07/11/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE				
								DRAWN			INTERVENTION DESCRIPTION	ROCK MASONRY CHUTE				
								T. HARVEY			QUATERNARY No.	S32E	-	WETLAND No.	03	-
								DESIGNED			DATE	08/02/2019	INTERVENTION No.	202	-	PAGE NUMBER	01 OF 01	-
 Water, Wetlands and Environmental Engineering								T. PIKE		ENGINEER  REGISTRATION No. 20130774						
								CHECKED			REV	1				
								T.PIKE								

Details

Intervention	S32E-03-203-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Concrete spillway across channel and trickle pipe
Rehabilitation Objectives	To divert flows into left hand drain
Latitude (D°M'S")	32°24'35.02"S
Longitude (D°M'S")	26°45'47.04"E

Location Photograph: S32E-03-203-00



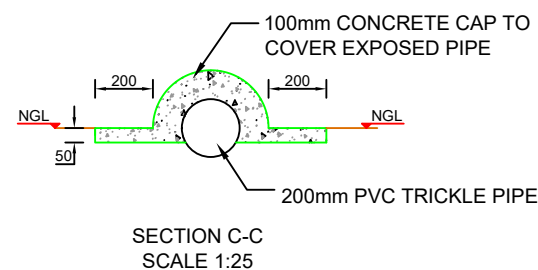
Bill of Quantities

Item	Units	Quantity
Excavation for structure	m ³	4.86
Concrete	m ³	3.00
200mm PVC pipe	m	30.00

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

The following site specific mitigation measures shall be implemented:





N/A



CONCRETE:

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
6SL SAND
8SL STONE
21L WATER
3. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
4. ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
5. CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
7. CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
9. FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CO-ORDINATES		
	LATITUDE	LONGITUDE
①	32°24'35.02"S	26°45'47.04"E
②	32°24'34.29"S	26°45'47.81"E

 www.aurecongroup.com		REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN		PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020							
		1	07/11/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3	<div>ENGINEER</div> <div>DATE</div> <div>08/02/2019</div> <div>  </div> <div>REGISTRATION No.</div> <div>20130774</div>		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE							
										INTERVENTION DESCRIPTION	CONCRETE SPILLWAY AND TRICKLE PIPE							
										DRAWING No.	QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV			
		 Water, Wetlands and Environmental Engineering												S32E	-	03	-	203	-	01 OF 01	-	1

Details

Intervention	S32E-03-204-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Concrete drop inlet weir
Rehabilitation Objectives	To raise water levels to backflood to upstream headcut
Latitude (D°M'S")	32°24'33.20"S
Longitude (D°M'S")	26°45'50.33"E

Location Photograph: S32E-03-204-00



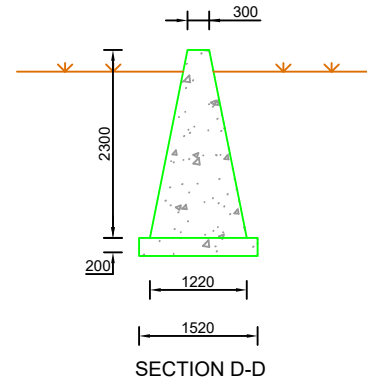
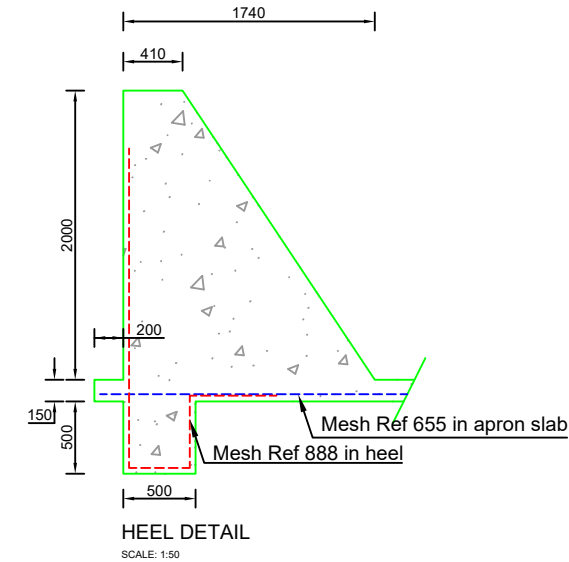
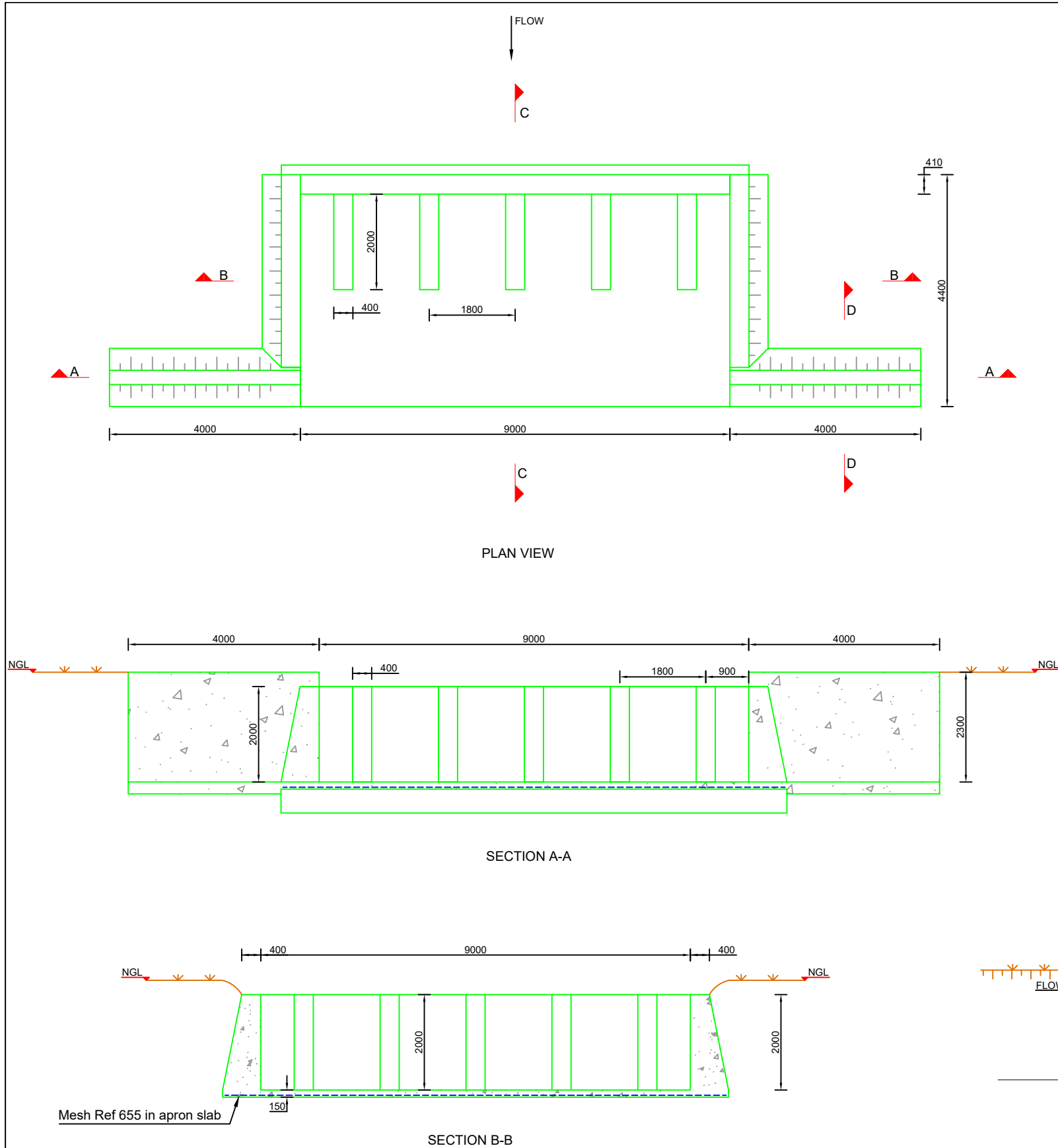
Bill of Quantities

Item	Units	Quantity
Excavation for structure	m ³	69.27
Concrete	m ³	55.83
Mesh ref 888 (6m x 2.4m sheets)	m ²	57.60
Mesh ref 655 (6m x 2.4m sheets)	m ²	72.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
32°24'33.20"S	26°45'50.33"E

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

ACRONYMS AND ABBREVIATIONS:

- NGL - NATURAL GROUND LEVEL
- C/C - CENTRE TO CENTRE
- µm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

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

- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOULD THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
- FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

Details

Intervention	S32E-03-205-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Earthen berm with base flow pipe
Rehabilitation Objectives	To raise water levels within the channel to flood adjacent wetland, while still maintaining base flow through the channel.
Latitude (D°M'S")	32°24'29.16"S
Longitude (D°M'S")	26°45'51.12"E

Location Photograph: S32E-03-205-00



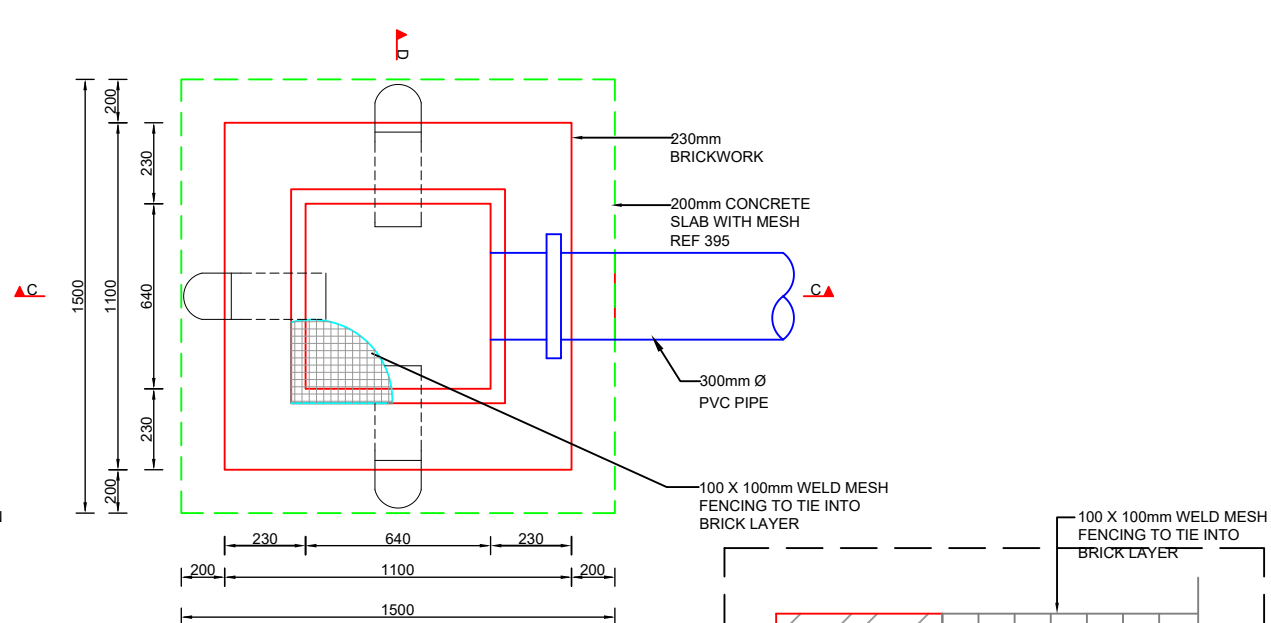
Bill of Quantities

Item	Units	Quantity
Earthworks for earthen berm	m ³	160.59
Excavation for sloping	m ³	345.00
Standard double skin brick	m ³	1.70
Concrete	m ³	0.45
Revegetation	m ²	100.11
Class4 300 mm PVC pipe	m	15.88
100 mm x 100 mm weld mesh fencing	m ³	0.80
Standard barbed wire	m ²	15.00
2150 mm (l) x 106 mm(ø) x 3mm(t) medium steel tubes	no.	4.00

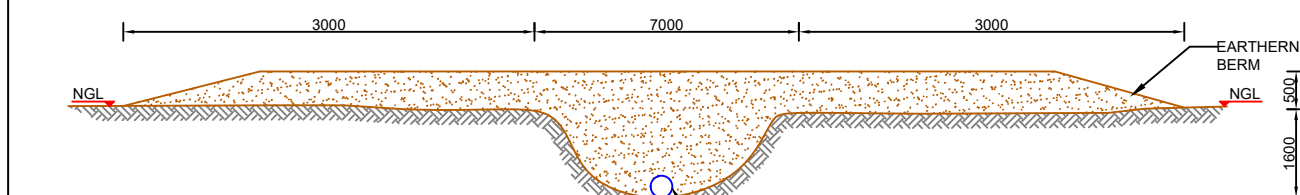
General construction notes as set out in the Construction Environmental Management Programme apply, along with all notes shown on design drawings and standard details. Where there is a conflict, the notes on design drawings apply.

The following site specific mitigation measures shall be implemented:

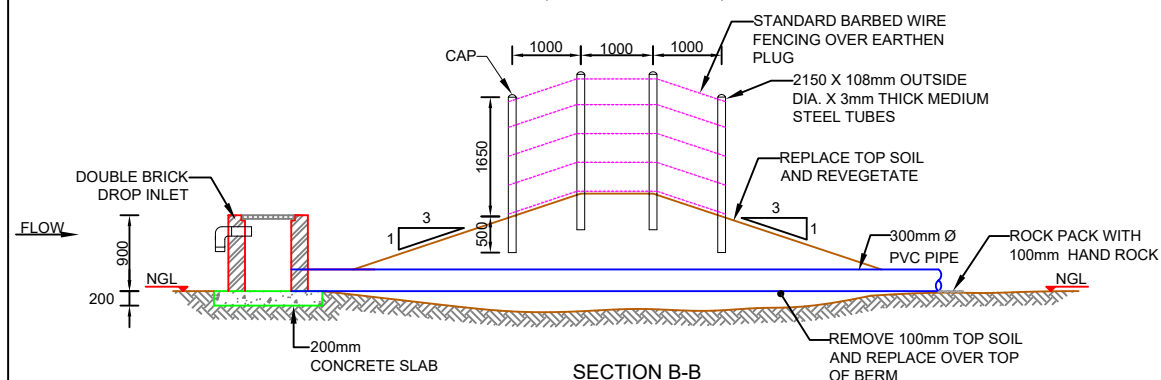
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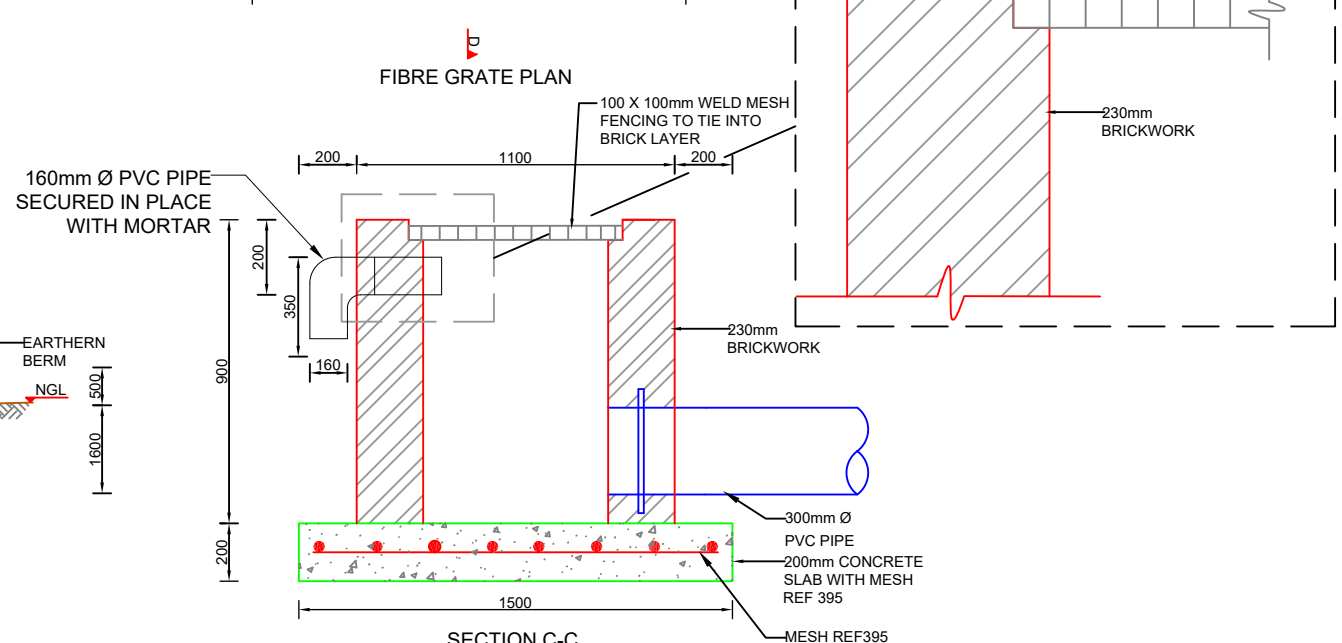
TYPICAL PLAN VIEW OF
EARTH PLUG



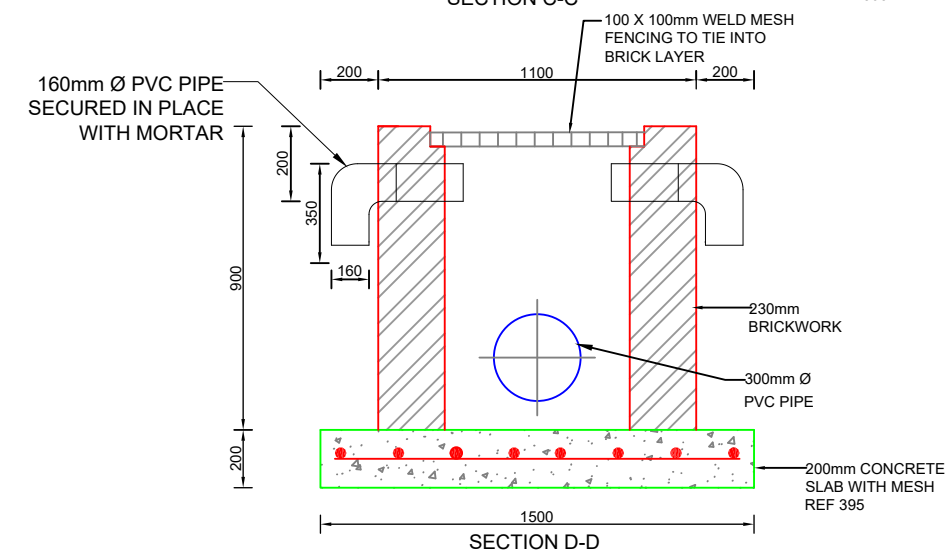
SECTION A-A
(SECTIONAL VIEW)



SECTION B-B



SECTION C-C



SECTION D-D

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

ACRONYMS AND ABBREVIATIONS:

1. NGL - NATURAL GROUND LEVEL
2. C/C - CENTRE TO CENTRE
3. μm - MICRO METER

EARTHWORKS/ EARTH STRUCTURES:

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

DISPERSIVE SOILS:

(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)

1. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
2. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
3. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
3. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
4. ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
5. CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
7. CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
9. FOUNDATION IMPROVMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°24'29.16"S	26°45'51.12"E

Details

Intervention	S32E-03-206-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Concrete buttress weir
Rehabilitation Objectives	To raise water levels to backflood to upstream headcut
Latitude (D°M'S")	32°24'24.90"S
Longitude (D°M'S")	26°45'55.64"E

Location Photograph: S32E-03-206-00



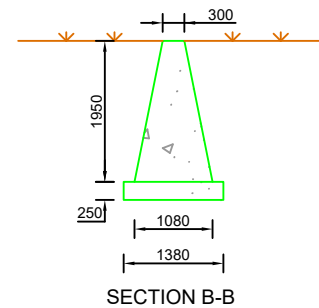
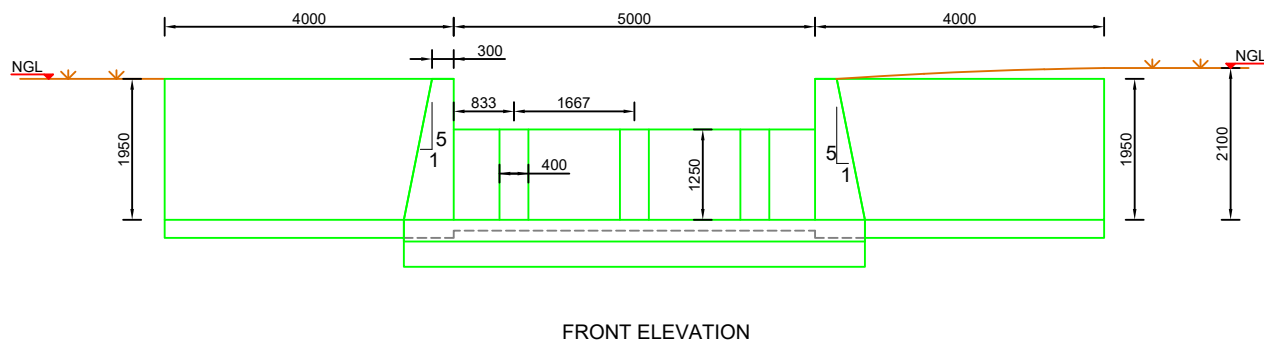
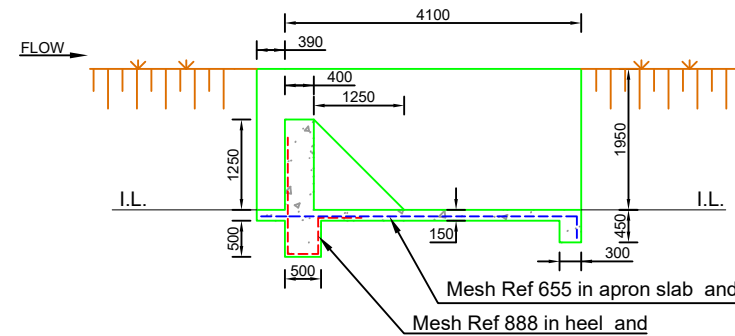
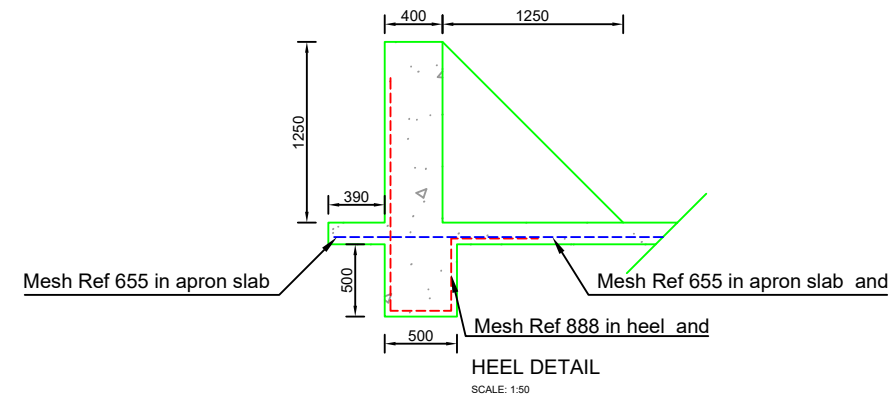
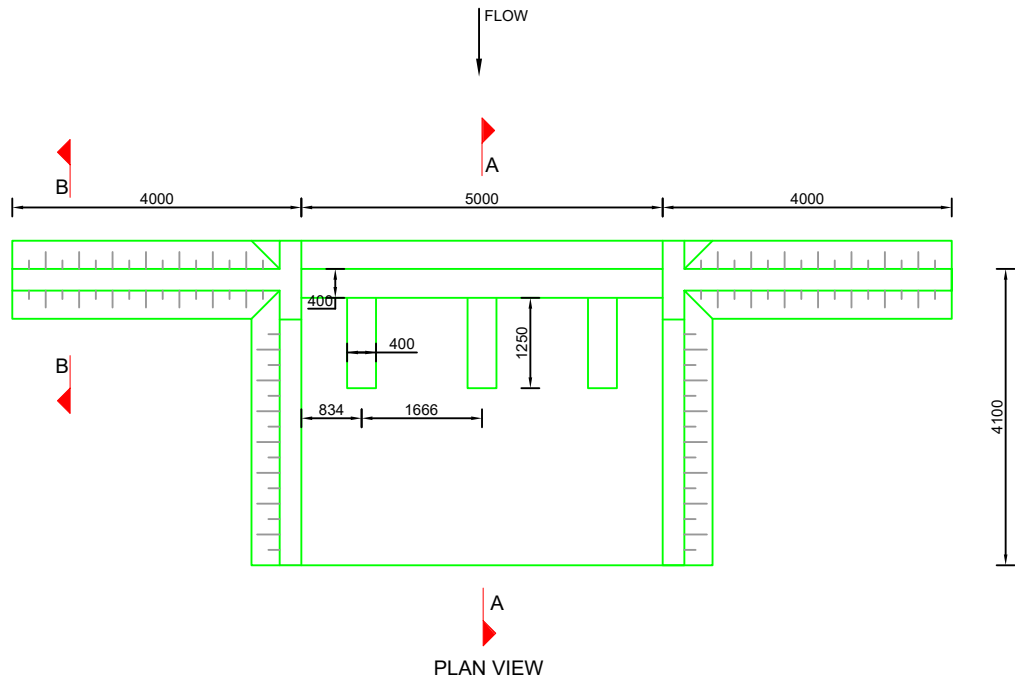
Bill of Quantities

Item	Units	Quantity
Excavation for structure	m ³	42.25
Concrete	m ³	31.08
Mesh ref 888 (6m x 2.4m sheets)	m ²	28.80
Mesh ref 655 (6m x 2.4m sheets)	m ²	43.20

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

The following site specific mitigation measures shall be implemented:

N/A



- NOTES
- AURECON AND GROUNDTRUTH ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. 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, GROUNDTRUTH AND THEIR ENGINEERS ARE INDEMNIFIED BY THE CLIENT AND DO NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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- NGL - NATURAL GROUND LEVEL
 - C/C - CENTRE TO CENTRE
 - µm - MICRO METER

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

- DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)
- IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BASE OF THE INTERVENTION SHOUL THEREFORE BE CONSTRUCTED AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
 - FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
 - ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

- CONCRETE:
- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
 - ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
 - MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
 - ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
 - CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
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 - FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

CO-ORDINATES	
LATITUDE	LONGITUDE
32°24'24.90"S	26°45'55.64"E



REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN		PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020					
1	08/11/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3	APPROVED		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE					
				DRAWN		ENGINEER		INTERVENTION DESCRIPTION	CONCRETE BUTTRESS WEIR					
				T. HARVEY		DATE								
				T. PIKE		08/02/2019								
				CHECKED		REGISTRATION No.								
				T.PIKE		20130774								
						QUATERNARY No.		WETLAND No.		INTERVENTION No.		PAGE NUMBER		REV
						DRAWING No.	S32E	-	03	-	206	-	01 OF 01	- 1

Details

Intervention	S32E-04-201-00
Designer	T. Pike
Design Date	01 February 2019
Type	New
Description	Concrete drop inlet weir and backfilling with ecologs at gradient changes and Ecolog stack upstream
Rehabilitation Objectives	To deactivate drain. Ecologs to deactivate headcuts
Latitude (D°M'S")	Start: 32°24'23.47"S Mid point: 32°24'22.85"S Finish: 32°24'22.22"S
Longitude (D°M'S")	Start: 26°45'58.71"E Mid Point: 26°45'59.15"E Finish: 26°45'58.89"E

Location Photograph: S32E-04-201-00



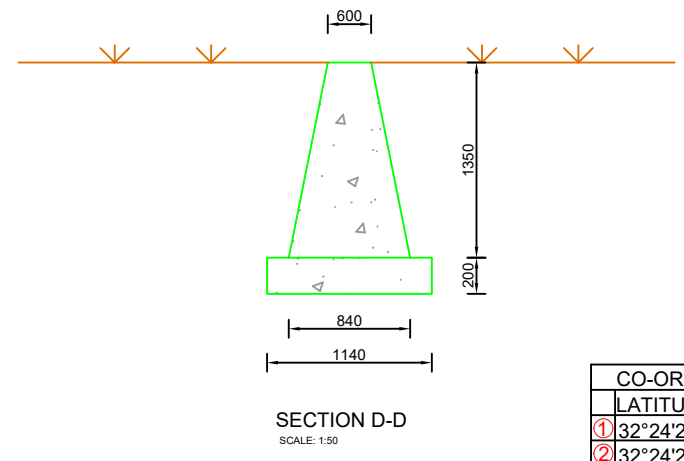
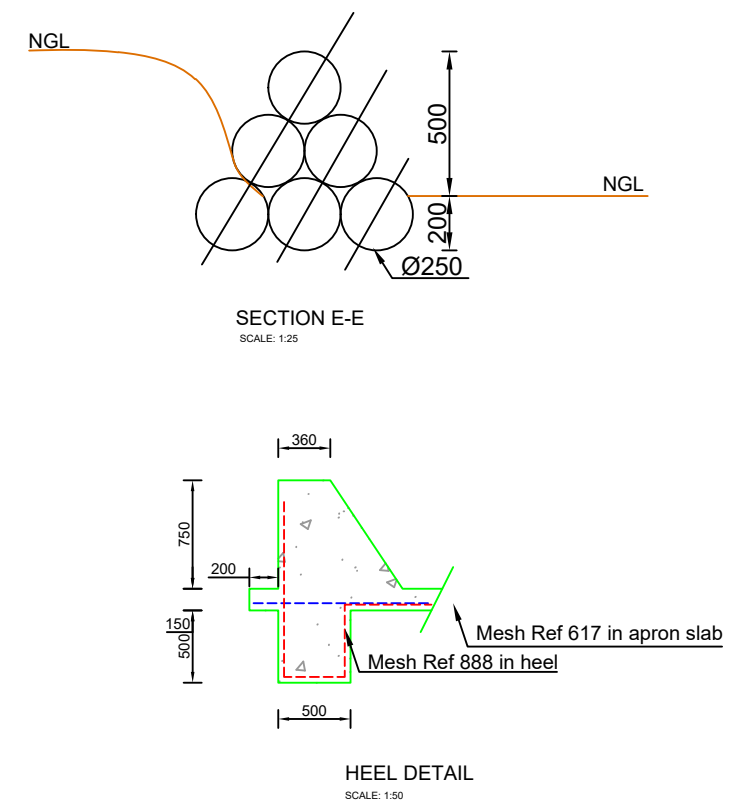
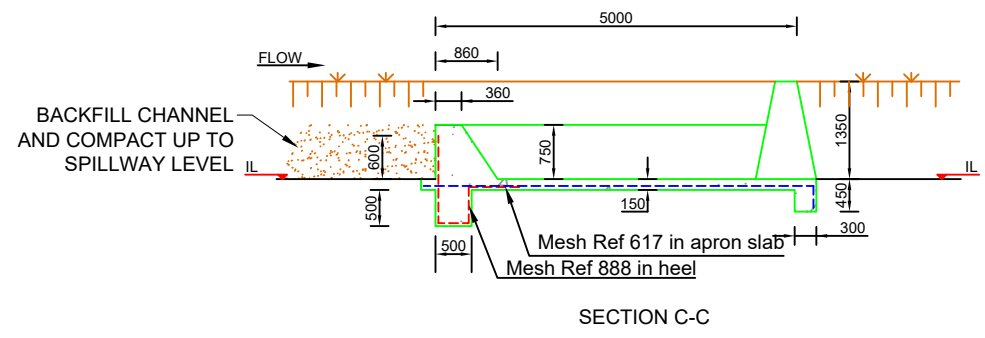
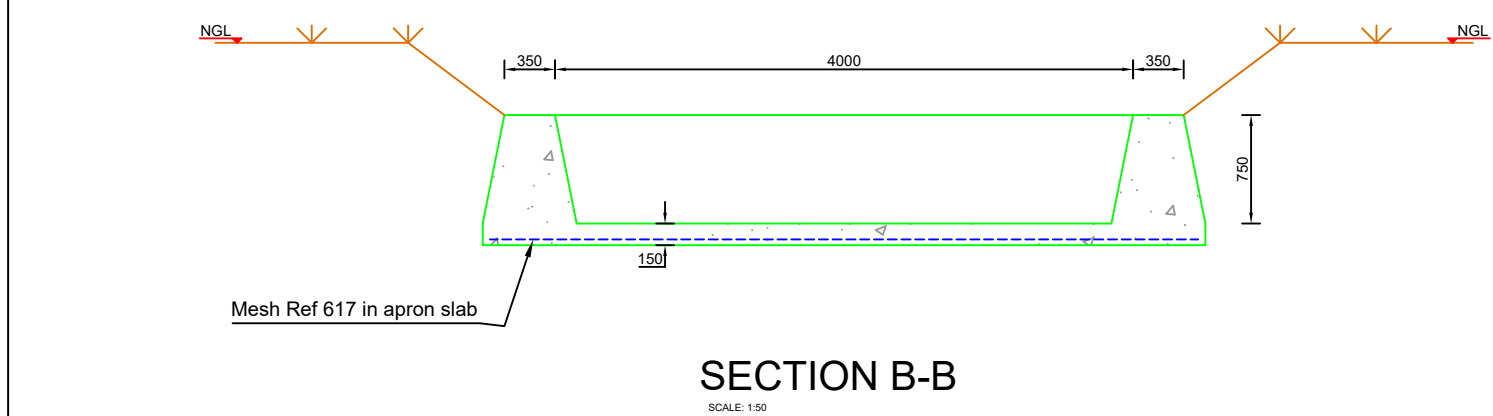
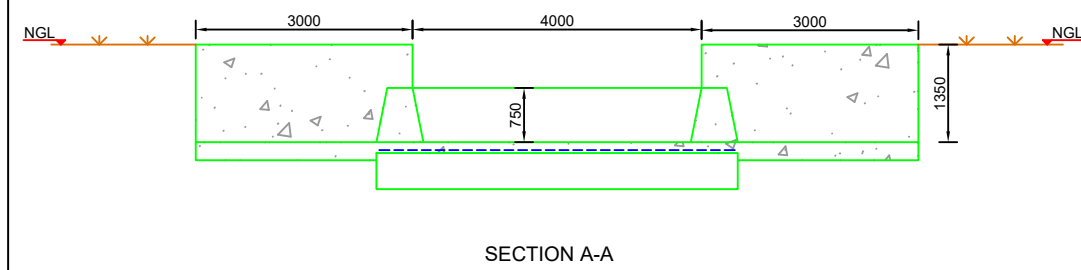
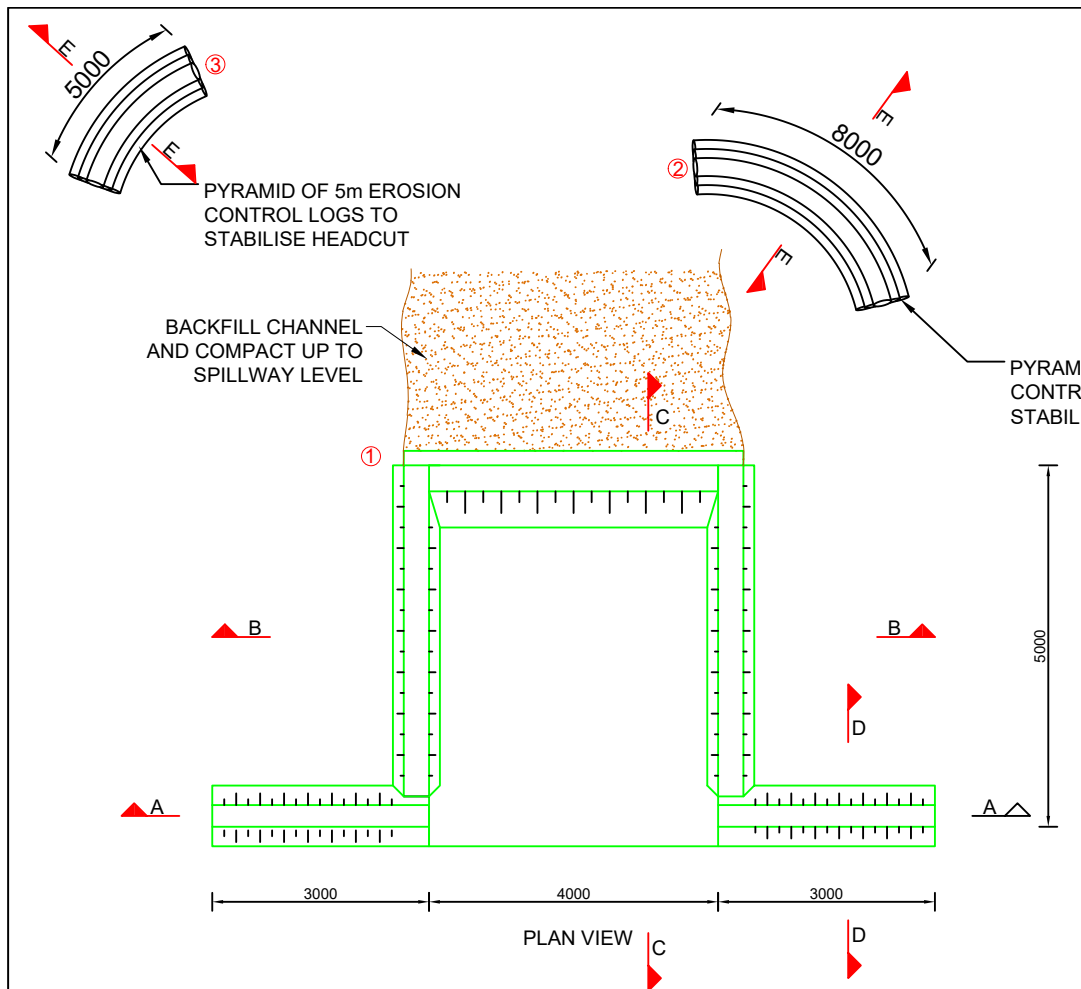
Bill of Quantities

Item	Units	Quantity
Excavation for structure	m³	25.88
Concrete	m³	18.10
Mesh ref 888 (6m x 2.4m sheets)	m²	28.80
Mesh ref 655 (6m x 2.4m sheets)	m²	43.20
Erosion control logs	m	78.00
Earthworks for backfilling	m³	250.00

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

The following site specific mitigation measures shall be implemented:

N/A



CO-ORDINATES	
LATITUDE	LONGITUDE
① 32°24'23.47"S	26°45'58.71"E
② 32°24'22.85"S	26°45'59.15"E
③ 32°24'22.22"S	26°45'58.89"E

NOTES

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- ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED. 100MM OF TOP SOIL TO COVER BERM. REVEGETATION TO BE UNDERTAKEN AT SUITABLE TIMING OF YEAR TO IMPROVE CHANCES OF TAKING.
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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS)

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- FILL MATERIAL TO BE GOOD QUALITY. WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
- ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METER OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

CONCRETE:

- NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19-26mm.
- ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
1 BAG CEMENT
65L SAND
85L STONE
21L WATER
- MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.
- ALL MESH REINFORCING TO HAVE 50mm OVERLAPS BETWEEN SHEETS.
- CONSTRUCTION JOINTS TO BE USED WHEREVER NRE CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.
- IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.
- CONCRETE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
- ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.
- FOUNDATION IMPROVEMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL.

ECOLOGS:

- WOODEN PEGS USED TO ANCHOR ECOLOGS ARE TO BE NO LESS THAN 40mm DIA AND 1000mm IN LENGTH
- PEGS SHOULD PROTRUDE NO LESS THAN 600mm FROM THE SOIL @ 1000 c/c



REV	DATE	REVISION DETAILS	APPROVED	SCALE	SIZE	PRELIMINARY DESIGN		PROJECT	WORKING FOR WETLANDS PROGRAMME 2017-2020					
1	08/11/2018	DRAFT FOR REHAB PLAN	T. PIKE	AS SHOWN	A3	APPROVED		PROVINCE - PROJECT AREA	EASTERN CAPE - AMATHOLE					
				DRAWN		DATE		INTERVENTION DESCRIPTION	CONCRETE DROP INLET WEIR					
				T. HARVEY		08/02/2019								
				T. PIKE		REGISTRATION No.								
				T.PIKE		20130774								
						QUATERNARY No.	WETLAND No.	INTERVENTION No.	PAGE NUMBER	REV				
						DRAWING No.	S32E	- 04	- 201	- 01 OF 01	- 1			

APPENDIX D

ENVIRONMENTAL AUTHORISATION

A Basic Assessment Report has been submitted to the Department of Environmental Affairs for consideration with an application for Environmental Authorisation (EA). Should the Department issue a positive decision, the EA will be included in this section prior to the Rehabilitation Plan being implemented. No construction may occur without an EA.

APPENDIX E
LANDOWNER AGREEMENTS



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA



Working for Wetlands Programme

Wetlands Rehabilitation Activities Consent

Property Details	
Property Type:	KOLOMANA Communal Land
Registration Division:	N/A
Farm Number:	N/A
Portion Number:	N/A
Farm Name:	N/A
Surveyor-General Key:	N/A
Province:	EASTERN CAPE PROVINCE
Unique Wetland Number:	S32E-03

Owner Details	
Owner Name: (Full Names/Full Registered Name)	SIVUYIKE JACKSON TYAH
Person Type:	<input type="checkbox"/> Company <input type="checkbox"/> Close corporation <input type="checkbox"/> Trust <input checked="" type="checkbox"/> Natural person
Registration/Identity Number:	4611075570082 (Where applicable. For a trust, attach a copy of the latest letters of trusteeship issued by the Master of the High Court.)
Owner's chosen address for delivery of notices and documents:	Postal Address: KOLOMANDIN AREA Box 11 5750
	Telephone Number: 0743624006
	Physical Address: Email Address:

Project Name:	WORKING FOR WETLAND - KOLEMANA
----------------------	--------------------------------

I/We hereby consent to the Working for Wetlands Programme and its appointed implementers undertaking the wetland rehabilitation activities listed in annexure "WFW 003A" attached hereto, for the project referred to above, subject to my/our approval of the relative Wetland Rehabilitation Plan, on the property described above of which I am the owner.

Name	SIVUYILE JACKSON	Position	SENIOR TRADITIONAL LEADER
Signature	S. TYAM	Date	22.01.2019

Please fax or post this form to: 	With a copy to: Dr Farai Tererai, PhD, Deputy Director: Planning, Monitoring and Evaluation Working for Wetlands, Natural Resources Management Programme, Department of Environmental Affairs, Environment House, Private Bag X447, Pretoria, 0001 Email: ftererai@environment.gov.za
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environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA



Working for Wetlands Programme

Wetlands Rehabilitation Activities Consent

Property Details	
Property Type:	KOLOMANA COMMUNAL LAND
Registration Division:	N/A
Farm Number:	N/A
Portion Number:	N/A
Farm Name:	N/A
Surveyor-General Key:	N/A
Province:	EASTERN CAPE
Unique Wetland Number:	S32E-04

Owner Details				
Owner Name: (Full Names/Full Registered Name)	SWUSILE JACKSON TYALI			
Person Type:	<input type="checkbox"/> Company	<input type="checkbox"/> Close corporation	<input type="checkbox"/> Trust	<input checked="" type="checkbox"/> Natural person
Registration/Identity Number:	7611078840082 (Where applicable. For a trust, attach a copy of the latest letters of trusteeship issued by the Master of the High Court.)			
Owner's chosen address for delivery of notices and documents:	Postal Address: KOLOMANA ADMIN AREA Box 11 5450		Physical Address:	
	Telephone Number: 0743624006		Email Address:	

Project Name:	Working For WETLANDS KOLONANA
----------------------	-------------------------------

I/We hereby consent to the Working for Wetlands Programme and its appointed implementers undertaking the wetland rehabilitation activities listed in annexure "WFW 003A" attached hereto, for the project referred to above, subject to my/our approval of the relative Wetland Rehabilitation Plan, on the property described above of which I am the owner.

Name	SIMONILE TSAH	Position	SENIOR TRADITIONAL LEADER
Signature	S-TSAH	Date	22.01.2019

Please fax or post this form to: 	With a copy to: Dr Farai Tererai, PhD, Deputy Director: Planning, Monitoring and Evaluation Working for Wetlands, Natural Resources Management Programme, Department of Environmental Affairs, Environment House, Private Bag X447, Pretoria, 0001 Email: ftererai@environment.gov.za
---	---



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA



Working for Wetlands Programme

Wetlands Rehabilitation Activities Consent

Property Details	
Property Type:	KOLOMANA COMMUNAL LAND
Registration Division:	N/A
Farm Number:	N/A
Portion Number:	N/A
Farm Name:	N/A
Surveyor-General Key:	N/A
Province:	EASTERN CAPE
Unique Wetland Number:	S32E-01

Owner Details			
Owner Name: (Full Names/Full Registered Name)	SIVUSILE JACKSON TYAKU		
Person Type:	<input type="checkbox"/> Company	<input type="checkbox"/> Close corporation	<input type="checkbox"/> Trust <input checked="" type="checkbox"/> Natural person
Registration/Identity Number:	7611075570082 (Where applicable. For a trust, attach a copy of the latest letters of trusteeship issued by the Master of the High Court.)		
Owner's chosen address for delivery of notices and documents:	Postal Address: KOLOMANA ADMIN AREA Box 11 5450	Physical Address:	
	Telephone Number: 044 3624606	Email Address:	

Project Name:	Working For WETLANDS KOLONANA
----------------------	-------------------------------

I/We hereby consent to the Working for Wetlands Programme and its appointed implementers undertaking the wetland rehabilitation activities listed in annexure "WFW 003A" attached hereto, for the project referred to above, subject to my/our approval of the relative Wetland Rehabilitation Plan, on the property described above of which I am the owner.

Name	Siwusile Tshani	Position	SENIOR TRADITIONAL LEADER
Signature	S. Tshani	Date	22.01.2019

Please fax or post this form to: 	With a copy to: Dr Farai Tererai, PhD, Deputy Director: Planning, Monitoring and Evaluation Working for Wetlands, Natural Resources Management Programme, Department of Environmental Affairs, Environment House, Private Bag X447, Pretoria, 0001 Email: ftererai@environment.gov.za
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environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA



Working for Wetlands Programme

Wetlands Rehabilitation Activities Consent


Property Details	
Property Type:	CAIRNS COMMUNAL LAND
Registration Division:	N/A
Farm Number:	N/A
Portion Number:	N/A
Farm Name:	N/A
Surveyor-General Key:	N/A
Province:	EASTERN CAPE
Unique Wetland Number:	Kolomana 14

Owner Details					
Owner Name: (Full Names/Full Registered Name)	SIMON VIWE HEBE				
Person Type:	<table><tr><td>Company</td><td>Close corporation</td><td>Trust</td><td><input checked="" type="checkbox"/> Natural person</td></tr></table>	Company	Close corporation	Trust	<input checked="" type="checkbox"/> Natural person
Company	Close corporation	Trust	<input checked="" type="checkbox"/> Natural person		
Registration/Identity Number:	7609175346080 (Where applicable. For a trust, attach a copy of the latest letters of trusteeship issued by the Master of the High Court.)				
Owner's chosen address for delivery of notices and documents:	Postal Address: P.O Box 369 ALICE 5700	Physical Address: NO:1 DEVELING STR ALICE 5700			
	Telephone Number: 071 556 6385	Email Address: SIMONHEBE@ICLOUD.COM			

Project Name:

Kolomane Wetland

I/We hereby consent to the Working for Wetlands Programme and its appointed implementers undertaking the wetland rehabilitation activities listed in annexure "WFW 003A" attached hereto, for the project referred to above, subject to my/our approval of the relative Wetland Rehabilitation Plan, on the property described above of which I am the owner.

Name	Yiwe Simon HEBE	Position	NKOSI
Signature		Date	12.03.2019

Please fax or post this form to:	With a copy to:
 	Dr Farai Tererai, PhD, Deputy Director: Planning, Monitoring and Evaluation Working for Wetlands, Natural Resources Management Programme, Department of Environmental Affairs, Environment House, Private Bag X447, Pretoria, 0001 Email: ftererai@environment.gov.za

THEMBU TRADITIONAL COUNCIL
BOLD POINT GREAT PLACE
P.O. BOX 364 WHITTLESEA - 5360
CELL: 082 694 8264 FAX: 086 610 479
Email: simon@beresfordinvestment.com
EASTERN CAPE PROVINCE



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

WFW 003



Working for Wetlands Programme

Wetlands Rehabilitation Activities Consent

Property Details	
Property Type:	SOLSBURY COMMERCIAL FARMING
Registration Division:	N/A
Farm Number:	N/A
Portion Number:	N/A
Farm Name:	N/A
Surveyor-General Key:	N/A
Province:	EASTERN CAPE
Unique Wetland Number:	Kolomana 5

Owner Details				
Owner Name: (Full Names/Full Registered Name)	XOLISE ALBERT HEBE			
Person Type:	Company	Close corporation	<input checked="" type="checkbox"/> Trust	Natural person
Registration/Identity Number:	5409055178089 (Where applicable. For a trust, attach a copy of the latest letters of trusteeship issued by the Master of the High Court.)			
Owner's chosen address for delivery of notices and documents:	Postal Address:	Physical Address:		
	P.O. Box 486 WHITTLESEA	BOLD POINT VILLAGE WHITTLESEA		
	Telephone Number:	Email Address:		
	078 970 7850	N/A		

Project Name:	Kolomane Wetland
----------------------	------------------

I/We hereby consent to the Working for Wetlands Programme and its appointed implementers undertaking the wetland rehabilitation activities listed in annexure "WFW 003A" attached hereto, for the project referred to above, subject to my/our approval of the relative Wetland Rehabilitation Plan, on the property described above of which I am the owner.

Name	XOWILE A Hebe	Position	CHAIRPERSON
Signature	X. A. Hebe	Date	12.03.2019

Please fax or post this form to:	With a copy to:
	Dr Farai Tererai, PhD, Deputy Director: Planning, Monitoring and Evaluation Working for Wetlands, Natural Resources Management Programme, Department of Environmental Affairs, Environment House, Private Bag X447, Pretoria, 0001
	Email: ftererai@environment.gov.za

APPENDIX F
ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

WORKING FOR WETLANDS PROGRAMME



CONSTRUCTION ENVIRONMENTAL MANAGEMENT PROGRAMME

Date: September 2017
Version: 5

Prepared by:
Aurecon South Africa (Pty) Ltd
PO Box 494
Cape Town
8000



Prepared for:
Working for Wetlands Programme
Department of Environmental Affairs:
Natural Resource Management
Private Bag X447
0001

REPORT CONTROL

Document control					
Report title		Working for Wetlands Programme: Construction Environmental Management Programme			
Prepared by		Aurecon South Africa (Pty) Ltd PO Box 494 Cape Town 8000			
On behalf of		Working for Wetlands Programme (WfWetlands) Department of Environmental Affairs: Natural Resource Management Private Bag X447 0001			
Client contact		Ms Franci Gresse Tel: 021 526 9400	WfWetlands contact	Dr Farai Tererai Tel: 012 399 8970	
Rev	Date	Author	Reviewer	Verifier	Approver
1	Sept. 2010	SANBI	N/A	N/A	SANBI
2	Oct. 2012	A. Beetge	A. Beetge	A. Beetge	U. Bahadur
3	July 2015	Z. Palmer	F. Gresse	A. Beetge	F. Tererai
4	Nov. 2015	Z. Palmer	F. Gresse	A. Beetge	F. Tererai
5	Sept. 2017	M. Lowies & F. Gresse	F. Gresse	A. Beetge	F. Tererai
Approval					
Author signature			Approver signature		
Name			Name		
Title			Title		
Date			Date		



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ACRONYMS

BAR	Basic Assessment Report
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EMPr	Construction Environmental Management Programme
EPWP	Expanded Public Works Programme
GPS	Global Positioning System
IE	Implementing Entity
NEMA	National Environmental Management Act (Act 107 of 1998)
NRM	Natural Resource Management
PC	Provincial Coordinator ¹
PDP	Professional Driving Permit
PIP	Project Implementation Plan
PPE	Personal Protective Equipment
PPR	Project Progress Report
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resources Agency
SEP	Site Environmental File
SETA	Sector Education and Training Authority

¹ Also referred to as Assistant Director: Wetlands Programme.



DEFINITIONS

Alien species²:

- (a) a species that is not an indigenous species; or
- (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Approved: Means approved in terms of the applicable legal requirements (e.g. NEMA approval/ Environmental Authorisation) and/or has been approved by the WfWetlands Programme's Deputy Director: Planning, Monitoring and Evaluation and/or an authorised representative of the WfWetlands Programme.

Archaeological³:

- (a) material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;
- (b) rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- (c) wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which the South African Heritage Resource Agency (SAHRA) considers to be worthy of conservation; and

Auditing⁴: A systematic, documented, periodic and objective evaluation which provides verifiable findings, in a structured and systematic manner, on:

- (a) the level of performance against and compliance of an organisation or project with the provisions of the requisite environmental authorisation or Environmental Management Programme (EMPr) and, where applicable, the closure plan; and
- (b) the ability of the measures contained in the EMPr, and where applicable the closure plan, to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity.

Authority: National, regional or local authority, that has a decision-making role or interest in the project.

Basic Assessment Report (BAR): A report as described in Regulation 19 of GN R982 (2014, as amended) of the National Environmental Management Act (No. 107 of 1998, as amended) (NEMA).

Best Management Practice (BMP): Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWetlands implementers.

² National Environmental Management: Biodiversity Act (No. 10 of 2004)

³ National Heritage Resources Act (No. 25 of 1999)

⁴ Regulation 34 of GN R982 (2014, as amended) of NEMA



Cement laden water: Means water (fresh or wash water) which has been in contact with partially cured concrete/mortar or raw cement product and which contains suspended and dissolved cement solids.

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Contaminated water: Means water contaminated by the Implementing Entity's activities such as with hazardous substances, hydrocarbons, paints, solvents and runoff from plant, workshop or personnel wash areas but excludes water containing cement/ concrete or silt.

Corrective (or remedial) action: Reactive response required to address an environmental problem that is in conflict with the requirements of the EMP. The need for corrective action may be determined through monitoring, audits or management review.

Dam⁵: Any barrier dam and any other form of impoundment used for the storage of water, excluding reservoirs.

Dangerous goods: Goods containing any of the substances as contemplated in South African National Standard No. 10234, supplement 2008 1.00: designated "*List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)*" published by Standards South Africa, and where the presence of such goods, regardless of quantity, in a blend or mixture, causes such blend or mixture to have one or more of the characteristics listed in the Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards.

Decommissioning⁶: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned.

Dust⁷: Any material composed of particles small enough to pass through a 1 mm screen and large enough to settle by virtue of their weight into the sampling container from the ambient air.

Eco-log: A cylindrical sleeve made from, for example wire mesh, filled with organic material and/or soil used to prevent and/or repair minor erosion.

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

Endangered species: Means any indigenous species listed as an endangered species in terms of section 56 of the National Environmental Management Biodiversity Act ((No. 10 of 2004).

Endemic: An "endemic" is a species that grows in a particular area (i.e. it is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

⁵ GN R983 (2014, as amended) of NEMA

⁶ GN R983 (2014, as amended) of NEMA

⁷ National Dust Regulations GN R827 (2013)



Environment⁸: Means the surroundings within which humans exist and that are made up of:

- i. the land, water and atmosphere of the earth;
- ii. micro-organisms, plant and animal life;
- iii. any part or combination of i) and ii) and the interrelationships among and between them; and
- iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

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

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

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

Environmental impact: Change in an environment resulting from the effect of an activity on the environment, whether positive or negative. Impacts may be the direct consequence of an individual's or organisation's activities or may be indirectly caused by them (DEAT, 1998).

Erosion: The loss of soil through the action of water, wind, ice or other agents, including the subsidence of soil.

Establishment of grass: Refers to all necessary procedures taken to produce an acceptable cover of specified live grass over an area.

Gabion: A structure made of wire mesh baskets filled with regularly sized stones, and used to prevent and/or repair erosion. They are flexible and permeable structures which allow water to filter through them. Vegetation and other biota can also establish in/around the habitat they create.

Hazard: Means a source of or exposure to danger.

Invasive alien species control:

- (a) to combat or eradicate an alien or invasive species; or
- (b) where such eradication is not possible, to prevent, as far as may be practicable, the recurrence, re-establishment, re-growth, multiplication, propagation, regeneration or spreading of an alien or invasive species.

Implementing Entity: The entity responsible for the construction of WfWetlands rehabilitation interventions by means of various contracted teams.

Indigenous vegetation⁹: Refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

⁸ NEMA

⁹ GN R983 (2014, as amended) of NEMA



Interested and Affected Parties (I&APs)¹⁰:

- (a) all persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;
- (b) all persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; c) all organs of state which have jurisdiction in respect of the activity to which the application relates.

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

Invasive species¹¹: Means any species whose establishment and spread outside of its natural distribution range-

- (a) threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and
- (b) may result in economic or environmental harm or harm to human health.

Listed invasive species: Any invasive species listed in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the National Environmental: Biodiversity Act (No. 10 of 2004).¹²

Maintenance period: The period after the Establishment Period (Practical Completion), up to and until the end of the Maintenance Period (i.e. a period of 12 months).

Maintenance¹³: Means actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint.

Mine:

- (a) used as a noun-

any excavation in the earth, including any portion under the sea or under other water or in any residue deposit, as well as any borehole, whether being worked or not, made for the purpose of searching for or winning a mineral;

any other place where a mineral resource is being extracted, including the mining area and all buildings, structures, machinery, residue stockpiles, access roads or objects situated on such area and which are used or intended to be used in connection with such searching, winning or extraction or processing of such mineral resource; and

- (b) used as a verb-

in the mining of any mineral, in or under the earth, water or any residue deposit, whether by underground or open working or otherwise and includes any operation or activity incidental thereto, in, on or under the relevant mining area.

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

¹⁰ Regulation 42 GN R983 (2014, as amended) of NEMA

¹¹ National Environmental Management: Biodiversity Act (No. 10 of 2004)

¹² Also refer to GN 864 (2016): Alien and Invasive Species Lists

¹³ GN R983 (2014, as amended) of NEMA



Mitigation¹⁴: Means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible;

Monitoring¹⁵: The repetitive and continued observation, measurement and evaluation of environmental criteria to follow changes over a period of time and to assess the efficiency of control measures.

Nursery conditions: This refers to the necessary conditions that must be in place for maintaining strong healthy growth in all container plant materials on site. This includes for the protection of all container plants against wind, frost, direct sunlight, pests, disease and drought. It also includes for the provision of adequate and suitable water supply, fertilisers and all other measures necessary to maintain strong and healthy plant growth.

Offensive odour: Any smell which is considered to be malodorous or a nuisance to a reasonable person.

Pollution¹⁶: Means any change in the environment caused by substances;

(ii) radioactive or other waves; or

(iii) noise, odours, dust or heat,

emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or wellbeing or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.

Post-construction: Refers to the period of 12 months after the completion of the construction works, the onset coinciding with the maintenance period.

Potentially hazardous substance: Any substance or mixture of substances, product or material declared to be a hazardous substance under section 2(1) of the Hazardous Substance Act (1973).

Pre-construction: Refers to the period leading up to the establishment on site by the Implementing Entity.

Project: A defined area for which an approved rehabilitation plan exists for the WfWetlands Programme.

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

Quaternary Catchment: A fourth order catchment in a hierarchal classification system in which a primary catchment is the major unit and that is also the “principal water management unit in South Africa”¹⁷

¹⁴ GN R983 (2014, as amended) of NEMA

¹⁵ DEAT, 1998

¹⁶ National Environmental Management Act (No. 107 of 1998, as amended)

¹⁷ DWS Groundwater Dictionary. Available online:

http://www.dwaf.gov.za/Groundwater/Groundwater_Dictionary/index.html?introduction_quaternary_catchment.htm



Reasonable: Means, unless the context indicates otherwise, reasonable in the opinion of the relevant environmental authority.

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

Restoring processes and characteristics that are sympathetic to and not conflicting with the natural dynamic of an ecological or physical system¹⁸.

Scarifying: Loosening the soil in areas which have become hard and compacted and which need to be loosened in order to facilitate revegetation.

Shaping: Finishing all slopes which do not form part of the permanent works so that they do not exceed the maximum gradient stipulated in the approved rehabilitation plan.

Significant impact: Means an impact that may have a notable effect on one or more aspects of the environment or may result in k with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence.

Silt laden water: Means water (mostly overland surface runoff) containing a substantial concentration of suspended solids with increased turbidity. Usually occurs as a result of exposed/cleared ground surfaces, concentration of runoff and/or erosion of excavated or imported materials.

Site: This is the area described in the approved/authorised rehabilitation plan for the implementation of the rehabilitation measures. Where the area is not demarcated, it will include all adjacent areas, which are reasonably required for the activities for the Implementing Entity, and approved for such use by the Environmental Control Officer (ECO).

Slope: The inclination of a surface expressed as 1 unit of rise or fall for so many horizontal units.

Subsoil: The soil horizons between the topsoil horizon and the underlying parent rock.

Topsoil: The upper soil profile irrespective of the fertility appearance, structure, agriculture potential, fertility and composition of the soil, usually containing organic material and which is colour specific. Also referred to as the "O" and "A" horizons.

Waste: Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 the National Environmental Management: Waste Act (No. 59 of 2008)¹⁹. Examples include construction debris, chemical waste, used oils and lubricants, batteries, metal and wood off-cuts, excess cement/ concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Watercourse:

- (a) a river or spring;
- (b) a natural channel in which water flows regularly or intermitted;
- (c) a wetland, pan, lake or dam into which, or from which, water flows

¹⁸ Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008

¹⁹ National Environmental Management: Waste Act (No. 59 of 2008, as amended)



A reference to a watercourse includes, where relevant, its bed and banks

Weir: A dam-type structure placed across a watercourse to raise the water table of the surrounding ground and trap sediment on the upstream face without preventing water flow. Weirs are generally used to prevent erosion from progressing up exposed gullies.

Wetland: Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils²⁰ and,

Land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants living there²¹.

²⁰ National Water Act (No. 36 of 1998, as amended)

²¹ Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008



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1 INTRODUCTION

1.1 Project Overview

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

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

1.2 Purpose of the EMPr

An Environmental Management Programme (EMPr) is compiled as part of the requisite submissions contained in a Basic Assessment Report (BAR) or Environmental Impact Report (EIR) in order to obtain an Environmental Authorisation (EA) to proceed with a listed activity(ies) as defined in GN R982 (2014, as amended) of the National Environmental Management Act (No. 107 of 1998), as amended. Upon approval of the BAR or EIR and resultant issuing of the EA, the EMPr becomes a legally binding document of which compliance has to be audited by an independent and appropriately qualified auditor as per Regulation 34 of GN R982 (2014, as amended).

The EMPr's main purpose is to document general and specific avoidance, mitigation and termination actions in order to address general and project specific impacts as identified by means of the EIA and/or Phase 2 planning process. Implementation of the actions specified in the EMPr can be contractually delegated to various parties involved in the project execution. However, legal compliance with the EA and EMPr remains with the EA holder and cannot be delegated or transferred. It is therefore of utmost importance that WfWetlands ensures that all parties involved are familiar with the contents and requirements of the EMPr as non-conformances can ultimately have legal and financial consequences to primarily the EA holder but also subsequently all other parties involved.

1.3 Auditing of compliance with the EA and EMPr

Compliance auditing has been transformed from a vague requirement under the 2006 and 2010 EIA regulations to a very specific set of actions and outcomes which are to be achieved under the 2014 EIA regulations. An audit report is now also subject to a specified structure and with specific content requirements (Appendix 7 of GN R982), as amended. According to GN R982 Appendix 7 (Section 2) the objectives of an audit report include *inter alia* the following:

- a) to report on—
 - i. the level of compliance with the conditions of the environmental authorisation and the EMPr, and where applicable, the closure plan; and
 - ii. the extent to which the avoidance, management and mitigation measures provided for in the EMPr, and where applicable, the closure plan achieve the objectives and outcomes of the EMPr, and closure plan;



- b) identify and assess any new impacts and risks as a result of undertaking the activity;
- c) evaluate the effectiveness of the EMPr, and where applicable, the closure plan;
- d) identify shortcomings in the EMPr, and where applicable, the closure plan; and
- e) identify the need for any changes to the avoidance, management and mitigation measures provided for in the EMPr, and where applicable, the closure plan.

As per Regulation 34, sub-regulation 4 of GN R982, where the findings of the environmental audit report contemplated in sub-regulation (1) of GN R982 indicate:

- (a) insufficient mitigation of environmental impacts associated with the undertaking of the activity; or
- (b) insufficient levels of compliance with the environmental authorisation or EMPr and, where applicable the closure plan;

the holder must, when submitting the environmental audit report to the competent authority in terms of sub-regulation (1), submit recommendations to amend the EMPr or closure plan in order to rectify the shortcomings identified in the environmental audit report.

When submitting recommendations in terms of sub-regulation (4), such recommendations must have been subjected to a public participation process, which process has been agreed to by the competent authority and was appropriate to bring the proposed amendment of the EMPr and, where applicable the closure plan, to the attention of potential and registered interested and affected parties, including organs of state which have jurisdiction in respect of any aspect of the relevant activity and the competent authority, for approval by the competent authority.

Given the strict and onerous above-mentioned requirements in terms of compliance with the EA and EMPr as well as auditing thereof, it is therefore of utmost importance that the EMPr specifies realistic and auditable avoidance, mitigation and cessation actions which can be applied across a wide range of project in various geographical settings. The approach to the structure and content of this EMPr is discussed in more detail under Section 1.7 below.

1.4 Frequency of compliance auditing

The ECO and Implementing Entity is responsible for ensuring compliance with the EMPr. The ECO shall inspect the site prior to commencement of any construction activity, at least once per month during construction and on completion of construction to establish the level of compliance with this CEMP. At sensitive sites, bi-weekly inspections shall take place as a minimum.

Monthly site audits shall be undertaken by the ECO and a bimonthly Project Inspection Report submitted to the Working for Wetlands Deputy Director: Planning, Monitoring and Evaluation for review prior to the annual Compliance Audit taking place.

The annual Compliance Audit Report shall be submitted to the DEA collating the year's completed checklists. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified to the DEA.

1.5 Content of an EMPr

Environmental management programmes are intended to be documents which indicate how the mitigation and management measures proposed for a project can be implemented in practice. As such they should be practical, reasonable and feasible. They must also meet the requirements of the legislation (Table 1), in particular regulation 19 (4) of the 2014 EIA regulations (GN R982).



Table 1: Requirements of an EMPr as per Appendix 4 of the 2014 EIA regulations, GN R982 (2014, as amended)

Section	Description	Heading/ section in this EMPr
(a)	details of- (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Report control sheet Annexure E
(b)	a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Sections 1.1, 1.2 and 1.7
(c)	a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Chapter 6 Annexure C
(d)	a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including- (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities;	Chapters 3-5
(f)	a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraphs (d) will be achieved, and must, where applicable, including actions to - (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	Chapters 4-5
(g)	the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Chapters 4-5
(h)	the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Chapters 4-5
(i)	an indication of the persons who will be responsible for the implementation of the impact management actions;	Section 2.1; Chapters 4-5
(j)	the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 2.1



Section	Description	Heading/ section in this EMPr
(k)	the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Chapters 4-5
(l)	a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Sections 1.3 and 1.4
(m)	an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 3.3 and Chapter 6
(n)	any specific information that may be required by the competent authority.	NA

1.6 Relevant legislation, guidelines and other documents

This EMPr should be read in the context of the following documents:

- Constitution of the Republic of South Africa Act (No. 108 of 1996)
- National Environmental Management Act, (No. 107 of 1998, as amended)
- National Environmental Management: Waste Act (No. 59 of 2008)
- National Forest Act (No. 84 of 1998)
- National Water Act (No. 36 of 1998)
- National Heritage Resources Act (No. 25 of 1999)
- Municipal Systems Act (No. 32 of 2000)
- Occupational Health and Safety Act (No. 85 of 1993)

Note that the EMPr is not intended to replace any of the above, but rather augment them. Compliance with the EMPr does not exempt the EA holder, i.e. WfWetlands, from compliance with the legal or management requirements of any other licence or permit issued in terms of the project.

1.7 The EMPr in the context of the WfWetlands programme

As discussed under the previous sections, an EMPr and compliance with the EMPr (including compliance auditing) is specifically and strictly regulated under the 2014 EIA regulations, as amended. The implementation of a standard EMPr across a programme as diverse as WfWetlands does however pose various challenges as a result of the wide variety of interventions, site conditions, types of wetland systems, ecological integrity and complexity and so forth.

As a result the EMPr has been written with the abovementioned challenges in mind. It therefore focuses on the typical activities and impacts related to a WfWetlands project and generic avoidance, mitigation and termination actions. The EMPr is augmented by a site specific Rehabilitation Plan which includes more site specific mitigation measures and requirements where required. It is recommended that



compliance auditing takes into account the specific mitigation measures recommended in the accompanying Rehabilitation Plan for each individual project as well.

- Allowance will also be made throughout the document for minor deviations to allow for site specific scenarios but with the condition that each deviation be approved by the provincial Programme's Provincial Coordinator (PC) and in the case of major deviations by the DEA (also see Annexure B).



2 IMPLEMENTATION OF THE EMPr

The EMPr is ultimately intended to aid in the implementation of specific actions on site in order to ensure that the impacts of a project are avoided or mitigated during the various project implementation phases. A number of role-players are required to actively participate in the implementation of the EMPr with different roles and responsibilities typically assigned to each. The various roles and responsibilities are outlined below.

2.1 Role-players and their functions/responsibilities

2.1.1 DEA

Responsible Entity: DEA	
<ul style="list-style-type: none"> DEA (specifically the Legal Authorisations and Compliance Inspectorate) holds the ultimate authority and mandate in terms of ensuring environmental legislation is adhered to. 	
Responsibilities	Duration
<ul style="list-style-type: none"> Investigate reported non-compliances with EAs and EMPrs either as a result of findings by an ECO/auditor, reporting by the EA holder or public complaints. Enforce compliance and adherence to the EA, EMPr or any other environmental legislation through a number of administrative and legal procedures should it prove that a person or organisation is in contravention of an EA, EMPr or other environmental authorisation. 	Project lifespan

2.1.2 The EA holder

Responsible Entity: WfWetlands			
<ul style="list-style-type: none"> Holds sole legal liability in terms of ensuring compliance to the EA and EMPr. Some responsibilities resulting from the EA or EMPr can be delegated or transferred contractually. 			
Responsibilities	Duration		
<table border="1"> <tr> <td>Contractual</td><td> <ul style="list-style-type: none"> Ensure that the EA and EMPr is included in the contract documentation for a project in order to ensure that compliance with the EA and EMPr is contractually binding. Ensure that current standards and specifications forming part of the standard contract documentation allow for or are aligned to the requirements of the EA and EMPr. Ensure that all PCs and Implementing Entities are familiar with the requirements of the EA and EMPr. </td></tr> </table>	Contractual	<ul style="list-style-type: none"> Ensure that the EA and EMPr is included in the contract documentation for a project in order to ensure that compliance with the EA and EMPr is contractually binding. Ensure that current standards and specifications forming part of the standard contract documentation allow for or are aligned to the requirements of the EA and EMPr. Ensure that all PCs and Implementing Entities are familiar with the requirements of the EA and EMPr. 	Appointment; Project lifespan
Contractual	<ul style="list-style-type: none"> Ensure that the EA and EMPr is included in the contract documentation for a project in order to ensure that compliance with the EA and EMPr is contractually binding. Ensure that current standards and specifications forming part of the standard contract documentation allow for or are aligned to the requirements of the EA and EMPr. Ensure that all PCs and Implementing Entities are familiar with the requirements of the EA and EMPr. 		

Responsibilities		Duration
Approvals and licences	<ul style="list-style-type: none"> Identify, obtain and comply with all other necessary approvals, permits, authorisations and requirements set by the relevant National and Provincial Departments and Local Authority for the construction of engineering interventions for the rehabilitation of wetlands before any site preparation activities are undertaken. 	Pre-construction
Record keeping	<ul style="list-style-type: none"> Ensure that a proper record keeping system is in place to keep track of proof that copies of the EA and EMPr were issued to the PCs and Implementing Entities. 	Pre-construction; Project lifespan

2.1.3 The PC

Responsible Entity: PC		
<ul style="list-style-type: none"> The PC shall be responsible for his/her specific province to ensure compliance with the EMPr. 		
Responsibilities		Duration
Approvals and licences	<ul style="list-style-type: none"> Be fully aware of and understand all the requirements of the EA(s) and EMPr(s) issued for projects in his/her province. Ensure compliance with the EA and implementation of the EMPr. Ensure that each Implementing Entity receives a copy of the EA and EMPr for distribution to each contractor, with proof of receipt (e.g. a transmittal note or similar). Ensure that each Implementing Entity fully understands the contents and requirements of the EA and EMPr and the legal and financial consequences of non-compliance. 	Pre-construction; Project lifespan
Communication	<ul style="list-style-type: none"> Communicate environmental issues associated with the site to the Implementing Entity, including having adequate environmental knowledge in the field of wetland rehabilitation to understand the detailed environmental issues associated with the project. 	Pre-construction; Project lifespan
Site management	<ul style="list-style-type: none"> Assist with developing a site environmental file and ensuring all documentation is filed correctly. Assist with site or project specific challenges or problems which might result in a non-conformance with the EA and EMPr. Provide guidance to Implementing Entities on practical solutions in achieving the outcomes and requirements of the EA and EMPr. 	Pre-construction; Project lifespan

Responsibilities		Duration
Environmental training	<ul style="list-style-type: none"> Confirm that Environmental Awareness training has been undertaken on all sites prior to construction commencing. 	Pre-construction

2.1.4 The ECO

Responsible Entity: ECO		
<ul style="list-style-type: none"> The PC shall perform the duties of the ECO via monthly inspections in order to minimise adverse environmental impacts and effects. Any changes to any environmental management documentation must be reviewed and understood by the ECO. The ECO has access to the construction site at all times. Remain appointed until the site has been rehabilitated as specified in the EMPr. 		
Responsibilities		Duration
Approvals and licences	<ul style="list-style-type: none"> Ensure compliance with the EA, EMPr, permits issued and all the environmental legislation. Be fully knowledgeable with the contents and the conditions of the EA and all amendments. Be fully knowledgeable with the contents of the latest revision of the EMPr. Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with them. 	Pre-construction
Communication	<ul style="list-style-type: none"> Ensure that the contents of the EMPr are communicated to the Implementing Entity. Escalate serious or repeat non-conformances to the relevant competent authority (i.e. DEA, DWS, SAHRA, etc.). 	Pre-construction; Project lifespan
Site management	<ul style="list-style-type: none"> Approve the site layout plan (showing environmental sensitive/no-go areas). Ensure that all relevant activities being undertaken on site are within the scope of the EA and within the boundaries of the approved layout plan. 	Project lifespan
Environmental training	<ul style="list-style-type: none"> Confirm that Environmental Awareness training has been undertaken on all sites prior to construction commencing. 	Pre-construction
Method statements	<ul style="list-style-type: none"> Ensure that all method statements required are submitted and approved prior to site establishment. 	Pre-construction

Responsibilities		Duration
Record keeping	<ul style="list-style-type: none"> Keep and maintain a schedule of current site activities including the monitoring of such activities. Keep copies of all reports submitted to DEA. Obtain and keep record of all documentation including: environmental authorisation from DEA, EMPr, basic assessment, site layout plan, method statements, all communication detailing changes that may have environmental implications, site inspection checklist, Environmental awareness training attendance register, Environmental incident report, environmental performance certificates (once a project has been completed) photographic records (before, during and after development), records of non-compliance and corrective action taken to remediate, permits, licenses, and authorisations such as waste disposal certificates, hazardous waste landfill site licenses etc. which are required by this facility. 	Project lifespan
Audits	<ul style="list-style-type: none"> Compile an audit checklist which complies with the requirements of GN R982 Appendix 7 and is able to measure compliance against the EA, EMPr, other relevant permits and contract environmental specifications (where applicable). Escalate serious or repeat non-conformances to the relevant competent authority (i.e. DEA, DWS, SAHRA, etc.). Work with the Implementing Entity and relevant stakeholders to resolve any areas of non-compliance with appropriate corrective action. Assist the Implementing Entity in finding environmentally responsible solutions to problems. Giving a report back on the environmental issues at the monthly site meetings and other meetings that may be called regarding environmental matters. Submit final audit report to DEA upon project closure in accordance with the requirements of the EA and EMPr. 	Project lifespan; Project closure

2.1.5 The Implementing Entity

Responsible Entity: Implementing Entity

- The Implementing Entity will be acting as the Project Manager and is responsible for complying with the EMPr during the construction phase of the development on a day-to-day basis.
- The Implementing Entity will be responsible for any non-compliance with the EMPr and will pay for any remedial work that may result from non-compliance resulting directly from his/her negligence. Failure to comply with the EMPr is addressed in Section 2.2.3.

Responsibilities		Duration
Approvals and licences	<ul style="list-style-type: none"> Ensure that a copy of the EMPr, EA and any other applicable permit/licence are available on site. 	Pre-construction; Project lifespan
Communication	<ul style="list-style-type: none"> Submit all required documentation (e.g. proof of training, method statements, layout plans, and requests for deviations) to the ECO on a timely basis. Communicate any issues or concerns of the surrounding community regarding the development to the ECO or other responsible party and visa-versa. Ensure that all materials and equipment required for daily environmental compliance is ordered through the correct channels if such is not available. 	Pre-construction; Project lifespan
Site management	<ul style="list-style-type: none"> Ensure that appointed contractors, participants and sub-contractors are familiar with the EMPr and that they abide by it. Monitor and verify on a daily basis that the EMPr and specifications (if applicable) is adhered to at all times and taking the necessary action to ensure compliance is achieved where it is lacking. Ensure that site demarcation and no-go areas are maintained. Monitor and verify that environmental impacts as a result of construction activities are kept to a minimum. Ensure that all materials and equipment required for daily environmental compliance are available on site and ensure that the aforementioned is ordered through the correct channels if such is not available. Inspect the site and surrounding areas regularly with regard to compliance with the EMPr. Keep a photographic record of progress on site from an environmental perspective. 	Project lifespan
Environmental training	<ul style="list-style-type: none"> Provide environmental awareness training for all new personnel coming onto site and filing proof of such training in the Environmental File on site. 	Pre-construction
Method Statements	<ul style="list-style-type: none"> Ensure compliance with approved Method Statements. 	Pre-construction; Project lifespan

Responsibilities		Duration
Record keeping	<ul style="list-style-type: none"> • Submit all required documentation (e.g. proof of training, method statements, layout plans, and requests for deviations) to the ECO on a timely basis. • File proof of environmental awareness training in the Environmental File kept on site. • Keep and maintain a detailed incident (including spillage of fuels, chemicals, or any other material) and complaints register on site indicating how these issues were addressed, what rehabilitation measures were taken and what preventative measures were implemented to avoid re-occurrence of incidents/complaints. • Ensure that all relevant documentation illustrating or proving environmental compliance are filed on site in the Environmental File for inspection by the ECO or Competent Authority. • Keep a photographic record of progress on site from an environmental perspective. 	Project lifespan
Audits	<ul style="list-style-type: none"> • Complete start-up and site closure checklists on a weekly or monthly basis or as otherwise specified. 	Project lifespan

2.2 Record keeping (site related activities)

The development of an EMPr for a project is an important and necessary task that is aimed at assigning responsibilities and mitigation options to a variety of activities. However, it can be an ineffective tool in the absence of auditing or monitoring activities. Auditing or monitoring activities involve the structured observation, measurement, and evaluation of environmental data over a period of time.

2.2.1 Site Environmental File

The Site Environmental File (SEF) is a critical part of compliance record keeping, specifically in terms of proof of activities undertaken on a regular basis on site to ensure compliance with the EA and EMPr. The SEF is further a key component to demonstrate compliance to the ECO or relevant Competent Authority official during a compliance audit. The typical SEF contents should include *inter alia* the following:

1. Rehabilitation Plan and EMP

2. Approvals and licences

- 2.1. EA
- 2.2. Section 21(c) and (i) General Authorisation
- 2.3. Waste licence (if applicable)
- 2.4. Mining permit/licence (e.g. for proof of quarry legitimacy)

3. Communication

- 3.1. Important correspondence e.g. notice to Competent Authority of commencement of construction
- 3.2. Copy of public complaints register



4. Site management

- 4.1. Approved layout
- 4.2. Site instructions (or copies thereof)

5. Environmental Training

- 5.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)

6. Method statements

- 6.1. Approved method statements

7. Records

- 7.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)
- 7.2. Proof of legal/safe waste disposal
- 7.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)
- 7.4. Record of water usage (if applicable)
- 7.5. Log of topsoil samples (if applicable)

8. Audits

- 8.1. ECO audit reports
- 8.2. Internal audits/check conducted by the Implementing Entity
- 8.3. Incident and non-conformance reports

Typical examples of checklists and other types of record keeping are included in Annexure B.

2.2.2 Progress / Site Meetings

Environmental issues shall be put on the agenda as a discussion point during these meetings. The Implementer, or a designated person involved with environmental issues on the project, shall attend the progress and/or site meetings on a regular basis to provide feedback on any outstanding or contentious environmental matter.

2.2.3 Failure to comply with the EA and EMPr

The WfWetlands Programme, as the holder of the Environmental Authorisation, is responsible for ensuring compliance with the conditions by any person acting on their behalf including Implementing Entities. The EA holder must notify the DEA in writing within the period specific in the EA if any condition in the Environmental Authorisation is or cannot be complied with. Upon receiving such notification the DEA (Compliance Directorate) will assess the reported non-conformance and inform the EA holder of further actions and submissions required.

In addition to the above, the ECO may order the Implementing Entity to suspend part or all of the works if, based on the ECO's reasoned opinion, the Implementing Entity has, is in the process of or will cause significant environmental damage and/or cause a non-conformance to the EA and/or EMPr. The ECO shall report this instruction to the WfWetlands' *Deputy Director: Programme Implementation* **within 24 hours** of the instruction being issued. Should the aforementioned suspension of work be as a result of negligence or actions by the Implementing Entity, no extension of time will be granted for such delays and all costs will be borne by the Implementing Entity. Apart from direct non-compliance with the EA or EMPr, the following will be regarded as indirect non-compliance:

- Failure to comply with corrective or other instructions issued by the Implementing Entities, ECO or Competent Authority within a specified time.
- Failure to produce the supporting documentation proving compliance with the EA or EMPr.
- Failure to ensure that sub-contractors appointed by the Implementing Entity comply with the EA and EMPr.



3 PRECONSTRUCTION/PLANNING PHASE

3.1 Compliance with environmental legislation

Ensure relevant approvals from regulatory authorities are obtained, in particular in terms of:

- National Environmental Management Act (No. 107 of 1998) (NEMA), as amended;
- National Water Act (No. 36 of 1998);
- National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004);
- National Forests Act (No. 84 of 1998);
- National Heritage Resources Act (No. 25 of 1999); and
- Other provincial and local environmental legislation.

3.2 Submission of method statements

- Method Statements must be compiled by the Implementing Entity.
- All Method Statements must be submitted and approved prior to site establishment commencing.
- The content and required actions of the Method Statements must be communicated to site staff through a compulsory environmental induction.
- Approved Method Statements will be dated and signed by all relevant parties (Implementing Entity, ECO, DEA, Engineer).
- Should a Method Statement need to be revised, a formal revision will be issued, signed and dated. The updated Method Statement will be filed in the SEF.
- The submitted Method Statements (see Annexure B) will include but not be limited to:
 - Site division, demarcation and no-go areas (incl. site camp establishment, access, construction working widths).
 - Site clearance and topsoil management.
 - Stockpiling and laydown areas.
 - Solid waste management (general and hazardous, incl. disposal).
 - Hazardous substances storage and management.
 - Contaminated water management and disposal.
 - Cement storage and handling as well as concrete batching.
 - Fuel storage and management.
 - Ablution facilities and eating areas.
 - Dust and noise/nuisance control.
 - Protection of flora, fauna and natural features.
 - Stormwater management and erosion.



- Site de-establishment and rehabilitation.
- The submission of a site layout plan (see Annexure B) by the IE to the ECO for approval is compulsory. The layout plan must indicate all areas of relevance including *inter alia*:
 - The location of the site camp as well as the site camp layout indicating the location of materials storage (general and hazardous), fuel storage, the site office, ablution facilities, vehicle/machinery parking areas.
 - Access to the site camp and intervention sites.
 - Any required stormwater management measures such as diversion berms, cut-off drains, silt fences etc.
 - Stockpiling and laydown areas.
 - Concrete/mortar mixing/batching areas.
 - No-go or sensitive areas.
 - Limit(s) of the construction footprint.

The layout plan must take into consideration the buffer distances and restrictions as specified in the EMPr. Where applicable²² the IE must make use of multiple layout plans to indicate the location of the abovementioned areas.

3.3 Environmental induction/training

Training and induction forms an integral part of ensuring and maintaining compliance with the EA and EMPr. Every person on site needs to understand the importance of compliance with the EA and EMPr and their specific role(s) in achieving this. Environmental induction and/or training must be specific or relevant to the level of responsibility of the person receiving the training. Environmental training and/or induction shall comply with the following requirements:

- The Implementing Entity and any other staff with management responsibilities (e.g. HSE officer and the foreman) will undergo environmental compliance training prior to construction commencing. The induction/training shall include project specific requirements for compliance with the EA and EMPr and responsibilities assigned to each party.
- Once the Method Statement is approved, a copy of the Method Statement must be circulated and communicated to the responsible parties (see Section 3.2).
- General staff will receive a simplified environmental induction and/or training before the commencement of construction (i.e. site establishment). The induction/training shall address, but not be limited to, basic environmental awareness, basic health and safety awareness, prevention of water, soil, and air pollution, prevention of soil erosion and sedimentation, basic principles of materials handling and storage, fire risks, protection of fauna and flora, removal of invasive alien species (if relevant), emergencies and incident responses, spill response provisions, social responsibility, and administrative and reporting procedures.
- All project personnel shall further be trained in basic wetland awareness, including a basic understanding of the components of wetlands, how wetlands function, the benefits they provide,

²² Where the “site” covers an extensive area or where a large number of interventions are to be constructed.



why they need to be conserved and used sustainably, and the importance of rehabilitation in contributing to wetland conservation and sustainable use.

- Where work takes place in areas containing dangerous game, especially nature reserves and national parks, participants shall receive training in basic animal behaviour. A person trained in dangerous animal behaviour shall be present and suitably equipped to deal with such threats at all times. Before work commences each day, the site shall be checked for dangerous animals by the trained person. First aid training shall include current treatments for snakebites.
- Provision must be made for quarterly refresher environmental training to be undertaken during the course of the contract. The Implementing Entity shall ensure that all attendees sign an attendance register, and shall provide the Implementer with a copy of the attendance register the day after each course.
- Daily/weekly *Toolbox Talks* should include an environmental topic/issue in addition to a Health and Safety topic/issue.
- Proof (training material, attendance registers, photos) of training and attendance to be filed in SEF.
- Include environmental considerations as an item on the agenda of the monthly site meetings.



4 CONSTRUCTION PHASE

4.1 Compliance with the EA and successful implementation of EMPr, environmental specifications and other permits/licences

Identified impacts: The EA, EMPr and other relevant permits and licences are only of value if the conditions/requirements contained in them are adhered to. As these documents are legal documents, non-conformance in terms of adherence/implementation may constitute an offence and be subject to suspension of the authorisation/permit/licence and possible penalties or fines.

Objective of improved management:

- Continued and consistent compliance with the EA and EMPr as well as environmental specifications and other permits/licences

Specifications:

- The ECO shall be responsible for the implementation of this EMPr for the duration of the construction phase and until rehabilitation is completed.
- The ECO shall have full access to the site at all times.
- Audits²³ undertaken by the ECO shall comply with the requirements of GN R982 (2014, as amended).
- Although the EA/licence/permit holder can transpose contractual liabilities to the Implementing Entity in terms of compliance with the EA, EMPr, Environmental Specification and any other relevant permits/licenses, the EA/licence/permit holder will remain legally liable in terms of compliance.

Table 2: Compliance with the EA and successful implementation of EMPr, environmental specifications and other permits/licences

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none">A copy of the EA, EMPr, Environmental Specifications and any other relevant permits/licenses will be kept in the SEF on site.The Implementing Entity will familiarise himself/herself with the contents and requirements of the EA, EMPr, Environmental Specifications and any other relevant permits/licenses.	Implementing Entity, EA holder, ECO

²³ The ECO is responsible for providing an independent evaluation of compliance with the EMPr and not for enforcement of the conditions of the EMPr. The responsibility of enforcement of the conditions of the EMPr lies with the EA holder.



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> The Implementing Entity and/or EA holder will not knowingly proceed with any action which might compromise compliance with the EA, EMPr, Environmental Specifications or any other relevant permits/licenses. 	
Mitigation	<ul style="list-style-type: none"> Should a situation arise where compliance with the EA, EMPr, Environmental Specifications or any other relevant permits/licenses is likely to be compromised/deviated from due to exceptional circumstances or a change in scope of work, the Implementing Entity will notify the ECO immediately. The ECO will assess the type of deviation and its significance and will advise the Implementing Entity whether the deviation requires an amendment to the EA, EMPr, Environmental Specifications or any other relevant permits/licenses. 	Implementing Entity, EA holder, ECO
Stop work	<ul style="list-style-type: none"> Should a situation arise where there is accidental or intentional non-conformance with the EA, EMPr, Environmental Specification and any other relevant permits/licenses, the ECO may order all work to stop until such non-conformance has been assessed, reported to the relevant authority (if necessary) and appropriately mitigated A non-conformance will be recorded in writing by the ECO with a description (and photographic evidence where applicable) of the incident/non-conformance. A non-conformance report will contain detailed actions and action dates for each responsible party and will be signed off by the ECO and IE once completed/closed out. 	Implementing Entity, EA holder, ECO
Monitoring method and frequency	<ul style="list-style-type: none"> Daily/weekly monitoring by Implementing Entity. Formal monthly audits by ECO. 	Implementing Entity, EA holder, ECO
Management outcomes	<ul style="list-style-type: none"> Full and continued compliance with the EA, EMPr, Environmental Specifications and any other relevant permits/licenses. Identification of possible deviations in advance to avoid non-conformances. Independent and impartial monitoring of compliance by the ECO. 	Implementing Entity, EA holder, ECO



4.2 Site establishment

Identified impacts: Site establishment can often have a significant environmental impact in terms of vegetation clearance and/or the construction footprint and therefore needs to be carefully managed. It is also usually during site establishment that the site camp and laydown areas are identified and demarcated. If the aforementioned is not properly planned, it could have several secondary impacts such as water pollution, soil contamination, erosion and excessive dust.

Objective of improved management:

- To avoid excessive disturbance in terms of vegetation clearance and the construction footprint.
- Ensure that activities/facilities/site structures with pollution potential are located outside buffer zones and no-go areas, preferably in already disturbed or transformed areas. Examples include the site camp, material laydown areas, concrete batching plant, ablution facilities etc.
- Ensure that all activities remain within the approved construction footprint.

Specifications:

- Site establishment will not commence until such time that the EA appeal period has passed and will further be subject to the approval of the required method statements by the ECO.
- The wetland boundary shall be demarcated on the site plan and on site.
- Demarcation will be by means of brightly painted/white pegs/poles at least 1.5m in height and placed at regular (10m for linear or on every corner for non-linear) intervals on both sides of the approved construction footprint. **Demarcation shall be maintained for the duration of construction.**
- Danger tape and/or snow/barrier netting shall only be used for health and safety requirements along excavations or high risk areas.
- All areas outside approved and demarcated footprint are to be treated as no-go areas.

Table 3: Specific avoidance, mitigation and cessation management measures related to impacts identified with site establishment

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none">• The Implementing Entity must prioritise the use of disturbed areas for site camp establishment, laydown areas and stockpile areas.• The site camp shall be clearly demarcated and fenced subsequent to approval of the ECO.	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> The site camp, laydown and stockpile areas may not be established within any environmentally sensitive area. Refer to Annexure C for sensitivity and wetland boundary map. Should an extension/amendment to the construction footprint be required, the Implementing Entity must submit such a request to the ECO for approval prior to extending the construction footprint. All work will be executed within the approved working area. Temporary laydown areas will not be used for a period exceeding four (4) weeks and must be approved by the ECO prior to being used. Temporary laydown areas must be demarcated should it fall outside the approved construction footprint. The Implementing Entity is to ensure that all staff (e.g. plant operators, general workers) are informed of no-go areas as part of the induction/environmental awareness training. 	
Mitigation	<ul style="list-style-type: none"> Should the Implementing Entity disturb an area outside the approved footprint, then the Implementing Entity will be held liable to reinstate the impacted area to its original condition. All temporary footprint areas must be reinstated/rehabilitated at the end of construction. 	Implementing Entity
Stop work	<ul style="list-style-type: none"> Should the Implementing Entity fail to remain within the approved construction footprint or intentionally/negligently cause damage to a natural feature in a no-go area, the ECO reserves the right to suspend or partially suspend construction via written instruction in order to allow for the assessment, reporting and rectification of the impact. The aforementioned will be determined by the type and significance of the non-conformance and the risk of it reoccurring should construction proceed. 	ECO, Engineer
Monitoring method and frequency	<ul style="list-style-type: none"> Daily and weekly monitoring/inspections by the Implementing Entity. Formal monthly audits by the ECO. 	ECO, Implementing Entity



Management Measure	Detailed Description	Responsibility
Management outcomes	<ul style="list-style-type: none"> • Method Statements are submitted at least 14 days prior to the commencement of site establishment. • Site establishment only commences after approval of the Method Statements. • Already disturbed areas are prioritised for site camp, laydown and stockpile areas. • Construction footprint and vegetation clearance is controlled and kept to a minimum. • Activities are restricted to within the approved construction footprint. • Demarcation remains visible and in place for the duration of construction. 	Implementing Entity, EA holder, ECO



4.3 Channels of communication for public complaints

Identified impacts: The construction activities could lead to nuisance impacts and impacts on the adjacent properties. This may result in complaints from the public and/or adjacent landowners

Objectives of improved management:

- To record and address (within a reasonable timeframe) any complaints by the public arising from the construction activities and the impacts thereof.

Specifications: None

Table 4: Specific avoidance, mitigation and cessation management measures related to impacts identified with public complaints

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> The IE must contact the landowner and/or occupier of the land where the construction is to take place at last 10 working days prior to moving onto site. The IE must confirm the procedure to be followed for access including gates which must remain locked or open. The Implementing Entity must ensure that the site remains neat and that no littering occurs. Ensure that the public and adjacent landowners are informed well in advance of any construction activities to take place in the vicinity of their properties. Where the site is located in a nature reserve/park, the Implementing Entity must familiarise him/herself with the rules and regulations of the reserve/park and where necessary include such information in the environmental induction and training. Where the site is frequently visited by tourists, the Implementing Entity must ensure that his/her site does not cause a visual or noise disturbance. Also refer to the Code of Conduct attached under Annexure A. 	Implementing Entity
Mitigation	<ul style="list-style-type: none"> Provide a contact number of person responsible for the site on the site signage. Maintain a complaints register on site to allow public complaints to be recorded. 	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Verbal complaints must be recorded within 24 hours of being received with a copy provided to the complainant. Actions to address the complaints must be recorded in writing with sign-off by the ECO once the actions have been completed. Address all complaints within a reasonable timeframe (24 hours for initial contact and 5 working days to resolve minor issues or complaints). Ensure that actions are recorded in the SEF and the actions are implemented to avoid the future complaints regarding the same issue. 	
Stop work	<ul style="list-style-type: none"> Should a complaint relate to an action by the Implementing Entity which can cause/has caused a serious health and safety or environmental impact, the ECO may suspend or partially suspend work via instruction from the Engineer in order to assess the impact/complaint and identify any remedial actions required. 	ECO
Monitoring method and frequency	<ul style="list-style-type: none"> Reporting of serious complaints within 24 hrs to the ECO. Address all complaints within a reasonable timeframe (24 hours for initial contact and 5 working days to resolve minor issues or complaints). Ensure that all complaints are recorded in the complaints registered and that remedial actions are recorded, implemented and maintained. Daily and weekly monitoring/inspections by the Implementing Entity. Formal monthly audits by the ECO. 	Implementing Entity, ECO
Management outcomes	<ul style="list-style-type: none"> The public is timeously informed of construction activities which might impact them. Contact details of the Implementing Entity is visible on site signage at the site camp. A register is available at the site camp to record any community/public complaints. 	Implementing Entity, ECO



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> • All public complaints are recorded and closed out within a reasonable timeframe (24 hours for initial contact and 5 working days to resolve minor issues or complaints). • Repeat complaints regarding the same matter/issue are avoided. 	



4.4 Vegetation clearance

Identified impacts: Various activities that take place during the construction phase require the removal of vegetation, including clearing of the construction footprint for construction activities, site camp establishment, laydown and stockpile areas and access roads.

Objective of improved management:

- To retain natural vegetation in terrestrially sensitive areas.
- To minimise the extent of disturbance of vegetation/habitats on-site.
- Avoid the loss of species of conservation concern.

Specifications:

- Vegetation clearance must be restricted to the approved construction footprint.
- Removal of vegetation must occur at increments and must only be done up to two weeks ahead of actual construction commencing in an area.
- No burning of vegetation will be allowed.
- Where vegetation consists of grasses, bulbs and shrubs, it will be cleared (i.e. complete removal of the vegetation with its root system) as part of the removal of topsoil (i.e. to a maximum depth of 30cm) in order to maximise organic content and the available seedbank in the topsoil.
- Where vegetation consists predominately of reeds, the reeds will be slashed/cut to 30cm in height, measured from ground level, with the remainder of the plant and its root/rhizome system removed with the topsoil layer (i.e. at a maximum depth of 30cm).
- Vegetation/ plant material is not allowed to be disposed of as waste at a landfill site and should be stored for mulching purposes upon completion of the construction works.

Table 5: Specific avoidance, mitigation and cessation management measures related to impacts identified with vegetation clearance

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none">• Limit vegetation clearance in “sensitive areas” as identified in the BAR and as indicated on the maps under Annexure C.• Prioritise the use of already disturbed and degraded areas for site camps, laydown and stockpiling areas.	Implementing Entity, ECO



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Do not remove/clear vegetation outside the approved construction footprint. Ensure that site demarcation is maintained throughout the construction phase. Clearly mark shrubs and trees which should not be disturbed/damaged during construction. Remove/relocate species of conservation concern where possible and practical. 	
Mitigation	<ul style="list-style-type: none"> Ensure that all temporary footprint areas are rehabilitated at the completion of construction in a specific area. Ensure that topsoil is removed and conserved in order to ensure successful revegetation/rehabilitation (also see Section 4.5). Any area disturbed outside the approved construction footprint must be reinstated at the Implementing Entity's cost to the satisfaction of the ECO. Ensure that sufficient funds are allocated in the BoQ for rehabilitation of temporary footprints. 	Implementing Entity, ECO, Engineer
Stop work	<ul style="list-style-type: none"> Should the Implementing Entity fail to remain within the approved construction footprint or intentionally/negligently cause damage to a natural feature/vegetation in a no-go area, the ECO reserves the right to suspend or partially suspend construction via instruction from the EA holder in order to allow for the assessment, reporting and rectification of the impact. The aforementioned will be determined by the type and significance of the non-conformance and the risk of it reoccurring should construction proceed. 	ECO, Engineer
Monitoring method and frequency	<ul style="list-style-type: none"> Daily and weekly monitoring/inspections by the Implementing Entity. Formal monthly audits by the ECO. 	Implementing Entity, ECO
Management outcomes	<ul style="list-style-type: none"> Work is contained to the approved construction footprint. Site demarcation is maintained for the duration of construction. 	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> • Vegetation clearance is limited in sensitive areas. • No site camps, laydown or stockpile areas in sensitive areas. • Plants of conservation concern are relocated where possible and feasible (with the necessary permits/licences/approvals in place). • Temporary footprint areas are rehabilitated once work in an area has been completed. • Topsoil is removed and managed properly (see Section 4.5 below) to aid in successful rehabilitation. 	



4.5 Topsoil management

Identified impacts: Topsoil is an essential component to achieve successful rehabilitation/revegetation of a disturbed area. Poor topsoil management practices such as double handling, compaction, contamination, erosion and failing to control weeds/alien invasive species on stockpiles all contribute to the degradation and loss of topsoil. This in turn compromises the success of rehabilitation or results in additional costs to improve or import topsoil.

Objective of improved management:

- To ensure that topsoil is properly removed and managed during construction in order to enable successful rehabilitation at the completion of construction.

Specifications:

- Topsoil must be removed to a maximum depth of 30cm.
- Where the topsoil layer is shallow or alternating in depth, it must be removed to the maximum depth possible.
- Topsoil removal must occur at increments and will only be done up to two weeks ahead of actual construction commencing in an area.
- Topsoil will be removed with the appropriate equipment i.e. pointed or flat tip shovel/spade and a wheelbarrow.
- Topsoil stockpiles must be stored on level areas to a maximum height of 1.5m. The stockpile areas will be properly planned and will be approved as part of the site demarcation process and will be indicated on the site layout plan.
- Stockpiles will not block access routes or endanger any person or animal.
- The stockpiles must be protected from erosion and contamination by subsoil or imported materials.
- Topsoil will not be driven over or compacted and stockpiles will not be reworked or moved unnecessarily.
- Topsoil stockpiles must be kept free of weeds for the duration of construction until reapplied during rehabilitation.
- Topsoil will only be reapplied after all civil work has been completed in order to avoid compaction.

Working in peat wetlands:

Some of the wetlands identified for priority rehabilitation may occur in soils with a high organic composition, known as peat. These soils hold huge importance globally due to their nature to hold high levels of carbon (known as carbon sequestration). The following considerations should be made for site clearance in peatlands:



- Work shall only be done in periods with low rainfall (Winter rainfall areas - November to March and Summer rainfall areas - May to September).
- No material will be removed from the peatland for construction purposes e.g. boulders, rocks, sand.
- All access to the intervention site in the peatland will be by foot, no vehicles will be allowed in the peatland.
- Where materials need to be transported into the peatland, it will be done by means of wheelbarrows on demarcated walkways lined by wooden planks, geotextile or similar material.
- The Implementing Entity will use only one access path/point per Intervention Point and will not create multiple access paths or points.
- No foreign vegetable matter (e.g. mulch) may be brought into the wetland area (especially from alien species).
- Topsoil shall be removed specifically in the form of sods (20 to 20cm (length) x 20cm (width) x 20cm (depth)):
 - The first sod shall include the roots/rhizome layer (i.e. the rootstalks and their associated nodes/tubers)
 - The sods shall be stored in a wet area, on site, in their original orientation and order.
 - Vegetation can be cut short if it will make it easier to handle the sods.
 - Soil shall be stockpiled according to the different soil layers (i.e. in separate stockpiles) as per the soil profile. Where possible, soils shall be stockpiled as high as possible to retain moisture, but not higher than 0.5m.
 - Stockpiles will be located in a saturated area with shallow surface water immediately adjacent to the Intervention Point. Sods will be placed on the existing vegetation. Where vegetation height exceeds 30cm, the vegetation can be cut and used as mulch/cover layer.
 - The stockpile area will be indicated by means of painted pegs at each corner.
 - Stockpiles shall only be handled twice i.e. during removal and during placement for rehabilitation.
 - Stockpiles shall be covered with 10cm mulch or cloth (geotextile with <0.5cm aperture) to ensure that the moisture content is maintained by restricted evaporation and evapotranspiration.



Table 6: Specific avoidance, mitigation and cessation management measures related to impacts identified regarding topsoil management

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> Ensure topsoil is stockpiled in areas on site where opportunity for compaction and contamination due to other construction activities are limited. Avoid moving/handling the topsoil more than twice (i.e. restricted to initial stripping and final reapplication). Ensure weeds and alien invasive species are removed from the stockpiles prior to reaching seed formation stage. Do not move topsoil between different areas on site i.e. it should be reapplied in the same area that it was removed from. 	Implementing Entity
Mitigation	<ul style="list-style-type: none"> Remove more than 15cm of topsoil where possible to compensate for areas of shallow/no topsoil as well as topsoil loss due to mismanagement. Apply mulch to the topsoil if the topsoil quality has been impacted significantly and will compromise the success of revegetation (based on the reasoned opinion of the ECO or wetland specialist). Enforce a stricter and more frequent weeding/alien invasive removal regime where there was failure to remove weeds/alien invasive species from topsoil stockpiles prior to seed formation stage. 	Implementing Entity, ECO, Engineer
Stop work	N/A	
Monitoring method and frequency	<ul style="list-style-type: none"> Use of approved site layout to confirm correct location of topsoil stockpiles. Continuous monitoring during initial topsoil removal/stripping. Weekly to bi-weekly monitoring of stockpiles for signs of erosion and weeds. Monthly audits for general topsoil management practices. 	Implementing Entity, ECO
Management outcomes	<ul style="list-style-type: none"> Topsoil is removed to a minimum depth of 15cm. Topsoil is not contaminated by other materials. 	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> • There is no compaction of topsoil. • Topsoil is not eroded or washed away. • Handling of topsoil is restricted to initial removal and final reapplication. • The topsoil applied during rehabilitation matches the quality and thickness of topsoil removed during site clearance. • Weeds and alien invasive species on topsoil stockpiles are removed on a regular basis prior to the plants reaching seed formation stage. 	



4.6 Materials management (non-hazardous)

Identified impacts:

- Material delivered to areas not approved by the ECO and Engineer e.g. outside the approved construction footprint, on steeply sloped areas, etc.
- Imported materials introduce new alien invasive species to site.
- Materials spilling from vehicles causing a safety or pollution risk.
- Materials are eroded and washed into wetland systems as a result of being stockpiled in areas with concentrated stormwater runoff or on sloped areas.
- Materials are mixed with the underlying natural ground surface causing contamination of soil, excessive quantities of material remaining on site after construction, localised plant die-off, increase in sedimentation etc.
- Wetland systems are impacted and/or polluted due to an insufficient buffer width between site camps, laydown and stockpile areas and water resource.
- Materials susceptible to wind erosion results in a dust nuisance and contamination of surrounding areas.
- Materials are stored on site for extended periods leading to the need for increased storage area due to materials not being used.

Objectives of improved management:

- Ensure material delivery and storage takes place in such a manner that it does not cause pollution or degradation of the surrounding environment.
- Plan material use and delivery in order to ensure that material storage on site does not take place for extended periods of time (i.e. > 4 weeks).
- Minimise the use of intact/undisturbed areas for material stockpiling/storage.
- Minimise exposure of materials to wind and water erosion.
- Ensure that materials are stored on site for the shortest possible period to limit the extent of areas required for storage and stockpiling.

Specifications: None



Table 7: Specific avoidance, mitigation and cessation management measures related to impacts identified with materials management (non-hazardous)

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> It will be the Implementing Entity's responsibility to ensure that delivery drivers/suppliers are aware of the relevant EMP requirements. The Implementing Entity shall ensure that materials are sourced from legal and approved sources. If unsure the Implementing Entity will obtain permission from the ECO prior to using a certain material resource. Imported materials shall be free of weeds, litter and contaminants. Materials shall be appropriately secured to ensure safe passage between destinations. Loads including, but not limited to, sand, stone chip, fine vegetation, refuse, paper and cement, shall have appropriate cover to prevent them spilling from the vehicle during transit. The Implementing Entity shall be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials. The Implementing Entity will identify appropriate storage and laydown areas prior to delivery to site. The areas will be approved by the ECO either as part of the required Method Statement or on an <i>ad hoc</i> basis. Open, disturbed areas will be prioritised for stockpiling and laydown areas. Bulk stockpile areas will be outside the wetland boundary and any other areas prone to seasonal flooding unless otherwise approved by the ECO. The Implementing Entity will schedule the delivery of materials in such a manner that it does not require excessive periods (>4 weeks) of on-site storage unless otherwise approved by the ECO e.g. where delivery/source distances are excessive. Minor stockpiles (not covering an area exceeding 4m² unless otherwise approved by the ECO) will be allowed next to an Intervention Point for specific use at the Intervention Point. Minor stockpiles next to intervention sites will be utilised within 2 weeks of the material being stockpiled i.e. it will not be left adjacent to a planned or completed Intervention Point for an excessive period of time. 	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Laydown and storage areas where such occurs on vegetation, topsoil or in a wetland shall be on hessian, PVC sheeting or a similar material in order to separate the imported material from the vegetation/topsoil and to ensure easy and proper removal of excess material. Stockpile heights will be limited to 1.5m where the material is fine (i.e. susceptible to wind erosion) or in areas known to regularly (weekly to fortnightly basis) experience wind speeds exceeding 20km/h. Alternatively, material which can be windblown will be covered with shade cloth, PVC sheeting, hessian or similar suitable material. Stockpile areas will be flat and not subject to concentrated stormwater runoff or surface water flow. Materials such as precast pipes and culverts, gabions baskets, MacMat-R, hessian etc. can be placed directly on vegetated areas to avoid the disturbance and clearance of vegetation and topsoil. This will be at the discretion of the ECO based on the merits of avoiding vegetation and topsoil removal. 	
Mitigation	<ul style="list-style-type: none"> Should material be washed or blown into the surrounding environment, the Implementing Entity will be responsible for the removal/recovery of such material. Whether removal/recovery is required will be determined by the ECO based on the type of material, volume of material and whether the material can be recovered/removed without causing substantial additional degradation of the surrounding environment. Materials not used at a specific Intervention Point will be removed once the activity requiring the material has been completed e.g. stones for gabions. Where sand/fill material is legally sourced from a dam, existing borrow pit or similar with clear presence of invasive alien species, the Implementing Entity will allow for a weeding programme at the on-site stockpile area and Intervention Point. The weeding programme will span a winter and summer period consecutively to ensure that introduced invasive alien and weed species are removed prior to seed formation stage. All remaining/waste material will be removed off-site before or by the end of construction. 	Implementing Entity
Stop work	N/A	



Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	<ul style="list-style-type: none"> Daily and weekly monitoring/inspections by the Implementing Entity. Formal monthly audits by the ECO. 	Implementing Entity, ECO
Management outcomes	<ul style="list-style-type: none"> Imported materials are stored/stockpiled on already disturbed areas within the approved construction footprint. Material delivery and storage takes place as in such a manner that it does not cause pollution or degradation of the surrounding environment. Materials are not eroded and/or deposited in the surrounding environment. Materials are used within four weeks of delivery. No new or additional alien invasive species are introduced via imported material. Where such are imported, the Implementing Entity implemented a weeding programme spanning at least one winter and one summer i.e. a year. All imported material is removed from site at the completion of construction. 	



4.7 Hazardous chemicals and potential hazardous substances

Identified impacts:

- Includes, but are not limited to: drums of fuel, grease, oil, brake fluid, hydraulic fluid, paint, batteries and herbicides (for alien plant clearing), etc.
- Spills resulting in pollution of nearby aquatic systems and water resources.
- Spills resulting in soil contamination and degradation.
- Fauna and/or (indigenous) flora fatalities/die-off.
- Illegal/improper disposal of materials contaminated with hazardous product/spill.

Objectives of improved management:

- Ensure the controlled and documented management of hazardous chemicals and substances.
- Avoid and minimise spillages through proper storage and dispensing practices.
- Ensure that the appropriate mitigation measures are in place in the event of a spill.
- Ensure that hazardous materials are stored in designated/approved areas away from sensitive receptors/environments.

Specifications:

- The Implementing Entity must supply the ECO with a list of all hazardous materials that would be present on site during the construction period.

Table 8: Specific avoidance, mitigation and cessation management measures related to impacts identified with hazardous materials management

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none">• All hazardous materials and products must be stored in containers marked as per SANS 10234 requirements i.e. in its original container.• All containers will have lids and stored in a covered and bunded area or in a flammables/hazardous store with a metal drip tray able to contain 110% of the volume of the largest container.	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> A register of hazardous materials and products will be kept at the site officer or flammables/hazardous store together with up to date Material Safety Data Sheet (MSDS). Containers with a volume of more than 20l will have proper dispensing equipment. Dispensing of hazardous materials into smaller containers or equipment will only occur at the site camp on a lined or impermeable surface- Hazardous materials and products will only be stored at the site camp. 	
Mitigation	<ul style="list-style-type: none"> The Implementing Entity must ensure that there is an emergency procedure in place to deal with accidents and incidents (e.g. spills) arising from hazardous substances. The Implementing Entity must ensure that all personnel on site are properly trained concerning the proper use, handling and disposal of hazardous substances. The Implementing Entity must report major incidents to the ECO immediately. Any spill incidents must be cleaned up immediately and in according with the emergency procedure 	Implementing Entity
Stop work	<ul style="list-style-type: none"> Should the Implementing Entity through negligent or wilful action/behaviour cause a significant/major spill or dispose of hazardous materials illegally, the ECO reserves the right to suspend or partially suspend construction via instruction from the EA Holder in order to allow for the assessment, reporting and rectification of the impact. Depending on the severity of the non-conformance, the ECO will also inform the relevant competent authority to confirm the Implementing Entity's liability to be prosecuted and/or fined. 	ECO, EA Holder
Monitoring method and frequency	<ul style="list-style-type: none"> Visual inspection. Immediate response to spillage. Completion of an incident form for major spillages (>5l). Reporting of major spills within 24 hrs to the ECO. 	Implementing Entity, ECO



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Daily and weekly monitoring/inspections by the Implementing Entity. Formal monthly audits by the ECO. 	
Management outcomes	<ul style="list-style-type: none"> Hazardous materials are properly managed including recording keeping, storage, dispensing and disposal. Spillages are avoided and minimised through proper storage and dispensing practices. All personnel on site are properly trained concerning the proper use, handling and disposal of hazardous substances. The Implementing Entity has a designated and trained individual on-site to respond to spills on site. Spillages are removed/cleaned/treated immediately after occurring. Ensure that the appropriate mitigation measures are in place and implemented in the event of a spill. Hazardous materials are stored in designated/approved areas away from sensitive receptors/environments. Spills are reported to the ECO within 24hrs of occurring. Spilled hazardous product and materials used for clean-up are stored and disposed of as hazardous waste or collected by a registered service provider. 	Implementing Entity, ECO



4.8 Contamination of soils and water

Identified impacts: Soil and water can be contaminated or polluted by construction activities via several pathways. In terms of soil contamination, pollution can result in the soil being unsuitable for certain land uses and it can also indirectly contribute to sustained pollution of both surface and groundwater resources. The pollution of water resources can lead to numerous direct and indirect impacts including the following:

- Water becoming unsuitable for certain uses such as human consumption and certain agricultural activities due to a decline in water quality.
- A loss of aquatic biodiversity through a change in species composition and diversity and/or species die-off in reaction to a decline in water quality.
- An increase in alien invasive fauna and flora species as a result of higher tolerance capacity in terms of water quality changes/deterioration.
- Increased costs of treating contaminated water for human consumption.

Objective of improved management:

- To conduct/manage construction activities in such a manner that the contamination of soil and water resources is avoided and/or minimised.

Specifications: None

Table 9: Specific avoidance, mitigation and cessation management measures related to impacts identified regarding contamination of soil and water

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none">• Ensure that all equipment, machinery and vehicles are in good working order.• No maintenance will take place on site and broken equipment, machinery and vehicles must be removed off-site within 24 hours of the breakdown.• Use drip trays for all stationary or parked equipment, machinery and vehicles showing signs of leakage.• Ensure that substances that pose a risk of water/soil contamination are appropriately stored and disposed of (also refer to Section 4.7).• Site camps are not allowed in a wetland.• Hazardous materials storage areas are not allowed within 100m of watercourses.	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Concrete mixers may only operate on a stable, level site. Concrete shall be mixed on trays or other suitable lining material to prevent contamination of the soil and/or waterbodies. Ensure that minor mixing of concrete and mortar is done on impermeable surfaces or in wheel barrows. Store chemicals in clearly marked, sealable containers in bunded areas as approved by the ECO. Inspect the containers at regular intervals for any leaks. Use proper dispensing equipment on containers for hazardous products and store the dispensing equipment in weatherproof containers when not in use. Ensure that equipment and plant is in proper working condition and do not leak fuel or oil, especially during work in or near watercourses. Ensure designated staff are trained in the prevention and mitigation of spills. The construction camp and any major stockpiling or storage areas should be outside any watercourse unless otherwise approved by the ECO. Stormwater runoff must be diverted around the site camp and stockpile areas (material susceptible to erosion) by means of cut-off berms or trenches to avoid contamination of clean overland runoff. Stockpiles (topsoil, subsoil and imported materials such as sand and fill material) must be on flat surfaces in areas which are not susceptible to concentrated stormwater runoff or flow. Ablution facilities must be located outside the boundary of any watercourse unless otherwise approved by the ECO. Workers should not be allowed to urinate or defecate near or in bushes or rivers/streams. 	
Mitigation	<ul style="list-style-type: none"> All spills to be contained and adequately cleaned-up or treated <i>in situ</i>. Conduct activities with high pollution potential in the low rainfall months. 	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Use designated washing areas for all equipment used for concrete work with the necessary mechanisms in place to retain contaminated runoff and allow for the necessary treatment/filtering of polluted water. 	
Stop work	<ul style="list-style-type: none"> Should a major spill occur (as per Section 4.7), the ECO reserves the right to suspend or partially suspend construction via instruction from the EA Holder in order to allow for the assessment, reporting and rectification of the impact. Depending on the severity of the non-conformance and degree of negligence on the Implementing Entity's part, the ECO will also inform the relevant competent authority to confirm the Implementing Entity's liability to be prosecuted and/or fined. 	ECO, EA Holder
Monitoring method and frequency	<ul style="list-style-type: none"> Daily visual inspection of equipment, vehicles and machinery for signs of leaks. Immediate response to spillage of product or material with pollution potential. Completion of an incident form for major spillages (>5l). Reporting of major spills within 24 hrs to the ECO. Daily and weekly monitoring/inspections by the Implementing Entity. Formal monthly audits by the ECO. 	Implementing Entity, ECO
Management outcomes	<ul style="list-style-type: none"> All activities and materials with a notable pollution potential or located away from any watercourse unless otherwise approved by the ECO. All the necessary pollution prevention measures are in place. Plant is in good and working condition with leaks repaired immediately or the plant removed from site where more extensive repairs are required. All hazardous products/materials are handled/managed correctly as per Section 4.7. All hazardous liquid product spills are cleaned/treated/removed immediately as per procedure under Section 4.7. 	Implementing Entity



4.9 Concrete mixing and cement handling

Identified impacts: Concrete batching/mixing operations can have several impacts, most notably soil and water pollution (increase in pH, TSS, TDS and minor levels of Aluminium, Iron and Magnesium oxides) as a result of cement laden runoff not being properly contained or purposeful discharge of cement laden runoff. Poor cement handling, storage and disposal practices can also contribute to the aforementioned impacts. Hardened concrete is however stable and inert as a waste.

Objective of improved management:

- Ensure proper cement handling, storage and disposal, avoiding discharge or disposal into the environment.
- Ensure that cement laden water/runoff from concrete/mortar mixing and application activities is collected and retained on site to allow for reuse in construction activities, avoiding discharge into the environment.

Specifications:

- A concrete batching plant/portable mixer will not be allowed to operate until a temporary washwater and runoff containment system has been constructed/established.

Table 10: Specific avoidance, mitigation and cessation management measures related to impacts identified in terms of concrete batching and cement handling

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> • Where concrete is mixed in bulk (i.e. portable concrete mixer), the following will apply: <ul style="list-style-type: none"> ○ The mixer will be placed on a level, surfaced/lined area. ○ Bulk mixing will not occur in the wetland unless the distance from the wetland boundary to the Intervention Point necessitates <i>in situ</i> mixing. This must be approved in all instance by the PC/ECO prior to the commencement of bulk mixing concrete. • Cement storage will be in a closed container. • Waste or contaminated cement powder will be stored in a marked container with a lid until disposal or reuse. • Cement bags must be emptied properly and stored in a weatherproof container until disposal. 	Implementing Entity, ECO



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Minor concrete and mortar mixing will be done on an impermeable surface such as a wooden board, wheelbarrow, metal tray etc. 	
Mitigation	<ul style="list-style-type: none"> Equipment and containers used for minor concrete/mortar work and mixing will be washed in a designated container and the contents disposed of in the settling system at the concrete batching plant. Washwater can alternatively be reused in concrete/mortar mixing or application, but may not be disposed of onto the ground surface or into a water resource. Concrete (not cement) spills will be allowed to harden and removed within 2 days for reuse or disposal as a Type 4 waste to a Class D landfill. 	Implementing Entity
Stop work	<ul style="list-style-type: none"> Mismanagement of waste concrete and/or cement laden runoff can result in the suspension of bulk concrete mixing activities via instruction from the ECO until non-conformances have been rectified to the ECO's satisfaction. 	Implementing Entity, ECO, Engineer
Monitoring method and frequency	<ul style="list-style-type: none"> Daily visual inspection of areas where concrete/mortar work is taking place (Foreman). Weekly inspection of settling system at batching plant (Foreman). Reporting of major spills within 24 hrs to the ECO. Formal monthly audits by the ECO. 	Implementing Entity, ECO
Management outcomes	<ul style="list-style-type: none"> Cement laden runoff is contained to site in an appropriately sized settling system. Cement product is properly handled and stored and does not result in pollution of soil or water resources. No equipment or plant used for concrete/mortar mixing or application is washed in a watercourse. The settling system at the batching plant/portable mixer is maintained and does not overflow. Waste concrete is removed within 2 days and reused or disposed of as inert waste. 	Implementing Entity



4.10 Stormwater management, erosion and sedimentation

Identified impacts: The clearance of vegetation and earthworks associated with construction usually results in an increase in stormwater runoff volume and velocity. This in turn results in an increase in erosion and sedimentation, impacting both terrestrial and aquatic systems. Temporary structures, stockpiles and access roads can also further contribute to a concentration of runoff and resultant increase in erosion and sedimentation on site.

Objective of improved management:

- To avoid and mitigate the increase in stormwater volumes and velocity, thereby reducing erosion and sedimentation on site.

Specifications: None

Table 11: Specific avoidance, mitigation and cessation management measures related to impacts identified in terms of stormwater management, erosion and sedimentation

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> • Vegetation and topsoil clearance will occur at increments and will only be done up to two weeks ahead of actual construction (i.e. excavation) commencing in an area. • Material (excavated and imported) stockpiles will not be located in areas of concentrated runoff/flow. 	Implementing Entity
Mitigation	<ul style="list-style-type: none"> • Stormwater generated on the cleared construction footprint will be allowed to discharge into the surrounding vegetation at regular intervals and will not be allowed to collect and concentrate in large volumes or discharge at high velocities. • Disturbed areas must be rehabilitated as soon as possible after construction has been completed in order to stabilise exposed surfaces which are susceptible to erosion. • Implement temporary stormwater management and erosion prevention measures in areas with high erosion potential (in consultation with the ECO). 	Implementing Entity
Stop work	N/A	



Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	<ul style="list-style-type: none"> • <i>Ad hoc</i> visual inspections of site by the Implementing Entity after rainfall exceeding 15mm per day. • Formal monthly audits by the ECO. 	Implementing Entity, ECO
Management outcomes	<ul style="list-style-type: none"> • Exposed ground surfaces are limited and rehabilitated immediately after completion of construction activities in an area. • Stormwater runoff is dissipated and allowed to discharge at regular intervals. • Erodible stockpiles are located outside areas of stormwater concentration. • The construction site does not contribute notably to erosion on-site and in the immediate vicinity of the site. • Erosion is detected/identified and addressed/mitigated within 14 days of occurring. • Temporary stormwater management and erosion prevention measures are implemented in areas with high erosion potential of signs of extensive erosion occurring. 	Implementing Entity, ECO



4.11 Dust nuisance

Identified impacts: Construction activities will typically lead to dust generation and general exhaust emissions from vehicles and construction plant. Given the limited extent of vegetation clearance and low number of vehicles and construction plant used on a typical WfWetlands site, dust generation is expected to generally be minimal and restricted to mostly a nuisance impact.

Objective of improved management:

- To limit the generation of dust and where needed mitigate dust nuisance.

Specifications:

- Watering for dust suppression purposes is only recommended in instances where dust will create a significant health and/or safety hazard.

Table 12: Specific avoidance, mitigation and cessation management measures related to impacts identified regarding dust nuisance

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> • As far as possible stockpile materials which are prone to become airborne away from areas where dust will be a nuisance or a hazard. • Limit the height of stockpiles which could cause a dust nuisance to 1m. • Where the abovementioned cannot be achieved, cover stockpiles consisting mostly of fine material with shade cloth, hessian or a similar acceptable cover. • Limit earthworks in during windy conditions (i.e. winds above 40 km/h). • Limit vehicle travelling speeds on unsurfaced roads to 40 km/h. 	Implementing Entity
Mitigation	<ul style="list-style-type: none"> • Where dust poses a notable health and/or safety hazard, implement a watering schedule to address the particular area of concern. • Ensure that a watering schedule is maintained over weekends and holidays where a dust nuisance could pose a health and/or safety hazard to the public using the road. • Record and address any public/community complaints regarding dust generation in the Complaints Register. 	Implementing Entity



Management Measure	Detailed Description	Responsibility
Stop work	<ul style="list-style-type: none"> Work causing excessive dust will be halted at wind speeds exceeding 40km/h. Where dust generation leads to/results in a complaint by the public or landowner, the ECO reserves the right to suspend or partially suspend work on site until the source of dust is identified and mitigation measures implemented. 	Implementing Entity, ECO
Monitoring method and frequency	<ul style="list-style-type: none"> Daily visual monitoring. Recording of public complaints regarding dust generation in Complaints Register. 	Implementing Entity
Management outcomes	<ul style="list-style-type: none"> The dustfall rate as specified under regulation 3 of GN R827 (National Environmental Management: Air Quality Act (No. 39 of 2004) - National Dust Control Regulations, 2013) is not exceeded. Stockpiles which could cause a dust nuisance are limited to 1m in height or covered with a suitable material. No public complaints are received regarding dust nuisance and/or health and safety hazard. Where required, a watering schedule is implemented where required i.e. where dust causes a health and/or safety hazard. Alternative dust binding products are used where long-term watering (> 4 weeks) over an extensive area (>1ha) is required. Vehicle travelling speed is limited to 40km/h on unsurfaced roads. 	Implementing Entity, ECO



4.12 Noise nuisance

Identified impacts: Typical construction activities can lead to excessive noise which could cause a disturbance or nuisance to neighbouring land uses/receptors. Typical construction related noise which would usually be regarded as permissible in urban areas might also be regarded as a disturbance in areas such as nature reserves or on farms.

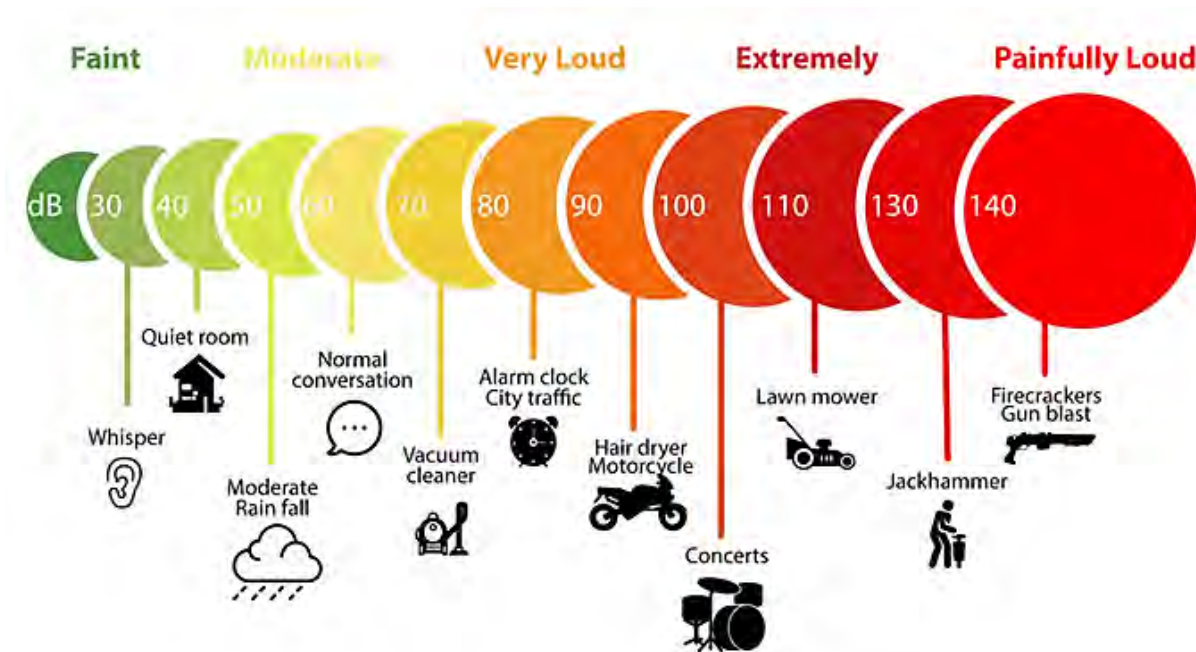


Figure 1: Example of typical everyday noises and related dB values²⁴

Objective of improved management:

- Manage the level and duration of excessive noise generated as a result of construction activities and avoid resultant public complaints. Also ensure that sensitive receptors are notified in advance where excessive noise cannot be avoided for a certain period of time or activity.

Specifications: None

²⁴ <http://ototronixdiagnostics.com/images/decibelthermometer-horizontal.jpg>

Table 13: Specific avoidance, mitigation and cessation management measures related to impacts identified regarding noise nuisance

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> • Fit silencers to equipment as required. • Ensure equipment and vehicles are properly maintained and in working order. • The Implementing Entity shall limit noise levels (e.g. install and maintain silencers on machinery). The provisions of SANS 1200A Sub-clause 4.1 regarding “built-up areas” shall apply to all areas within audible distance of residents whether in urban, peri-urban or rural areas. • Appropriate directional and intensity settings are to be maintained on all hooters and sirens. 	Implementing Entity
Mitigation	<ul style="list-style-type: none"> • Limit working hours with noisy equipment to weekdays between 07H00 and 18H00. • Inform sensitive receptors in advance of construction activities. • Construction activities generating output levels of 50dB (A) or more, in peri-urban areas, shall be confined to the hour's 08h00 to 17h00 Mondays to Saturdays. • Record and address any public/community complaints regarding noise generation in the Complaints Register. • Request formal approval of extension of working hours by the ECO prior to implementing extended hours or working over weekends. 	Implementing Entity, ECO
Stop work	N/A	
Monitoring method and frequency	<ul style="list-style-type: none"> • Daily monitoring (by means of a dB meter application on a cell phone) should any loud activities take place. • Recording of public complaints regarding noise generation in Complaints Register. 	Implementing Entity



Management Measure	Detailed Description	Responsibility
Management outcomes	<ul style="list-style-type: none"> Compliance with the Environment Conservation Act (No. 73 of 1989): Regulations in terms of Section 25 - Noise Control (GN R154, 1992)²⁵. No public complaints are received regarding noise generation and/or health and safety hazard. 	Implementing Entity, ECO

²⁵ Please note: These regulations have been repealed in Gauteng by Gen N 5479 / PG 75 / 19990820; in the Free State by Gen N 24 / PG 35 / 19980424 and in the Western Cape by RN 627 / PG 5309 / 19981120. Proposed Noise Control Regulations have been published for Eastern Cape under Gen N 181 / PG 824 / 20011210. Please also note that various municipalities have their own By-Laws regarding noise control.



4.13 Ablution

Identified impacts: A lack of proper and well placed ablution facilities can result in poor working conditions, health risks as well as environmental pollution.

Objective of improved management:

- To provide sanitary working conditions and avoid health risks and environmental pollution as a result of a lack of ablution facilities.

Specifications: None

Table 14: Specific avoidance, mitigation and cessation management measures related to impacts identified in terms of ablution

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> • Prior to construction commencing the Implementing Entity must provide sanitation for Contractors at a ratio of one (1) toilet for every 15 workers. • Toilets should preferably be located outside the wetland boundary and must be approved by the ECO. • Toilets shall be placed on level surfaces and secured to the ground outside areas susceptible to potential flooding. • The Implementing Entity shall supply toilet paper at all toilets at all times. The Implementing Entity shall ensure that the workers make use of the toilets provided. • The Implementing Entity shall be responsible for the cleaning, maintenance and servicing of the toilets. • The Implementing Entity shall ensure that the toilets are protected from vandals. No litter or general waste shall be placed in the toilets. • Upon completion of the contract, the pit latrines shall be filled in and all structures shall be removed from site. • Washing areas with soap and sufficient clean water shall be provided for hand washing after use of ablutions. 	Implementing Entity
Mitigation	N/A	
Stop work	N/A	



Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	<ul style="list-style-type: none"> • Daily inspection (by the Implementing Entity) to allow for timely removal/servicing of the ablution facilities. • Monthly compliance audits (including checking of disposal slips where relevant) by the ECO. 	Implementing Entity, ECO
Management outcomes	<ul style="list-style-type: none"> • A sufficient number of ablution facilities is provided at locations approved by the ECO. • Toilets are placed on level areas and secured to the ground. • Toilets are provided at a ratio of one (1) toilet for every 15 workers. 	Implementing Entity



4.14 Waste management

Identified impacts: The construction phase will produce typical construction waste such as general waste, waste containers, cement bags, off-cuts etc. The volumes of waste to be generated on a typical WfWetlands site are expected to be low.

Objective of improved management:

- To prevent general littering and to ensure that waste is correctly stored on-site and disposed of off-site. Licenced waste disposal facilities (landfill, transfer, recycling) can be found using the search function at the following link <http://sawic.environment.gov.za/?menu=88>.

Specifications: None

Table 15: Specific avoidance, mitigation and cessation management measures related to impacts identified in terms of waste management

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> Waste will not be buried or burned on site. The quantity of materials and product brought to site will not be in notable excess of what is required for construction. Waste from other construction sites where the Implementing Entity is working will not be brought onto site or stored on site. Waste storage facilities will outside the wetland boundary or other sensitive areas. Waste storage facilities and containers will be weather and scavenger proof with sufficient capacity to avoid waste accumulating outside of the facility or containers. The Implementing Entity shall ensure that general and inert waste does not become contaminated by hazardous waste thereby generating larger volumes of hazardous waste requiring disposal at a Class A landfill. 	Implementing Entity
Mitigation	<ul style="list-style-type: none"> The Implementing Entity shall, in conjunction with the ECO, designate restricted areas for eating. The feeding, or leaving of food, for stray or other animals in the area is strictly prohibited. 	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Waste generated on site will be collected and transported to the waste storage area at the site camp on a daily basis. Each foreman will do a daily inspection/walkthrough of his area and ensure that it is litter free. Waste storage areas will be restricted to the site camp. Hazardous and general waste will be separated and designated and marked bins/containers provided for each. In the case of skippy bins being used, the bins will be covered with secured shade cloth or other cover approved by the ECO. Skippy bins are only allowed for storage of inert waste such as wood off-cuts, hardened concrete etc. Waste transport will be by means of an appropriate vehicle with containers and/or bags secured and covered to prevent waste being blown from the vehicle during transport. Used oil will be collected and taken to or collected by a registered oil recycling company. Other hazardous waste as per Schedule 3 of NEM:WA and Annexure 1 of GN R634 (2013) will be disposed of at a Class A landfill or collected by an approved service provider. Proof of safe transfer/disposal will be filed in the SEF. Waste disposal restrictions as per GN R636 (2013) shall apply. Of specific relevance is: <ul style="list-style-type: none"> Lead acid batteries, corrosive or oxidizing products. Waste which is flammable with a flash point lower than 61°C. Waste compressed gases. Re-usable, recoverable or recyclable used lubricating mineral oils, as well as oil filters, but excluding other oil containing wastes. Re-usable, recoverable or recyclable used or spent solvents. 	



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> ○ Lamps. ○ Tyres (whole or quartered). ○ Liquid waste or waste with a moisture content of >40%. 	
Stop work	N/A	
Monitoring method and frequency	<ul style="list-style-type: none"> • Daily inspection of working area for any litter/waste. • Weekly checking of waste storage area to ensure timeous removal of waste off-site prior to storage areas becoming overfull. • Proof of safe disposal filed in Environmental File and audited monthly by ECO. 	Implementing Entity, ECO
Management outcomes	<ul style="list-style-type: none"> • No waste disposed of or burned on site. • No visible littering. • Waste transport does not result in waste being blown from the vehicle along the route. • Appropriate and separate storage of different types of waste in approved locations. • Proper record keeping of hazardous waste generated and safe and legal disposal thereof. 	Implementing Entity



4.15 Removal of alien invasive species

Identified impacts: The WfWetlands programme often involves the removal of alien invasive species as part of an intervention(s) to improve wetland functioning. The method for removal is usually specified in the aforementioned situation. A construction site, due to its inherent disruptive nature, does however also lead to conditions ideal for the establishment of weeds/pioneer species and alien invasive species (hereafter collectively referred to as “weeds”) which could compromise the habitat integrity and ecological functioning of the wetland system as well as downstream systems. It is therefore important to implement strict control measures to ensure that alien invasive species are not introduced into a system or/and are not allowed to dominate an area post-construction.

Objective of improved management:

- No new alien invasive/pioneer species are introduced into the wetland system and catchment.
- Emerging weeds are removed prior to seed formation stage.

Specifications:

- Where project activities include the eradication of invasive alien plants, Working for Water guidelines and policies shall be adhered to.
- Weeds will be removed prior to reaching seed formation stage.
- Prior to construction, the Implementing Entity shall ensure that invasive alien vegetation is cleared from the entire site in accordance to the applicable Working for Water guidelines and policies. Follow up clearing may be necessary if the species re-establish following the initial clearing.
- Species that are declared invasive species (according to NEMBA’s Alien and Invasive Species Regulations, 2014 (GN R598)) must be recorded and polygons of the affected area must be submitted to the Working for Water national alien invasive plant database.
- The Alien and Invasive Species Lists 2016 (GN 864) will apply when identifying species which require removal/eradication.
- No trees within the environmentally sensitive areas may be removed, whether alien species or not, unless permitted by the ECO.
- Other alien species (non-listed) occurring on site may not be used in the landscaping and should be removed from site where possible.
- Where an individual or group of an invasive alien specimens/plants has potential cultural or heritage value e.g. a blue gum lane, tree at a grave site, the landowner and/or community will be consulted prior to the removal of the specimen(s). The aforementioned might also be protected under the NHRA, in which case removal might not be allowed.



Table 16: Specific avoidance, mitigation and cessation management measures related to the removal of Alien Invasive/pioneer species

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> Imported material shall be free of weeds. Stockpiles (topsoil and subsoil) will be checked for emerging weeds on a fortnightly basis. Topsoil sourced from areas with notable weeds infestation will not be used in other areas for rehabilitation or fill purposes. 	Implementing Entity
Mitigation	<ul style="list-style-type: none"> Where sand/fill material is legally sourced from a dam, existing borrow pit or similar with clear presence of invasive alien species, the Implementing Entity will allow for a weeding programme at the on-site stockpile area and Intervention Point. 	Implementing Entity
Stop work	N/A	
Monitoring method and frequency	<ul style="list-style-type: none"> Fortnightly inspections of disturbed/cleared areas and stockpiles for signs of emerging weeds. Monthly audit/visual inspection by ECO. 	ECO
Management outcomes	<ul style="list-style-type: none"> Construction activities are restricted to the approved construction footprint. The Implementing Entity's activities does not lead to the negligent or wilful damage to a natural feature. 	Implementing Entity



4.16 Impact on fauna

Identified impacts: Typical construction activities could lead to fatalities of small fauna e.g. birds, reptiles, rodents through direct impact and the destruction of habitat. The proposed project will however be limited to the road reserve which is already completely transformed and subject to daily traffic. The upgrade/replacement of culverts and bridges might result in the destruction of a number bird nests attached to the structures.

Objective of improved management:

- Protect fauna in the study area, preserve the ecological functioning along the development footprint as much as is possible.

Specifications: None

Table 17: Specific avoidance, mitigation and cessation management measures related to impacts on fauna

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none">• Do a site walkthrough prior to construction commencing to remove any slow moving animals and to identify nesting sites, burrows etc.• Demarcate nesting sites which should be avoided as no-go areas by means of painted pegs.• Avoid disturbance of burrows, nests etc. where possible.• Create awareness of conservation of fauna during environmental induction and toolbox talks.• Fauna may not be captured, poisoned, trapped or killed.• Do not feed wildlife.• Where working in a nature reserve with potentially dangerous animals present, ensure that the team is accompanied by a suitably qualified game ranger at all times.• A speed limit of 20 km/h in nature reserves will apply unless otherwise indicated by the reserve road signage.• Inspect excavations for trapped animals prior to work commencing each day.• Do not use pesticides on site.	Implementing Entity



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Do not burn vegetation. Store waste in weather and scavenger proof bins to avoid ingestion of waste by wildlife. 	
Mitigation	<ul style="list-style-type: none"> Limit the construction footprint. Reinstate temporary footprints after construction has been completed. Report any animal fatalities of significance to the ECO and relevant reserve management (where applicable) and identify measures to avoid reoccurrence. 	Implementing Entity, ECO
Stop work	N/A	
Monitoring method and frequency	<ul style="list-style-type: none"> Daily inspections of trenches and excavations prior to construction commencing. Weekly inspections of demarcated no-go areas. Recording of incidents and near misses (e.g. vehicle-antelope collision) in the site diary and at site meetings. Disciplinary action against any construction staff guilty of purposefully capturing, poisoning, trapping or killing wildlife. 	Implementing Entity
Management outcomes	<ul style="list-style-type: none"> No unnecessary fauna fatalities. Limited habitat disturbance and reinstatement of temporary construction footprints. 	Implementing Entity



4.17 Protection of natural features

Identified impacts: Construction activities could result in damage to natural features such as rock outcrops and exposed rock faces/cliffs. The project is not located in an area associated with rock paintings, caves, waterfalls, trees of historical or cultural significance etc. and the risk of damage to natural features is generally considered low.

Objective of improved management:

- No damage to natural features due to negligent or purposeful action during construction.

Specifications:

- Demarcation will be by means of brightly painted/white pegs/poles at least 1.5m in height and placed at regular (10m for linear or on every corner for non-linear) intervals on both sides of the approved construction footprint.
- Danger tape and/or snow/barrier netting shall only be used for health and safety requirements along excavations or high risk areas.
- All temporary barriers and signage must be removed and the site restored on completion of the project.

Table 18: Specific avoidance, mitigation and cessation management measures related to impacts on natural features

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none">• Construction activities shall be restricted to the approved construction footprint.• Sensitive or no-go areas in close proximity (<100m) to the construction site will be demarcated with painted pegs and marked as no-go areas.• The Implementing Entity shall not deface, paint, damage or mark any natural features (e.g. trees or rock formations) situated in or around the site for survey or other purposes unless agreed beforehand with the ECO and Engineer.	Implementing Entity
Mitigation	<ul style="list-style-type: none">• Any features affected by the Implementing Entity as a result of negligence or wilful conduct shall be restored/rehabilitated to the satisfaction of the ECO and/or relevant competent authority.	Implementing Entity
Stop work	N/A	



Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	<ul style="list-style-type: none"> Monthly audit/visual inspection by ECO. 	ECO
Management outcomes	<ul style="list-style-type: none"> Construction activities are restricted to the approved construction footprint. The Implementing Entity's activities does not lead to the negligent or wilful damage to a natural feature. 	Implementing Entity



4.18 Protection of heritage resources (including palaeontological objects)

Identified impacts: The nature and location of typical WFWetlands interventions seldom have the potential to cause the destruction or lead to the discovery of palaeontological objects such as fossils. An exception is peat wetlands which can contain fossils at usually substantial depth. Heritage resources are identified during the EIA phase and indicated as no-go areas. There is however still the opportunity for the discovery or damage to new objects during the construction phase.

Objective of improved management:

- To avoid damage to known heritage objects and to ensure a protocol is in place in the case of discovery of an unknown heritage or palaeontological object.

Specifications: None

Table 19: Specific avoidance, mitigation and cessation management measures related to impacts on heritage resources (including palaeontological objects)

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> • The Implementing Entity shall avoid all “no-go” areas as identified during the EIA. • General staff awareness training in terms of the protection and conservation of heritage resources during the environmental induction and toolbox talks. 	Implementing Entity
Mitigation	<ul style="list-style-type: none"> • Should any cultural, archaeological or palaeontological artefacts/objects or evidence be discovered at any stage during construction, the Implementing Entity will cease work in the vicinity of the artefact/object and inform the ECO who will in turn inform the relevant specialists and authorities. • Site staff is not allowed to collect or keep on artefact or object of cultural, archaeological or palaeontological significance. 	Implementing Entity, ECO, Specialist
Stop work	<ul style="list-style-type: none"> • Should any cultural, archaeological or palaeontological artefacts/objects or evidence be discovered, partial suspension of construction activities in the immediate vicinity of the object might need to be required until the object can be evaluated and/or removed. 	Implementing Entity, ECO, Specialist



Management Measure	Detailed Description	Responsibility
Monitoring method and frequency	<ul style="list-style-type: none"> Continuous during construction. Monthly audit by ECO in terms of no-go areas being maintained. 	Implementing Entity
Management outcomes	<ul style="list-style-type: none"> No-go areas (i.e. all areas outside the approved construction footprint) are treated as no-go areas with no disturbance of heritage/cultural objects on private land adjacent to the construction site. Proper procedure followed should any object or artefact be discovered during construction. 	Implementing Entity



4.19 Visual impact

Identified impacts: The nature of a typical WfWetlands project is seldom such that it causes significant visual disturbance, with the visual impact of the operational outcome usually being positive. Construction activities can however lead to temporary and permanent landscape scarring and impacts, which can be excessive if not controlled and mitigated properly.

Objective of improved management: Ensure that visual impacts caused by landscape scarring are minimised through proper planning and mitigated through successful rehabilitation.

Specifications: None

Table 20: Specific avoidance, mitigation and cessation management measures related to visual impacts

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> • Avoid excessive vegetation clearance. • Ensure construction remains within the approved construction footprint. • Do not paint or deface any natural feature. 	EAP, ECO, Implementing Entity
Mitigation	<ul style="list-style-type: none"> • Ensure that materials used for construction limits visual impacts e.g. use natural colours where possible. • Ensure that the site remains neat and tidy with no littering etc. • Use shade cloth or construction cordon in areas specifically sensitive to visual disturbances e.g. areas frequented by tourists or the public. • Record and address community complaints as per procedure specified under Section 4.3. • Ensure rehabilitation is successful as specified under Section 5. 	Implementing Entity
Stop work	N/A	
Monitoring method and frequency	As specified for rehabilitation under Section 5.	ECO



Management Measure	Detailed Description	Responsibility
Management outcomes	<ul style="list-style-type: none"> Visual impacts are minimised and managed. The extent of disturbance is minimised and limited to the approved construction footprint. The extent of intervention infrastructure remaining bare i.e. no vegetated is limited as best as possible. Rehabilitation meets the requirements and targets as per Section 5. 	Implementing Entity, ECO



5 REHABILITATION PHASE

Identified impacts: Poor rehabilitation can often lead to secondary impacts such as erosion, an increase in alien invasive species, decreased biodiversity, decreased habitat connectivity, poor ecological integrity and functioning and so forth. Given the core focus of the WfWetlands programme, successful rehabilitation is also a key factor, but should entail more than the functioning of an intervention with focus on ensuring that the permanent footprint of the construction site and actual structure is minimal.

Objective of improved management:

- To ensure that construction footprints are rehabilitated and that site rehabilitation is undertaken in such a manner that the permanent footprint of the construction site of the Intervention Point is minimal.

Specifications:

- All working areas shall be rehabilitated once work has been completed and before the team leaves the site. This includes closure and rehabilitation of temporary access routes.
- All foreign material not utilised in the rehabilitation activities shall be removed from the site.
- Re-vegetation of all exposed soils, and measures to address any potential erosion risk shall be done before the team leaves the site.
- Where project activities include the eradication of invasive alien plants, Working for Water guidelines and policies shall be adhered to.
- All rehabilitated areas shall be considered “no-go” areas upon completion and the Implementing Entity shall ensure that none of his staff or equipment enters these areas.
- Specific Site Rehabilitation measures have been included in the project specific Rehabilitation Plans and shall be referred to for site closure. Due notice of the conditions of Environmental Authorisation and requirements of the General Authorisation for water uses (Annexure B) must be complied with.
- Specifically, on the completion of the construction activities:
 - All disturbed areas must be re-vegetated with local indigenous vegetation suitable to the area.
 - An active campaign for controlling new exotic and alien vegetation must be implemented within the disturbed areas.
 - Structures must be inspected after a major rain event (i.e. more than 50mm rainfall) or annually for the accumulation of debris, blockages, instabilities and erosion with concomitant remedial and maintenance actions.



Table 21: Specific avoidance, mitigation measures related to rehabilitation of the project footprint

Management Measure	Detailed Description	Responsibility
Avoidance	<ul style="list-style-type: none"> Manage site demarcation and vegetation clearance as per Sections 4.2, 4.4 and 4.5 respectively. Ensure that sufficient topsoil is available through proper removal, stockpiling and maintenance procedures as specified under Section 4.5. 	Implementing Entity
Mitigation	<p>General:</p> <ul style="list-style-type: none"> All waste will be collected and removed (also look beyond immediate working area for any waste which might have been blown into the surrounding area). All spoil and excess material must be removed material. All spills and waste concrete must be removed. All temporary markings and site demarcation must be removed. All temporary construction signage must be removed. Where temporary access roads cut across contours, diversion berms will be constructed at 30m intervals to avoid erosion and concentration of runoff prior to vegetation establishing. Mulching shall be applied to the decommissioned temporary access road. <p>Shaping and revegetation:</p> <ul style="list-style-type: none"> Material will be backfilled in the order on which it was removed. Compacted soil shall be scarified prior to topsoil and seed application. Topsoil shall be applied at a minimum depth of 75mm. Where the Implementing Entity failed to manage topsoil properly, the Implementing Entity shall be held responsible to source topsoil of similar quality from a commercial source OR to remediate compromised topsoil by means of compost, fertiliser and seeding as agreed by the ECO. 	Implementing Entity, ECO, Engineer



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> • Topsoil shall match the type and quality of topsoil removed from that area. • Special care shall be taken where rehabilitation occurs across several wetland zones and or crossing between wetland and dryland habitats to match the soil removed to the area where it is reapplied. • Seeding/re-seeding should, where possible, be timed to take advantage of the rainy season. • All reinstated slopes will be at a gradient of 1:3 to 1:4. • Slopes of 1:2 and 1:1 shall be stabilised by means of suitable geotextiles, hard structures or any other means as approved by the ECO. • Slopes of 1:2 and 1:1 will be revegetated by means of sods and/or plugs of an approved indigenous grass specie. No Kikuyu shall be used for revegetation purposes. • Local indigenous plants shall be used in the landscaping of the site. Plants that are proclaimed as problem plants or noxious weeds (see Section 4.15) are to be excluded from the landscaping plan and must be removed immediately, should they occur on site. • Plants introduced into the project sites must be guided by ecological rather than horticultural principles. For example ecological communities of indigenous plants provide more biodiversity and habitat opportunities and would blend with natural vegetation. • Where sods are sourced from the surrounding environment, the sods must be 30x30cm, sourced in a checkered pattern in a flat area (i.e. not on slopes). The sods must be sourced 1m in radius apart and will be planted within 24 hours of removal unless otherwise approved by the ECO. • Should the reshaping of watercourse banks be required it will match the natural preconstruction geomorphology and slope structure. Extensive reshaping of watercourse banks (and beds if applicable) will be done under close supervision of the ECO or relevant specialist. 	



Management Measure	Detailed Description	Responsibility
	<ul style="list-style-type: none"> Areas where sods, plugs or seeds have been used as part of slope stabilisation measures will be watered at least every third day for a minimum period of 6 weeks unless the area is in a permanently wet zone of a wetland i.e. no watering required. <p>Rehabilitation of peatlands:</p> <ul style="list-style-type: none"> Upon rehabilitation, the removed sods and soil stockpiles shall be placed back into the system in the original order/layers (i.e. deeper layers shall be placed first with the rhizosphere layer at ground level), and orientation (according to the natural slope). Should the moisture content of the sods be less than 90% moisture, the Implementing Entity shall be required to peg them with wooden stakes. The site shall be mulched (alternatively cloth/geotextile may be used) and livestock shall be fenced out for at least two seasons. Alternatively brush packs can be used to keep livestock and/or game away from the site. If compaction took place, the Implementing Entity shall loosen the soil with a fork on flat surfaces, and create small contour berms on paths with slopes. 	
Stop work	N/A	
Monitoring method and frequency	<ul style="list-style-type: none"> The Implementing Entity shall notify the ECO once rehabilitation in an area has been completed. The ECO shall be responsible for the technical, not contractual, sign-off of the rehabilitated sections. Only once the rehabilitation has been approved by the ECO, may the contractual sign-off be effected. The ECO shall conduct monthly inspections of rehabilitated areas for the first three months and then continue with inspections on a quarterly basis until the end of the contract period. The ECO should audit the site at the end of the Implementing Entity's retention period to establish whether rehabilitation has been successfully carried out. If not, the retention money could be used to implement additional rehabilitation measures. 	Implementing Entity, ECO, Engineer
Management outcomes	<ul style="list-style-type: none"> Vegetation clearance is limited to the approved construction footprint. All sloped areas are stable with no sign of slope failure or erosion. 	Implementing Entity, ECO, Engineer



6 EMERGENCY REPORTING AND PROCEDURES

The Implementing Entity must ensure that all emergency procedures are in place prior to commencing work. The nearest emergency service provider shall be identified and the up-to-date contact details of this emergency centre, as well as the police and ambulance services shall be displayed on a notice board and shall be made available to staff on-site. Emergency equipment including fire-fighting equipment shall be positioned at accessible locations near to areas where such emergencies may arise.

6.1 Emergency Awareness

The Implementing Entity shall ensure that site staff are aware of the procedure to be followed for dealing with emergencies, which shall include notifying the Implementer and relevant authorities of the event. All site staff shall be briefed regarding the requirements for dealing with potential emergencies including fires, accidental leaks and spillage of pollutants (also see Section 4.7 and 4.8), as well as Health and Safety incidents. Education of site staff shall focus on both preventative and remedial actions in the case of an emergency.

6.2 Incident Recording

The Implementing Entity shall complete an Incident Report (refer to template under Annexure B) in the case of any environmental emergencies, accidents or incidents (including near misses). The ECO shall monitor that the necessary procedures and responses are followed to close out any entries in the Environmental Incident Report. The aforementioned report will be filed in the SEF.

6.3 Fire

The Implementing Entity must take all reasonable measures to ensure that fires are not started as a result of construction activities on site, and shall also ensure that their operations comply with the Occupational Health and Safety Act (Act No. 85 of 1993). Where possible, all work done in the dry season shall be organised in liaison with the landowners so that it fits into their firebreak/ fire protection programme. No large open fires are permitted on site. Smoking on site shall only be permitted in designated areas and in the presence of a fire extinguisher.

Basic functional fire-fighting equipment (one back pack and at least five beaters) shall be made available at each work site at all times. In forestry areas there must also be two rake hoes per team. The Implementing Entity shall appoint a member of his staff to be responsible for the installation and inspection of this equipment. Where work will take place in a peatland or wetland with a high organic soil content, a Method Statement shall be prepared for the ECO's approval, detailing all the actions that will take place should a fire occur, as well as the relevant emergency contacts.

Where fuels and machines are used on site, the prescribed fire extinguishers in working condition must be made available by the Implementing Entity.

Sparks generated during welding, cutting of metal or gas cutting can result in fires. Every possible precaution shall therefore be taken when working with this equipment near potential sources of combustion. Such precautions include having an approved fire extinguisher immediately available at the site of any such activities.

The Implementing Entity is to ensure that he/ she has the contact details of the nearest fire station in case of an emergency.



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Annexure A: Basic Code of Conduct / Implementation

- Private property access is only permitted on previous agreement with the affected landowner, or will be considered trespassing. Trespassing on adjacent properties shall be subject to disciplinary and legal action.
- Ensure that closed gates are kept closed. When in doubt, the landowner should be consulted.
- Teams working outside of the active site, or requiring access to private properties are to carry identification on their persons that includes their name, position, company of employ, and reference to the Working for Wetlands Project. Similarly, such information shall be displayed on vehicle dashboards/exterior.
- All work shall be based on an approved rehabilitation plan.
- Any deviations from the planned specification need to be approved by the PC and the relevant Engineer.
- A construction supervisor shall be appointed. The appointment letter shall be made available on site.
- Work sites shall be properly planned and marked out, preferably in collaboration with the Implementing Entity. Areas shall be demarcated for vehicle access and parking, off-loading, mixing etc. (refer to Section 4.2).
- No unauthorised person may enter the work site.
- The location and position of all rehabilitation interventions shall be precisely demarcated by the Engineer and the Implementer, according to the rehabilitation plan.
- Dimensions of rehabilitation interventions shall also be marked out where appropriate (e.g. depth of an excavation).
- Implementation of all interventions will be done with a focus on cost-effectiveness and efficiency, while maintaining quality and appropriateness.



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Annexure B: Site Environmental File & Templates

Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes



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Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

2 Implementing Entity Agreements

2.1 Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements

PROJECT NAME:

IMPLEMENTING ENTITY:

DATE:

I, _____ (name), ID number _____ hereby confirm the following:

1. I have received a copy of the Environmental Authorisation (EA), Environmental Management Programme (EMPr) and Rehabilitation Plan for this project.
2. I have familiarised myself with the contents of aforementioned documents and understand what is required from me as the Implementing Entity.
3. I understand that I will be audited against the EA, EMPr, Rehabilitation Plan and approved Method Statements.
4. I understand that the EA is legally binding and that a contravention of an EA condition can lead to the suspension of the EA and thus construction.
5. I understand that I am responsible for the actions of my employees and will ensure that all staff on site are aware of the requirements and restrictions as per the EA, EMPr, Rehabilitation Plan and Method Statements.

Signed

Designation

Dated



Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

4 Communication

4.2 Copy of public complaints register

COMPLAINTS REGISTER

PROJECT NAME:	.....
IMPLEMENTING ENTITY:	.....
DATE:	.....
REVISION:	.....



Id.	Date	Time	Complainant Name	Address	Contact Details	Path for complaint (Phone, Discussion, email)	Description of complaint	Detail of investigation	Result of investigation	Corrective action	Response to complaint
1											
2											
3											
4											
5											
6											
7											
8											



Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

7 Method Statements

The Implementing Entity is to complete this section, taking cognisance of the relevant EA, EMP, environmental specifications and SANS.

7.1 Combined method statements

PROJECT NAME:	.....
IMPLEMENTING ENTITY:	.....
DATE:	.....
REVISION:	.....

ACRONYMS

ECO	Environmental Control Officer
EMPr	Environmental Management Programme
NEMA	National Environmental Management Act (Act 107 of 1998)
SHE	Safety Health Environment

DEFINITIONS

Alien species¹:

- (a) a species that is not an indigenous species; or
- (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Approved: Means approved in terms of the applicable legal requirements (e.g. NEMA approval/ Environmental Authorisation) and/or has been approved by the WfWetlands Programme's Deputy Director: Planning, Monitoring and Evaluation and/or an authorised representative of the WfWetlands Programme.

Archaeological²:

- (a) material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;
- (b) rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- (c) wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the

¹ National Environmental Management: Biodiversity Act (No. 10 of 2004)

² National Heritage Resources Act (No. 25 of 1999)



Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which the South African Heritage Resource Agency (SAHRA) considers to be worthy of conservation; and

Auditing³: A systematic, documented, periodic and objective evaluation which provides verifiable findings, in a structured and systematic manner, on:

(a) the level of performance against and compliance of an organisation or project with the provisions of the requisite environmental authorisation or Environmental Management Programme (EMPr) and, where applicable, the closure plan; and

(b) the ability of the measures contained in the EMPr, and where applicable the closure plan, to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity.

Authority: National, regional or local authority, that has a decision-making role or interest in the project.

Best Management Practice (BMP): Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWetlands implementers.

Cement laden water: Means water (fresh or wash water) which has been in contact with partially cured concrete/mortar or raw cement product and which contains suspended and dissolved cement solids.

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Contaminated water: Means water contaminated by the Implementing Entity's activities such as with hazardous substances, hydrocarbons, paints, solvents and runoff from plant, workshop or personnel wash areas but excludes water containing cement/ concrete or silt.

Corrective (or remedial) action: Reactive response required to address an environmental problem that is in conflict with the requirements of the EMPr. The need for corrective action may be determined through monitoring, audits or management review.

Dam⁴: Any barrier dam and any other form of impoundment used for the storage of water, excluding reservoirs.

Dangerous goods: Goods containing any of the substances as contemplated in South African National Standard No. 10234, supplement 2008 1.00: designated "*List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)*" published by Standards South Africa, and where the presence of such goods, regardless of quantity, in a blend or mixture, causes such blend or mixture to have one or more of the characteristics listed in the Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards.

Decommissioning⁵: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned.

³ Regulation 34 of GN R982 (2014, as amended) of NEMA

⁴ GN R983 (2014, as amended) of NEMA

⁵ GN R983 (2014, as amended) of NEMA



Dust⁶: Any material composed of particles small enough to pass through a 1 mm screen and large enough to settle by virtue of their weight into the sampling container from the ambient air.

Eco-log: A cylindrical sleeve made from, for example wire mesh, filled with organic material and/or soil used to prevent and/or repair minor erosion.

Endangered species: Means any indigenous species listed as an endangered species in terms of section 56 of the National Environmental Management Biodiversity Act ((No. 10 of 2004).

Endemic: An "endemic" is a species that grows in a particular area (i.e. it is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment⁷: Means the surroundings within which humans exist and that are made up of:

- i. the land, water and atmosphere of the earth;
- ii. micro-organisms, plant and animal life;
- iii. any part or combination of i) and ii) and the interrelationships among and between them; and
- iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

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

Environmental impact: Change in an environment resulting from the effect of an activity on the environment, whether positive or negative. Impacts may be the direct consequence of an individual's or organisation's activities or may be indirectly caused by them (DEAT, 1998).

Erosion: The loss of soil through the action of water, wind, ice or other agents, including the subsidence of soil.

Gabion: A structure made of wire mesh baskets filled with regularly sized stones, and used to prevent and/or repair erosion. They are flexible and permeable structures which allow water to filter through them. Vegetation and other biota can also establish in/around the habitat they create.

Hazard: Means a source of or exposure to danger.

Invasive alien species control:

- (a) to combat or eradicate an alien or invasive species; or
- (b) where such eradication is not possible, to prevent, as far as may be practicable, the recurrence, re-establishment, re-growth, multiplication, propagation, regeneration or spreading of an alien or invasive species.

Implementing Entity: The entity responsible for the construction of WfWetlands rehabilitation interventions by means of various contracted teams.

Indigenous vegetation⁸: Refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

⁶ National Dust Regulations GN R827 (2013)

⁷ NEMA

⁸ GN R983 (2014, as amended) of NEMA



Interested and Affected Parties (I&APs)⁹:

- (a) all persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;
- (b) all persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; c) all organs of state which have jurisdiction in respect of the activity to which the application relates.

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

Invasive species¹⁰: Means any species whose establishment and spread outside of its natural distribution range-

- (a) threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and
- (b) may result in economic or environmental harm or harm to human health.

Listed invasive species: Any invasive species listed in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the National Environmental: Biodiversity Act (No. 10 of 2004).¹¹

Maintenance period: The period after the Establishment Period (Practical Completion), up to and until the end of the Maintenance Period (i.e. a period of 12 months).

Maintenance¹²: Means actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint.

Mine:

- (a) used as a noun-

any excavation in the earth, including any portion under the sea or under other water or in any residue deposit, as well as any borehole, whether being worked or not, made for the purpose of searching for or winning a mineral;

any other place where a mineral resource is being extracted, including the mining area and all buildings, structures, machinery, residue stockpiles, access roads or objects situated on such area and which are used or intended to be used in connection with such searching, winning or extraction or processing of such mineral resource; and

- (b) used as a verb-

in the mining of any mineral, in or under the earth, water or any residue deposit, whether by underground or open working or otherwise and includes any operation or activity incidental thereto, in, on or under the relevant mining area.

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

Mitigation¹³: Means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible;

⁹ Regulation 42 GN R983 (2014, as amended) of NEMA

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

¹¹ Also refer to GN 864 (2016): Alien and Invasive Species Lists

¹² GN R983 (2014, as amended) of NEMA

¹³ GN R983 (2014, as amended) of NEMA



Monitoring¹⁴: The repetitive and continued observation, measurement and evaluation of environmental criteria to follow changes over a period of time and to assess the efficiency of control measures.

Nursery conditions: This refers to the necessary conditions that must be in place for maintaining strong healthy growth in all container plant materials on site. This includes for the protection of all container plants against wind, frost, direct sunlight, pests, disease and drought. It also includes for the provision of adequate and suitable water supply, fertilisers and all other measures necessary to maintain strong and healthy plant growth.

Offensive odour: Any smell which is considered to be malodorous or a nuisance to a reasonable person.

Pollution¹⁵: Means any change in the environment caused by substances;

(ii) radioactive or other waves; or

(iii) noise, odours, dust or heat,

emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or wellbeing or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.

Post-construction: Refers to the period of 12 months after the completion of the construction works, the onset coinciding with the maintenance period..

Potentially hazardous substance: Any substance or mixture of substances, product or material declared to be a hazardous substance under section 2(1) of the Hazardous Substance Act (1973).

Pre-construction: Refers to the period leading up to the establishment on site by the Implementing Entity.

Project: A defined area for which an approved rehabilitation plan exists for the WfWetlands Programme.

Quaternary Catchment: A fourth order catchment in a hierarchal classification system in which a primary catchment is the major unit and that is also the “principal water management unit in South Africa”¹⁶

Reasonable: Means, unless the context indicates otherwise, reasonable in the opinion of the relevant environmental authority.

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

Restoring processes and characteristics that are sympathetic to and not conflicting with the natural dynamic of an ecological or physical system¹⁷.

Significant impact: Means an impact that may have a notable effect on one or more aspects of the environment or may result in k with accepted environmental quality standards, thresholds or targets

¹⁴ DEAT, 1998

¹⁵ National Environmental Management Act (No. 107 of 1998, as amended)

¹⁶ DWS Groundwater Dictionary. Available online:

http://www.dwaf.gov.za/Groundwater/Groundwater_Dictionary/index.html?introduction_quaternary_catchment.htm

¹⁷ Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008



and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence.

Silt laden water: Means water (mostly overland surface runoff) containing a substantial concentration of suspended solids with increased turbidity. Usually occurs as a result of exposed/cleared ground surfaces, concentration of runoff and/or erosion of excavated or imported materials.

Site: This is the area described in the approved/authorised rehabilitation plan for the implementation of the rehabilitation measures. Where the area is not demarcated, it will include all adjacent areas, which are reasonably required for the activities for the Implementing Entity, and approved for such use by the Environmental Control Officer (ECO).

Slope: The inclination of a surface expressed as 1 unit of rise or fall for so many horizontal units.

Subsoil: The soil horizons between the topsoil horizon and the underlying parent rock.

Topsoil: The upper soil profile irrespective of the fertility appearance, structure, agriculture potential, fertility and composition of the soil, usually containing organic material and which is colour specific. Also referred to as the "O" and "A" horizons.

Waste: Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 the National Environmental Management: Waste Act (No. 59 of 2008)¹⁸. Examples include construction debris, chemical waste, used oils and lubricants, batteries, metal and wood off-cuts, excess cement/ concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Watercourse:

- (a) a river or spring;
- (b) a natural channel in which water flows regularly or intermitted;
- (c) a wetland, pan, lake or dam into which, or from which, water flows

A reference to a watercourse includes, where relevant, its bed and banks

Weir: A dam-type structure placed across a watercourse to raise the water table of the surrounding ground and trap sediment on the upstream face without preventing water flow. Weirs are generally used to prevent erosion from progressing up exposed gullies.

Wetland: Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils¹⁹ and,

Land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants living there²⁰.

¹⁸ National Environmental Management: Waste Act (No. 59 of 2008, as amended)

¹⁹ National Water Act (No. 36 of 1998, as amended)

²⁰ Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008



SECTION 1: SITE ESTABLISHMENT

Briefly describe where the site camp will be located. Also provide a layout on the next page.
Coordinates:
How will you demarcate the site camp (note no danger tape allowed)
What will the size of the site camp be?
Are there any sensitive areas, trees, shrubs or landscape features (e.g. a heritage site) that must be avoided to prevent disturbances and/or damage? How will disturbances or damage be prevented?

Is the site camp on a flat area (i.e. slope not exceeding 1:3)?	Y	N
Is the site camp located away from areas of stormwater concentration and areas prone to flooding?	Y	N
Are there any recently disturbed areas close to the site which can be used as a site camp?	Y	N
Is there sufficient space available at the identified site to accommodate all site camp components i.e. ablution facilities, eating areas, laydown areas, stockpile areas, vehicle parking area, concrete wash water settling area?	Y	N
Can the site camp remain at one location? I.e. it does not need to be moved on a regular basis (i.e. every two to four weeks) due to intervention sites being far apart?	Y	N

If, "No", attach the approved for request for deviation form to the back of this document.



Indicate the following (ignore if not relevant): Ablution facilities, waste storage area (general and hazardous), eating area, laydown area, stockpile area, concrete/mortar mixing/batching area, concrete wash water settling system, site office, access, vehicle parking area, any stormwater diversion measures required, the wetland boundary and sensitive features that must be avoided.

Site camp layout (please use multiple layout plans if required).

SECTION 2: SITE DEMARCATION

Indicate the working area required for each intervention site.

Intervention No	Type of intervention	Area required (incl. temporary laydown and stockpile areas, topsoil stockpiling, equipment etc.)

How will you demarcate the working area required for each intervention?

--

SECTION 3: ACCESS ROUTES/HAUL ROADS

Length of new access road required for each intervention site.

Intervention No	Existing access (Y/N)?	Length of access road required

Describe how access roads will be made and demarcated (i.e. avoiding unnecessary access roads and the creation of multiple access roads).

--

**Include a simple layout indicating the proposed access routes as an addendum to this document.*

SECTION 4: MATERIALS HANDLING, USE AND STORAGE

Briefly list the materials (including volumes) to be used during construction (e.g. bidim, gabion baskets, stones, gravel, shuttering oil, cement, sand, MacMat-R, geotextile):		
Where will the materials be off-loaded?		
Where are you sourcing the material from?		
If it is not a commercial source, have you written obtained permission from the ECO and any other relevant party e.g. the landowner, provincial roads, Department of Mineral Resources? Please attached a copy of the written permission/consent to the end of this METHOD STATEMENT .	Y	N



Are the areas you've identified for stockpiling of bulk material outside of the wetland? If "No", consult with the ECO.	Y	N
Are the areas you've identified for stockpiling level (i.e. not steeper than 1:30)? If no, explain the measures which will be implemented to prevent materials washing away during rainfall.	Y	N
Have you planned how to get the materials from the stockpile/laydown area to the intervention working area? Please provide details on the proposed methodology below. Differentiate between the various materials where required.	Y	N
Do you have sufficient covered storage space for products such as cement, and shuttering oil? Please provide details of the storage areas to be used and the type of cover e.g. roofed, shade cloth, storage container.	Y	N
Do you need to stockpile bulk materials e.g. rock, sand next to an intervention? If "Yes", please provide details on the duration of stockpiling, the volume and the measures to be taken to avoid erosion of material and contamination of topsoil.	Y	N
Have you worked out a delivery schedule to avoid materials being stored on site for longer than 4 weeks?	Y	N
Is there any material which will be prone to become windblown e.g. sand? If yes, describe how you will contain the material.	Y	N

SECTION 5: SOLID WASTE MANAGEMENT AND DISPOSAL

What types of waste is expected to be generated during the construction period?		
List any wastes that are potentially hazardous ²¹ (e.g. empty sealant containers, materials from spill kit used to clean spillages, batteries, contents from portable toilets, herbicide containers):		
How will waste be stored on site (i.e. where and in what)?		
General:		
Hazardous:		
How often, how and where will waste be disposed of?		
General:		
Hazardous:		
Is a substantial quantity of vegetation clearance required?	Y	N

²¹ Refer to National Environmental Management: Waste Amendment Act 26 of 2014 and SANES 234



If "yes" indicate how vegetation material not removed as part of topsoil stripping will be dealt with e.g. chipping, brush packing, donate to local community.

* Please remember to clearly indicate waste storage areas on the layout plan.

SECTION 6: HAZARDOUS CHEMICALS AND POTENTIAL HAZARDOUS SUBSTANCES

List potentially hazardous substances to be used on the project. (*Hazardous being defined in terms of Hazardous Substances Act (No.187 of 1993) and associated regulations as well as SANS 10234. Examples include, but are not limited to: drums of fuel, grease, oil, brake fluid, hydraulic fluid, paint, batteries and herbicides (for alien plant clearing).*)

--

How and where will these substances be stored?

--

How will these substances be applied or dispensed?

--

How will spills be prevented?

--

In the event of a spill, how will it be mitigated?

Procedure:

Materials:

Person responsible and contact details:

*Attach the relevant Material Safety Data Sheet (MSDS) of hazardous materials to be stored on site as an addendum to this document.

SECTION 7: FUEL

What is the volume of fuel planned to be stored on site?

--

How and where will fuel be stored?

--

How will fuel be dispensed?

--

What precautions will be taken to prevent accidental spills or fires?

--



In the event of a spill, how will it be mitigated (i.e. cleaned up)?

Procedures:

Materials:

Person responsible and contact details:

How will hydrocarbon contaminated materials be managed and disposed of? Note hydrocarbon contaminated soil is only allowed to go to a Class A landfill (previously H:H landfill site).

SECTION 8: WATER USE

What source will be used to obtain water for construction purposes?

What source will be used to obtain water for drinking and sanitation purposes?

SECTION 9: CONCRETE BATCHING AND CEMENT HANDLING

List activities where concrete or mortar will be used:

If ready mix is not used, where and how will concrete be mixed and how will it be transported to the intervention location?

How will cement laden runoff be managed? Specify for the concrete mixing area as well as washing of equipment.

Where and how will cement be stored?

How and where will cement bags be stored until taken off site?

How will excess concrete and concrete remains be disposed of?

SECTION 10: ABLUTION FACILITIES

How many people will be on site?



How many toilets will be required at a ratio of 1 toilet for every 15 people?

What type of toilet will be used (e.g. chemical or pit latrine) and where will it be located?

If chemical toilets are used, specify how and when they'll be serviced.

SECTION 11: EATING AREAS

Where will the eating area be located?

How will you prevent littering around the eating area?

** Also clearly indicate the designated eating area(s) on the layout plan.*

SECTION 12: VEHICLES AND EQUIPMENT

Describe the number and type of vehicles to be used on site.

Where will vehicles be parked or equipment stored overnight, during weekends and during holidays?

Describe the procedure to be implemented for dealing with vehicles or equipment leaking oil or fuel:

Describe emergency equipment maintenance procedures:

Procedure:

Materials:

Person responsible:

SECTION 13: NOISE

Are there any houses nearby? Do you need inform the landowners of any noisy activities that will take place? How will this be done?

Describe the measures to be implemented to prevent excessive noise disturbance during construction:



SECTION 14: DUST

What is the distance to the closest occupied building and what type of building is it (e.g. house, school, clinic, etc.)

--

List activities and material that might lead to the generation of dust:

--

If closer than 100m from a sensitive receptor e.g. occupied building, road, orchard, describe the activities to be implemented to limit and mitigate the generation of dust:

--

SECTION 15: IMPLEMENTING ENTITY'S SAFETY HEALTH ENVIRONMENT (SHE) OFFICER

Who will be responsible to ensure that Health and Safety and Environmental Requirements are implemented on site? Describe responsibilities of the relevant person:

Name:
Responsibilities:
Reporting to:

SECTION 16: ENVIRONMENTAL AWARENESS TRAINING

Describe how environmental awareness and training for senior staff will be addressed:

--

Describe how environmental awareness and training for general labour will be addressed:

--

** Please include a copy of the training material and attendance register in the environmental folder.*

SECTION 17: FIRE CONTROL

List activities on site with a fire risk e.g. smoking areas, generators.

--

How will fires be prevented?

--

Describe the procedure to be followed in case of a fire on site:

Process:
Materials:



Responsible person:

SECTION 18: COMMUNITY RELATIONS

Who is/are the landowner(s) of the property/properties where work will be conducted?

Has the landowner been contacted and notified of construction commencing and are there any specific concerns or requests which need to be taken into account?

Describe how good community relationships will be ensured (e.g. complaints register, contact details of Implementing Entity on site):

SECTION 19: PROTECTION OF FAUNA AND FLORA

Are you working in a conservancy, nature reserve or biosphere? If, yes, what are the precautions to be taken to avoid the accidental or intentional killing and/or trapping of animals?

Are you aware of any nesting or breeding sites close to any of the interventions?

Describe the procedure to be followed pre-construction to check for slow moving animals in the vicinity of the construction area.

Describe the procedure to be followed to check excavations of 0.5m and deeper for trapped animals.

If you are working in an area with potentially dangerous animals, describe the measures to be taken to ensure the safety of staff.

Are there any trees or shrubs that may not be disturbed or damaged? Have these been clearly marked to prevent disturbances and potential damage?

SECTION 20: STORMWATER MANAGEMENT

Is the site located in floodplain or valley? If "Yes", have you verified the typical rainfall patterns in the area and when increased flow/flooding can be expected?



Are you aware of any major dams or impoundments upstream of the site? If yes, do you have the contact details of the entity/responsible person in control of releases from the dam or impoundment and have you notified them of work being undertaken downstream?

Are you doing work in the “seasonal” or “permanent zone” of the wetland i.e. an area that is seasonally or permanently wet? If “Yes”, describe the dewatering procedures to be followed (i.e. will pumping be required, where will the pumped water be discharged, how will you reduce sediment loads in pumped water, how will you prevent scouring at the pipe outlet?)

Do you need to divert flow to enable construction/work being undertaken? If “Yes”, provide details on the type and duration of the diversion.

SECTION 21: EROSION AND SEDIMENTATION CONTROL

How will you prevent the erosion of access roads?

Will there be significant exposed areas (areas exceeding 10m²) during the rainfall season? If “Yes”, how will you protect bare soil surfaces exposed for a month or longer (e.g. stormwater diversion, temporary revegetation, geotextile)?

Do you need to work on steep (1:4) slopes? If “Yes”, describe the measures to be implemented to avoid the erosion of exposed ground surfaces, excavated material and construction material.

Are there any known stormwater structures discharging towards the site e.g. culverts, stormwater outlets. If “Yes”, is the diversion of the stormwater required to protect the site from erosion and how will it be done?

SECTION 22: PROTECTION OF ARCHAEOLOGICAL AND PALAEOLOGICAL SITES

Are you aware of any known heritage artefacts (e.g. old buildings, Stone Age sites, shell middens, caves, historic grave sites, monuments) close to the site? If “Yes”, describe how you will protect the site.

Describe the procedure to be followed in the event that an object of heritage, archaeological or paleontological is discovered:



Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

7 Method Statements

7.2 Additional method statements

INFORMATION ON METHOD STATEMENTS

Method Statements are to be completed by the person undertaking the work (i.e. the Implementing Entity). The Method Statement will enable the potential negative environmental impacts associated with the proposed activity to be assessed.

The Method Statement can only be implemented once approved by the PC in consultation with the ECO.

The Implementing Entity (and, where relevant, any sub-contractors) must also sign the Method Statement, thereby indicating that the works will be carried out according to the methodology contained in the approved Method Statement.

The PC and/or ECO will use the Method Statement to audit compliance by the Implementing Entity with the requirements of the approved Method Statement.

Changes to the way the works are to be carried out must be reflected by amendments to the original approved Method Statement; amendments require the signature of the PC, denoting that the changed methodology or works are necessary for the successful completion of the works, and where applicable the PC will consult with the ECO regarding to environmental concerns. The Implementing Entity will also be required to sign the amended Method Statement thereby committing him/herself to the amended Method Statement.

This Method Statement MUST contain sufficient information and detail to enable the PC (and ECO where applicable) to apply his/her mind to the potential impacts of the works on the environment. The Implementing Entity will also need to thoroughly understand what is required of him/her in order to undertake the works.

THE TIME TAKEN TO PROVIDE A THOROUGH, DETAILED METHOD STATEMENT IS TIME WELL SPENT. INSUFFICIENT DETAIL WILL RESULT IN DELAYS TO THE WORKS WHILE THE METHOD STATEMENT IS REWRITTEN TO THE ASD's SATISFACTION



METHOD STATEMENT

PROJECT NAME:

IMPLEMENTING ENTITY:

DATE:

PROPOSED ACTIVITY *(give title of method statement):*

E.g. construction of diversion structure, temporary damming of stream, deviation from standard rehabilitation procedures

Scope	
Potential Impacts	E.g. litter, spills, damage to flora, contamination of water
Start Date:	
End Date:	
Description (i.e. how will the Method Statement be implemented?):	
Location:	
Person(s) responsible for implementing (Name and designation):	



DECLARATIONS

1) Environmental Consultant/Environmental Control Officer

The work described in this Method Statement, if carried out according to the methodology described, is satisfactorily mitigated to prevent avoidable environmental harm:

_____	_____	_____
Signed	Print name	Dated

2) Implementing Entity

I understand the contents of this Method Statement and the scope of the works required of me. I further understand that this Method Statement may be amended on application to other signatories and that the PC/ECO will audit my compliance with the contents of this Method Statement

_____	_____	_____
Signed	Print name	Dated

3) Engineer/Engineer's Representative

The works described in this Method Statement are approved.

_____	_____	_____
Signed	Print name	Dated

4) Approving authority: PC

_____	_____	_____
Signed	Print name	Designation

Dated: _____



Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
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7.2. Additional method statements	Yes
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8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

8 Records

8.5 Request for deviations from standard EMPr or Rehabilitation Plan requirement

PROJECT NAME:	.....
IMPLEMENTING ENTITY:	.....
DATE:	.....

DEVIATION 1 (*Implementing Entity to complete*)

Description of deviation	<i>E.g. mixing of concrete in wetland</i>
Reason for deviation	<i>E.g. major wetland system resulting in excessive transport distances</i>
Start Date:	
End Date:	
Relevant section in EMPr	
Potential impacts associated with deviation	<i>E.g. concrete spills in wetland, additional vegetation clearance, water pollution</i>
Mitigation measures identified	<i>E.g. mixing boards, dedicated wash bins, no cement storage in wetland next to mixing area, regular clean-up</i>

DEVIATION 2 (*Implementing Entity to complete*)

Description of deviation	
Reason for deviation	
Start Date:	
End Date:	
Relevant section in EMPr	
Potential impacts associated with deviation	
Mitigation measures identified	



PC CHECKLIST

Does the deviation carry a high risk e.g. pollution, structure failure	Yes	No	Unsure	If “yes” or “unsure” consult with Engineer
Does the proposed deviation trigger a new listed activity	Yes	No	Unsure	If “yes” or “unsure” consult with EAP
Does the deviation involve a change in design of the IP	Yes	No	Unsure	If “yes” or “unsure” consult with Engineer and Wetlander
Is the deviation outside the approved wetland system?	Yes	No	Unsure	If “yes” or “unsure” consult with EAP



DECLARATIONS

1) Environmental Consultant/Environmental Control Officer

The work described in this request for deviation does not trigger any additional listed activities and will not result in excessive environmental damage:

_____	_____	_____
Signed	Print name	Dated

2) Person undertaking the works/Implementing Entity

I understand the scope of deviation requested and will implement the mitigation measures as indicated.

_____	_____	_____
Signed	Print name	Dated

3) Engineer/Engineer's Representative

The works described in this Method Statement are approved.

_____	_____	_____
Signed	Print name	Dated

4) Approving authority

_____	_____	_____
Signed	Print name	Designation

Dated _____



Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
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8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

9 Audits

9.1 Baseline audit/ inspection prior to commencement of construction

PROJECT NAME:	.....
IMPLEMENTING ENTITY:	.....
DATE:	.....

SECTION 1: WETLAND ZONE IN WHICH WORK WILL BE UNDERTAKEN:

Permanent	Seasonal	Temporary	Outside wetland boundary
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SECTION 2: CONDITION OF VEGETATION

Coverage:	Poor	Moderate	Good
Species diversity:	Poor	Moderate	Good
Grazing in wetland:	Yes	No	
Harvesting of vegetation in wetland:	Yes	No	
Level of alien invasive species infestation:	Low	Moderate	High

Insert photos:

SECTION 3: SOIL

Topsoil depth:	≥10cm	≥30cm	≥ 50cm
Peat known to be present?	Yes	No	
Evidence of erosion	Yes	No	
Type of erosion	Dryland	Gullies/donga	In-stream (undercutting, lateral, scouring)
	Stormwater outlets	Dispersed overland flow	Tunnelling (dispersive soils)



SECTION 4: IS THERE ANY EXISTING WASTE OR SPOIL ON SITE?

Yes	No
-----	----

If yes, specify the type and estimated quantity

--

Insert photos:

SECTION 5: ARE THERE EXISTING ALIEN INVASIVE SPECIES ON THE SITE?

Yes	No
-----	----

If yes, list the species

--

Are any of the species Category 1a or b species? (Alien and Invasive Species Regulations, 2014 - GN R598/2014)

Yes	No
-----	----

If yes, list the species and number/density of plants.

--

Insert photos:

SECTION 6: ARE THERE EXISTING ACCESS ROADS TO THE SITE?

Yes	No
-----	----

If yes, what is the condition of the road(s)?

Good	Moderate	Poor
------	----------	------

SECTION 7: ARE THERE OTHER IMPACTED OR DISTURBED AREAS

Cleared area	Mining area	Kraal	Previous site camps	Ploughed agricultural land
Roads	Settlements	Other:		

SECTION 8: EXISTING WATER QUALITY ISSUES

High sediment loads (murky/cloudy water)	Eutrophication (excess algal growth)	High TDS (salt deposits)	Low pH (orange coloured water)	<i>E. coli</i> (leaking sewer lines, concentration of animals)
--	--------------------------------------	--------------------------	--------------------------------	--



SECTION 9: IS THERE EXISTING FENCING ON THE PROPERTY WHERE THE WORK WILL BE CONDUCTED?

Yes	No
-----	----

If yes, what type of fencing and what is the condition of the fencing?

--

Insert photos:

SECTION 10: ARE THERE ANY KNOW PROTECTED PLANT SPECIES ON SITE?

Yes	No
-----	----

If yes, list the species

--

Insert photos:

SECTION 11: ARE THERE ANY SIGNIFICANT TREES OR CLUMPS OF TREES WHICH NEED TO BE CONSERVED?

Yes	No
-----	----

If yes, specify the species and location.

--

Insert photos:

SECTION 12: ARE THERE ANY KNOWN OR VISIBLE HERITAGE OBJECTS (E.G. OLD KRAAL, OLD FURROW, CORNER POSTS, OLD BUILDINGS)?

Yes	No
-----	----

If yes, specify the type of object and location.

--

Insert photos:

SECTION 13: ARE THERE ANY EXISTING ANIMAL (DOMESTIC OR WILD) CROSSINGS ON OR CLOSE TO THE SITE?

Yes	No
-----	----

If, yes, will the planned work impact on the crossings and movement of the animals?

Yes	No
-----	----

SECTION 14: ARE THERE ANY EXISTING SERVICES ON OR NEAR THE SITE (E.G. POWER LINES, SUB-STATIONS, PIPELINES, TELEPHONE LINES)?

Yes	No
-----	----

If yes, specify the type of infrastructure and whether it will be impacted by the activities on site

--

Insert photos:



Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

9 Audits

9.3 Internal audits/check conducted by the Implementing Entity

PROJECT NAME:	.....
IMPLEMENTING ENTITY:	.....
DATE:	.....
WEEK:	<i>E.g. Week 1 / Week 2</i>

SECTION 1: SITE CONDITIONS

--

SECTION 2: LAYDOWN AREAS & SITE OFFICES

ITEM	DESCRIPTION	EVALUATION		NOTES
		Not to Standard	To Standard	
2.1	Litter control			
2.2	Dust suppression			
2.3	Erosion control			
2.4	Storm water / Runoff control			
2.5	Toilets			
2.6	Fuel & oil storage & dispensing			
2.7	Material handling or Storage			
2.8	Waste management			
2.8.1	<i>Domestic Waste</i>			
2.8.2	<i>Hazardous Waste</i>			
2.9	Noise control			

SECTION 3: CONSTRUCTION SITES

ITEM	DESCRIPTION	EVALUATION		NOTES
		Not to Standard	To Standard	
3.1	Litter control/Recycle			



3.2	Dust suppression			
3.3	Erosion control			
3.4	Toilets			
3.5	Eating areas			
3.6	Material handling and Storage			
3.7	No go areas, natural features and trees have not been damaged			
3.8	Drip trays			
3.9	Waste management			
3.9.1	<i>Domestic Waste</i>			
3.9.2	<i>Hazardous Waste</i>			
3.10	Noise control			
3.11	Environmental Awareness Training			

SECTION 4: COMPLAINTS WITH THE EA CONDITIONS AND EMP AND/OR ENVIRONMENTAL INCIDENTS

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SECTION 5: GENERAL NOTES

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Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

9 Audits

9.4 Incident and non-conformance reports

9.4.1 Environmental Incident Report

PROJECT NAME:

IMPLEMENTING ENTITY:

DATE:

REVISION:

SECTION 1: DESCRIPTION OF INCIDENT

SECTION 2: REMEDIAL ACTION REQUIRED

Remedial Action Due Date:	

SECTION 3: RELEVANT DOCUMENTATION

SECTION 4: SIGNATURES

ECO:		Implementing Entity:	
Name:		Name:	
Date:		Date:	



SECTION 5: REMEDIAL ACTION COMPLETED

Implementer to sign when remedial action has been completed and return original to ECO:	
Name:	
Date:	

SECTION 6: REMEDIAL ACTION VERIFIED

ECO:		Implementing Entity:	
Name:		Name:	
Date:		Date:	

SECTION 7: DRAWING/SKETCH

--



9.4.2 Environmental Non-Conformance Notice

PROJECT NAME:

IMPLEMENTING ENTITY:

DATE:

REVISION:

SECTION 1: INCIDENT SEVERITY

High	Medium	Low
Number of previous similar non-conformances on same contract:		

SECTION 2: DESCRIPTION OF INCIDENT

--

SECTION 3: DRAWING/SKETCH

--

SECTION 4: REMEDIAL ACTION REQUIRED

Remedial Action Due Date:	



SECTION 5: DRAWING/SKETCH**SECTION 6: RELEVANT DOCUMENTATION****SECTION 7: SIGNATURES**

ECO:		Implementing Entity:	
Name:		Name:	
Date:		Date:	

SECTION 8: REMEDIAL ACTION COMPLETED

Implementer to sign when remedial action has been completed and return original to ECO:	
Name:	
Date:	

SECTION 9: REMEDIAL ACTION VERIFIED

ECO:		Implementing Entity:	
Name:		Name:	
Date:		Date:	



Section	Template available
1. Rehabilitation Plan and EMP	
2. Implementing Entity Agreements	
2.1. Undertaking in terms of Environmental Authorisation, Environmental Management Programme, Rehabilitation Plan and submitted Method Statements	Yes
3. Approvals and Licenses	
3.1. Environmental Authorisation	
3.2. Section 21(c) and (i) General Authorisation	
3.3. Waste license (if applicable)	
4. Communication	
4.1. Important correspondence e.g. notice to Competent Authority of commencement of construction	
4.2. Copy of public complaints register	Yes
5. Site Management	
5.1. Approved layout	
5.2. Site instructions (or copies thereof)	
6. Environmental Training	
6.1. Proof of toolbox talks, environmental awareness and induction (incl. attendance register and training material)	
7. Method Statements	
7.1. Combined method statements	Yes
7.2. Additional method statements	Yes
8. Records	
8.1. Record of waste generation – quantity, type, fate (incl. general/hazardous, liquid/solid)	
8.2. Proof of legal/safe waste disposal	
8.3. Record of chemicals on site and Material Safety Data Sheets (MSDS)	
8.4. Record of water usage (if applicable)	
8.5. Request for deviations	Yes
9. Audits	
9.1. Baseline Audit	Yes
9.2. ECO audit reports	
9.3. Internal audits/check conducted by the Implementing Entity	Yes
9.4. Incident and non-conformance reports	Yes
9.5. Site closure	Yes

9 Audits

9.5 Site closure

PROJECT NAME:	.....
IMPLEMENTING ENTITY:	.....
DATE:	.....

SECTION 1: SITE CLOSURE INSPECTION SHEET

Slope:	
Alien invasives:	
Topsoil:	
Anti-erosion:	
Waste:	
Other:	
Timeframe for completion:	

PC signature

Implementing Entity
signature

Date

Date



SECTION 2: POST SITE CLOSURE INSPECTION COMMENTS

Slope:	
Alien invasives:	
Topsoil:	
Anti-erosion:	
Waste:	
Other:	

Outstanding items:

1. _____
2. _____
3. _____

Completion date: _____

PC signature

Date

Implementing Entity
signature

Date



Annexure C: Sensitive Areas

Sensitive areas (incl. delineated wetland boundary)



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Annexure D: Minimum Standards for Construction and Maintenance

Note that maintenance information of structures (position, numbering and BoQ) will be determined as part of the planning process (by the PC and/or the Engineer) and will be included in the Rehabilitation Plan together with new wetlands. This information will be available on WetIS for inclusion in the PIPs. It is the Implementing Entity's responsibility to make provision for maintenance activities in the PIP as discussed and agreed with the PC.

Concrete Batching

- Concrete shall be mixed according to the correct MPa and mix information as specified in the construction notes of the respective design drawings.
- All material used in the mixing of concrete are to be of good quality, clean and clear of any organic material.
- Manufacturer's directions for mixing, consistency and treatment after pouring shall be complied with.
- Cement shall be stored in dry conditions for no longer than six weeks after delivery.
- When cement is stored temporarily infield it shall be kept on a dry waterproof base with a waterproof cover.
- The batching of concrete shall be done on a smooth impermeable surface (e.g. shutter plywood sheets). The batching area shall be prepared by cutting (not removing) the existing vegetation and covering the natural ground level (NGL) with Geotextile lining (minimum A4 grade). A sand retaining berm is to be constructed on top of the geotextile on the downstream end to contain any run-off. A 250µm plastic lining is to cover the geotextile and sand berm while secured to the NGL. The prepared area should be of sufficient size to prevent overspill of any material of substance. All wastewater resulting from batching of concrete shall be disposed of via a contaminated water management system and shall not be discharged into the environment.
- Contaminated water storage areas shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented.
- A demarcated site at least 20m away from water/ wetland edge shall be used for cement mixing. No batching activities shall occur directly on unprotected ground.
- Empty cement bags shall be stored in weather proof containers to prevent windblown cement dust and water contamination. Empty cement bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose. Unused cement bags shall be stored so as not to be affected by rain or runoff events. In this regard, closed steel containers shall be used for the storage of cement powder and any additives.
- The Implementing Entity shall ensure that sand, aggregate, cement or additives used during the mixing process are contained and covered to prevent contamination of the surrounding environment.
- The Implementing Entity shall take all reasonable measures to prevent the spillage of cement/ concrete during batching and construction operations. During pouring, the soil surface shall be protected using plastic and all visible remains of concrete shall be physically removed on completion of the cement/ concrete pour and appropriately disposed of. All spoiled and excess



aggregate/ cement/ concrete shall be removed and disposed of via the solid waste management system.

- Construction using shuttering shall take into consideration the structure design dimensions and safe working heights to prevent over extension of shuttering. Steel shuttering panel sizes shall be used to match the dimensions of the final concrete section as close as possible.
- Concrete will be mixed and used on the same day. Time from mixing to final compaction should not exceed 45 minutes.
- The maximum haul distance of mixed concrete by means of wheel barrows should be limited to ensure the maximum time from mixing to final compaction does not exceed 45 minutes.
- Where sand, stone and cement are transported by wheelbarrow to their point of mixing the distance travelled should be limited to 150m.
- Where applicable, the location of the batching site (including the location of cement stores, sand and aggregate stockpiles) shall be as approved by the PC. The concrete batching plant shall be kept neat and clean at all times.
- Water used for mixing purposes will be of suitable non-potable quality and may not be obtained from natural water resources.

Concrete Structures:

- Concrete mix to follow the design specification.
- Participants shall be trained in concrete mixing and placing by an accredited organisation prior to performing construction of concrete structures.
- Concrete to be placed in 300mm layers and vibrated using a concrete vibrator.
- Minimum 50mm cover required on all concrete reinforcing and mesh unless otherwise specified.
- 250µm plastic sheets to be placed under structure.
- All concrete walls to be fully supported until they are backfilled to the designed level.
- All mesh reinforcing to have 500mm overlaps between sheets.
- Buttresses and walls to be cast monolithically with footing.
- Construction joints to be used wherever new concrete is cast against previously cast concrete.
- If rebar or mesh crosses a construction joint, it should be continuous through the joint and extend 600mm into each side.
- Foundation improvement to be constructed from 70kg sandbags made of BIDIM A4 and filled with sand or well graded gravel, where indicated.

Gabion Structures:

- Gabion work shall be done according to design specifications.
- Participants shall be trained in gabion construction by an accredited organisation prior to performing placing or construction of gabion structures.
- Gabion baskets and Reno mattresses to be constructed of minimum double twisted, hexagonal galfan galvanised wire mesh of nominal diameter and 80mm mesh. Frame wire to be 3.4mm outside diameter (o/d) and mesh wire to be 2.7mm o/d with partitions at 1m centres.



- Support and binding wire shall be a minimum 2.2mm. Lacing shall be done according to specification.
- Support wires (bracing) shall be in place according to manufacturer's specifications.
- All adjoining baskets shall be laced together according to manufacturer's specifications.
- Geotextile shall line all faces of the gabion baskets that are exposed to earth and certain water exposed sides with a minimum of 200mm overlap in all directions and stitched with either polyester or galvanised wire at 300mm c/c.
- Water corrosivity shall be determined at each site; if necessary PVC coated gabion wire shall be used as specified.
- Soil dispersivity shall be determined at each site. If dispersive soils are detected, the ECO / Engineer shall be contacted.
- Density of fill material shall satisfy the gabion design. Clay bricks, weathered rock and sandstone and shale shall not be used as fill material. Any unconventional fill material shall be approved by the ECO / Engineer.
- Fill material shall not be smaller than mesh size.
- Where fill material is hauled to its point of placement by means of wheelbarrows, the haul distance shall not be greater than 150m.

Stone Masonry Structures:

- Stone to be packed and mortared in place using concrete with specified strength.
- Concrete mix to follow the design specification
- 100mm - 200mm stone to be used in all stone masonry, gabions and Reno mattresses. Stone fill must be non-friable & insoluble e.g. Granite, basalt, limestone or sandstone.

Geo Cells:

- Geo cells shall not be used in conditions that exceed their design specifications.
- Geo cell material shall be UV resistant.
- Geo cells shall be anchored in by the "trench" method and in such a way that prevents undermining of the cells.
- Fill material shall conform to the design specifications. The following general rules shall be applied: If soil is used to fill the cells, it shall be re-vegetated immediately with optimum prepared soil conditions.
- If concrete is used to fill the cells, some degree of permeability of the structure shall be permitted. If concrete is used as fill, concrete baffles should be inserted or as per specified design. Rock is not suitable for this purpose.

Earth Works

- Excavations may not exceed 1.5m depth without stepping, shoring and/or reinforcement.
- All excavated material temporarily stored shall be placed on Geotextile sheets covering the NGL. If stockpiled for extended periods, it will be done so at predetermined positions approved by the ECO.
- Excavation and compaction must comply with design specifications.



- The ECO / Engineer must be consulted for work undertaken in dispersive, unstable and organic soils.
- Backfilling in trenches must be done in layers of thickness not exceeding 100mm before compaction. Each layer shall be compacted using hand compactors or mechanical rammers at optimum moisture content.
- Where excavation material is hauled by means of wheelbarrows, the haul distance shall not be greater than 150m.

All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities, particularly with regards to erosion and dust generation. No equipment associated with earthworks shall be allowed outside of the Site and defined access routes unless expressly permitted by the ECO / Engineer.

Rock Packing:

- Stone must be non-friable and insoluble, e.g. granite, basalt, limestone or sandstone
- Rock packs placed across a stream to be tied min 1m into each bank.
- The ECO must approve the source of rocks if not supplied by suitable rock supplier.
- The haul distance may not be greater than 150m where rocks are transported to their point of placement by means of wheel barrows
- The size of rocks must comply with the specifications shown on the drawings and must be handled in a safe manner particularly during offloading/placing. Heavy duty gloves to be worn when handling rocks.

Ecologs:

- Wooden pegs used to anchor EcoLogs are to be no less than 40mm diameter and 1000mm in length.
- Pegs should protrude no less than 600mm from the soil @ 1000 c/c.

MacMat / MacMat-R

- MacMat / MacMat-R to be installed to manufacturers specifications.

Working with Wire (Ecologs, fencing, silt traps)

- Wire used must comply with the engineer's specifications.
- The appropriate tools are to be used for safe handling of wire.
- Heavy duty gloves must be worn when handling wire.
- No loose wire/sharp edges are to remain on completed interventions.
- All excess wire must be removed from the site.
- Stakes used for pegging should not present a tripping/piercing risk (as far as practically possible).



Annexure E: Curriculum Vitae of EAP





Franci Gresse

Franci is a senior environmental practitioner in Aurecon's Cape Town office. She has been involved in various environmental investigations, including environmental impact assessments (EIA's), environmental management plans (EMP's), environmental management programmes (EMP's), rehabilitation plans maintenance management plans (MMP's) and fatal flaw analysis.

Franci has been involved with the Working for Wetlands rehabilitation programme for the past five years, of which she has been acting as the Team Leader for the environmental assessment practitioners (EAP's) for the last three years. The Working for Wetlands project won the 2012 Aurecon Chairman's Award for its positive contribution to the natural and social environment. In addition, Franci has also been involved with a number of projects in the renewable energy sector.

Franci served on the committee of the South African affiliate of the International Association for Impact Assessment (IAIA) for the Western Cape Branch from 2009 to 2011, and remains a member. She completed a Bachelor of Science and an Honours Degree in Conservation Ecology at the University of Stellenbosch (South Africa).

Qualifications

BSc (Hons) Conservation Ecology

Member, International Association of Impact Assessment (IAIA)

Specialisation

Environmental Impact Assessment Practitioner

Years in industry

8.08

Experience

Working for Wetlands plan 2016 - 2018, Regional South Africa, Department of Environmental Affairs: Natural Resource Management Directorate, 06/2016 - Date, Project Leader

The Natural Resource Management Directorate of the Department of Environmental Affairs appointed Aurecon to provide environmental and engineering services for the Working for Wetlands Programme which is a national wetland rehabilitation programme. Responsibilities include the management and coordination of the overall project, management of the environmental authorisation component of the project, as well as the compilation of basic assessment reports (BAR) for the country. Other responsibilities include the compilation of wetland rehabilitation plans for the Western Cape, Northern Cape and Limpopo Provinces, liaison with authorities and the public (public participation process) and management of wetland specialists.

Integrated Environmental Impact Assessment (EIA) for the proposed extension of the Ash Dam facility at Kriel power station, Mpumalanga Province, South Africa, Eskom Holdings, 06/2016 - date, Project Leader

Appointed by Eskom to conduct an integrated environmental impact assessment (EIA) for the proposed construction of a fourth ash dam facility at the Kriel power station. Responsible for the general project management and finances, authority liaison and the compilation and review of the EIA documentation.

Amended Environmental and Socio-Economic Impact Assessment for a concentrated solar plant facility near Arandis in the Erongo Region, 02/2016 – 10/2016, Project Leader

Aurecon was appointed by the NamPower to amend the Environmental Clearance Certificate (ECC) issued for the Erongo Coal-fired Power Station at Arandis, to a Concentrated Solar Plant. Responsibilities included project management (programme, finances and client expectations), liaison with authorities and relevant stakeholders, review of specialist reports and the compilation and review of the Amendment Report.



Franci Gresse Senior Environmental Impact Assessment Practitioner

Table Mountain Group (TMG) Aquifer feasibility study and pilot project, Western Cape Province, South Africa, City of Cape Town, 2015 - date, Environmental Consultant

The TMG Aquifer Feasibility Study and Pilot Project was initiated in 2002 and is a long term planning initiative to investigate the groundwater potential of the TMG Aquifer as a water source to augment Cape Town's water supply. Given the recommendations in the Exploratory Phase report, and the fact that the TMG Aquifer has since been utilised as a water resource in areas such as Hermanus and Oudtshoorn, the City of Cape Town decided to omit the Pilot Phase and rather proceed with an extended Exploratory Phase, which would include limited pump testing. Aurecon was appointed to undertake the extended Exploratory Phase work. Responsibilities include the compilation of Environmental Management Plans for the additional test sites, liaison with the relevant authorities and landowners and management of the Environmental Control Officers on the project.

Implementation of the Hoekplaas environmental authorisation (EA), Northern Cape Province, South Africa, Mulilo Renewable Energy, 11/2013 - 05/2015, Project Leader

Aurecon assisted the holder of the environmental authorisation (EA) for the 100 MW photovoltaic (PV) facility in De Aar with the implementation of the environmental conditions to ensure compliance to all relevant environmental legislation. Responsible for the management of tasks and review of all documentation. Also assisting client with questions on the environmental impact assessment (EIA) process.

Environmental impact assessment and compilation of an environmental management plan (EMP) for the Swakopmund-Mile 7 Water Supply, Phase 2, Swakopmund, Namibia, NamWater, 11/2013 - 10/2015, Project Leader

NamWater appointed Aurecon to assist with the environmental impact assessment process for the proposed construction of a new bulk water pipeline between Swakopmund and Mile 7. Responsible for the management and review of the environmental impact assessment (EIA) reports and processes, as well as the project's finances.

Working for Wetlands plan 2014 - 2016, Regional South Africa, South African National Biodiversity Institute (SANBI), 06/2013 – 05/2016, Task Leader

The South African National Biodiversity Institute (SANBI) appointed Aurecon to provide environmental and engineering services for the Working for Wetlands Programme which is a national wetland rehabilitation programme. Responsible for the management of the environmental authorisation component of the project, as well as the compilation of basic assessment reports (BAR) for the country. Other responsibilities include the compilation of wetland rehabilitation plans for the Western Cape, Northern Cape, North West and Limpopo Provinces, liaison with authorities and the public (public participation process) and management of wetland specialists.



Franci Gresse Senior Environmental Impact Assessment Practitioner

Maintenance management plans (MMP's) for flood damaged road infrastructure, Western Cape Province, South Africa, Western Cape Provincial Government Department of Transport and Public Works, 06/2013 - Date, Project Staff

The project entails the compilation of maintenance management plans (MMP's) for two local municipal areas (Laingsburg and Worcester), as well as obtaining the necessary permits/ water use authorisations. Personally involved during the project commencement with regards to strategy development, meetings with the relevant authorities and assistance with the development of the MMP's.

Environmental impact assessment (EIA) for the expansion of approved solar energy facilities located near Prieska and De Aar, Northern Cape Province, South Africa, Mulilo Renewable Energy, 03/2013 - 09/2015, Phase Leader

Mulilo Renewable Energy decided to expand the approved solar energy facilities on the farms Hoekplaas and Klipgats in Prieska, as well as on the farms Badenhorst Dam and Du Plessis Dam in De Aar. The expansion of Hoekplaas farm in Prieska includes ten additional 75 MW photovoltaic (PV) facilities and six additional PV units at Klipgats Pan farm. The expansion at Badenhorst Dam farm includes four additional 75 MW PV facilities and three additional PV units at Du Plessis Dam farm. Responsible for the management and review of the environmental impact assessment (EIA) reports and processes, as well as the project's finances.

Fatal flaw study for two potential Wind Energy Facility (WEF) sites, Northern and Western Cape Provinces, South Africa, Juwi Renewable Energies (Pty) Ltd, 03/2013 - 04/2013, Environmental Practitioner

The study entailed a fatal flaw analysis of two potential wind energy facility (WEF) sites in the Northern and Western Cape Provinces. Responsible for the assessment of the sites and compilation of the fatal flaw report.

Richtersveld wind energy facility (WEF), Northern Cape Province, South Africa, TRE Tozzi Renewable Energy S.p.A and Guma Group, 07/2012 - 09/2013, Environmental Practitioner

The project entailed a due diligence of the proposed wind energy facility (WEF) to review compliance with the requirements of the Department of Energy's independent power producer (IPP) process. Responsible for the review of the environmental reports and compilation of the due diligence report.

Three photovoltaic (PV) energy facilities near Copperton, Northern Cape Province, South Africa, Mulilo Renewable Energy (MRE), 09/2011 - 05/2015, Environmental Practitioner

The project entailed three environmental impact assessments (EIA's) for three photovoltaic (PV) energy facilities comprising 75 MW to 150 MW, located near Copperton. Responsible for the management the EIA process and project specialists, compilation of scoping and EIA reports and liaison with authorities.

Fatal flaw study for four potential wind energy facility (WEF) sites, Northern and Western Cape Provinces, South Africa, Mainstream Renewable Power South Africa, 11/2011 - 05/2012, Environmental Practitioner

The study entailed a fatal flaw analysis of four potential wind energy facility (WEF) sites across the Northern and Western Cape Provinces. Responsible for the management of specialists, review of reports, assessment of the sites and compilation of the fatal flaw report.



Franci Gresse Senior Environmental Impact Assessment Practitioner

Implementation of the Klipgats Pan environmental authorisation (EA), Northern Cape Province, South Africa, Mulilo Renewable Energy, 09/2011 - 05/2015, Project Leader

Aurecon was appointed to undertake three environmental impact assessments (EIA's) for three proposed photovoltaic (PV) solar energy plants near Copperton. The first PV solar energy plant will generate around 100 MW (preferred alternative) or 150 MW (alternative) on the Hoekplaas Farm (Farm 146/RE). The proposed PV plant will cover approximately 300 ha (preferred alternative) or 450 ha (alternative). The second includes a PV solar energy plant to generate roughly 100 MW on the farm Klipgats Pan (Farm 117/4) near Copperton in the Northern Cape. The proposed PV plant will cover an estimated 300 ha. An alternative site for a 100 MW PV plant with a 300 ha footprint is also being considered. The third comprises a PV solar energy plant to generate about 100 MW (preferred alternative) or 300 MW (alternative) on the farm Struisbult (Farm 104, portion 1) which will cover 300 ha to 900 ha. Responsible for managing tasks and reviewing all documentation for updating the environmental management plan (EMP) and implementing the environmental authorisation (EA). Also assisted client with questions on the EIA process.

Proposed rehabilitation of Wetlands as part of the Working for Wetlands, Regional, South Africa, South African National Biodiversity Institute (SANBI), 08/2011 - 09/2013, Environmental Practitioner

Appointed by the South African National Biodiversity Institute (SANBI) to conduct environmental impact assessments (EIA's) for the rehabilitation of specific wetlands in all provinces of South Africa over a five year period. Responsible for the compilation of basic assessment reports (BAR) and Wetland Rehabilitation Plans for the Western Cape, Northern Cape, Gauteng and Limpopo Provinces. Other responsibilities included liaison with authorities, public participation process, management of specialists and general project management of the environmental component of the project.

Repair of flood damage to road structures in the Eden District Municipality, Western Cape Province, South Africa, Western Cape Provincial Department of Transport and Public Works, 01/2011 - Date, Environmental Practitioner

The project entails the compilation of maintenance management plans (MMP) for seven areas within the Eden District Management Area to repair. Responsible for compilation of MMP's, review of reports and liaison with stakeholders and authorities.

Environmental impact assessment (EIA) for the proposed extension of the Ash Dam facility at Kriel power station, Mpumalanga Province, South Africa, Eskom Holdings, 11/2009 - 12/2015, Environmental Practitioner

Appointed by Eskom to conduct an environmental impact assessment (EIA) for the proposed construction of a fourth ash dam facility at the Kriel power station. Responsible for the general project management and finances, screening process, compilation of the scoping and EIA reports, public participation and the compilation of a waste management licence application.



Franci Gresse Senior Environmental Impact Assessment Practitioner

Environmental impact assessment (EIA) for proposed relocation of solar energy facility, Onder Rietvlei Farm, Aurora, Western Cape Province, South Africa, Solaire Direct Southern Africa, 2010 - 2011, Project Leader

Appointed by Solaire Direct to undertake a basic environmental impact assessment (EIA) process for the proposed relocation of an approved, but not yet constructed 10 MW solar energy facility. Responsible for the management and review of the EIA process and finances.

Environmental impact assessment (EIA) for proposed solar energy facility, Onder Rietvlei Farm, Western Cape Province, South Africa, Solaire Direct Southern Africa, 07/2010 - 02/2012, Environmental Practitioner

Appointed by Solaire Direct to undertake a basic environmental impact assessment process for the proposed construction of a 10 MW solar energy facility. Responsible for the compilation of the draft and final reports, public participation process, management of specialists and general project management.

Proposed Paarl Mountain and Ysterbrug pumping main upgrades, Western Cape Province, South Africa, Drakenstein Municipality, 06/2010 – 12/2015, Environmental Advisor

The Drakenstein Municipality appointed Aurecon's engineers to investigate and plan the proposed upgrade of the Paarl Mountain and Ysterbrug Pumping Scheme. The upgrading of the pipelines feeding the Meulwater Water Treatment Works from the Bethel and Nantes dams, also part of this scheme, was also investigated. Responsible for providing advice on environmental processes required. Other responsibilities included the management of the independent environmental assessment practitioner and the review of all environmental impact assessment (EIA) documentation.

Environmental sensitivity study (ESS) for a proposed solar energy facility on a farm Near Aurora, Western Cape Province, South Africa, Solaire Direct Southern Africa, 2010, Environmental Practitioner

Appointed to provide an environmental sensitivity study (ESS) which inter alia highlights the potential constraints ('red flags') and opportunities presented by the site from an environmental perspective. Responsible for the compilation of the ESS.

Proposed remediation, rehabilitation and restoration of the Spruit, Krom, Leeu and Palmiet Rivers, Western Cape Province, South Africa, Drakenstein Municipality, 2009 - 2010, Environmental Practitioner

Appointed by the Drakenstein Municipality to undertake the requisite environmental impact assessment (EIA) process for the rehabilitation, remediation and stabilisation of four rivers in Paarl and Wellington. Responsible for the EIA and public participation processes.

Proposed construction of a new pipeline from Bovlei Winer to Withoogte Dam, Wellington, Western Cape Province, South Africa, Drakenstein Municipality, 2009 - 2010, Environmental Practitioner

The Drakenstein Municipality proposed to replace a section of the existing pipeline extending from the Withoogte Dam to the Welvanpas Reservoir near Wellington as part of the municipality's water master plan in order to improve the overall water supply. Responsible for the compilation of the environmental impact assessment (EIA) report, management of specialists and the public participation process.



Franci Gresse Senior Environmental Impact Assessment Practitioner

Proposed erection of Eskom communication sirens and public announcement (PA) systems, Blaauwberg, Western Cape Province, South Africa, Eskom, 2009 - 2010, Environmental Practitioner

The project entailed three environmental impact assessment (EIA) processes for the (a) erection of 10 new sirens in the Parklands area, (b) the relocation of one siren in Bloubergstrand, and (c) the upgrade of five sirens on farms near Melkbosstrand. Responsible for compiling environmental impact assessment (EIA) reports, and the public participation process.

Overberg District Municipality integrated transport plan (ITP) strategic environmental informants, Western Cape Province, South Africa, Overberg District Municipality, 2009, Environmental Practitioner

Aurecon's Transportation Unit was appointed to revise the integrated transport plan (ITP). The Environmental Unit was subcontracted to provide environmental input. Responsible for identifying and describing the relevant informants.

Annandale Commercial: development of petrol filling station on portion of Erf 5561, Kuils River, Western Cape Province, South Africa, Communicate, 2009, Environmental Practitioner

Appointed to compile a construction environmental management plan (CEMP) for the construction of a filling station on the corner of Gladioli Street and Amandel Drive, Kuils River. Responsible for the compilation of the project specification document as part of the CEMP.

Environmental impact assessment (EIA) for the proposed Langezand Quays development in Struisbaai Harbour, Western Cape Province, South Africa, Golden Falls (Pty) Ltd, 2008 - Date, Environmental Practitioner

Aurecon was appointed to undertake an environmental impact assessment (EIA) process for the proposed development of a four storey development on Erf 848 within the Struisbaai harbour precinct. Responsible for drafting responses to the Department of Environmental Affairs' independent review report on the proposed development.

Pre-feasibility and feasibility studies for augmenting the Western Cape water supply system, South Africa, Department of Water Affairs (DWA), 2008 - 2013, Project Staff

The Department of Water Affairs commissioned pre-feasibility and feasibility studies for the augmentation of the Western Cape water supply system through the further development of the surface water resources. Surface water schemes to be investigated were identified by the Western Cape water supply system reconciliation strategy study. Responsible for the public participation process, managing environmental specialists, and compiling a socio-economic overview of the study area.

Proposed redevelopment of the Blaauwberg Conservation Area: Eerstestein Node, Western Cape Province, South Africa, City of Cape Town, 2008 - 2010, Environmental Practitioner

The project entailed an environmental impact assessment (EIA) process for redeveloping the Eerstestein Conservation Area on the West Coast. Responsible for compiling the EIA report, as well as managing specialists and the public participation process.



Franci Gresse Senior Environmental Impact Assessment Practitioner

Table Mountain Group aquifer feasibility study and pilot project, Western Cape Province, South Africa, City of Cape Town, 2008 - 2010, Environmental Control Officer

The City of Cape Town initiated a study into the Table Mountain Group Aquifer as a potential water source to augment the city's supply. The feasibility and pilot project phase record of decision (RoD) required completion for site-specific environmental management plans (EMP's) for drilling sites that were assessed to be environmentally sensitive. Site-specific EMP's were designed for sensitive sites to ensure minimal environmental impact during the drilling phase. Responsible for monitoring compliance with the RoD and EMP during the drilling phase.

Water reconciliation strategy for the Algoa water supply area, Eastern Cape Province, South Africa, 2008 - 2009, Environmental Practitioner

This project provided an assessment of the environmental opportunities and constraints for a suite of water schemes in the Algoa water supply area. This was undertaken as part of a broader study in the area.

Application for rectification in terms of Section 24G of the National Environmental Management Act (NEMA) for the unlawful commencement of a fruit processing factory on Op de Tradouw Farm, Number 69, Barrydale, Western Cape Province, South Africa, Schoonies Family Trust, 2008 - 2009, Environmental Practitioner

The project consisted of an application for rectification in terms of Section 24G of NEMA. Responsible for compiling an environmental impact report and an environmental management plan (EMP) for the application, as well as managing the public participation process.

Proposed development of apple and pear orchards on Soetmelksvlei Farm, Western Cape Province, South Africa, BETCO, 2008 - 2009, Project Staff

This Agri-development project involved the development of 50 ha of apple and pear orchards in the Riviersonderend region. Responsible for compiling the basic assessment report, environmental management plan (EMP), and managing the specialists and public participation process.

C.A.P.E. Olifants-Doring Catchment Management Agency project: Development of a catchment management strategy water resource protection sub-strategy for the Olifants-Doring Catchment, South Africa, CapeNature, 2008 - 2009, Environmental Practitioner

Appointed by CapeNature to compile a catchment management strategy water resource protection sub-strategy for the Olifants-Doorn catchment. Responsible for compiling a database that lists all institutions and their respective mandates in terms of water resource protection and biodiversity conservation decision making for the Olifants-Doring Catchment, workshop arrangements, and general project related work.

Environmental sensitivity study for the proposed Dasdrif poultry farm in Moorreesburg, Western Cape Province, South Africa, Eikenhoff Poultry Farms (Pty) Ltd, 2008, Project Staff

The project consisted of an environmental sensitivity study (ESS) which, inter alia, highlighted the potential constraints ('red flags') and opportunities presented by the site from an environmental perspective. Responsible for compiling the ESS.



Margaret Lowies

Senior Environmental Scientist

Margaret is a senior environmental scientist currently based in Aurecon's Port Elizabeth office. She has over seven years of experience in environmental impact assessment (EIA) processes, water use licence applications, waste licence applications, environmental compliance auditing, mining permit applications, wetland assessments, due diligence assessments and water quality assessments. Most of these projects have been focussed at a municipal level within the various municipalities of the Eastern Cape, and her roles include both the technical work and overall project management. Her role as an environmental control officer (ECO) has also given her a very practical understanding of how projects of various scales are implemented.

She obtained a BSc degree in Geography and Environmental Management, a BSc in Geography (Hons) as well as an MSc degree in Geography from the University of Johannesburg, South Africa in 2008, 2010 and 2014 respectively. She is registered as an environmental assessment practitioner with the Environmental Assessment Practitioners Association of South Africa (EAPSA) and is a registered candidate natural scientist with the South African Council for Natural Scientific Professions (SACNASP). She is also member of the Institute of Waste Management of South Africa (IWMSA) and the South African affiliate of the International Association of Impact Assessment (IAIAsa).

Qualifications

MSc Geography
BSc (Geography and Environmental Management)
BSc Geography (Hons)
Environmental Assessment Practitioner, Interim Certification Board of Environmental Assessment Practitioners of South Africa
Candidate Natural Scientist, South African Council for Natural Scientific Professions (SACNASP)
Member, International Association for Impact Assessment (IAIAsa), South Africa
Member, Institute of Waste Management of Southern Africa (IWMSA)

Specialisation

Environmental Specialist

Years in industry

7

Languages

Afrikaans

English

Experience

Training & Capacity Building

Working for Wetlands ECO training, South Africa,

Having worked on the planning cycles of the Working for Wetlands Programme for many years, Margaret provided training on the importance of implementing the appropriate mitigation measures during wetland rehabilitation. This was guided by her experience as an Environmental Control Officer.

Environmental Control Officer

Construction of Zone 7 municipal infrastructure to service the TNPA Tank Farm, Eastern Cape Province, South Africa, Coega Development Corporation (CDC), 10/2007 - 12/2025, Environmental Control Officer

The project involved the construction of roads, a stormwater detention pond and the installation of various services. Responsible for ensuring compliance with environmental assessment and CDC standard environmental specifications.

Dordrecht water and sanitation services upgrade, Eastern Cape Province, South Africa, Chris Hani District Municipality, 10/2015 - 12/2017, Environmental Control Officer

This project is divided into four future projects, which includes the construction of new sewage treatment facilities; the construction of new reticulation in Dordrecht; immediate water supply upgrades and long-term bulk water supply upgrades. Responsible for report review.



Margaret Lowies Senior Environmental Scientist

Northern outfall sewers, Mthatha, Eastern Cape Province, South Africa, Amatola Water - Amanzi, 06/2013 - 12/2017, Environmental Control Officer

The project entailed consulting engineering, social facilitation and environmental services for the construction of the outfall sewers along the banks of the Mthatha River. This involved the installation of 1 200 mm diameter sewer pipes, crossing the river above ground and below the river bed level. The sewage will discharge into a 17 m-deep pump station, from where it will be pumped into the head of the existing wastewater treatment works (WWTW). The project also entailed the application for a water use licence application (WULA). Responsible for management of environmental site officer, report writing and WULA report/application review.

Construction of Graaff-Reinet solid waste site, Eastern Cape Province, South Africa, Camdeboo Local Municipality, 12/2010 - 12/2016, Environmental Control Officer

The project comprised the construction of a new solid waste site outside Graaff-Reinet. Responsible for monitoring compliance with the environmental management plan (EMP) and record of decision (ROD).

Construction environmental management plan (EMP) for Ugie particle board plant, Eastern Cape Province, South Africa, PG Bison, 08/2006 - 08/2016, Environmental Control Officer

The project entailed a construction environmental management plan (EMP), operation environmental management plan (OEMP), atmospheric emissions license (AEL) reviews and ongoing monitoring for the Ugie particle board plant. Responsible for operational compliance auditing.

Sidwadweni Bulk Regional Water Supply Scheme, Eastern Cape Province, South Africa, Amatola Water - Amanzi, 09/2012 - 07/2016, Environmental Control Officer

The project included the construction of river abstraction, raw water reservoir, water treatment works (WTW), clear water pump station and bulk supply mains for the Sidwadweni Bulk Regional Water Supply Scheme. Responsible for report review.

Idutywa East Water Supply Scheme (WSS), Eastern Cape Province, South Africa, Amathole District Municipality (ADM), 05/2006 - 12/2015, Environmental Control Officer

Aurecon undertook the design and construction of the Idutywa East Water Supply Scheme (WSS) in the Eastern Cape Province. Responsible for ensuring environmental compliance and report review.

Khayamnandi housing development project, Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 02/2011 - 01/2015, Environmental Control Officer

The project entailed environmental services for the development of Khayamnandi extension on erven 114, 609, 590 and 24337, Bethelsdorp, including the construction of 7 960 residential stands, business stands and community facilities and supporting infrastructure. Responsible for overall environmental monitoring and inputs as well as compilation/review of monthly audit reports.



Margaret Lowies **Senior Environmental Scientist**

Cookhouse Wind Farm project, Eastern Cape Province, African Clean Energy Developments (ACED), 12/2012 - 12/2014, Environmental Control Officer

Aurecon was appointed as owner's engineer for the construction of a 140 MW wind farm in the Eastern Cape Province of South Africa. The scope of services included design review, site supervision, environmental monitoring, health and safety monitoring and witnessing of commissioning and testing. The Cookhouse Wind Farm Stage 1 comprise 66 x Suzlon S88 2.1 MW wind turbines, associated roads and foundations, electrical reticulation, substation, supervisory control and data acquisition (SCADA) system as well as a 132 kV overhead line (OHL) to the Poseidon substation. The scope of owner's engineer services has been structured to align with the role and obligations of the owner's engineer defined in the draft engineering, procurement and construction (EPC) agreement for the project. Responsible for overseeing environmental compliance of the project including updating of the environmental management plan (EMP), approval of method statements, environmental authorisation and layout amendments, bi-weekly audits with a monthly environmental assessment (EA) and EMP compliance report.

Advisory

Reconciliation strategy for Algoa Water Supply System (WSS), Eastern Cape Province, South Africa, Department of Water and Sanitation, 04/2016 - 03/2019, Environmental Specialist - Advisory

The project objectives are to put arrangements and resources in place for the ongoing implementation of the recommendations and maintenance of the Algoa Reconciliation Strategy; to evaluate the efficiency of the Orange-Fish-River Project and to remove potential operating system constraints for the sustainable delivery of the Orange River bulk water supply to the Lower Sundays River Government Water Scheme (LSRGWS) and to Nelson Mandela Bay Municipality (NMBM) for water requirements up to 2040. In order to evaluate the efficiency of the Orange River Project Aurecon will estimate water use efficiency; determine catchment yields of the Fish and Sundays catchments; give recommendations for the phasing-out of current gratis allocations; identify potential water savings and provide options for re-allocation as well as confirm an official allocation from the Teebus Tunnel to the Orange-Fish System (OFS) in the Eastern Cape. While the focus is on providing additional balancing storage in addition to the Scheepersvlakte Balancing Dam, the provision of storage at other potential locations in the bulk transfer infrastructure must also be considered. Responsible for ad hoc advisory relating to environmental legislation compliance and general environmental matters.

Public Servant Association Social and Labour Plan (SLP), Eastern Cape Province, South Africa, Public Servant Association, 12/2010 - 02/2011, Environmental Assessment Practitioner

The Social and Labour Plan (SLP) was done in order to obtain a mining right conversion for the Department of Mineral Resources (DMR) for the Gonubie Sand Mine. Responsible for compilation of SLP and communication with DMR.



Margaret Lowies **Senior Environmental Scientist**

Integrated Environmental Permitting (EIAs, EMPs and MMPs)

Working for Wetlands Programme, Department of Environmental Affairs, 06/2011 - 04/2018, Environmental Assessment Practitioner - Coordinator of the Mpumalanga and Eastern Cape Provincial teams

Aurecon was appointed in 2011, 2013 and then again in 2016 for a three-year cycle for the design, planning, environmental, project and risk management of the Working for Wetlands programme. The programme's objective is to rehabilitate damaged wetlands throughout South Africa, with an emphasis on complying with the principles of the Expanded Public Works Programme (EPWP) through employing only local small, medium and micro enterprises (SMMEs). Involvement included site work, a rehabilitation plan and basic assessment report to enable the rehabilitation of various wetlands within the Mpumalanga and Eastern Cape provinces. Responsible for coordination of provincial team (wetland specialist, engineer and DEA Assistant Director) and report writing.

Motherwell North Bulk Sewer, Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 12/2015 - 10/2017, Project Leader/Environmental Assessment Practitioner

Aurecon was appointed to undertake environmental authorisations for the Motherwell North Bulk Sewer project. This included environmental impact assessment (EIA), heritage, water use licenses (WUL) and specialist studies for the 1.5 m diameter collector sewer of 10 km. Responsible for project management and review of report.

Misgund augmentation bulk water supply, Eastern Cape Province, South Africa, Amatola Water - Amanzi, 01/2014 - 06/2017, Environmental Assessment Practitioner/Specialist

The project entailed a study to determine the technical feasibility of bulk water supply in Misgund as per the Department of Water Affairs (DWA) guidelines for Regional Bulk Infrastructure Grant (RBIG) projects. Responsible for environmental impact assessment (EIA) process, water use licence application (WULA) and wetland assessment.

Upgrading and permitting of the Klipplaat landfill site, Eastern Cape Province, South Africa, Ikwezi Local Municipality, 10/2011 - 06/2016, Environmental Assessment Practitioner

The project involved the upgrading and permitting of the existing Klipplaat landfill site. This includes a scoping-environmental impact assessment (EIA) process as well as waste licence application process. Responsible for managing the EIA process, including public participation and report writing and review.

Bende water supply scheme, Eastern Cape Province, South Africa, Amathole District Municipality, 05/2014 - 02/2015, Environmental Assessment Practitioner

Aurecon was appointed for the environmental management for the proposed implementation of two rural water supply schemes at Bende and Shixini in the Eastern Cape Province. Responsible for report review, appointment of specialists and management of environmental impact assessment (EIA) process.

Upgrading of National Route 61 Section 6 (R61/6) from All Saints (Km 68.5) to Section 7 - Baziya (Km 12), between Baziya and Queenstown, Eastern Cape Province, South Africa, South African National Roads Agency Limited



Margaret Lowies Senior Environmental Scientist

(SANRAL), 04/2012 - 12/2014, Environmental Assessment Practitioner/Environmental Specialist

Aurecon was appointed by Jeffares & Green (J&G), on behalf of the South African National Roads Agency Limited (SANRAL), to undertake an all environmental authorisation and public participation process (PPP) for the proposed road upgrade of National Route R61. The project involved the upgrading of a 36 km stretch of road as well as replacing five bridges. Responsible for project management, report writing and water quality specialist report.

Social impact assessment (SIA) for augmentation of the Driftsands collector sewer, Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 08/2011 - 10/2011, Environmental Assessment Practitioner

The project involved a survey of households in the Walmer Township that are impacted by the augmentation of the Driftsands sewer collector. Responsible for coordination of survey, capturing of data and report writing.

Other Environmental Permitting/ Management Projects

- Churchill water treatment works (WTW), Eastern Cape Province, 03/2007 – 12/2020, Environmental Assessment Practitioner
- Upgrade of Brickfields pre-treatment works in Nelson Mandela Bay Metropolitan Municipality, 12/2010 – 07/2020, Environmental Assessment Practitioner
- Sewer maintenance backlog study for the Nelson Mandela Bay Metropolitan Municipality, Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 10/2004 - 07/2020, Environmental Assessment Practitioner
- Environmental impact assessment for pipe upgrade of Eastbury Drive Sewer, KwaZulu-Natal Province, South Africa, eThekweni Municipality, 06/2016 - 05/2019, Environmental Assessment Practitioner
- Environmental services for upgrading of R75, Eastern Cape Province, South Africa, South African National Roads Agency Limited (SANRAL), 02/2015 - 02/2018, Project Leader/Environmental Assessment Practitioner
- Woodchem water use licence, Mpumalanga Province, South Africa, KAP Diversified Industrial (Pty) Ltd, 04/2016 - 07/2017, Environmental Specialist
- Environmental impact assessment (EIA) for Coega wastewater treatment works (WWTW), Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 12/2014 - 05/2017, Project Leader/Environmental Assessment Practitioner
- Water use licence application (WULA) and wetland assessment for Grassridge to Melkhout 132 kV line, Eastern Cape Province, South Africa, Eskom SOC Ltd, 11/2014 - 12/2015, Environmental Specialist/Project Leader
- Proposed construction of the Ingquza Hill Museum - basic assessment, Eastern Cape Province, South Africa, National Department of Arts and Culture, 08/2013 - 10/2013, Environmental Assessment Practitioner

APPENDIX G

STAKEHOLDER DATABASE

Stakeholder Database

Stakeholder	Contact	Organisation
National Stakeholders	Mr Mark Anderson	Birdlife South Africa
	Ms Mpume Ntlokwana	Department of Agriculture Forestry & Fisheries
	Ms Serah Muobeleni	Department of Agriculture Forestry & Fisheries: Land Use and Soil Management
	Ms Wilma Lutsch	Department of Environmental Affairs: Biodiversity Conservation
	Mr Danie Smit	Department of Environmental Affairs: Sensitive Environments
	Ms Naomi Fourie	Department of Water and Sanitation
	Dr Paul Meulenbeld	Department of Water and Sanitation
	Ms Jackie Jay	Department of Water and Sanitation
	Ms Barbara Weston	Department of Water and Sanitation
	Mr Kelvin Legge	Department of Water and Sanitation
	Mr Bongani Madikizela	Water Research Commission
	Ms Olga Jacobs	SANParks: Biodiversity and Social Projects
	Mr Steven Segang	Endangered Wildlife Trust
	Mr Ahmend Khan	Department of Environmental Affairs
	Mr Louwrens Ferreira	Department of Environmental Affairs
	Mr Wemer Roux	Department of Environmental Affairs
	Ms Kerry Morrison	Endangered Wildlife Trust
	Ms Tanya Smith	Endangered Wildlife Trust
	Morgan Griffiths	WESSA
	Mr Dumisani Mabona	Department of Environmental Affairs: Sensitive Environments
	Mr Umesh Bahadur	Department of Environmental Affairs: Working for Wetlands
	Mr Farai Tererai	DEA: Working for Wetlands: Manager: Planning, Monitoring and Evaluation
	Dr Piet-Louis Grundling	Department of Environmental Affairs: Working for Wetlands

Stakeholder	Contact	Organisation
	Mr Seoka Lekota	DEA: Biodiversity Conservation
	Mr Dumisani Mabona	Department of Environmental Affairs: Directorate Biodiversity Conservation
	Khosa Tsunduka	Department of Water and Sanitation
	Malaudzi Nkumbudzeni	Department of Water and Sanitation
	Lumka Kuse	Department of Water and Sanitation
	Xolani Hadebe	Department of Water and Sanitation
Provincial Stakeholders: State Authorities	Mr Gerry Pienaar	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
	Ms Nomalwande Mbangana	Eastern Cape Department of Agriculture, Forestry and Fisheries
	Mr Michael Kawa	Department of Environmental Affairs
	Mr Briant Noncembu	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
	Mr Melvin Charlie	Department of Agriculture, Forestry and Fisheries
	Ms Fourie Lizna	Department of Water and Sanitation
	Ms V Rwexu	Department of Economic Development, Environmental Affairs and Tourism
	Ms ZJ Ngxowa	Eastern Cape Department of Agriculture, Forestry and Fisheries
	Mr Eric Qonya	Department of Economic Development, Environmental Affairs and Tourism (DEDEAT): Wetlands Representative
	Ms Tamara Gqamane	Department of Economic Development, Environmental Affairs and Tourism
	Ms Sinazo Songca	Department of Economic Development, Environmental Affairs and Tourism
	Ms Gwendoline Sqwabe	Department of Agriculture, Forestry and Fisheries
	Mr MC Dandala	Eastern Cape Department of Agriculture, Forestry and Fisheries
	Ms Portia Makhanya	Department of Water and Sanitation

Stakeholder	Contact	Organisation
	Mr Mxolisi Dan Malgas	Department of Agriculture, Forestry and Fisheries
	Mr Kagiso Mangwale	Eastern Cape Parks and Tourism Agency
	Mr. Elliot Weni	Department of Water and Sanitation
	Mr Buntu Mzamo	Department of Economic Development, Environmental Affairs and Tourism
	Ms Phumla Mzazi	Department of Economic Development, Environmental Affairs and Tourism
	Mr SS Kwinana	Department of Agriculture
	Mr Alan Southwood	Department of Economic Development, Environmental Affairs and Tourism
	Mr Japie Buckle	Department of Environmental Affairs
	Mr Hennie Swanevelder	Department of Economic Development, Environmental Affairs and Tourism (DEDEAT)
	Ms Carina Potgieter	Fort Fordyce Nature Reserve (Eastern Cape Parks & Tourism)
	Ms Noluntando Bam	Department of Economic Development, Environmental Affairs and Tourism
	Mr Dayalan Govender	Department of Economic Development, Environmental Affairs and Tourism
	Sinonzulu Mtongana	Department of Economic Development, Environmental Affairs and Tourism
	Zizipho Siyeka	Department of Economic Development, Environmental Affairs and Tourism
	Philasande Makhuba	Department of Economic Development, Environmental Affairs and Tourism
	Chwayita Mapekula	Department of Economic Development, Environmental Affairs and Tourism
	Yongama Mbangezeli	Department of Economic Development, Environmental Affairs and Tourism
	Viwe Mabongo	Department of Economic Development, Environmental Affairs and Tourism
	Masibulele Msongelwa	Department of Economic Development, Environmental Affairs and Tourism

Stakeholder	Contact	Organisation
	Bongikhaya Ngcango	Department of Economic Development, Environmental Affairs and Tourism
	Viwe Banzi	Department of Economic Development, Environmental Affairs and Tourism
Landowner	Roelof Pierre Oelofsen	Krugersland 812
	T Kritzinger	Meltrust (Farm Hendrikskraal)
	Tsitsikamma Development Trust	Fingo Reserve
	C Carstens	Tsitsikamma
	Sivuyile Tyali	Kolomana Communal Land
Municipal Stakeholders	Gcobisa Dadamasi	Kouga Local Municipality
	Mr Charl du Plessis	Kouga Local Municipality
	Dr Thandekile Mnyimba	Amathole District Municipality
	Cllr Nomafusi Nxawe	Amathole District Municipality
	Mr Luyanda Mafumba	Amathole District Municipality
	Mr Lusanda Menze	Raymond Mhlaba Local Municipality
	N Platjies	Raymond Mhlaba Local Municipality
	Cllr Bandile Ketelo	Raymond Mhlaba Local Municipality
	Jane Galo	Buffalo City Metropolitan Municipality
	Mathongo Lamani	Buffalo City Metropolitan Municipality
	Mr Ted Pillay	Sarah Baartman District Municipality
	Cllr Khunjuzwa Eunice Kekana	Sarah Baartman District Municipality
	Mr Pumelelo Maxwell Kate	Kou-Kamma Local Municipality
	Mr Nathan Jacobs	Kou-Kamma Local Municipality
General I&APs	Mr Mark Anderson	Chairperson Hogsback Conservancy
	Ms Laura Conde	WESSA
	Mr Ben Cooper	Amahlathi Local Municipality
	Ms Gcobisa Foxi	Eastern Cape Parks and Tourism Agency
	Dr Ulrike Irlich	ICLEI (LAB Wetland Projects)
	Lehman Lindeque	United Nations Development Programme (UNDP)
	Mr Sipho Mayebwa	Eastern Cape Wetland Forum

Stakeholder	Contact	Organisation
	Ms Cikizwa Mbolambi	Eastern Cape Parks and Tourism Agency
	Ms Nonzukiso Mbona	SANBI
	Ms Kerry McLean	WESSA Eastern Cape
	Ms Kululwa Mkosana	Department of Water and Sanitation
	Mr Edwill Moore	Gamtoos Irrigation Board
	Thembelihle Mtamba	Eastern Cape Parks and Tourism Agency
	Dr Nikite Muller	Amatola Water
	Mr Nkosinathi Nama	EWT (Amathole Catchment Management Forum representative)
	Mr Mpho Nangammbi	Milongani Eco Consulting
	Ms Zukiswa Ngxowa	Department of Agriculture, Forestry and Fisheries
	Ms Shane October	Eastern Cape Parks and Tourism Agency
	Ms Kelly Stroebe	CSIR
	Dr Jeanne Tarrant	EWT (Threatened Amphibian Programme Manager) - Amathole Toad Conservation project)
	Mr Loutjie Theron	Wood@Heart
	Ms Anitha van der Byl	Eastern Cape Parks and Tourism Agency
	Ms Zingisa Xabu	Eastern Cape Parks and Tourism Agency
	Mr Samuel Mpumelelo Vuso	Kou-Kamma Local Municipality
	Mr Mbulelo Xalu	Department of Economic Development, Environmental Affairs and Tourism
	Nomhlophe Maxuxuma	Inkwenkwezi Private College

APPENDIX H
EAP & SPECIALIST CVs

Curriculum Vitae – Craig Cowden

Personal Details:

Name: Craig Cowden
Profession: Wetland Ecologist
Date of Birth: 14 March 1978
Nationality: South African



Key Qualifications:

Seventeen years' experience in ecosystem functioning and management, specializing in wetland ecosystems. Involvement in a variety of studies to determine practical and applied ecological solutions. Specialist input into various studies, focusing on:

- Mapping and infield delineation of wetland habitat within various regions of Southern Africa, including South African provinces of KwaZulu-Natal, Mpumalanga, Free State, Eastern Cape and Gauteng, and Lesotho for inventory and management purposes.
- Assessment of various wetland ecosystems to highlight potential impacts, within current and proposed landscape settings, and recommend appropriate mitigation and offsets based on assessing wetland ecosystem service delivery (functioning) and ecological health/integrity.
- Assessment of various wetland ecosystems to plan appropriate wetland rehabilitation activities and performance evaluation and monitoring of wetland rehabilitation projects.
- Literature reviews and research relating to impacts, best management practices, promoting biodiversity, monitoring and evaluating rehabilitation within wetland ecosystems.

Education and Training:

- 2017 MSc (Environmental Science) Rhodes University, Grahamstown. MSc has been accepted pending corrections.
- 2017 Wetland Delineation Course - Wetland Training Institute, Convington (Louisiana), USA.
- 2017 Natural Processes for the Restoration of Drastically Disturbed Sites. VII World Conference on Ecological Restoration, Foz do Iguassu, Brazil, August 26, 2017.
- 2015 A Methodology for Determining Buffer Zones for Rivers, Wetlands and Estuaries. National Training and Development Workshop, Pretoria, Gauteng, November 24-25, 2017.
- 2005 Wetland Assessments to Inform Wetland Rehabilitation Planning - University of KwaZulu-Natal.
- 2001 Forest Certification Course - SGS Qualifor.
- 2001 Wetland Rehabilitation Planning and Implementation - Mondi Wetlands Project.
- 1999 B.Sc. (Agriculture) University of Natal, Pietermaritzburg – Four-year Degree (Honours equivalent), majoring in Wildlife Science & Zoology.

Professional Memberships:

- Professional Natural Scientist (Pr.Sci.Nat) in Ecological Science - The South African Council for Natural Scientific Professions (Reg. No. 400197/05)
- Founding Member - South African Wetland Society
- Member -Society of Wetland Scientists (International)
- Member -Society of Ecological Restoration (International)

Professional Awards:

- National Wetland Award under the "Stewardship" category awarded in 2013 in recognition of the wetland rehabilitation associated with the Greater Edendale Mall development.
- Mondi Wetlands Programme acknowledgment of "Contributions towards wetland conservation" awarded in 2012.

Experience Record:

2009 to Present: GroundTruth (GT) - Management of the wetland division within GT.

2001 to 2009: Land Resources International (LRI) - Management of the environmental division within LRI.

Examples of Projects:

- Implementation of wetland rehabilitation planning in various provinces, including KwaZulu-Natal, Mpumalanga, Limpopo, Gauteng, Free State and Western Cape for the Working for Wetlands Programme from 2005-2012, 2016-2018.
- Wetland specialist input and support to Burundi Nature Action and Association pour la Conservation de la Nature au Rwanda on behalf of the International Union for the Conservation of Nature – Netherlands Committee.
- Assessments of impacted wetland systems and rehabilitation planning to inform the offset requirements for proposed development at the Cascades Mall in Pietermaritzburg.
- Assessments of impacted wetland systems and rehabilitation planning to inform the offset requirements for Exxaro coal mining operations.
- Assessment of wetland systems potentially affected by the proposed expansion of Lumwana Mine near Solwezi, Zambia on behalf of SRK Consultants.
- Water Research Commission research project on developing a monitoring and evaluation framework to assess wetland rehabilitation in South Africa.

Publications

- **Cowden C**, Kotze DC, Ellery WN & Sieben EJJ. 2014. *Assessment of the long-term response to rehabilitation of two wetlands in KwaZulu-Natal, South Africa*. African Journal of Aquatic Science, Vol. 39, No. 3.
- Rivers-Moore NA, **Cowden C**. 2012. *Regional prediction of wetland degradation in South Africa*. *Wetlands Ecology and Management*, DOI 10.1007/s11273-012-9271-5.
- Macfarlane DM, Walters D & **Cowden C**, 2011. A wetland health assessment of KZN's priority wetlands. Draft Unpublished Report prepared for Ezemvelo KZN Wildlife, Pietermaritzburg.
- **Cowden C** & Kotze DC, 2009. WET-RehabEvaluate: Guidelines for the monitoring and evaluation of wetland rehabilitation projects. WRC Report No. TT 342/08, Water Research Commission, Pretoria.
- Kotze DC, **Cowden C**. 2009. KZN Biodiversity Stewardship Programme: Guidelines for the *in situ* Management of Ecosystems in KwaZulu-Natal, according to Biodiversity Conservation Principles – Wetlands. Unpublished Report prepared for Ezemvelo KZN Wildlife by Land Resources International, Pietermaritzburg.
- **Cowden C**, Ellery W, Kotze D, Grenfell M, McCulloch D, Woods D, Grenfell S, Bambus O. 2009. *Performance evaluation of the wetland rehabilitation undertaken at Killarney Wetland in Ntsikeni Nature Reserve, KwaZulu-Natal Province* **In** Kotze DC, Ellery WN. 2009. *WET-OutcomeEvaluate: An Evaluation of the rehabilitation outcomes at six wetland sites in South Africa*. WRC Report No. TT 343/09. Water Research Commission, Pretoria.

Conference Presentations:

- **Cowden C**, Kotze D, Walters D, Browne B. Monitoring and evaluation framework for wetland restoration in South Africa, using an urban wetland case study. *Presented during VII World Conference on Ecological Restoration*. Foz do Iguassu, Brazil, August 28 - September 1, 2017.
- **Cowden C**. Wetland specialist input into the Working for Wetlands rehabilitation planning cycle. 21st National Wetlands Indaba, Hoedspruit, Mpumalanga, October 25-28, 2016.
- **Madikizela B**, Cowden C, Kotze D, Ellery W. *Documenting lessons and refining the wetland restoration field of practice in South Africa: The response of two wetlands to Working for Wetlands Restoration*, *Presented during V World Conference on Ecological Restoration*. Wisconsin, USA, September 6-11, 2013.
- **Cowden C**, Kotze D, Ellery W. *Assessment of the long-term response of specific wetlands to rehabilitation interventions by Working for Wetlands*, 17th National Wetlands Indaba. Klein Kariba, Limpopo, October 23-26, 2012.
- **Cowden C**. *Urban Wetland Rehabilitation: A KwaZulu-Natal Case Study*, 16th National Wetlands Indaba. Didima, KwaZulu-Natal, October 18-21, 2011.



Jenny Youthed

Environmental Practitioner

Qualifications

PhD Geography
 MSc Geography
 BSc (Hons) Geography
 BSc Geography and Psychology
 BSc (Hons) Psychology
 Professional Member, Southern African Institute of Ecologists and Environmental Scientists (SAIEE)
 Member, International Association for Impact Assessment South African Affiliate (IAIASa)

Specialisation

Senior Environmental Practitioner

Years in industry

21,25

Jenny is employed as a senior environmental practitioner in Aurecon's East London office. She has worked in both the consulting and government sectors, which has given her valuable knowledge of regulatory authority procedures. Her expertise includes environmental legislation, the environmental impact assessment (EIA) process, EIA reviews, monitoring, screening and feasibility studies.

Jenny obtained a Doctor of Philosophy in Geography in 2009 and a Bachelor of Science (Honours) in Psychology in 2003, both from the University of South Africa (UNISA). She obtained her Master of Science in Geography in 1996, her Bachelor of Science (Honours) in 1995 and a Bachelor of Science in 1994, all from Rhodes University, South Africa. She is a member of the International Association for Impact Assessment South Africa (IAIASa) and a professional member of the Southern African Institute of Ecologists and Environmental Scientists (SAIEES).

Experience

Establishment of the Amathole Mountain Biosphere Reserve (AMBR), Eastern Cape Province, South Africa, Amathole District Municipality (ADM), 02/2013 - Date, Project Leader

The project involved consultative processes and awareness raising for the Amathole Mountain Biosphere Reserve (AMBR). Responsible for project management, report writing and presentations to the client as part of a team.

Upgrading of Woodchem's South African plan in Piet Retief, Mpumalanga Province, South Africa, 2012 - 2013

Responsible for the basic assessment process and managing the project.

High-level fatal flaw screening for Kinira Dam in Matatiele, Eastern Cape Province, South Africa, Sektor Consulting Engineers (Pty) Ltd, 10/2012 - Date, Senior Environmental Practitioner

Responsible for providing specialist environmental input to the project team and for drawing up the terms of reference (TOR) for the appointment of an independent environmental assessment practitioner.

Sidwadweni Regional Water Supply Scheme for Amatola Water, Eastern Cape Province, South Africa, Amatola Water - Amanzi, 09/2012 - Date, Environmental Engineer

Aurecon was appointed to construct a river abstraction, raw water reservoir, water treatment works (WTW), clear water pump station and bulk supply mains for the Sidwadweni Regional Water Supply Scheme in order to supplement the Nqadu Dam Supply. A water reticulation network was also constructed to service the various communities to meet reconstruction and development programme (RDP) standards. Two alternative water supplies will be provided, which will



guarantee an uninterrupted water supply to the community. Responsible for providing environmental input, in conjunction with Amatola Water, to the project team.

Environmental management for the Sundwana Water Supply Project, Eastern Cape Province, South Africa, HHO Africa, 02/2012 - 01/2014, Project Manager for the environmental impact assessment (EIA)

The primary objective of this project was to provide bulk domestic water supply to the remaining communities in the Sundwana area, according to the reconstruction and development programme's (RDP's) standards. The secondary objective entailed the provision of a regional bulk supply to augment the water supply to the Nqabara north and south schemes, the Mhlohlozi scheme and the Mendu scheme. Aurecon's appointment entailed conducting the basic assessment and scoping processes in accordance with the requirements of the environmental impact assessment (EIA) regulations (R543 of June 2010), governing acts and departmental guidelines. Responsible for undertaking the scoping and EIA processes and liaising with specialists.

Woodchem South Africa: Mkhondo, Mpumalanga Province, South Africa, 2012 - Date, Project Leader

Responsible for undertaking and managing the atmospheric emissions licence (AEL) process.

Working for Wetlands Programme for the Western Cape, Western Cape Province, South Africa, South African National Biodiversity Institute (SANBI), 08/2011 - 09/2013, Environmental Assessment Practitioner

Aurecon was appointed to undertake the planning, design and environmental, project and risk management of the South African government's Working for Wetlands Programme. Aurecon assembled a team of wetland ecologists, environmentalists, hydrologists and engineers to repair and rehabilitate over 100 wetland sites in the Western Cape through the implementation of interventions, usually in the form of engineered structures. Appropriate hydrological assessments and engineering techniques were devised to enable design and construction, in many cases without anchoring in bedrock. Responsible for undertaking basic assessments, writing the rehabilitation report in conjunction with the project team, coordinating project team of wetland specialist, provincial wetland coordinator, specialist and engineer and liaising with the project director.

Air emissions licence (AEL) applications for PG Bison in Boksburg, Gauteng Province, South Africa, PG Bison, 07/2011 - Date, Project Leader/Environmental Assessment Practitioner

The project involved applying for an air emissions licence (AEL) in order to obtain environmental approval in terms of the National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM: AQA). Responsible for compiling the necessary AEL application as well as the supporting documentation.

Air emissions licence (AEL) applications for PG Bison in Ugie, Eastern Cape Province, South Africa, PG Bison, 07/2011 - Date, Project Leader/Environmental Assessment Practitioner

The project involved applying for an air emissions licence in order to obtain environmental approval in terms of the National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM: AQA). Responsible for compiling the necessary AEL application as well as the supporting documentation.

Air emissions licence (AEL) applications for PG Bison in Piet Retief, Mpumalanga Province, South Africa, PG Bison, 07/2011 - Date, Environmental Assessment Practitioner

The project involved applying for an air emissions licence (AEL) in order to obtain environmental approval in terms of the National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM: AQA). Responsible for compiling the necessary AEL application, including the supporting documentation as well as ensuring that the AEL application ran in tandem with the required environmental impact assessment (EIA) application.



Mvezo Bridge, Eastern Cape Province, South Africa, Department of Rural Development and Land Reform (DRDLR), 09/2010 - Date

Responsible for undertaking monthly environmental audits to determine compliance with the environmental management plan (EMP).

High-level feasibility study for the Alice urban regeneration strategy, Eastern Cape Province, South Africa, Amathole Economic Development Agency trading as Aspire, 06/2010 - Date, Environmental Specialist

The client wished to investigate various options to stimulate the economic regeneration of the small town of Alice. A study team, including architects, a land use planner, engineer and environmental specialist, was assembled to assess the various development options presented by the client and the communities and to assist in implementing the selected options. Involved as a specialist on the study team and was responsible for providing environmental advice, assessing the proposed development options for environmental fatal flaws, giving environmental input into the high-level feasibility study and undertaking the necessary environmental processes to obtain the necessary environmental authorisation.

High-level feasibility study for the Hamburg urban regeneration strategy, Eastern Cape Province, South Africa, Amathole Economic Development Agency trading as Aspire, 06/2010 - Date, Environmental Specialist

The client wished to investigate various options to stimulate the economic regeneration of the small town of Hamburg. A study team, including architects, a land use planner, engineer and environmental specialist, was assembled to assess the various development options presented by the client and the community and to assist in implementing the selected options. Involved as a specialist on the study team and was responsible for providing environmental advice, assessing the proposed development options for environmental fatal flaws, giving environmental input into the high-level feasibility study and undertaking the necessary environmental processes to obtain necessary environmental authorisation.

Working for Wetlands Programme for various provinces, Various provinces, South Africa, South African National Biodiversity Institute (SANBI), 12/2009 - 10/2011, Environmental Assessment Practitioner

Aurecon was appointed to conduct the planning and implementation of rehabilitation interventions for the Working for Wetlands programme in the Gauteng, KwaZulu-Natal, Free State, Eastern and Western Cape, Limpopo and North West Provinces. The focus was on wetland conservation and poverty reduction through job creation and skills development. The project's key objective was to support and enable the protection, rehabilitation and sustainable use of South Africa's wetlands through cooperative governance and partnerships. The main work components included assessing wetland health for identification and prioritisation of remedial measures, obtaining environmental authorisation and undertaking the engineering design and site support for the implementation thereof. Responsible for undertaking basic assessments, writing the rehabilitation report in conjunction with the project team, coordinating the project team of wetland specialists, provincial wetland coordinator, specialist services, engineering and liaising with the project director.

Sidwadweni Regional Water Supply Scheme, Phase V, Eastern Cape Province, South Africa, OR Tambo District Municipality, 12/2009 - Date, Senior Environmental Practitioner

The Sidwadweni Regional Water Supply Scheme was split into five phases to allow for the spreading of the required funds over a number of financial years. Phase 5 included nine secondary reservoirs; 43 km of distribution mains; 135 km of village reticulation, including standpipes located so that no person has to walk more than 200 m to a water source. A total of 22 villages/sub-villages, with a population of 23 500, would be served. Responsible for undertaking regular environmental audits to ensure continued compliance with environmental requirements.



Relocation of a short cycle press for PG Bison, Mpumalanga Province, South Africa, PG Bison, 2009 - 2011, Environmental Assessment Practitioner

The project entailed the undertaking of a basic environmental assessment in order to obtain environmental approval in terms of the environmental impact assessment (EIA) regulations. Responsible for the undertaking the basic environmental assessment.

Blocked housing and breaking new ground (BNG) review process, Eastern Cape Province, South Africa, German Development Corporation/Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 05/2009 - 07/2010

The assignment involved two projects for research studies with the broad aim of establishing the extent of bottlenecks in the process of housing delivery in the province, and how these blockages could be corrected. Responsible for data collection and analysis and report writing in conjunction with the project team. Also responsible for presenting the results to the client's head of department (HOD).

Desalination contractual investigation for Nelson Mandela Bay Metropolitan Municipality (NMBMM), Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 12/2008 - 10/2010, Environmental Specialist

Aurecon was appointed as lead consultant and project manager to assist the Nelson Mandela Bay Municipality (NMBM) to conduct a study into the contractual considerations associated with a bid to implement desalination as a source of salt in the Coega Industrial Development Zone (IDZ). This included conducting technical, financial, and legal reviews to guide the municipality in responding to the bid, and to determine the impact on water tariffs. Involved as a specialist on the study team and was responsible for the environmental input into the study.

Ncera Macadamia Farming Project, Eastern Cape Province, South Africa, Ncera Macadamia Farming (Pty) Ltd, 06/2008 - 11/2013, Senior Environmental Practitioner

A Section 24G application in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) was submitted to rectify the illegal commencement of the above project in East London. This is the first community-owned Macadamia plantation in the Eastern Cape. Responsible for compiling the act.

Mncwasa bulk regional water supply scheme, Eastern Cape Province, South Africa, Amathole District Municipality (ADM), 04/2008 - 07/2010, Senior Environmental Practitioner

The project involved an environmental impact assessment (EIA) for the establishment of a bulk water supply scheme with an off-channel storage dam and water treatment works (WTW) in order to supply water to communities in the Mncwasa area, which falls under the Mbashe Local Municipality. Responsible for all environmental aspects of the project.

Study of sludge disposal options for the Nelson Mandela Bay Metropolitan Municipality (NMBMM), Eastern Cape Province, South Africa, Nelson Mandela Bay Metropolitan Municipality (NMBMM), 04/2008 - 04/2012, Environmental Specialist

Nelson Mandela Bay Metropolitan Municipality (NMBMM) requested an investigation into the various options available to them for the disposal of sewage sludge. The study included legal, engineering, financial and environmental aspects. Involved as a specialist on the study team and was responsible for the environmental input into the study.

Needs Camp - Kidd's Beach water supply pipeline, Eastern Cape Province, South Africa, Department of Agriculture, 2008 - Date, Senior Environmental Practitioner

The project entailed the basic assessment process for the construction of a bulk water supply pipeline from an existing reservoir at Needs Camp to a new reservoir at Kidd's Beach. Appointed to undertake the required basic assessment process. Responsible for undertaking the environmental impact assessment (EIA) process.



Environmental impact assessment (EIA) for the Dukathole Township infill development, Eastern Cape Province, South Africa, Maletswai Local Municipality, 09/2007 - 02/2011, Senior Environmental Practitioner

Maletswai Local Municipality was in the process of formalising parts of Dukathole Township and appointed Aurecon to undertake the necessary basic assessment process. Responsible for undertaking scoping and the environmental impact assessment (EIA) processes.

Sidwadweni Regional Water Supply Scheme, Phase IV, Eastern Cape Province, South Africa, OR Tambo District Municipality, 09/2007 - 06/2011, Senior Environmental Practitioner

Responsible for undertaking regular environmental audits to ensure continued compliance with environmental requirements.

Backlog review support for the Department of Environmental Affairs and Tourism (DEAT), Eastern Cape Province, South Africa, Department of Environmental Affairs and Tourism (DEAT), 2007 - 2008, Senior Environmental Practitioner

Aurecon was appointed to assist the department with the review of outstanding environmental impact assessment (EIA) applications in terms of the Environment Conservation Act (Act No. 73 of 1989) (NEMA) in the Eastern Cape. Responsible for assisting in the evaluation and processing of these applications.

Environmental auditing for PG Bison in Ugie, Eastern Cape Province, South Africa, PG Bison, 06/2007 - Date, Senior Environmental Practitioner

The project involved undertaking independent environmental audits of PG Bison's compliance with its environmental management plans (EMPs) during the construction and operational phases of the development. Responsible for quarterly operational phase audits.

Development of an operational environmental management plan (OEMP) for PG Bison, East London, South Africa, PG Bison, 06/2007 - Date, Senior Environmental Practitioner

PG Bison requested assistance with developing an operational environmental management plan (OEMP) for a new particle board factory in Ugie. Responsible for assisting with the finalisation of the OEMP for the project.

Sidwadweni Regional Water Supply Scheme, Phases I, II and III, Eastern Cape Province, South Africa, OR Tambo District Municipality, 11/2002 - Date, Senior Environmental Practitioner

The first phase of the Sidwadweni Water Supply Scheme covered the construction of the water treatment works (WTW) and the bulk electrical supply to the WTW. The second phase encompassed the construction of all bulk distribution mains and reticulation to the first five villages on the eastern side of the works and the third phase dealt with the construction of bulk distribution mains and reticulation to the first six villages on the western side of the works. Responsible for undertaking regular environmental audits to ensure continued compliance with environmental requirements.

Environmental auditing for the Needs Camp water supply scheme, Eastern Cape Province, South Africa, Buffalo City Metropolitan Municipality (BCMM), 05/2004 - 02/2009, Senior Environmental Practitioner

The project involved the construction of a bulk water supply pipeline across the Buffalo River as well as a bulk supply reservoir. Responsible for audits on the project to ensure compliance with environmental requirements.



Stream flow reduction licensing application assessment committee for afforestation applications, Eastern Cape Province, South Africa, Department of Water Affairs (DWA), 2004 - 2007, Senior Environmental Officer

Appointed as a member of the committee that coordinates the approval of afforestation developments in the Eastern Cape. Responsible for commenting on environmental aspects, advising on environmental impact assessment (EIA) processes and facilitating dovetailing of the various environmental approval processes.

Incident management system (IMS) for National Route 6 (N6) between Queenstown and Aliwal North, Eastern Cape Province, South Africa, Chris Hani District Municipality (CHDM), 2000, Senior Environmental Officer

Responsible for providing input into the development of an incident management system (IMS) for the section of National Route 6 (N6) between Jamestown and Aliwal North. Included in this plan were the environmental actions that needed to be taken in the event of an incident, such as a tanker fuel spill.

Integrated development plans (IDPs) for municipalities within the Chris Hani and Ukhahlamba municipal areas, Eastern Cape Province, South Africa, Various municipalities within the Chris Hani and Ukhahlamba District Municipalities, 1999 - 2007, Senior Environmental Officer

Appointed as a representative of the provincial environmental authority. Responsible for providing environmental input into the integrated development plan IDP processes for the municipalities.

Review of applications submitted in terms of the environmental impact assessment (EIA) regulations, Eastern Cape Province, South Africa, Department of Economic Development and Environmental Affairs (DEDEA), 1997 - 2007, Environmental Officer

Appointed as environmental officer at the Department of Economic Development and Environmental Affairs (DEDEA) in Queenstown. Key projects included the Beta-Delphi 800 kv line between Bloemfontein and Queenstown; the 66 kv line between Ugie and Qumbu; above and underground fuel storage; impact assessments for the construction of filling stations; PG Bison particle board plant at Ugie; golf estate at Zwartbosch; low-income township development applications; release of organisms for biological control; national environmental impact assessment (EIA) applications for the release of biological control agents; upgrading of Tiffindell Ski Resort; construction and upgrading of the Ugie-Langeni, Cala-Lady Frere and Maclear-Mount Fletcher roads; sewage treatment works (STWs) EIAs for Engcobo, Ugie, Maclear, Hofmeyer and Barkly East; telecommunications towers for Telkom, Vodacom, MTN, Cell C, Sentech and the South African Police Service (SAPS); waste disposal site EIAs for Lady Grey, Aliwal North, Steynsburg, Queenstown, Molteno, Sterkstroom, Ugie and Maclear; scoping reports for water supply schemes to villages in the Chris Hani and Ukhahlamba District municipal areas and the construction of dams at Jamestown, Barkly East, Maclear and Mount Fletcher. Tasks included reviewing over 500 EIA reports, undertaking site inspections, holding meetings with clients and drawing up the necessary records of decision (RoDs).

Review of environmental management plans (EMPs), Eastern Cape Province, South Africa, Department of Economic Development and Environmental Affairs (DEDEA), 1997 - 2007, Environmental Officer

Appointed as environmental officer at the Department of Economic Development and Environmental Affairs (DEDEA) in Queenstown. Responsible for reviewing environmental management plans (EMPs), including the PG Bison development at Ugie; the upgrading of Tiffindell Ski Resort and EMPs for water supply schemes, road upgrades and telecommunication masts. Also responsible for reviewing environmental management programme reports (EMPRs), including the prospecting of coal near Indwe; the development of a hard rock quarry between Maclear and Mount Fletcher; the establishment of borrow pits and sand mining. Responsible for assessing over 20 as required in terms of the environmental impact assessment (EIA) regulations as well as reviewing and providing comments on the EMPRs submitted to the provincial environmental authority for comment by the Department of Minerals and Energy (DME).

