

King Cetshwayo District Municipality



KING CETSHWAYO
DISTRICT MUNICIPALITY

PROPOSED MTUNZINI SANITATION PROJECT, KING CETSHWAYO DISTRICT MUNICIPALITY, KWAZULU-NATAL

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

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COMPLIANCE WITH THE REQUIREMENTS OF REGULATION R982 – APPENDIX 4

1	An EMPr must comply with section 24N of the Act and include -	Noted
	(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;	Page ii and Annexure 3
	(b) A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description	Section 1.2 and 1.3
	(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	Section 1.4 and Page 2 and 4
	(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;	Sections 4 – 8
	(e) A description and impact management outcomes required for the aspects contemplated in (d)	Sections 4 – 8
	(f) A description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include 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 provision for rehabilitation, where applicable;	Section 3 and Sections 4 – 8
	(g) The method of monitoring the implementation of the impact management actions contemplated in paragraph (f)	Sections 3.3; 7.12 and 8.9
	(h) The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f)	Section 3.3
	(i) An indication of the persons who will be responsible for the implementation of the impact management actions;	Section 3

	(j) The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Sections 3.2 and 3.3
	(k) The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 3
	(l) A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 3
	(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	Sections 4 and 3.3.7
	(n) Any specific information that may be required by the competent authority.	Sections 2.3 and 3
2	Where a government notice by the Minister provides for a generic EMPr, such generic EMPr as indicated in such notice will apply.	N/A

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ABBREVIATIONS AND ACRONYMS

ACER	ACER (Africa) Environmental Consultants
Amafa	Amafa aKwaZulu-Natali
BA	Basic Assessment
CLO	Community Liaison Officer
DEDTEA	Department of Economic Development, Tourism and Environmental Affairs (KwaZulu-Natal)
DEFF	Department of Environment, Forestry and Fisheries
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
EKZNW	Ezemvelo KwaZulu-Natal Wildlife
I&APs	Interested and Affected Parties
KCDM	King Cetshwayo District Municipality
KZN	KwaZulu-Natal
NEMA	National Environmental Management Act
RE	Resident Engineer

1. INTRODUCTION

1.1. Background

The King Cetshwayo District Municipality (KCDM) is planning to construct the proposed Mtunzini Sanitation Project which entails the construction of a new wastewater treatment works (WWTW), six new sump and pump stations and approximately 36 km of conventional sewer reticulation lines (including rising mains) and manholes.

The proposed project will take place in the town of Mtunzini which is located within the uMlalazi Local municipality, one of five local municipalities within the King Cetshwayo District Municipality in KwaZulu-Natal (Figure 1). This Environmental Management Programme (EMPr) has been prepared on behalf of the King Cetshwayo District Municipality by ACER (Africa) Environmental Consultants (ACER), in terms of the requirements of the Environmental Impact Assessment (EIA) Regulations of 2014 (as amended), published under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

The proposed Mtunzini Sanitation Project will include the following project components:

- The phased construction of a new Wastewater Treatment Works with a design capacity of 2.5 Ml when completed.
- The construction of approximately 36 km of 110 mm – 200 mm diameter conventional water borne sewer reticulation pipelines, rising mains and manholes.
- The construction of six new sumps and pumping stations.

1.2 Project Description

The proposed project is required in order to address the existing capacity shortfalls through the construction of a new WWTW that will allow for all erfs within Mtunzini to be connected to formal reticulated sanitation system. This will also allow for the decommissioning of existing septic tanks/soakaways thus also preventing any potential seepage of untreated sewerage from these systems into drainage lines and the ground water system. The new WWTW will be designed to have the necessary capacity for the future anticipated expansion of the town and will ultimately entail the connection of approximately 2172 stands/erfs in Mtunzini.

1.2.1 Sewer reticulation lines

The sewer reticulation lines will be installed throughout Mtunzini town in phases. The pipeline routes within the town will generally follow existing roads and servitudes while the section within the uMlalazi Nature Reserve will also be routed adjacent to existing roads. There will however be some areas where pipelines are required to be routed through areas of indigenous vegetation, albeit that the design intends to minimise disturbance to these areas.

The planned reticulation network will consist of the following project components:

- Sewer reticulation lines will be provided for each erf in Mtunzini and individual connection points with a rodding eye for each of the stands/erven will be provided. It should be noted that the Zini River Estate is excluded from this new reticulation network, because a reticulation network already exists within the estate.
- The sewer network will consist of ±30 km of 200 mm – 110 mm diameter conventional water borne sewer reticulation pipes, 6 km of rising main pipes and ± 700 manholes;
- The sewer network will be designed to follow, as far as possible, parallel along stand midblock or street front cadastral layouts.

- ❑ A gravity outfall sewer will be constructed to transport wastewater from all existing and future reticulation networks to the wastewater treatment plant, the gravity outfall sewer will incorporate the wastewater generated from the Zini River Estate which is currently pumped from two pump stations to the current Wastewater Treatment Works.
- ❑ Construction of rising main pipelines from strategically placed pump stations to discharge sewage into the gravity outfall sewer which will transport sewage to the proposed new Wastewater Treatment Works.

The layout of the sewer reticulation lines are largely dependent on the topography of the area with most of the network draining wastewater down to the proposed pump stations passively before being pumped through the rising mains to the gravity outfall sewer which transports the wastewater/untreated sewage to the Wastewater Treatment Works.

1.2.2 Wastewater Treatment Works

The design and capacity of the proposed WWTW has been selected based on the following parameters:

- ❑ The proposed new WWTW will be a conventional type design which will include an Inlet Works, Equalization tank, Reactors, sedimentation tank, pump station, chlorine contact tank, sludge drying beds, admin building and ancillary structures. The proposed design of the WWTW is based on a modular concept where initially a 1.5 MI plant will be constructed followed by an identical unit capable of handling 1 MI as and when required. At full capacity the new WWTW will have a design capacity to handle 2.5 MI/day. Factors considered in the establishing the required capacity of the new WWTW are described below:
 - The total number of stands/ervens (new and existing) to be served by the Mtunzini Sanitation Project is 2172.
 - The wastewater outflow from Zini River Estate, which can facilitate a maximum of 266 stands, is included in the total outflow generated to the WWTW.
 - The current number of stands to be serviced, excluding the Zini River Estate, is 738 of high-income group classification.
 - No low-cost housing forms part of the current stands to be serviced.
 - Due to the town being predominantly a tourist destination, the population during peak holiday seasons increases dramatically. This has been factored into the design considerations which has assumed that all stands/erven are occupied.
 - A daily wastewater generation rate of 1000 l / household / day has been assumed as prescribed by the "Guideline for Human Settlement planning and design" – Red Book.
 - According to a study conducted by Ilifa Engineers, the proposed development of the land between the N2 and the town of Mtunzini (which includes residential areas, business areas and schools) will generate wastewater at a rate of 972.28 kl/day when developed.
 - The total wastewater generation rate for Mtunzini, including Zini River Estate, all existing stands/erven, existing business areas, schools and excluding the proposed new N2 development is 1,337 kl/day.

The total wastewater generated for both existing developments plus future developments is 2,309 kl/day.

1.2.3 Sump and pumping stations

The design of the planned pump stations will consist of the following:

- Each pump station will consist of an inlet works, collection sump and above ground sewer pump station.
- Each pump station will be fitted with at least two pumps per pump station (one pump will act as an emergency back up the other pump)
- Each pump station will be designed with sufficient overflow storage capacity should there be prolonged electricity outages.

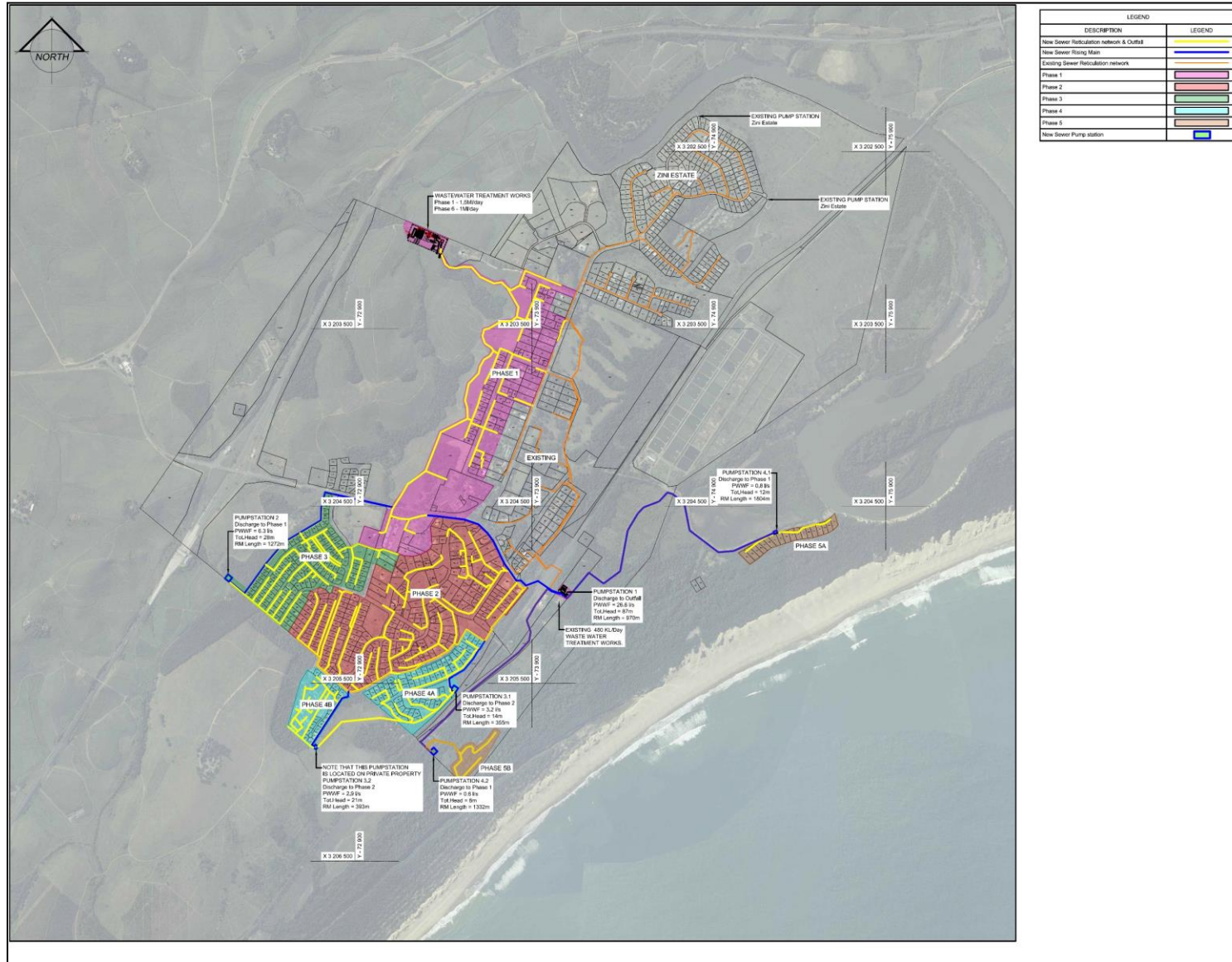


Figure 1 Mtunzini Sanitation Project

1.3 The Receiving Environment

1.3.1 Overview

The project area, Mtunzini, is approximately 41 km south of Richards Bay, located within the uMlalazi Local Municipality, which is one of five municipalities administered by the King Cetshwayo District Municipality.

The proposed project infrastructure will be constructed in and around the town of Mtunzini (with some upgrades proposed within the uMlalazi Nature Reserve), inclusive of sewer reticulation pipelines, rising mains, bulk gravity lines, sumps and pump stations. The proposed site for a new Wastewater Treatment Works is to the north-west of the town of Mtunzini between the N2 and Village Hardware on land currently owned by the uMlalazi Local Municipality.

1.3.2 Objective and Scope of the Environmental Management Programme

This Environmental Management Programme (EMPr) covers the principles, responsibilities and requirements applicable to implement effective environmental management during the design, pre-construction, construction and rehabilitation phases of the Mtunzini sanitation Project.

In addition, the EMPr does the following:

- ❑ Assigns roles and responsibilities to the parties charged with implementation.
- ❑ Sets out environmental specifications that are applicable to the project and its associated activities and provides guidance to achieve these environmental specifications.
- ❑ Defines corrective actions, which must be taken in the event of non-compliance with the environmental specifications of this EMPr.
- ❑ Specifies requirements and procedures for monitoring, auditing and reporting.
- ❑ Specifies requirements and procedures for record keeping.
- ❑ Makes provision for the fulfilment of other relevant legal requirements pertaining to the environment.

2. ENVIRONMENTAL PRINCIPLES AND LEGAL REQUIREMENTS

2.1 Environmental Principles

The following principles should always be considered by all parties during all phases of the project:

- ❑ The environment is composed of both biophysical and social components.
- ❑ Construction is a disruptive activity and all due consideration must be given to the environment, including the social environment, to minimise the impact during the execution of the project.
- ❑ Minimisation of areas disturbed by construction activities (i.e. the footprint of the construction area) should minimise many of the construction related environmental impacts of the project and reduce rehabilitation requirements and costs.
- ❑ As minimum requirements, all relevant standards relating to international, national, provincial and local legislation, as applicable, shall be adhered to. This includes requirements relating to waste emissions (e.g. hazardous, airborne, liquid and solid), waste disposal practices, noise regulations, road traffic ordinances, protected species, etc.
- ❑ Every effort should be made to minimise, reclaim and/or recycle "waste" material.
- ❑ Every effort should be made to apply the best practicable environmental option.

2.2 Environmental Standards

All applicable environmental standards contained within environmental legislation shall be adhered to. Without derogating from the generality of the above and without limitation, at the time of compiling this EMP, the following environmental guidelines and standards are highlighted. The list is intended to serve as a guideline only and is not exhaustive.

2.2.1 Air Quality Guidelines

In terms of air quality, the Contractor will be required to describe how effective dust control measures will be achieved during construction.

2.2.2 Noise Control Regulations

No provincial Noise Control Regulations have been promulgated in KwaZulu-Natal. Therefore, the national Noise Control Regulations of the Environment Conservation Act, 1989 (Act No. 73 of 1989), Government Notice Number GN 154 of Government Gazette 13717 of 10 January 1992, apply.

2.2.3 Storage of Hazardous Substances

Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards which may include the Hazardous Substances Act, 1973 (Act No. 15 Of 1973), the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), relevant associated regulations, and applicable SABS and international standards.

2.2.4 Health and Safety of Work Teams

Construction Regulations (2003) published under the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) apply to construction activities including “the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work”. A “health and safety plan” which addresses hazards identified, and includes safe work procedures to mitigate, reduce or control the hazards identified, is required under this Act. A risk assessment must be undertaken by an appropriately qualified person(s) and the Contractor shall ensure that all employees under his or her control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences and, thereafter, at such times as may be determined necessary in the risk assessment.

2.3 Environmental Legal Requirements (Norms and Standards, Licences, Approvals and Permits)

A number of laws and regulations apply to the protection and conservation of the environment. It is the responsibility of the KCDM to ensure that the necessary permits, approvals and licences are obtained prior to the commencement of construction.

2.3.1 Environmental Authorisation and the National Environmental Management Act (NEMA)

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998 (NEMA)), anyone who causes or may cause significant pollution or degradation of the environment must take reasonable measures to prevent this and to minimise and rectify such pollution or degradation of the environment (NEMA Section 28 - Duty of Care and Remediation of Environmental Damage).

2.3.2 Heritage Resources Permits

In terms of Section 27(1) of the KwaZulu-Natal Heritage Act, 2008 (Act No. 4 of 2008), any person who intends to undertake a development that meets the criteria of one or more of the listed activities, must, at the very earliest stages of initiating such a development, notify Amafa aKwaZulu-Natali (Amafa) and provide details regarding the location, nature and extent of the development.

This includes the construction of a pipeline or linear development exceeding 300 m in length, the construction of a bridge or similar structure exceeding 50 m in length, and a development, or other activity which will change the character of an area of land, or water exceeding 10,000 m² in extent. Amafa must notify the developer whether a Heritage Impact Assessment and Report are required prior to construction commencing. This has been done for the proposed project and an Exemption has been issued by Amafa.

If, during construction, archaeological or paleontological objects or material or a meteorite is discovered, the find must immediately be reported to Amafa. No person may, without a permit, destroy damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite.

2.3.3 National Water Act, 1998 (Act No. 36 of 1998)

Alteration of a stream or river (i.e. alteration of the course or river bed) and the disposal of waste water requires a licence from the Department of Water and Sanitation (DWS) in terms of Sections 21, 36, 40 and 41 of the National Water Act. In certain cases, a general authorisation is given to impede or divert the flow of a watercourse. Pollution of river water (silt-laden run-off, oil from machines, etc) is a contravention of the Act and is not permitted. Wetlands are also protected under this Act. No land use shall disturb the vegetation in a vlei or flood area of a watercourse in a manner that may cause damage or the deterioration thereof unless under license from DWS.

If water is required during construction, a licence is required from the Minister of Water Affairs for the abstraction of water where the abstraction exceeds the levels prescribed by a general authorisation. From time to time, general authorisations have been published in terms of Section 39 of the Act.

2.3.4 Protected Trees and Forests (National Protection)

In terms of the National Forests Act, 1998 (Act No. 84 of 1998), trees in natural forests or protected tree species (as listed in Government Gazette Notice 1012 of 27 August 2004) may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold, except under licence granted by the Department of Environment, Forestry and Fisheries (DEFF). Thus, protected species and natural forests should be avoided where possible. Where this is not possible, other mitigation measures should be implemented such as relocation or off-site rehabilitation. Furthermore, accurate and detailed records of plant specimens should be assembled and forwarded to DEFF for record purposes.

2.3.5 Protected Plants (Provincial Protection)

Certain indigenous plant and animal species in KwaZulu-Natal are provided with special protection under KwaZulu-Natal nature conservation legislation and permits are required from Ezemvelo KZN Wildlife (EKZNW) for their removal, destruction or translocation. This is in accordance with the Natal Nature Conservation Ordinance, No 15 of 1974. Accordingly, accurate and detailed records of plant specimens should be assembled and forwarded to EKZNW for record purposes.

2.3.6 *Control of Invasive Plants and Declared Weeds*

Declared weeds or invader plants are defined by the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) as follows:

- ❑ **Category 1: Declared weeds.** These species must be eradicated from all areas and are only permitted with written permission from the Executive Officer (as defined by the Act).
- ❑ **Category 2: Invader plants.** These species are only permitted in specially demarcated areas and should be eradicated in all areas, except where permission has been granted. These species are not permitted to grow within 50 m of the 1:50 flood line of a watercourse.
- ❑ **Category 3.** These plants shall not occur on any land or inland water surface other than in a biological control reserve. No land user shall allow Category 3 plants to occur within 30 metres of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.

In terms of Government Notice R 1048, the following regulations are applicable with regards to the control of invasive plants and declared weeds:

- ❑ It is illegal to have declared weed species or invasive alien vegetation on one's property.
- ❑ The landowner must immediately take steps to eradicate them by using the methods prescribed in the regulations, viz:
 - Uprooting and burning.
 - The application of a suitable chemical weed-killer (herbicide).
 - Any other method of permanent eradication.
- ❑ One may not uproot or remove such plants and dump or discard them elsewhere to re-grow or allow their seeds to be spread or to be blown onto other properties.
- ❑ If the landowner does not comply with requirements above, a person may be found guilty of a criminal offence.

Alien invasive plants are to be removed and thereafter controlled in the cleared construction areas and other areas disturbed by construction.

2.3.7 *Waste Disposal*

The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) aims to minimise the consumption of natural resources, avoid and minimise the generation of waste, reduce, re-use, recycle and recover waste whenever possible, treat and safely dispose of waste as a last resort, and prevent pollution and ecological degradation.

Waste produced by construction activities must be disposed at a licensed waste management facility, thus, no permitting or licensing will be required.

2.3.8 *Public Health*

Wastewater Treatment Works and other similar types of sewage effluent and human waste disposal facilities must be approved by the nearest local authority in terms of their by-laws and relevant provincial by-laws. For the proposed project, portable, chemical ablutions will be provided by a service provider to the Contractor during construction.

2.3.9 *Other Applicable Legislation*

This list is intended to serve as a guideline only and is not exhaustive:

- The Constitution of the Republic of South Africa Act, 1996 (Act No. 108 of 1996).
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983).
- Explosives Act, 1956 (Act No. 26 of 1956).
- Environment Conservation Act, 1989 (Act No. 73 of 1989).
- National Environmental Management Act, 1998 (Act No. 107 of 1998).
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
- National Environment Management: Air Quality Act (Act No. 39 of 2004).
- National Environmental Management: Waste Act (Act No. 59 of 2008).
- National Water Act, 1998 (Act No. 36 of 1998).
- National Heritage Resources Act, 1999 (Act No. 25 of 1999).
- National Roads Act, 1998 (Act No. 7 of 1998).
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998).
- Hazardous Substances Act, 1973 (Act No. 15 of 1973).
- Land Survey Act, 1921 (Act No. 9 of 1921).
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).
- KwaZulu-Natal Heritage Act, 2008 (Act No. 4 of 2008).
- Local Government Ordinances and Bylaws.

3. ADMINISTRATION AND REGULATION OF ENVIRONMENTAL OBLIGATIONS

3.1 Organisational Structure

An organisational structure for the construction phase of the project is illustrated in Figure 2¹. Communication and reporting lines related to the EMPr (including instructions, directives and information) shall be channelled according to the organisational structure implemented by the KCDM.

3.2 Roles and Responsibilities

The roles and responsibilities that are assigned to the various parties described hereunder are for all phases of the project.

3.2.1 *King Cetshwayo District Municipality (Employer)*

The King Cetshwayo District Municipality is responsible for ensuring that the conditions within the EMPr are met. The Employer is responsible for the following:

- Implementation of the EMPr.
- Submission of any substantial changes, updates or amendments to the EMPr to the KZN Department of Economic Development, Tourism and Environmental Affairs (DEDTEA) for approval.
- Ensuring that the provisions of the EMPr are binding on all Contractors operating on the site during the life of the project, including a performance-based requirement in all contract documents.
- Ensuring that monthly environmental site inspections and monthly audit reports are compiled during construction to establish how well the Contractor is complying with the EMPr. The monthly environmental audit reports must be submitted to DEDTEA.

¹ The organogram will need to be updated once all roles have been filled and companies appointed.

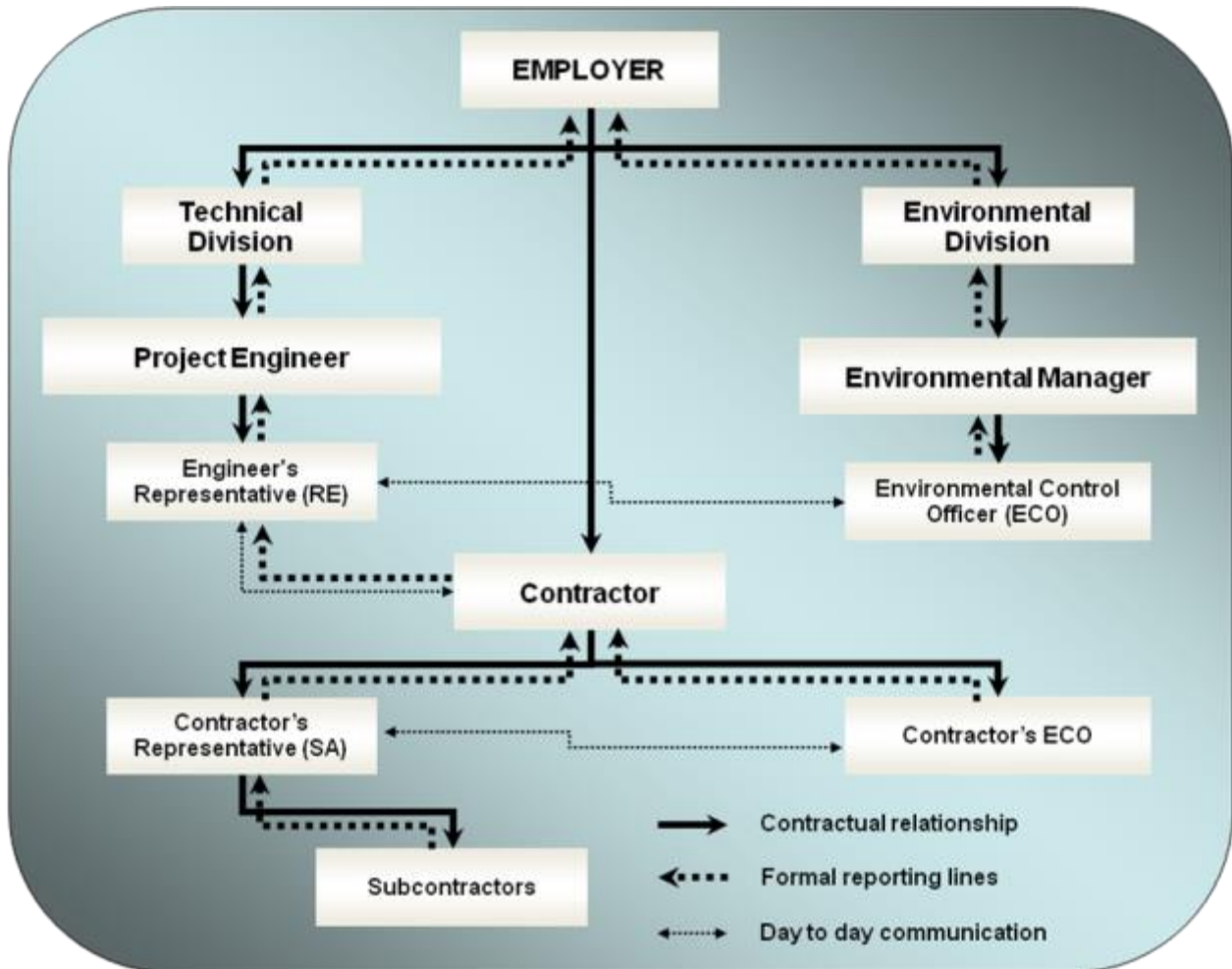


Figure 2 Organisational organogram for construction: communication/reporting relationship

- ❑ Ensuring that compliance/non-compliance records are kept in good order and made available on request by the authorities.
- ❑ Complying with all applicable environmental legislation, regulations and guidelines, and ensuring that Contractors undertake responsibility to do the same.
- ❑ Being committed to the principles contained within NEMA, including the prevention of pollution and sustainable development.

3.2.2 Project Engineer and Resident Engineer

The Project Engineer represents the Employer and co-ordinates all aspects of the project, including project co-ordination, design and construction. The Resident Engineer (RE) is the Project Engineer's representative on site. The Project Engineer is ultimately responsible for ensuring, on behalf of the Employer, that the provisions of the EMPr are complied with. The Project Engineer, assisted by the RE on site, is responsible for the following:

- ❑ Ensuring that the provisions of the EMPr are binding on all Contractors operating on the site during the construction of the project and that a performance-based requirement is included in all contracts.
- ❑ Including the approved EMPr as part of the contract documents.

- ❑ Ensuring that the Contractor(s) and Sub-contractor(s) are conversant with the requirements of the EMPr and that all members of staff on site have attended an environmental awareness-training course presented by the ECO.
- ❑ Compiling preliminary construction site layout plans prior to construction commencing.
- ❑ Approving final construction site layout plans in conjunction with the Environmental Manager.
- ❑ Ensuring that the Contractor(s) complies with the EMPr and, if not, ensure that the Contractor(s) bears the costs of damages/compensation resulting from non-compliance.
- ❑ If necessary, on the recommendation of the Environmental Manager, instruct the Contractor(s) to suspend any or all works on site, if the Contractor(s) or his/her Sub-contractors/suppliers fail to comply with the EMPr.
- ❑ Ensuring that the Contractor(s) conducts all activities in a manner that minimises disturbance to the project area and local communities and forwards complaints and queries by members of the public at the site office, to the RE.
- ❑ Liaison with stakeholders including landowners and land users, utility providers², neighbours, and relevant authorities. This should be done in association with the Contractor (and the Environmental Control Officer (ECO) where necessary).
- ❑ Ensuring that a register of complaints and queries by members of the public is maintained at the site office and the actions taken in response to these complaints.
- ❑ Liaising directly with the Environmental Manager in terms of environmental issues and maintaining close channels of communication with the Environmental Manager regarding foreseeable activities that may require environmental input.
- ❑ On behalf of the Employer, reviewing any substantial changes, updates or amendments to the EMPr prior to its submission to DEDTEA for approval.
- ❑ On behalf of the Employer, ensuring that the Environmental Manager keeps the compliance/non-compliance records in good order and makes them available on request to the authorities.
- ❑ Ensuring that all EMPr-related instructions from the RE to the Contractor are recorded in the site diary.
- ❑ Having available on request, a copy of the EMPr at the construction site at all times and ensuring that all staff, Contractors and Sub-contractors are familiar with or made aware of the contents of the EMPr.
- ❑ Complying with all applicable environmental legislation, regulations and guidelines, and ensuring that Contractors undertake responsibility to do the same.
- ❑ Ensuring that an environmental performance certificate is obtained from the Environmental Manager prior to awarding the Certificate of Completion to the Contractor(s).

3.2.3 Environmental Manager

The Environmental Manager is responsible for managing and co-ordinating environmental obligations and shall advise the Project Engineer, the Employer and Contractors on all environmental management matters relating to the project. This includes providing input during all phases of construction (including design), monitoring environmental performance of Contractors during construction and ensuring that all environmental specifications and EMPr requirements are always met .

The Environmental Manager is responsible for the following:

- ❑ Co-ordinating all matters relating to the environmental management of the project.
- ❑ Being fully conversant with the EMPr and all relevant environmental legislation, guidelines and standards.

² The Project Engineer is to ensure liaison with utility operators regarding safety requirements for work within utility servitudes or crossing utilities.

- ❑ Assisting the Employer, the Project Engineer, the RE and the Contractor(s) with EMPr compliance and all environmental legislation related to the project.
- ❑ Liaising with the relevant authorities with respect to licences, approvals, authorisations, permits, agreements etc., in collaboration with the Project Engineer and Contractor(s) where required.
- ❑ Ensuring that the Employer has obtained all authorisations, licences and permits required in terms of the applicable legislation.
- ❑ Liaising closely with and reporting any breaches of EMPr implementation and the relevant legislation to the Project Engineer.
- ❑ Attending project meetings and reporting and advising as necessary on environmental matters.
- ❑ Reviewing and updating the EMPr in relation to specific requests, non-compliances or changes in legislation and obtaining the necessary input from the Project Engineer.
- ❑ Providing input into construction site layout plans.
- ❑ Obtaining environmental specialist input as required.
- ❑ On behalf of the Employer and upon direction of the Project Engineer, informing DEDTEA of non-compliance of any of the conditions of the EMPr within a reasonable period.
- ❑ Providing the Project Engineer with an environmental performance certificate at the end of a contract confirming that all environmental specifications applicable to the Contractor have been met.
- ❑ Reviewing training programmes, construction site layout plans, method statements and specifications and advise as necessary.

In addition, the Environmental Manager will be responsible for the following:

- ❑ Assisting with enforcing environmental specifications on site via the RE.
- ❑ Conducting monthly site visits to monitor and verify compliance with the EMPr.
- ❑ Keep records of compliance/non-compliance.
- ❑ Producing a monthly environmental audit report. These monthly environmental audit reports must be submitted to DEDTEA.
- ❑ Identifying and assessing previously unforeseen, actual or potential impacts of the project on the environment.
- ❑ Bringing any environmental concerns to the attention of the Project Engineer.
- ❑ Recommending to the RE that the Contractor suspend any or all works on site if the third parties who carry out all or part of the Contractor's obligations fail to comply with the environmental specifications.
- ❑ Advising on the rectification of any pollution, contamination or damage to the project site, rights of way and adjacent land.
- ❑ Reviewing and approving construction method statements with input from the Project Engineer and RE, where necessary, in order to ensure that the environmental specifications contained within this EMPr are adhered to.
- ❑ Attending site meetings (scheduled and *ad hoc*).
- ❑ Keeping accurate and detailed records of all EMPr-related activities on site.
- ❑ Recording complaints or queries from I&APs and actions taken to address complaints. Copies of all interactions and correspondence shall be kept as part of record keeping.
- ❑ Maintaining a photographic record of construction activities and construction progress.
- ❑ Checking that a copy of the EMPr is available on site.
- ❑ Ensuring that the RE and Contractor(s) are made aware of all applicable changes to the EMPr.

3.2.4 Contractor and appointed Environmental Officer

The Contractor is the successful tenderer, appointed by the Employer to undertake the project. It is the responsibility of the Contractor to ensure that he or an appointed advisor, are well versed in environmental matters to efficiently carry out the requirements of the EMPr. The Contractor and their appointed Environmental Officer (EO) is responsible for the following:

- ❑ The implementation of the applicable environmental specifications in accordance with the requirements of this EMPr.
- ❑ Obtain written permission from the land user for use of a suitable site for erection of the construction camp, pipe storage yards, stores and stockpile areas.
- ❑ Appoint a Community Liaison Officer (CLO) to assist with procurement of labour and for general communication with the community.
- ❑ Liaise with stakeholders, including affected land users, utility and service providers, neighbours, and relevant authorities. This should be done in association with the Project Engineer and ECO.
- ❑ Ensuring that a register of complaints and queries by members of the public is maintained at the site office and the actions taken in response to these complaints.
- ❑ Ensure that all third parties who carry out all or part of the Contractor's obligations comply with the requirements and provisions of this EMPr.
- ❑ Be responsible for the timeous procurement of all applicable approvals, authorisations, licences and permits required for a particular activity that is part of the Contract and which are additional requirements to those already obtained by the Employer but as necessitated by the plans and/or actions of the Contractor.
- ❑ Report any non-compliance to the RE and ECO within 12 hours of the event occurring.
- ❑ Report any non-compliance event that constitutes an emergency immediately and in line with the protocol applicable to that particular emergency event.
- ❑ With the ECO, present an environmental awareness-training course to all Sub-contractors and employees.
- ❑ Ensure that all Sub-contractors and employees attend the environmental awareness-training course.
- ❑ Ensure that a copy of the EMPr is always available at the construction site .

3.3 Compliance Monitoring, Reporting and Record Keeping

3.3.1 Compliance Monitoring

During the various construction phases (design, pre-construction, construction and rehabilitation), the contractors Environmental Officer (EO), with assistance from the ECO, will monitor the overall compliance of the conditions of authorisation and mitigation measures outlined in the EMPr by all parties concerned.

3.3.2 Design Phase

During the design phase, the ECO will meet with the Project Engineer to highlight design needs as specified in the EMPr. On completion of the design, relevant information will be reviewed by the ECO to ensure that the design demonstrates compliance with environmental requirements. The Project Engineer will also provide preliminary construction site layout plans to the Contractors EO for review.

3.3.3 Construction Phase

3.3.3.1 Construction Site Layout Plan

Prior to construction, the Project Engineer, with input from the Contractor, must approve the construction site layout plan prepared by the Contractor showing the positions and extent of all permanent and temporary site structures and infrastructure. The Project Engineer is responsible for the co-ordination of construction site layout plans should there be overlap between multiple Contractors on site.

The earlier this information is provided to the Project Engineer and EO, the less likelihood of delays to construction and of unforeseen environmental impacts occurring during construction.

3.3.3.2 Method Statements

Prior to construction, the RE and EO will agree which activities require a written method statement. Where relevant, the Contractor must submit a written method statement, which should include the following:

- The type of construction activity.
- Locality where the activity will take place.
- Identification of impacts that might result from the activity.
- Identification of activities or aspects that may cause an impact.
- Methodology and/or specifications for impact prevention for each activity or aspect.
- Methodology and/or specifications for impact containment for each activity or aspect.
- Emergency/disaster incident and reaction procedures.
- Treatment and continued maintenance of impacted environment.

The appointed ECO must review the construction method statements to ensure that the environmental specifications contained within this EMPr are adhered to.

3.3.3.3 Site Handover

The contractors EO and the appointed ECO will attend the site handover meeting, where the EMPr will form part of the agenda. The construction site layout plan is a key component of site handover and must be finalised before site handover can be completed. The approved plan must be attached to the site handover meeting minutes. Amendments to this plan must be discussed and approved at subsequent site meetings.

3.3.3.4 Site Inspections and Meetings

The clients appointed ECO will conduct monthly site inspections and meetings to establish how well the Contractor is complying with the EMPr. The ECO will compile a site inspection checklist, to be forwarded to the RE and Contractor for their attention and records. The checklists will also be included as an appendix to the monthly audit report to be submitted to DEDTEA.

Anything of an environmental nature that arises between the site audits must be recorded in the site diary and in written correspondence to the EO and RE. If required, the ECO must conduct a site visit to address the matter and must report the matter in an addendum to the site inspection checklist.

3.3.3.5 Practical Completion

The ECO must attend the practical completion inspection. Outstanding environmental matters requiring attention must be provided to the RE for inclusion in the snag list, which is to be attached to the practical completion certificate.

3.3.3.6 Final Completion and Environmental Performance Certificate

Once the environmental items on the snag list have been addressed to the satisfaction of the ECO, the ECO will provide an environmental audit report confirming that the environmental specifications applicable to the Contractor(s) have been met. This report will be submitted to the Project Engineer prior to the final Certificate of Completion being issued.

3.3.3.7 Independent Environmental Auditing

Periodic auditing of environmental compliance by an independent auditor may be required and is also advisable as best environmental practice. In this regard, DEDTEA may undertake periodic site audits to confirm the findings of the monthly audit reports submitted to them by the ECO.

3.3.4 Non-Compliance and Remedial Action

Matters of non-compliance by any parties must be reported to DEDTEA within a reasonable period. This should be discussed with DEDTEA.

The Contractor(s) and their Sub-contractors are deemed not to have complied with the EMPr if:

- There is evidence of contravention of the EMPr specifications within the boundaries of the construction site, site extensions and access roads.
- There is contravention of the EMPr specifications that relate to activities outside the boundaries of the construction site.
- Construction activities take place outside demarcated areas.
- Environmental damage ensues due to negligence or intent.
- Failure to comply with corrective or other instructions issued by the Project Engineer within a specific time period.

Where the ECO identifies non-compliance by the Contractors and Sub-contractors, it will be discussed at the monthly site visits (when identified) and remedial actions and timeframes specified. The EO must record these incidents of non-compliance, the remedial actions and timeframes in the site inspection checklist. The RE must also record the relevant instructions for the Contractor(s) in the site diary.

If the specified remedial action has not been carried out by the Contractor(s) within the period stipulated, the non-compliance must be dealt with as follows:

- Where non-compliance has resulted in environmental damage to the site which cannot be rectified by the remedial action specified by the ECO, or the Contractor(s) has failed to carry out the remedial work within the prescribed time limit (or permitted extension thereof), the ECO shall convene a meeting between the RE and the Contractor to discuss the appropriate fine. Appropriate remedial work shall also be discussed and agreed.
- In determining appropriate remedial action, the ECO and Project Engineer shall consult with DEDTEA and, where necessary, obtain specialist input.

- ❑ The Project Engineer shall issue an instruction to the Contractor to procure execution of the remedial work as agreed between the parties, and the Contractor shall be obliged to procure such remedial work within the prescribed period to the satisfaction of the Project Engineer.
- ❑ Failure by the Contractor to comply with an instruction from the Engineer to procure the carrying out of the required remedial work shall constitute a material breach of the contract.
- ❑ Where the Employer has taken action to procure the remediation of such consequences, it shall be entitled to recover from the Contractor the full cost of remediation.

Incidents of non-compliance, the remedial actions and timeframes must be recorded in the site inspection checklist and the site diary. Fines applied at the discretion of the Engineer (with input from the Environmental Manager) must be applied in addition to any remedial costs incurred as a result of non-compliance. The Engineer will inform the Contractor of the contravention and the amount of the fine and will deduct the amount from monies due to the Contractor under the contract.

3.3.5 Penalty Clause

Any avoidable non-compliance with the EMPr, Environmental Authorisation or applicable regulations shall be considered sufficient grounds for imposing a penalty (fine). The penalty imposed shall be per incident. Upon receipt of a notice of non-compliance, the Contractor shall correct whatever is the cause of the issuing of the notice.

The Rand values of the penalties to be imposed per incident or violation are provided in Annexure 1. They reflect first-time incidents of non-compliance only. Penalties of repeat offences are calculated at an incremental increase of 10% up to a maximum of R 100,000. Thus, the penalty for a first-time repeat incident would be 110% of the original penalty value, 120% for a second-time repeat incident, etc. Certain penalties may be waived or reduced at the discretion of the Project Engineer (with the approval of the Employer's Environmental Manager).

The enforcement of penalties shall be through a separate agreement between the Employer, Project Engineer and Contractor.

Penalties for non-compliance are imposed over and above the costs required for remediation/rehabilitation, and/or penalties that may be imposed in terms of relevant legislation.

3.3.6 Regulatory Authorities' Site Inspections

DEDTEA, and other relevant authorities, e.g. DWS may conduct site inspections as desired.

3.3.7 Record Keeping

The EO must ensure that all documentation related to the EMPr is filed and made available on request to the authorities. The following documents may be relevant:

- ❑ Environmental Authorisation.
- ❑ Environmental Management Programme.
- ❑ Monthly site inspection checklists.
- ❑ Monthly audit reports.
- ❑ Design documents and drawings.
- ❑ Construction site layout plans.
- ❑ Method statements.
- ❑ Communication and correspondence.
- ❑ Environmental awareness training programme and attendance records.
- ❑ Environmental incident and accident reports.

- Emergency preparedness and response plans.
- Complaints register.
- Environmental performance certificates.

3.4 Environmental Awareness Training

A copy of the approved EMPr shall always be available at the construction site and all staff; Contractors and Sub-contractors shall be familiar with or be made aware of the contents of the EMPr and environmental authorisation.

The environmental awareness training programme, supplemented by toolbox talks, must include the following:

- The importance of compliance with all environmental policies, procedures, plans and systems.
- Understanding the importance of, and the reasons why, the environment must be protected.
- Basic awareness and understanding of the key environmental features of the work site and environs, particularly sensitive habitats.
- The significant environmental impacts, actual or potential, as a result of their work activities.
- The mitigation measures required to be implemented when carrying out their work activities.
- The environmental benefits of positive environmental performance.
- The various roles and responsibilities in achieving compliance with the EMPr, including emergency preparedness and response requirements.
- The potential consequences of departure from specified operating procedures.
- The importance of cultural heritage resources and the procedure to follow when chance finds are made.
- Health and safety awareness.

The Contractor must ensure that its Sub-contractors and employees (and any other third parties) attend the course. At the discretion of the EO, employees involved in events of non-compliance may be given further relevant training by the EO.

A record of the environmental awareness training programme and attendance lists must be kept by the EO.

3.5 Emergency Preparedness and Reporting

The Contractor must compile and maintain environmental emergency procedures to ensure that there will be an appropriate response to unexpected or accidental actions or incidents that will cause environmental impacts. The RE should be familiar with these procedures and be responsible for the co-ordination thereof should there be multiple Contractors on site simultaneously.

Emergencies are defined as serious cases of the following incidents, which cannot be dealt with according to the standard specifications contained in Sections 4 - 8, and include:

- Accidental discharges to water and land.
- Accidents involving members of the public.
- Accidental exposure of employees to hazardous substances.
- Accidental veld or forest fires.

- ❑ Accidental spillage of hazardous substances.
- ❑ Injurious encounters with dangerous animals.
- ❑ Natural disasters (e.g. flooding).

These plans should include:

- ❑ Emergency organisation (manpower) and responsibilities, accountability and liability.
- ❑ A list of key personnel.
- ❑ Details of emergency services applicable to the various areas along the route (e.g. the fire department, ambulance services, spill clean-up services, etc).
- ❑ Internal and external communication plans, including prescribed reporting procedures where required by legislation.
- ❑ Actions to be taken in the event of different types of emergencies.
- ❑ Incident recording, progress reporting and remediation measures required to be implemented.
- ❑ Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release.
- ❑ Training plans, testing exercises and schedules for effectiveness.

In compiling the emergency plans, the Contractor shall comply with the emergency preparedness and incident and accident-reporting requirements, as required by the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), the National Environmental Management Act, 1998 (Act No. 107 of 1998), the National Water Act, 1998 (Act No. 36 of 1998) and the National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998) as amended and/or any other relevant legislation.

3.6 Liaison with Interested and Affected Parties

Liaison with I&APs is to be co-ordinated by the Project Engineer and the Contractor. This shall include liaison with land users, utility and service providers³, neighbours, and relevant authorities.

Complaints or queries received from I&APs and actions taken to address complaints shall be addressed in writing (with copies forwarded to the RE and ECO). Copies of all interactions and correspondence shall be kept as part of record keeping by the EO.

3.7 Review and Updating of the EMPr

The EMPr is a living document and should be reviewed and updated in response to new or changing technical information, environmental conditions, legislation and policy, and environmental best practice. Substantial changes must be approved by DEDTEA.

Sections 4 to 8 contain the environmental specifications required for each of the stages, viz. design, pre-construction, construction, rehabilitation and operation. These sections are deliberately repetitive, as in many cases, an environmental aspect requires attention at more than one stage of the project cycle.

³ The Project Engineer is to ensure liaison with utility operators regarding safety requirements for work within or crossing utilities.

4. DESIGN PHASE

Various environmental management considerations must be dealt with prior to construction by the Project Engineer, Environmental Manager and/or the Contractor. Responsible parties are indicated in the sections below.

4.1 Technical Design

Environmental sensitivities identified during the Basic Assessment must be communicated to the Project Engineer by the Environmental Assessment Practitioner (EAP) so that, where applicable, project specific mitigation measures may be incorporated into the technical designs.

4.2 Erosion Control and Drainage

- ❑ Technical design and planned construction methods must build in measures to prevent soil erosion associated with construction, with particular attention given to scour points, crossings of water bodies and drainage lines, storm water outlets and other areas of high erosion potential, such as steep slopes (where these cannot be avoided).
- ❑ In determining the location of the construction camp, stockpile areas, pipe storage yards as well as any required new access roads and borrow pits/quarries (if required), areas of high erosion potential must be avoided.
- ❑ The design must allow for the ground conditions encountered, including adequate allowance for settlement of embankments and drainage layers.
- ❑ Technical design and planned construction methods must build in measures to avoid soil compaction associated with construction.
- ❑ Drainage systems must be kept as natural as possible. Natural drainage must be retained, and normal flow ensured at all times.
- ❑ Runoff must not be canalised or concentrated in areas where sheet flow may occur, or where highly erodible soils occur.
- ❑ Erosion or scouring of any watercourses resulting from construction must be prevented.
- ❑ Alteration of groundwater movement patterns must be prevented. To this end, design and planned construction techniques to provide for subsurface water movement are to be implemented.
- ❑ No excavation of alternative channels to re-route any river/stream may be done (to avoid unnecessary erosion).
- ❑ Design must include measures such as a drainage layer, well pointing, shoring and concrete encasement of the pipeline in sensitive areas.
- ❑ Excavation will be selective to ensure that the topsoil is placed back on top.
- ❑ Concrete encasement and other pipe protection measures will be used where the structural integrity of the pipe may be compromised.
- ❑ Shoring must occur where excavation is in loose sand.

Refer to Section 6.8 for further detail regarding erosion control and drainage considerations.

4.3 Protection of Sensitive Ecosystems and Habitats

- ❑ Prior to construction commencing, the project area must be inspected by the ECO to identify the following:
 - Protected trees (which should be avoided as far as possible).
 - In the event that a protected tree species needs to be removed, the Contractor must obtain the agreement of the ECO and the necessary licence from DEFF for its removal.
 - Identify and mark large, established, indigenous trees that should not be removed.

- Suitable sites for the relocation of sensitive plant material to be removed and trees to be transplanted (Annexure 2).
- Areas outside the construction site for off-site mitigation (where relocation is not possible).
- Identify, delineate, photograph and clearly mark likely wetlands and rivers/streams to be intersected by the project.
- Where necessary, appoint a suitably qualified botanist to provide assistance with the above-mentioned tasks.
- ❑ The Project Engineer, in consultation with the contractors EO, must prepare a programme to remove alien invasive plants on site during the construction period.
- ❑ In sensitive areas, such as wetlands and indigenous forest, it is recommended that the construction servitude be narrower.
- ❑ Watercourse and wetland protection measures must be put in place.
- ❑ Concrete encasement and other pipe protection measures will be used where the structural integrity of the pipe may be compromised.

Refer to Section 6.1.3 for further detail regarding the protection of sensitive environments.

4.4 Stockpile Areas

- ❑ Where possible, stockpile areas must be identified and approved by the Project Engineer and Environmental Manager during the design phase.
- ❑ Where possible, stockpile areas must be located within the construction site.
- ❑ Environmentally sensitive and no-go areas must be avoided.
- ❑ If the stockpile area is located closer than 50 m to a watercourse, erosion prevention measures must be designed and implemented.
- ❑ As far as possible, existing roads must be used to access stockpile areas.

Refer to Section 6.6 for further detail regarding stockpiling.

4.5 Spoil Areas

- ❑ The Contractor must dispose of excess trench excavation material and construction rubble in approved spoil areas.
- ❑ Where possible, spoil sites must be identified and approved during the design phase. In determining the appropriate location of spoil areas, cognisance must be taken of sensitive and no-go areas.
- ❑ Excess trench material may also be used to replace unsuitable local material (e.g. bedding for pipes).
- ❑ Spoil areas must not negatively affect surface drainage and must not alter the topography to the extent that they become visually intrusive.
- ❑ Spoil areas must be re-vegetated and rehabilitated after construction.

Refer to Section 6.6.2 for further detail regarding spoil.

4.6 Construction Site

4.6.1 Construction Site Layout Plan

A construction site layout plan must be compiled during the design phase by the Project Engineer, with assistance from the Environmental Manager. The plan should show the positions and extent of the known permanent and temporary site structures and infrastructure as listed below (as applicable). Additional items and amendments to this plan must be made during the pre-construction phase.

- Site access (including entry and exit points).
- Roads and access routes.
- Buildings and structures.
- Contractor camp(s).
- Pipe storage yards.
- Site office.
- Security requirements (including temporary and permanent fencing, and lighting) and accommodation areas for security staff.
- Gates and fences.
- Concrete batching areas.
- Essential services (permanent and temporary water, electricity and sewage).
- Sanitation (including the treatment/removal of sewage).
- Construction materials storage areas including the storage of fuels.
- Vehicle and equipment storage areas.
- Wash bays.
- Storm water control measures.
- Borrow areas (if required).
- Excavations and trenches.
- Stockpile/lay-down areas.
- Spoil areas.
- Waste management including waste storage and disposal sites.
- Areas where vegetation will need to be cleared.
- Features and plants to be conserved.

4.6.2 Construction Camps

The following must be designed with regard to construction camps:

- In determining the location and layout of these areas, cognisance must be taken of sensitive and no-go areas. The construction camp and pipe storage yards must be located in areas that will have minimal environmental impact, such as agricultural land, for which compensation may need to be paid.
- The construction camp and materials/pipe storage yards must be sited within previously disturbed areas but may not be located within 50 m of identified ecologically sensitive areas such as watercourses, drainage lines or wetland areas.
- No staff accommodation is allowed on site, except for security/emergency personnel.
- The construction camp must be fenced.

4.7 Access Roads

- ❑ The design phase must make provision for the utilisation of existing roads in the area (as far as possible).
- ❑ The design phase must make provision for the establishment of required temporary access roads within the boundaries of the construction site. Where roads are required outside the construction site, sensitive and no-go areas must be avoided.
- ❑ The final design must detail all access roads outside the construction site.
- ❑ Any clearing for access roads, both within, and where necessary, outside the construction site may only be undertaken once the necessary landowner/land user permission has been obtained.

Refer to Section 6.2.6 for further detail regarding roads and access.

4.8 Disturbance to Land Users and Service Providers

- ❑ The minimum disruption to services must be maintained at all times.
- ❑ The design must address the disturbance of access to affected land users during the construction phase, and must make provision for maintaining access, adequate notice of access closures and alternative routing if required.
- ❑ The accommodation of services, e.g. Telkom, Eskom and other utilities must be incorporated into the design with full liaison with the relevant utility companies regarding safety requirements for work within or crossing utility servitudes.
- ❑ Direct liaison is required between the design engineers and the relevant organs of state in order to identify exact positions, to negotiate permission to cross servitudes and/or services infrastructure and to identify optimal ways to minimise disruption and interruptions to services.
- ❑ Design must include mitigation measures in order to ensure construction noise levels are within permitted levels.
- ❑ Sufficient notice to the local community, including affected land users and/or tenants, must be provided by the Project Engineer in consultation with the Environmental Manager, before construction commences. Information regarding the expected types of construction activities must be supplied.

Refer to Section 6.10 for further detail regarding nuisance control.

4.9 Servitude Negotiations and Compensation

As soon as possible, the Employer must commence with servitude negotiations for land acquisition for the project elements (sump/pump stations, pipelines, temporary access roads, etc):

- ❑ The Project Engineer must ensure that liaison regarding land acquisition has been undertaken and that compensation has been agreed upon. The process must be aimed at obtaining mutual acceptance of compensation by all affected parties.
- ❑ Independent property valuers must be appointed (by the Employer) to determine the extent of compensation to affected parties.
- ❑ Compensation must be paid by the Employer.
- ❑ Information must be provided to affected land users regarding any servitude restrictions.
- ❑ Agreements must be entered into between the Employer and land users for access to the project site.

4.10 Aesthetics

- During design, the overall aesthetics of the project must be considered, with a view to minimising any potential negative impacts and/or improving the visual aesthetics of the local environment.

5. PRE-CONSTRUCTION PHASE

The pre-construction phase refers to the period following final project planning and the tender period, leading up to, but not including, the establishment of the appointed Contractor on site. These items may be the responsibility of the **Contractor** or the **Project Engineer**. Input and assistance may be obtained, where necessary, from the **Environmental Manager**.

5.1 Construction Site Layout Plan

A construction site layout plan must be compiled during the design phase by the Project Engineer, with assistance from the Environmental Manager. The plan should show the positions and extent of the known permanent and temporary site structures and infrastructure as listed below (as applicable):

- Site access (including entry and exit points).
- Roads and access routes.
- Buildings and structures.
- Contractor camp(s).
- Pipe and materials storage yards.
- Site office.
- Security requirements (including temporary and permanent fencing, and lighting) and accommodation areas for security staff.
- Gates and fences.
- Concrete batching areas.
- Essential services (permanent and temporary water, electricity and sewage).
- Sanitation (including the treatment/removal of sewage).
- Construction materials storage areas including the storage of fuels.
- Vehicle and equipment storage areas.
- Wash bays.
- Storm water control measures.
- Borrow areas (if required).
- Excavations and trenches.
- Stockpile/lay-down areas.
- Spoil areas.
- Waste management including waste storage and disposal sites.
- Areas where vegetation will need to be cleared.
- Features and plants to be conserved.

5.2 Construction Preparation

- The Contractor must ensure that any required written permission from the land users for use of land for the construction camp, pipe/materials storage yards, stores and stockpile areas has been obtained.
- The ECO must take detailed, colour photographs of the site before any clearing may commence.
- The Contractor must ensure that he/she is familiar with the following prior to construction commencing:

- Sensitive areas.
- Mitigation measures.
- Large, established, indigenous trees that should not be removed.
- Wetlands and rivers/streams likely to be intersected by the project.
- ❑ Sanitation arrangements must be made to the satisfaction of the Environmental Manager, the ECO, and the local authorities, and be compliant with all applicable legal requirements.
- ❑ The Contractor must ensure that the Project Engineer and Environmental Manager are given timeous notice of the intention to commence construction.

5.3 Acquisition of Permits and Licences

Applicable permits and licences must be obtained prior to construction, as per section 2.3.

5.4 Procurement Process

- ❑ The Contractor's procurement process is bound by the contract agreement with the Employer and must be in accordance with applicable procurement norms and standards.
- ❑ Local institutional structures, e.g. Amakhosi, must be included in the procurement process.
- ❑ Where practical and applicable, training must be provided to local labourers in order to perform more specialised jobs.
- ❑ The Contractor must trade locally for goods and services, where possible and practical.
- ❑ The Contractor is encouraged to make use of emerging contractors from formerly disadvantaged communities, as Sub-contractors or by the formation of joint ventures.

6 CONSTRUCTION PHASE

The construction phase refers to the period of the project during which construction activities are carried out. This section of the EMPr outlines those general environmental specifications that are required to be implemented by the **Contractor and their appointed EO** during construction. Where applicable, approval, assistance and/or guidance may be sought from the **Project Engineer, RE** and the **ECO**.

6.1 Site Establishment

When establishing the site, the environmental objective is to minimise the footprint of disturbance and to minimise the extent of soil erosion, loss of vegetation and the potential for pollution of soils and water resources.

The site must be established in accordance with the approved construction site layout plan, prior to the commencement of construction. Any relaxation or modification of the construction site layout plan must be approved by the Project Engineer and ECO.

6.1.1 Demarcation of the Site

The extent of the construction site, including working areas, must be clearly demarcated and no movement or work outside these areas is permitted. The Contractor must:

- ❑ Identify and demarcate the extent of the construction site as indicated on the approved construction site layout plan using barrier tape with steel droppers or another method as approved by the Project Engineer and ECO.
- ❑ Minimise the extent of the construction site footprint as much as possible.
- ❑ Ensure that the main site camp is completely fenced and has controlled security access.

- ❑ Identify and demarcate sensitive sites in collaboration with the ECO. This may require fencing or steel droppers with barrier tape.
- ❑ Maintain site demarcations in position until the cessation of construction works and ensure that no personnel or construction materials move outside the demarcated areas.
- ❑ Ensure that the site is not used for any other purpose other than for the carrying out of construction activities.
- ❑ Ensure that no natural features are painted or permanently marked. Marking for surveying and other purposes must be done using pegs, beacons or rope and droppers.
- ❑ Ensure that security lighting from the construction camp and pump stations does not unduly disturb neighbours.

6.1.2 Site Clearance

- ❑ Detailed, colour photographs shall be taken of the proposed site before any clearing may commence. These records are to be kept by the ECO to aid in the rehabilitation of the site.
- ❑ Prior to site clearance, the ECO must be informed, with 14 days' notice, in order to identify and demarcate any indigenous trees or plants, nesting sites or heritage sites that require protection or translocation.
- ❑ Areas of the construction site requiring clearance shall only be cleared immediately prior to construction activities commencing, i.e. at the last practicable stage.
- ❑ As far as possible, the preferred alignment of the reticulation lines, shall be selected to traverse areas which have been previously disturbed by anthropogenic factors (roads in Mtunzini).
- ❑ Clearance of indigenous vegetation must be kept to an absolute minimum.
- ❑ No indigenous trees or shrubs may be felled, lopped, pruned or removed without the prior permission of the EO and ECO. De-bushing and de-stumping are dealt with in Section 6.1.6 of this document.
- ❑ Topsoil is to be stripped, together with grass, groundcover and sedges, from all areas where permanent or temporary structures and access roads are to be constructed. Conservation and handling of topsoil must be undertaken as per the conditions of this document (Section 6.1.5).

Wood obtained from clearing and grubbing operations remains the property of the Employer and must be stacked at sites designated by the ECO. The Contractor shall be required to remove and dispose of any wood from site at a designated site for vegetation disposal, should this be required. Alternatively, the wood may be made available for use by local communities.

6.1.3 Protection of Sensitive Habitats

- ❑ The Contractor must ensure that the necessary rescue and translocation of plants and animals be undertaken prior to the commencement of construction.
- ❑ The width of the initial clearance for the construction servitude must be minimised to reduce the loss of indigenous vegetation and natural forest (if applicable).
- ❑ The removal of indigenous vegetation must be kept to a minimum by minimising the construction footprint and by confining areas for structures, services, stockpiling, new temporary access roads, etc, to existing disturbed areas or areas within the construction servitude.
- ❑ Protected trees should be avoided as far as possible. However, in the event of avoidance being impossible, the Contractor should obtain the agreement of the Environmental Manager for the removal. The ECO must identify these trees, in consultation with a suitably qualified botanist, before the commencement of construction.
- ❑ The removal of riparian and forest vegetation should be avoided where possible as per provincial legislation.

- ❑ As far as possible, indigenous plants or natural features should not be disturbed, defaced, destroyed or removed. The Contractor will be held liable for the replacement of any indigenous plant or natural feature that is removed or damaged by the Contractor's negligence or mismanagement.
- ❑ Should the ECO confirm that clearing of indigenous vegetation is unavoidable, plant material must be transplanted where practical and possible.
- ❑ Where possible, the clearance of indigenous forest should be mitigated by replanting elsewhere in the area with appropriate locally indigenous species.
- ❑ Where applicable, the method of excavation must be selected to minimise interference with indigenous forest to be retained on either side of the servitude, i.e. manual labour should be utilised for pipe laying in sensitive areas (large excavation machinery can cause considerable damage to trees outside of the construction footprint if working in a narrow corridor flanked by tall trees either side).
- ❑ No material storage or laydown is permitted under trees.
- ❑ Vehicle and pedestrian traffic outside the construction area must be avoided.

6.1.3.1 Protection of Watercourses and Drainage Lines

- ❑ The Contractor must not cause any physical damage to any aspect of a watercourse, other than that necessary to complete the works as specified and in accordance with the accepted method statement.
- ❑ No excavation of alternative channels to re-route any river/stream may be done (to avoid unnecessary erosion).
- ❑ All excavation of hydric soils for the laying of the reticulation pipeline and electrical cable must be done by hand using spades and picks as far as possible to avoid unnecessary disturbance of the watercourse by heavy machinery.
- ❑ The hydric soil removed must be placed in a designated spoil site in sequence and replaced in inverted sequence directly after each section has been laid.
- ❑ Short lengths of concrete encasement must be utilised to avoid erosion of the pipe fill material.
- ❑ The Contractor must repair the existing drainage systems and augment these where applicable with additional drainage or increased capacity so as to accommodate normal, as well as flood conditions.
- ❑ The Contractor must ensure that uncovered soil and stockpiles are not eroded and material washed away.

6.1.3.2 Wetland and River/Stream Crossings

- ❑ The ECO and Contractor must ensure that all wetlands and rivers/streams likely to be intersected by the project have been identified, delineated, photographed and clearly marked by the ECO prior to any construction work on the pipeline route.
- ❑ Any wetland and/or stream crossings that may occur along the route must be monitored to ensure no nick-point erosion develops in disturbed soils and that no undue sedimentation occurs downstream.
- ❑ Construction within or adjacent to any watercourse must take place within the dry season (i.e. April to mid-September) to reduce the risk of erosion and sedimentation of the downstream systems during construction.
- ❑ The Contractor must avoid unnecessary compaction on sensitive wetland and riparian soils.
- ❑ The pipeline crossings must be positioned at a right angle (perpendicular) to the longitudinal flow-path of the watercourses. This will limit the area of direct disturbance and may avoid scouring and undercutting from occurring.

- ❑ The pipeline should be laid under the hydric soils in areas where the infrastructure will be constructed within watercourses to avoid flow impediment. An estimated recommended depth below the surface is 1,200mm.
- ❑ No construction materials may be stockpiled in any wetland and riparian areas.
- ❑ Watercourses must be crossed with an open cut trench through the stream, with the pipe buried sufficiently deep not to interfere with the backfilled stream bed.
- ❑ Concrete encasement and other pipe protection measures should be used where the structural integrity of the pipe may be compromised.
- ❑ For the trenching operation in rivers/streams, the use of coffer dams to cross rivers/streams and confining construction work to the existing river/stream channel at all times is recommended.
- ❑ To avoid unnecessary erosion, no excavation of alternative channels to re-route any river/stream is allowed.
- ❑ Replanting of wetland and riparian vegetation must be undertaken immediately after surface reinstatement is complete.
- ❑ Where possible, plants must be replanted in wetland and river/stream areas from which they were removed.
- ❑ The pre-construction profile of the wetland and river/stream must be returned to one similar as before construction.
- ❑ Wetlands must have no created "ridge or channel" features present to ensure that no depressions remain, which could act as channels for preferential water flow thereby affecting the hydrological regime of the wetland.

6.1.3.3 Protection of Fauna

- ❑ Wild animals must not be fed, handled, removed, hunted, snared, captured, injured or killed or otherwise interfered with. The penalty clause associated with the needless destruction of wildlife is a fine and/or imprisonment⁴.
- ❑ The Contractor must ensure that the construction area is kept clean, tidy and free of litter/rubbish that would attract animal pests.
- ❑ The Contractor must not use any pesticides, unless approved by the Environmental Manager.
- ❑ Where trenches pose a safety risk to animals, the Contractor must ensure that they are adequately cordoned off.
- ❑ The ECO, in consultation with the Contractor, must report problem or injured wild animals to EKZNW.
- ❑ Cutting of trees must be undertaken in a way that no nest (birds or other) is in the cut portion, unless approval has been obtained from the ECO. The ECO should, consider the conservation status of the animal species in question before making a decision. Epiphytes (orchids and any other species identified by the ECO) are to be removed and relocated under the supervision of the ECO

6.1.4 Protection of Cultural Heritage Resources

If a cultural heritage artefact is uncovered on site, work in the immediate vicinity must be stopped immediately. The Contractor must take reasonable precautions to prevent any person from removing or damaging any such artefact and must immediately inform the Environmental Manager of such a discovery. Amafa aKwaZulu-Natali (Amafa), the provincial heritage authority of KwaZulu-Natal must be contacted so that an archaeological/heritage resources consultant can be appointed to record the site and excavate if necessary. Work may only resume once clearance is given in writing by Amafa.

⁴ In terms of the Animals Protection Act, 1962 (Act 71 of 1962) Section 2.

6.1.5 Topsoil Conservation

- ❑ Ahead of all construction, the topsoil layer must be stripped from all areas to be cleared, excavated, compacted or otherwise disturbed.
- ❑ In the absence of a recognisable topsoil layer, the upper most 150 mm of soil must be stripped.
- ❑ The topsoil must be stockpiled separately from overburden material (subsoil and rocky material).
- ❑ Construction works must be co-ordinated to limit unnecessarily prolonged exposure of stripped areas and stockpiles.
- ❑ Vegetation and soil must be retained in position for as long as possible, removing it immediately ahead of construction/earthworks in that area.
- ❑ The stockpile height of topsoil must not exceed 2 m.
- ❑ The stripped topsoil must be stored in an approved location and in an approved manner for later reuse in the rehabilitation process.
- ❑ Topsoil stripped from different sites must be stored in sequence and stockpiled separately, as re-application during rehabilitation must preferably be site specific.
- ❑ Topsoil obtained from different sites must not be mixed.

6.1.6 De-bushing and De-stumping

- ❑ Prior to any disturbance/stockpiling and clearing of natural vegetation and soil (either within the construction servitude, working footprint or at designated or instructed areas outside the construction servitude), the Contractor must submit a method statement to the Project Engineer for approval (in line with the approved construction site layout plan (Sections 5.6.1 and 6.1)). The plan must contain reference points (e.g. chainage) of the areas to be disturbed for easy identification at a later stage.
- ❑ The Contractor must obtain permission from the Environmental Manager to proceed with de-bushing as this needs to be carefully co-ordinated with specified plant rescue and DEFF permit requirements⁵ (Section 2.2).
- ❑ The Contractor must only debush specified areas as indicated on the approved construction site layout plan (Sections 5.6.1 and 6.1).
- ❑ Remaining plant material and stumps must be disposed as solid waste or left on site to decompose naturally as advised by the ECO.
- ❑ De-stumping must only be carried out in consultation with the Environmental Manager.

6.2 Site Infrastructure

6.2.1 Structures

- ❑ All buildings and structures, including offices, workshops, stores, etc. must be located as per the approved construction site layout plan.
- ❑ Only security and emergency personnel may be housed on the construction site. Accommodation for other construction staff must be located in suitable venues off site.
- ❑ On site accommodation for security and emergency personnel must be securely fenced. These fences must remain in position for the duration of construction.
- ❑ Essential services must be provided and maintained in a functional state and not overloaded. Defects and inadequacies must be rectified immediately.

⁵ Permits in terms of the National Forests Act, 1998 (Act No. 84 of 1998).

6.2.2 Services

6.2.2.1 Water

- ❑ Permission from the relevant land user and DWS must be obtained prior to abstracting water from any watercourse where the volumes abstracted require registration or licensing in terms of the National Water Act, 1998 (Act No. 36 of 1998) and any general authorisation in terms of Section 39(1) of the National Water Act.
- ❑ The point and method of abstraction must be approved by the RE and EO.

6.2.2.2 Sanitation and Ablution Facilities

- ❑ The Contractor's intended methods for waste management and waste minimisation must be implemented at the outset of the contract and approved by the Project Engineer.
- ❑ Adequate sanitation facilities⁶ must be provided and maintained for construction workers and security personnel along the entire route of the project.
- ❑ Sanitation facilities must be in the form of portable serviced toilets.
- ❑ Separate sanitation facilities must be provided for male and female workers.
- ❑ Outside toilets must be adequately secured to prevent them from blowing over and provided with doors and locks.
- ❑ The facilities must be placed outside areas susceptible to flooding.

6.2.2.3 Power Supply

- ❑ The power supply to be used is to be approved by the Project Engineer and EO.
- ❑ If generators are to be used, establish generators, motors and stored fuel on a hardened, bunded surface and ensure any associated pollution is controlled (Section 6.4.4).
- ❑ Noise from generators must be controlled (Section 6.4.6).

6.2.3 Batching Sites

- ❑ Locate the batching activity in an area of low environmental sensitivity⁷ to be identified and approved by the Environmental Manager.
- ❑ Clear topsoil from the batching site and stockpile for later rehabilitation purposes.
- ❑ Cement may not be mixed directly on the ground, but rather on a protective sheet or board.
- ❑ Protect the batching plant on the up-slope side with an earth berm or sandbag system to deflect clean surface runoff away from the plant.
- ❑ Contain the batching plant on the down-slope side with a trench and earth berm or sandbag system to control contaminated runoff and construction water emanating from within the plant.
- ❑ Effluent from concrete batch plants should be treated in a designated sedimentation (sludge) dam to the legally required standards to prevent surface and groundwater pollution.
- ❑ Ensure that measures are in place to prevent the overflow of sludge dams during heavy rains and storm conditions.
- ❑ Ensure screening and containment are in place to prevent wind-blown contamination associated with bulk cement silos, loading and batching.
- ❑ The concrete mixing site must be suitably bunded so as to prevent contamination runoff and to prevent clean surface runoff from being contaminated.

⁶ Chemical toilets and hand washing facilities.

⁷ Do not locate batching plants or associated sludge dams within the 1:100 year flood line, or within a horizontal distance of 100 m (whichever is greater) of a watercourse, drainage line or identified wetland, unless unavoidable and approved by the Environmental Manager. Do not locate batching plants or associated sludge dams within any riparian vegetation zone.

6.2.4 Construction Camp, Lay-Down Areas and Pipe Storage Yards

- ❑ The construction camp will house administrative offices, construction plant, material stockpiles, fuels, storage facilities and security guard accommodation.
- ❑ No construction workers may be accommodated at the construction camp.
- ❑ All pipe storage yards, storage areas and material lay-down sites must be located within predetermined zones as per the approved construction site layout plan.
- ❑ Additional areas required by the Contractor for pipe storage yards, lay-down and storage must be approved by the Project Engineer with input from the ECO, in the form of an amended construction site layout plan indicating the extent and anticipated utilisation of the storage and lay-down areas.
- ❑ The construction camp, pipe storage yards and lay-down areas must be kept secure and neat at all times with appropriate access control measures employed during construction.
- ❑ In determining the location of the construction camp, stockpile areas, pipe storage yards and any temporary roads, areas of high erosion potential must be avoided.
- ❑ Security lighting must be positioned so that it does not pose a nuisance to neighbouring properties.

6.2.5 Storm Water Control

- ❑ Appropriate drainage measures must be taken to ensure that excessive run-off, and as a result, soil erosion, does not occur from the construction site.
- ❑ Where directed by the ECO, embankments must be grassed to minimise erosion.
- ❑ Runoff must not be canalised or concentrated in areas where sheet flow may occur, or where highly erodible soils occur.
- ❑ All stormwater channels and cut-off drains must have slope of <1% to reduce the surface water flow velocity downslope to encourage infiltration.
- ❑ Storm water diversions must be constructed above the construction campsite to direct run-off away from the site.
- ❑ Drainage systems must be kept as natural as possible. Natural drainage must be retained, and normal flow ensured at all times.

6.2.6 Roads and Access

- ❑ As far as possible, existing roads must be used for access purposes, as per the construction site layout plan.
- ❑ Adequate vehicle turning areas must be allowed.
- ❑ Alternative temporary access routes must be provided where construction will obstruct existing access.
- ❑ Routes through drainage lines and riparian zones must be avoided wherever possible. When this is unavoidable, only one road is permitted, constructed perpendicular to the drainage line (use of existing crossing points is recommended).
- ❑ Speed limits appropriate to the type and condition of road must be enforced at all times.
- ❑ Safe pedestrian access and crossing must be provided where necessary.
- ❑ All access routes and roads must be adequately maintained in order to minimise erosion, undue surface damage and pollution.
- ❑ Topsoil (and other material) that has accumulated inside drains of roadways must be regularly removed to keep these open and functional.
- ❑ Gravel or cement spillage must be cleared immediately (both within and outside the construction site).
- ❑ Damage to public or private roads caused by the Contractor during the construction phase must be repaired immediately to the same or a better state.

- No off-road driving is permitted outside of the demarcated construction area or in sensitive areas.
- Traffic disruptions along roads must be minimised and controlled.

6.3 Implements and Equipment

- Mobile plant and equipment which is appropriate to the task must be utilised in order to minimise the impact and extent of damage to the environment.
- Should the EO at any time determine that the method, mobile plant or equipment utilised by the Contractor is unsuitable for the task at hand, or unnecessarily detrimental to the environment, then he/she must specify the use of a suitable alternative.

6.4 Site Management

6.4.1 Solid Waste

- The Contractor must ensure that personnel make use of the litter bins provided and that the construction site and the construction camp are kept tidy and litter free at all times.
- All domestic waste must be collected in litter bins.
- Litter bins must be equipped with a closing mechanism to prevent their contents from blowing out and scavengers from getting in.
- Litter bins must be emptied weekly (or as required before they reach capacity).
- Domestic waste must be taken to a licensed landfill site. Waste must be transported responsibly, avoiding waste spills en-route.
- Where necessary, a storage area must be dedicated on site for the collection of construction waste.
- No solid waste may be burned or buried on site.
- Where feasible, wastepaper, glass and metal waste must be collected separately and arranged for collection by recycling contractors.

6.4.2 Liquid Waste

- Suitable, sufficient and conveniently located sanitation facilities must be provided as per the approved construction site layout plan.
- Toilets must be regularly emptied and serviced.
- The Contractor is entirely responsible for enforcing their use and for maintaining all toilets in a clean, orderly and sanitary condition to the satisfaction of the ECO.
- Sewage must be disposed at a licensed wastewater treatment facility and may under no circumstances be dumped in the bush or buried.

6.4.3 Hazardous Waste

- Compliance with all national, regional and local legislation must be ensured with regard to the storage, handling and disposal of hydrocarbons, chemicals, solvents and any other harmful and hazardous substances and materials.
- Hazardous waste must be stored as indicated on the approved construction site layout plan.
- Drip trays must be used where dispensing mechanisms or stored receptacles may leak.
- No spillage of hazardous products must be allowed on site. Special care must be taken to avoid contamination of surface or groundwater.
- Under no circumstances shall the spoiling of hazardous products on site be allowed.
- Waste oils and batteries must be retained for recycling by the supplier, wherever possible.
- Used oil and lubricants must be collected in a holding tank and disposed at a licensed hazardous waste disposal site. Disposal certificates must be provided in the Environmental File on site.

- ❑ Hazardous waste not earmarked for reuse, recycling or resale must be disposed at a licensed hazardous waste disposal site. Disposal certificates must be provided in the Environmental File on site.
- ❑ The repair and/or maintenance of vehicles and equipment on site are not permitted, other than emergencies (excepting within the Contractor's site camp).

6.4.4 Pollution Control

- ❑ The storage for any substance, which causes or is likely to cause pollution must not be located within the 1:100-year flood line, or within a horizontal distance of 100 m (whichever is greater) of a watercourse, drainage line or identified wetland.
- ❑ Waste or foreign material must not be dumped into any watercourses or wetland areas.
- ❑ Watercourses and wetland areas must not be used for swimming, bathing, or the cleaning of clothing, tools, equipment or vehicles.
- ❑ The discharge of water containing polluting matter or visible suspended materials, fines and sediments directly into drainage lines or wetlands is prohibited.
- ❑ Unpolluted water/runoff must be deflected away from any dirty area.
- ❑ Where necessary, turbid water pumped from excavations within watercourses must be passed through a sand filter or settling pond before being released back into the watercourse. Discharge of this water must be in a controlled manner, and no erosion may result.
- ❑ No storm water must enter any drainage installation for the reception, conveyance, storage and/or treatment of sewage.
- ❑ Special care during rainy periods must be taken to prevent the contents of sumps and drip trays from overflowing.
- ❑ Before any water is permitted to enter natural drainage lines, the quality of the water must comply with the South African Water Quality Guidelines (Department of Water Affairs and Forestry, 1996) and the Standard Requirements for Effluent and Waste Water⁸.
- ❑ Watercourses must be protected from direct or indirect spillage of pollutants such as refuse, garbage, cement, concrete, sewage, chemicals, fuels, oils, aggregate, tailings, wash water, organic materials, etc.
- ❑ The Contractor must ensure that an emergency preparedness plan is in place for implementation in the case of a spill of substances that can be harmful to an individual or the receiving environment.
- ❑ Oil or fuel spills must not be hosed into a storm water drain or sewer, or into the surrounding natural environment.
- ❑ Small oil or fuel spills must be cleaned with an approved absorbent material, such as 'Drizit' or 'Spill-sorb'.
- ❑ Oil or fuel spills must be contained in water using an approved oil absorbent fibre.
- ❑ Soil contaminated by oil or fuel must be treated using one of the following approved methods, as per instruction of the Environmental Manager:
 - The soil to the depth of the contamination must be removed and disposed at a licensed hazardous waste disposal site. Disposal certificates must be provided in the Environmental File on site.
 - The soil to the depth of the contamination must be removed and regenerated using approved bio-remediation methods.
- ❑ All on-site operations that involve the use of cement and concrete must be carefully controlled.
- ❑ Cement and concrete mixing must be limited to single sites, where possible.
- ❑ Plastic trays or liners must be used when mixing cement and concrete (cement and concrete must not be mixed directly on the ground).

⁸ As set out in Government Notice 399 (26 March 2004) – Revision of General Authorisations in terms of Section 39 of the National Water Act, 1998 (Act No 36 of 1998) Sections 21(f), (h) and (g).

- ❑ All visible remains of excess cement and concrete must be disposed after the completion of tasks. Solid waste concrete must be treated as inert construction rubble, but wet cement and liquid slurry, as well as cement powder must be treated as hazardous waste.
- ❑ Water and slurry from cement and concrete mixing operations must be contained and directed into a settlement pond or sludge dam for later disposal.
- ❑ Trucks delivering concrete may not be washed on site.

6.4.5 Air Quality

- ❑ Dust-suppression techniques (e.g. the use of water spray vehicles) must be employed on all exposed surfaces during periods of high wind. Additional dust suppressing activities include:
 - Remove only limited vegetation to accommodate construction activities.
 - Spray unpaved roads and construction areas, including stockpiles and spoil, with water routinely throughout construction to contain dust.
 - Implement traffic control measures to limit vehicle entrained dust from unpaved roads (e.g. by limiting construction vehicle speeds and by restricting traffic volumes).
 - Re-vegetate verges and cuttings once all construction is completed, and when the lay down area/construction camp is vacated.
- ❑ Vehicles emitting black smoke and fumes must be repaired and maintained.
- ❑ No burning of waste material shall be allowed anywhere on site.

6.4.6 Noise Control

- ❑ Compliance with the legislation with respect to noise is mandatory.
- ❑ Noisy activities must take place during normal working hours.
- ❑ Adjacent residents must be notified of after-hours construction work and of any other activity that is likely to cause a nuisance.
- ❑ Noise suppression measures must be applied to all construction equipment.
- ❑ Construction equipment must be kept in good working order and, where appropriate, fitted with silencers.
- ❑ Community complaints with regard to noise must be responded to, taking reasonable action to ameliorate the impact.

6.4.7 Fire Control

- ❑ Adequate precautions must be taken to ensure that fires are not started as a result of construction. The Contractor will be held liable for any damage to property adjoining the site as a result of any fire caused by one of his employees.
- ❑ The Contractor must compensate affected neighbours for any loss due to fire resulting from the contract.
- ❑ The construction camp must be equipped with adequate firefighting equipment⁹ (this includes at least rubber beaters when working in agricultural areas, and at least one fire extinguisher in each vehicle of the appropriate type, irrespective of the site).
- ❑ Immediate steps must be taken to extinguish any fire, which may break out on the construction site.
- ❑ No open fires are permitted anywhere on site.
- ❑ Fuel or chemicals must not be stored under trees.
- ❑ Gas and liquid fuel must not be stored in the same storage area.
- ❑ Smoking must not be permitted within 3 m of any fuel or chemical storage area, or refuelling area.

⁹ In terms of SABS 1200.

6.4.8 Health and Safety

- Adhere to the requirements of the Occupational Health and Safety Act, and associated Construction Regulations.
- All staff are to be clearly visible with high visibility vests and identification tags. No staff are permitted on site between sunset and sunrise (with the exception of security staff).
- All excavations are to be demarcated and have barrier mesh placed around them.
- All fences/walls that are removed must be replaced with a temporary barrier to the satisfaction of the property owner prior to the contractor leaving the site for the day. Permanent repairs must be undertaken as soon as the construction process is complete.
- Ensure that emergency numbers and First Aid supplies are always easily accessible.
- Obey speed limits and travel more slowly where conditions dictate.
- Ensure that operators and drivers limit their potential of endangering humans and animals at all times, by observing strict safety precautions.

6.4.9 Safety and Security

Where relevant, implement security measures to:

- Prevent access by people with criminal intent.
- Prevent dangerous animals entering the site.
- Comply with the relevant provisions under the Occupational Health and Safety Act, and associated Construction Regulations.
- Inform staff of the risk of contraction, the symptoms thereof, and the steps for prevention and treatment of the following:
 - HIV/AIDS.
 - Tick bite fever.
 - Heat stroke.
 - Cholera (guidelines for cholera are available from the Department of Environmental Health, Pietermaritzburg).
- All fences/walls that are removed must be replaced with a temporary barrier to the satisfaction of the property owner prior to the contractor leaving the site for the day. Permanent repairs must be undertaken as soon as the construction process is complete.

6.5 Earthworks

6.5.1 Excavations and Trenches

- Excavations must be undertaken carefully, incorporating appropriate drainage.
- For significant trees identified by the ECO, trenching must be outside the drip line of the tree as specified by the ECO.
- The pipeline must be constructed with the dig and lay method where pipes are laid length by length. Excavate and backfill trenches on a progressive basis.
- The Contractor must not have more than 500 m of trench open at any one time.
- Excavations must not stand open for longer than two days, where possible (maximum of four days). Excavations should preferably be opened and closed on the same day.
- If de-watering is required where the water table is high, the trench should only be open for one day.
- Where trenches pose a risk to human or animal safety, they must be adequately cordoned off to prevent accidents.
- Wild animals that are found trapped in excavations must be assisted provided there is no risk to workers' safety. Should there be a danger to workers, or the animal is injured, the matter should be reported to EKZNW as soon as possible.

- ❑ Excavation must be programmed to take place once the required materials are on site. This facilitates the immediate laying of services and/or construction of subsurface infrastructure and minimises open trench time.
- ❑ Where trenching through wetlands and drainage lines is required (as per the approved site layout plan), the Contractor must return the profile of the wetland/drainage line to one similar to the pre-construction profile. No ridge or channel feature may remain.
- ❑ Trench breakers must be constructed within the subsurface pipe channels to reduce the risk of the formation of preferential flow paths.
- ❑ During construction through a wetland, the majority of the flow of the wetland must be allowed to pass downstream. In-stream diversions must be used rather than the construction of new channels.

6.5.2 Shaping and Trimming

- ❑ The Contractor must execute bulk (shaping) and fine (trimming) earthworks according to the design (aimed at the prevention of soil erosion, efficient storm water control, the eventual reestablishment of vegetation and of ultimately achieving aesthetically acceptable landscapes).
- ❑ The shaping and trimming operations must be planned to allow for topsoil application: final trimmed levels must make provision for the specified depth of reapplied topsoil.
- ❑ Trimmed surfaces must be left slightly rough to facilitate topsoil binding for the natural establishment of vegetation.
- ❑ Where machine operations are not practicable, trimming must be carried out using hand tools.

6.5.3 Borrow Pits and Rock Quarries

- ❑ Where it is required to import material, this shall be from legal¹⁰ commercial sources or legal borrow areas. Sources of material are to be approved by the Environmental Manager, to ensure that no importation of alien invasive plant seeds or other potentially hazardous substances occurs.
- ❑ Do not commence with quarrying activities before the necessary Department of Mineral Resources and Energy (DMRE) approvals are in place.
- ❑ Comply with the provisions of the environmental management programme for the development, use and rehabilitation of the borrow pit. Of particular importance is to:
 - Remove and separately stockpile topsoil and overburden for use during rehabilitation, locating these in areas where they will not be disturbed by the progress of the gravel pit/quarry.
 - Avoid stripping material to bedrock. This limits rehabilitation potential for these areas.
 - Minimise the flow of any surface water or floodwater into borrow areas. Where necessary, protect borrow areas with an earth berm or sandbag system to deflect clean surface runoff away from the excavations.
 - Allow for the natural free drainage of borrow areas. All borrow areas must be drained unless otherwise specified.
 - Bury coarse material incapable of supporting vegetation beneath the finer material.

¹⁰ In terms of the requirements of the National Mineral and Petroleum Resources Development Act, 2002.

6.6 Stockpiles, Storage and Handling

6.6.1 Topsoil

- If temporary stockpiling is required, stockpiles must be positioned as indicated on the approved construction site layout plan.
- Any additional topsoil stockpile areas required by the Contractor must be approved by the Environmental Manager, in the form of an amended construction site layout plan indicating the position and extent thereof.
- Topsoil is to be kept separate from subsoil and handled twice only – once to strip and stockpile, and once to replace and level.
- Topsoil stockpiles must be positioned on the higher side of a disturbed area, and above the 1:50 year flood line wherever possible.
- The stockpile height must not exceed 2 m.
- All topsoil must be stored in such a way and in such a place that it will not cause the damming up of water, erosion gullies, or wash away itself.
- Topsoil must be stockpiled in windrows parallel to the excavation.
- Near watercourses or wetland areas, topsoil must be stockpiled above the riverine zone.
- Topsoil must not be stockpiled in drainage lines.
- Topsoil must not be stockpiled in sensitive areas.
- Topsoil must be stockpiled in a suitable form in order to minimise visual impact.
- Topsoil stockpiles must be protected from erosion by wind and water.
- Topsoil must not be compacted in any way during storage.
- Exotic/invasive plants and broad leaf weeds that emerge on topsoil stockpiles must be removed.
- If topsoil is to be stockpiled for extended periods, especially during the wet season, the ECO must recommend one of the following measures:
 - The stockpiles must be re-vegetated with indigenous grasses as indicated by the ECO.
 - The stockpiles must be covered with protective material, such as hessian mats.
- Topsoil must not be buried, mixed with spoil (excavated subsoil), rubble or building material, or subjected to compaction or contamination by vehicles or machinery. This will render the topsoil unsuitable for use during rehabilitation.
- The Contractor will be held liable for the replacement of any topsoil rendered unsuitable for use during rehabilitation, for reasons due to his negligence or mismanagement on site.

6.6.2 Spoil

- A photographic record (before construction and after rehabilitation) must be kept of all spoil sites for monitoring purposes.
- The reinstated construction site, used as a spoil area for excess trench excavation material, must only have a net increase in ground level of less than 200 mm. The reinstated site must be lightly compacted and made free draining.
- Excess trench material may also be used to replace unsuitable local material (e.g. bedding for pipes).
- Spoil areas must not negatively affect surface drainage, and they must not alter the topography to the extent that they become visually intrusive.
- Dumping of material over embankments is not permitted.
- The use of spoil sites for the disposal of hazardous or toxic wastes is not permitted.
- No spoil site may be located within 100 m of any watercourse or in sensitive areas.
- Spoil must be positioned on the higher side of a disturbed area, and above the 1:20 year flood line wherever possible.
- Spoil must be stored in such a way and in such a place that it will not cause the damming up of water, erosion gullies, or wash away itself.
- No slopes steeper than 1(V):3(H) are allowed.

- ❑ Coarser material must be buried beneath the finer material, and all permanent spoil overlaid with a layer of 200 mm topsoil.
- ❑ If required, additional spoil storage areas required by the Contractor must be approved by the Environmental Manager, in the form of an amended construction site layout plan. The following information is required for approval:
 - The location, description and access to proposed sites.
 - The quantity of material to be spoiled.
 - The type of material to be spoiled.
 - The proposed method of spoiling.
 - A proposal for the reinstatement and rehabilitation plan, including the final profile.
 - Written approval from the land user/relevant authority that material may be spoiled on the land in question, subject to conditions.
- ❑ Spoil areas must be re-vegetated and rehabilitated after the construction phase.

6.6.3 Vehicles and Equipment

- ❑ Vehicles used during construction must have the minimum impact on the environment and other road users.
- ❑ Vehicles, machinery and equipment must be checked regularly to ensure that none have leaks or cause spills of oil, diesel, grease or hydraulic fluid. Problematic vehicles, machinery or equipment must be removed from site immediately and sent for repair.
- ❑ Drip trays must be provided for any machinery that will be in position for longer than one day. Drip trays are to be watertight and must be emptied regularly and before rain events. The contents of drip trays are to be treated as hazardous waste.
- ❑ All the necessary handling and safety equipment for vehicles, machinery and equipment must be provided by the Contractor and used or worn by staff.

6.6.4 Fuel

- ❑ Fuel stores must be positioned as indicated on the approved construction site layout plan.
- ❑ Fuel depots must not be located within the 1:100-year flood line, or within a horizontal distance of 100 m (whichever is greater) of a watercourse, drainage line or identified wetland.
- ❑ In the event the Contractor has a diesel tank on site at the construction camp, the diesel tank must be on a stand, within a bunded area, with a metal drip tray under the dispensing hose. The dispensing hose must have a control pump with a valve, tap, hose and funnel.
- ❑ An impervious layer (paving or PVC sheeting with a layer of sand) must be provided adjacent to the diesel tank upon which vehicles must park during refuelling. This will help to accommodate fuel spills during refuelling.
- ❑ All spills (within the bund and dispensing area) must be directed to a collection sump.
- ❑ Spills and the contents of the sump must be treated as hazardous waste.
- ❑ All the necessary handling and safety equipment for fuels must be provided by the Contractor and used or worn by staff.

6.6.5 Hazardous Substances

- ❑ Compliance with all national, regional and local legislation must be ensured with regard to the storage, transport and use of harmful and hazardous substances and materials.
- ❑ The Contractor must provide a register of hazardous substances to be used on site and must provide proof to the Project Engineer that relevant authorisation to store such substances has been obtained from the relevant authority. In addition, hazard signs indicating the nature of the stored materials must be clearly displayed on the storage facility or containment structure.
- ❑ The Contractor must provide the Project Engineer with details of the preventative measures that are proposed to be installed in order to mitigate against pollution of the surrounding

environment from leaks or spillages. This must include the emergency procedures to be implemented in the event of misuse or spillage of substances that will negatively impact on an individual or the environment.

- ❑ Hazardous substance stores must be positioned as indicated on the approved construction site layout plan, in areas not threatening human life or the environment.
- ❑ Hazardous substances may only be stored under controlled conditions (in a secured, appointed area that is fenced, has restricted entry, has weatherproof facilities, and is underlain by a bunded concrete slab to protect against soil and water pollution).
- ❑ Controlled loading/unloading areas must be provided which are underlain by an impervious paving or PVC sheet to protect against soil and water pollution.
- ❑ Personnel handling hazardous substances must be trained in terms of the correct handling, use and disposal thereof.
- ❑ Empty containers in which hazardous substances were kept must be treated as hazardous waste.
- ❑ The responsibility for spill treatment lies with the Contractor. The individual responsible for, or who discovers a hazardous waste spill must report the incident to the RE. The ECO must assess the situation in consultation with the RE and act as required. In all cases, the immediate response shall be to contain the spill. The exact treatment of polluted soil/water must be determined by the Environmental Manager in consultation with the Project Engineer. Areas cleared of hazardous waste must be re-vegetated according to the Environmental Manager's instructions.
- ❑ Should the spill be serious and constitute an emergency, the emergency procedure must be applied.
- ❑ Should water downstream of the spill be polluted, and fauna and flora show signs of deterioration or death, specialist hydrological or ecological advice must be sought for treatment and remedial procedures to be followed. The requirement for such input shall be agreed with the Environmental Manager. The costs of containment and rehabilitation shall be for the Contractor's account, including the costs of specialist input.

6.7 Water Use

- ❑ Water must not be wasted (e.g. leaks must be repaired).

6.8 Erosion Control

6.8.1 Drainage Systems

- ❑ Design calculations shall prove that the optimum solution is being implemented.
- ❑ Drainage must be controlled to ensure that runoff from the site will not culminate in off-site pollution or cause water damage to the environment or properties downstream of the site.
- ❑ Surface water or storm water must not be concentrated or permitted to flow along pipeline routes without erosion protection measures being in place.
- ❑ Wetlands, drainage lines and riverbanks must not be drained, filled or altered in any way, unless this forms part of construction or upon specific instruction by the ECO¹¹.
- ❑ The extent of hardened or paved areas must be kept to a minimum.

6.8.2 Erosion Protection

- ❑ All areas susceptible to erosion must be protected to ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and construction areas.
- ❑ Natural trees, shrubbery and grass species must be retained, wherever possible.

¹¹ Relevant permits from DWS and DEDTEA are to be in place before such instruction may be given.

- ❑ Vehicular or pedestrian access must not be permitted into areas beyond the demarcated boundary of the construction area.
- ❑ Only light equipment must be used for access and deliveries into areas of unstable soils, in areas where erosion is evident, and at stream and river embankments.
- ❑ In sensitive areas, measures such as a drainage layer, well pointing, shoring and concrete encasement of the pipelines where the pipelines cross watercourses, must be taken.
- ❑ Sediment traps must be erected downslope of all construction activities, specifically along the banks of the Rip02 and Rip04 streams, as well as within UVB02, Seep10, Seep13, WF01 and the Mlalazi Estuary.
- ❑ Shoring must occur where excavation is in loose sand and/or wet areas.
- ❑ Erosion donga crossings must be addressed as watercourse crossings, applying soil erosion control and bank stabilisation procedures as specified by the RE and ECO.
- ❑ Erosion problems must be repaired on a progressive basis throughout the contract.
- ❑ Slopes steeper than 1(V):3(H) or slopes where the soils are by nature dispersive or sandy must be stabilised (in consultation with the ECO). One or more of the following methods may be required:
 - Topsoil covered with a geotextile¹², plus a specified grass seed mixture¹³.
 - A 50:50 by volume rock:topsoil mix 200 mm thick, plus specified grass seed mixture¹⁴.
 - Logging or stepping (logs placed in continuous lines following the contours).
 - Earth or rock-pack cut-off berms¹⁴.
 - Benches (sand bags).
 - Packed branches.
 - Ripping and/or scarifying along the contours.
 - Storm water berms.
- ❑ Slopes of watercourse diversions must be protected with one or more of the following (in consultation with the ECO):
 - Sandbags.
 - Reno mattresses.
 - Plastic liners and/or coarse rock (undersize rip-rap).
- ❑ During the course of construction, the ECO may identify additional slopes in need of stabilisation and will specify actions in terms of the most appropriate approved method and technology.

6.9 Weed and Invader Plant Control

- ❑ The Contractor is responsible for the control of weeds and invader plants within the construction area for the duration of construction.
- ❑ This control involves killing the plants present, killing the seedlings, which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (as amended) or in terms of Working for Water guidelines.
- ❑ The ECO must identify alien plants (terrestrial and aquatic species) that should be removed by the Contractor.
- ❑ The ECO must monitor all sites disturbed by construction activities for colonisation by weeds, exotics or invasive plants, to be controlled by the Contractor as they emerge.
- ❑ Removed vegetation must be disposed at a DWS licensed waste disposal facility.
- ❑ Only properly trained people must handle and make use of chemical herbicides. Workers must wear protective clothing when applying the herbicides.

¹² Preferably made of sisal, with openings of at least be 225 mm² and guaranteed to last at least 24 months.

¹³ The subsoil must be broken up/roughened to properly bind with the topsoil.

¹⁴ Angled across the contour at approximately 30 degrees form the bisector of the contour.

- ❑ Spraying must not take place in windy conditions, when the herbicide may drift onto healthy indigenous plants.
- ❑ The use of herbicides is not permitted within identified sensitive areas. The removal of weeds and invader plants within these areas must be undertaken by hand.
- ❑ Affected areas must be reinstated and rehabilitated as soon as practically possible.

6.10 Nuisance Control

- ❑ Disruptions to farming activities must be minimised and managed.
- ❑ Private property, access roads and other existing services on and in the vicinity of the construction site must be treated with respect and protected against damage.
- ❑ No construction to be undertaken within the uMlalazi Nature Reserve during peak holiday periods (school holidays).
- ❑ The Contractor must bear the cost of the repair of damage as a result of the Contractor's operations on site.
- ❑ On-going liaison with affected land users, service providers and other parties must be undertaken to minimise disruption and interruptions to services.
- ❑ The Contractor must accommodate planting, maintenance and harvesting regimes (mainly agricultural crops) in the construction schedule.
- ❑ Sufficient prior notice must be provided to affected land users, service providers and other parties of the disruption of access.
- ❑ Construction activities must be restricted to within the construction site.
- ❑ The movement of construction workers must be confined, as far as possible, to the construction areas.
- ❑ Working areas must be clearly demarcated with barrier tape and signage.
- ❑ While the trenches are open, they must be clearly cordoned off with signage to prevent people or vehicles accidentally falling in or damaging them.
- ❑ Between the opening of trenches and the laying of the pipelines, ramps across trenches at community access points must be provided to keep loss of access as short as possible.
- ❑ Construction equipment must be kept in good working order and, where applicable, fitted with silencers.
- ❑ All trenches must be back filled and rehabilitated as soon as the pipes have been laid, i.e. on a progressive basis.
- ❑ The local community must be kept informed as to restrictions within the servitude areas.

7 REHABILITATION PHASE

The concept of progressive rehabilitation is to be implemented throughout the life of the project. As soon as work in one area is complete, rehabilitation of that site is to commence. This will involve returning the condition of the disturbed areas to a state that they were in before the project began, or better. The Project Engineer with assistance from the Environmental Manager will be responsible for the monitoring of rehabilitation.

Unless specified otherwise, the Contractor shall be held responsible for the re-establishment of vegetation within the construction site boundaries for all areas disturbed during construction.

7.1 General Specifications

- ❑ The principle of progressive reinstatement must be followed wherever possible. This includes the reinstatement of disturbed areas on an ongoing basis, immediately after the specified construction activities for that area are concluded.
- ❑ As soon as a section of pipeline or a pump/sump station site is finished and a construction site or pipe storage yard vacated, the disturbed areas must be rehabilitated by levelling, alien

plant eradication, topsoil dressing, vegetation establishment and landscaping, including the planting of replacement trees where trees have had to be removed.

- ❑ Erosion control measures must be implemented and the effectiveness thereof must be monitored and corrected where necessary. Environmental damage due to the failure of erosion control measures must be rehabilitated to a state agreed with DEDTEA.

7.2 Removal of Structures and Infrastructure

- ❑ All construction plant, equipment, signage, storage containers, temporary fencing and gates, temporary services, fixtures, foundations and any other temporary construction infrastructure must be cleared from the construction site.
- ❑ Access roads utilised during construction (which are not earmarked for closure and rehabilitation) must be returned to a usable state and/or a state no worse than prior to construction.
- ❑ Unless otherwise directed by the Project Engineer, all temporary access roads earmarked for closure must be ripped, scarified, top soiled and seeded.

7.3 Stockpiles, Inert Waste and Rubble

- ❑ All stockpiles and surplus material must be transported to an approved location off site.
- ❑ After the stockpiled material has been removed, the site must be re-instated and rehabilitated.
- ❑ The site must be cleared of all inert waste and rubble, including surplus rock and foundations.
- ❑ Excess spoil and inert rubble must be transported to waste sites as approved by the Project Engineer.
- ❑ All domestic waste must be removed and disposed at a licensed waste disposal site. Disposal certificates must be provided to the Environmental Manager.

7.4 Hazardous Waste and Pollution Control

- ❑ All fuel stores, hazardous substance stores, hazardous waste stores and pollution control sumps must be removed from site.
- ❑ Pollution containment structures must be removed from site.
- ❑ All sanitation infrastructure and wastewater disposal systems must be removed from site.

7.5 Final Shaping

- ❑ All excavations must be backfilled with *in situ* material.
- ❑ All dangerous excavations must be made safe by backfilling and grading as required.
- ❑ The reinstated construction site must be graded to ensure free flow of run-off and to prevent damming of water.
- ❑ Slopes must not be steeper than 1(V):3(H). The slopes must mimic the natural slopes and topography of the surrounding environment.
- ❑ The backfilling of excavations must be programmed so that subsoil is deposited first, followed by topsoil. The layers must be compacted as part of final shaping.
- ❑ Backfilled areas must be monitored for subsidence (as the backfill settles) and depressions filled using available material.
- ❑ Temporary drifts and watercourse crossings must be dismantled and flattened, reinstating all drainage lines to approximate the original profile.
- ❑ All disturbed areas must be shaped to blend in with the surrounding landscape.
- ❑ No excavated material or stockpiles must be left on site and all material remaining after backfilling must be smoothed over to blend with the surrounding landscape.
- ❑ The site must be monitored for signs of erosion and remedial action taken where there are problems.

7.6 Topsoil Replacement and Soil Amelioration

- ❑ Topsoil must be replaced prior to the rainy season or any expected wet weather conditions.
- ❑ Stockpiled topsoil must be replaced and redistributed, together with herbaceous vegetation, overlying grass and other fine organic matter in all disturbed areas of the construction site, including temporary access routes and roads.
- ❑ Topsoil must be replaced to the original depth (i.e. as much as was removed prior to construction).
- ❑ Topsoil must be replaced in the same area from where it was stripped. If there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil of similar quality may be brought from other areas¹⁵ (this must be approved by the Environmental Manager).
- ❑ Topsoil suspected to be contaminated with the seed of alien vegetation must not be used.
- ❑ Imported topsoil must be sprayed with specified herbicides (approved by the Environmental Manager).
- ❑ Topsoil not utilised must be shaped in an acceptable manner to blend in with the local surrounding area.
- ❑ After topsoil placement is complete, available stripped vegetation must be spread randomly by hand over the top-soiled area.
- ❑ In the event that no topsoil is available on site prior to construction, and thus no topsoil is available for rehabilitation, the following ameliorative action must be undertaken (in consultation with the Environmental Manager):
 - The soil must be sampled to a depth of 200 mm in all areas allocated for grass planting and the samples sent for soil analysis to determine the type of fertiliser and rate thereof to be applied.
 - The necessary soil ameliorants as indicated by soil tests must be added to and worked into the soil.
 - After the application of fertilisers, a waiting period of six to eight weeks is required prior to the execution of planting and/or grassing.

7.7 Ripping and Scarifying

- ❑ Following the application of topsoil, all areas must be ripped¹⁶ and/or scarified¹⁷ to facilitate mixing of the upper most layers. The ECO will specify whether ripping and/or scarifying is necessary.
- ❑ All disturbed and compacted areas of the construction site must be ripped and/or scarified, including the site offices, stockpile areas, temporary access routes and roads.
- ❑ Ripping and/or scarifying must be done along the contour to prevent the creation of down-slope channels.
- ❑ Ripping and/or scarifying must be done at 300 mm intervals (not more than 400 mm intervals).
- ❑ Ripping and/or scarifying must not be done under wet conditions (the soil will not break up).

7.8 Reinstatement of Wetland Areas and Water Courses

Where water courses or wetlands have been affected by construction activities:

- ❑ Ensure that watercourse banks are returned to their original profile.

¹⁵ The suitability of substitute material will be determined by means of a soil analysis addressing soil fraction, fertility, pH and drainage, and approved by the Environmental Manager.

¹⁶ Loosening of the soil to a depth of 300 mm.

¹⁷ The roughening of the surface of the soil to a depth of approximately 50 mm, creating a smoother surface than ripping.

- ❑ The surface reinstatement of wetland areas is to ensure that no depressions remain that could act as channels for preferential water flow (thereby affecting the hydrological regime of the wetland).
- ❑ Areas within the delineated outer boundaries of the at-risk watercourses that have been excavated and subsequently infilled must be landscaped to the near-natural topography and revegetated with either hydrophilic vegetation, or woody tree species depending on whether in the active channel, or riparian zone. The appointed site ECO must guide this process in consultation with a suitably qualified botanist.
- ❑ The Contractor shall preserve all riparian and wetland vegetation for use in rehabilitation of those environments. This vegetation is to be kept moist at all times. It is to be placed in the shade and covered with moistened hessian cloth until replanting, which is to be undertaken immediately after surface reinstatement is complete.
- ❑ Plants are to be, as nearly as possible, replanted in areas from which they were removed.
- ❑ Plant of emergent hydrophytes plugs on the margin and instream of the tributary downstream of the WWTW to act as flow dissipaters and a filtration network.
- ❑ Construct slope stabilisation structures along both banks at the outfall point to reduce the risk of bank-slump and/or undercutting.

7.9 Planting

- ❑ All planting work must be undertaken by a suitably qualified Sub-contractor.
- ❑ The sourcing of seed or other plant material used for vegetation establishment must be from within 50 km radius of the site and within the bio-climatic region.
- ❑ The reinstatement of disturbed areas with locally indigenous herbaceous vegetation must be conducted progressively.
- ❑ In moist areas, re-vegetation must include hygrophilous grassland or reed bed, and in dry areas indigenous runner grasses must be used.
- ❑ The use of fertilisers must be carefully controlled by the ECO. No fertiliser must be used in the re-vegetation process near or in watercourses and wetlands areas.
- ❑ If possible, reseeding and replanting must occur just prior to or during the wet season. If planting and reseeding occurs in a dry period, it may be necessary to irrigate plants to ensure their successful establishment.

7.10 Grassing

- ❑ Grassing must be undertaken by a suitably qualified Sub-contractor.
- ❑ Sodding may be done at any time of the year but seeding must be done during summer when the germination rate is better.
- ❑ Hydro-seeding with a winter mix will only be specified where regrassing is urgent and cannot wait for the summer.
- ❑ Within terrestrial, non-wetland areas, indigenous runner grasses, such as *Stenotaphrum secundatum*, *Dactyloctenium australe* and *Cynodon dactylon* must be used. Exotic invasive grasses, such as Kikuyu (*Pennisetum clandestinum*) must not be used.
- ❑ In wet areas, hygrophilous grassland or reed bed must be encouraged as the final vegetation cover depending on the degree of local wetness (temporary/seasonal/permanent wetland).

7.11 Weed and Invader Plant Control

- ❑ The Contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the rehabilitation phase.
- ❑ The control involves killing the plants present, killing the seedlings, which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the

Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (as amended) or in terms of Working for Water guidelines.

- ❑ Removed vegetation must be disposed at a licensed waste disposal facility.
- ❑ Only properly trained people must handle and make use of chemical herbicides. Workers must wear protective clothing when applying the herbicides.
- ❑ Spraying must not take place in windy conditions, when the herbicide may drift onto healthy indigenous plants.
- ❑ The use of herbicides is not permitted within identified sensitive areas. The removal of weeds and invader plants within these areas must be undertaken by hand.
- ❑ Affected areas must be reinstated and rehabilitated as soon as practically possible.

7.12 Monitoring of Rehabilitated Areas

- ❑ Upon completion of all work, the Environmental Manager and Resident Engineer must survey all rehabilitated areas to ensure compliance with specifications.
- ❑ A monitoring and alien weed control programme must be implemented (by the Employer) for a minimum of one year to ensure no nick-point erosion develops in disturbed soils, wetland vegetation re-establishes and that alien weeds are controlled.
- ❑ A photographic record must be maintained.
- ❑ Monitoring should be done quarterly each year, for the minimum of one year, or until the rehabilitated areas are well established.
- ❑ Alien weed control and soil erosion will be the main items that require monitoring.

8. OPERATIONS PHASE

The operations phase refers to the period of the project during which the project will be in operation. This section of the EMP outlines general environmental specifications that are required to be implemented by the Employer.

8.1 Operational Site

- ❑ The Employer must identify and demarcate the extent of the operational servitude and its access points and indicate these on an operational site layout plan.
- ❑ No movement or work outside the servitude is permitted other than activities involving gaining access to the site along approved access roads/tracks.
- ❑ Any areas disturbed outside of the operational servitude by the Employer, its staff or visitors will be subject to reinstatement and rehabilitation at the Employer's cost.

8.2 Maintenance of Sanitation Infrastructure

- ❑ The operational servitude may not be used for any purpose other than for the proper carrying out of operational/maintenance activities.
- ❑ A regular monitoring and maintenance program must be developed.
- ❑ Permission must be obtained from each relevant land user prior to going on site.
- ❑ Operational staff must protect and take cognisance of private property, fences and gates. The open or closed status of gates must be respected during operational activities.
- ❑ During maintenance activities, there must be minimal disruption to affected land users and/or tenants.
- ❑ Operations staff should not create excess noise during operational activities.
- ❑ On-going liaison with affected land users and other parties must be undertaken to minimise disruption and interruptions to services.

8.3 Alien Invasive Species Control

- ❑ The Employer is responsible for the control of weeds and invader plants. The Employer must monitor all sites disturbed by operational activities for colonisation by weeds, exotics or invasive plants, and these are to be controlled as they emerge.
- ❑ The control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) or in terms of Working for Water guidelines.
- ❑ Removed vegetation must be disposed at a licensed waste disposal facility.
- ❑ Only properly trained people must handle and make use of chemical herbicides and workers must wear protective clothing when applying the herbicides.
- ❑ Spraying must not take place in windy conditions, when the herbicide may drift onto healthy indigenous plants.

8.4 Access Roads

- ❑ The project site must be accessed using existing roads.
- ❑ No private access roads other than those required directly for operational purposes may be used. The land user's permission must be obtained.
- ❑ Speed limits, appropriate to road conditions and the vehicle driven, are to be observed at all times.
- ❑ Damage or erosion to access roads incurred as a result of operational activities must be rectified by the Employer.
- ❑ Access roads must be adequately maintained in order to minimise erosion and undue surface damage. Runoff from roads must be managed to avoid erosion and pollution problems. Responsibility for the general maintenance of access roads should be clearly defined and understood between the relevant parties.

8.5 Soil Erosion and Storm Water Control

- ❑ Soils must be monitored for signs of erosion at regular intervals. Upon identification of a potential erosion problem, measures are to be put in place to prevent further soil loss.
- ❑ Particular attention must be paid to areas around sump/pump stations.
- ❑ Any wetland and/or stream crossings that may occur along the sewer reticulation network must be checked to ensure no nick-point erosion develops in disturbed soils and that no undue sedimentation is occurring downstream.
- ❑ Runoff must not be canalised or concentrated in areas where sheet flow may occur, or where highly erodible soils occur.
- ❑ Storm water drainage measures must be implemented where necessary to control runoff, prevent soil erosion and sedimentation of water bodies.

8.6 Waste Management and Pollution Control

- ❑ No litter or any other debris shall be left on site after the completion of monitoring or maintenance activities.
- ❑ Watercourses and rivers must be protected and maintained free of any pollution as a result of operational activities.

8.7 Protection of Fauna and Flora

- ❑ Fauna and flora within the operational servitude and surrounding environment must not be disturbed unnecessarily.
- ❑ Sensitive indigenous vegetation¹⁸ must be avoided, where possible, by operations staff.
- ❑ The penalty clause associated with the needless destruction of wildlife is a fine and imprisonment¹⁹.

8.8 Emergency Preparedness

The Employer must compile and maintain environmental emergency procedures to ensure that there will be an appropriate response to emergency incidents that will cause environmental impacts, such as:

- ❑ Accidental discharges to water and land due to burst pipes, collapsed reservoirs or storage facilities.
- ❑ Accidental veld fires.
- ❑ Responsible management and operation of the WWTW must be undertaken at all times. The following actions must be taken by the OM should the WWTW experience a system failure:
 - Downstream users are to be notified immediately by the OM if a total system failure takes place.
 - A list of contact details of suitably qualified technicians (fitters, electricians etc.) must be on site.
 - All relevant municipal and provincial water authorities are to be immediately notified in case of flooding, accidental overflow or leakage from the WWTW.
- ❑ In terms of the Occupational Health and Safety Act (OHSA), all WWTWs must have a safety representative, all personnel on the site must know who the safety representative is and safety meetings should take place regularly.
- ❑ Maintenance and management roles should be clearly defined.
- ❑ All new operational staff and maintenance contractors to undergo general environmental awareness training before working on site, as well as health and safety induction.
- ❑ All staff are to be suitably qualified and have the necessary training to work and operate the WWTW.
- ❑ Suitable response protocols must be implemented to ensure optimum and safe operation of the WWTW and corrective actions must be implemented in the event of any sewage leaks or spills. Hydrocarbon spill remediation products (eg. spill sorb, drizzat mats) must always be available on site.
- ❑ All chemicals must be safely stored with controlled access. Adequate accessibility must be provided to all parts of the plant that need maintenance.
- ❑ A complaints register must be kept at the WWTW and must be accessible to the general public. All emergency equipment must be checked at least every 6 months and serviced as required. Records of checks and services must be kept on file at the WWTW.
- ❑ All associated records, documentation and registers, reports, monitoring data must be stored on file and available for audit purposes.
- ❑ Emergency plans/procedures must indicate revisions (dates reviewed and approved by the OM).

The Employer must report any incidents to the authorities and undertake remedial actions as required in terms of Section 28 of NEMA (Act No. 107 of 1998).

¹⁸ Swamp forest, indigenous natural forest, protected trees, wetlands, rivers and other watercourses (including riparian vegetation).

¹⁹ In terms of the Animals Protection Act, 1962 (Act No. 71 of 1962) Section 2.

8.9 Sludge Handling and Disposal

- ❑ If applicable, all sludge and must be handled in accordance with the DWAF Guidelines for the Utilization and Disposal of Wastewater Sludge. These guidelines were developed to encourage the implementation of beneficial use of sludge and are available from the DWAF – Department: Resource Protection and Waste (www.dwaf.gov.za).under the following volumes:
 - Volume 1: Selection of Management options.
 - Volume 2: Requirements for the agricultural use of sludge.
 - Volume 3: Requirements for the on-site and off-site disposal of sludge.
 - Volume 4: Requirements for the beneficial use of sludge.
 - Volume 5: Requirements for thermal sludge management practices and for commercial products containing sludge.

8.10 Disposal of solid waste generated by the WWTW

- ❑ The Operational Manager (OM) must ensure that sludge is properly processed and safe before being allowed to be removed from site.
- ❑ Sludge or dry sludge waste will be disposed of at a suitable licensed waste management facility or disposal site, or the dried sludge will be composted on site and either be used as humus on the current WWTW site or sold to other parties.
- ❑ Sludge or dry sludge is not to accumulate excessively on site.
- ❑ Sludge or dry sludge is it to be stored in a manner that does not allow leachate or run off to soak into the bear soil or enter the general storm water system.
- ❑ The OM must ensure that regular visual monitoring of general waste (litter) as well as containment prior to disposal is regularly undertaken.
- ❑ The OM must ensure regular visual monitoring of the sludge removal processes and associate facilities for signs of overflow or similar poor operation. Records must be kept of waste sludge removal from site. These should indicate who is removing this waste and to where.
- ❑ The OM must undertake visual monitoring of all other waste handling on site on a regular basis.

8.11 Treated Effluent Quality/Output

- ❑ Direct discharge of untreated effluent into the river is not permissible.
- ❑ Treated effluent should be chemically and microbiologically analysed according to a schedule. Effluent that does not meet national quality guidelines should not be discharged into the receiving environment. Should guidelines not be met, the operation of the WWTW should be adjusted in order to improve the quality.
- ❑ The outlet should be inspected daily and after major rainfall, to identify erosion gully's / channels near the outlet works.
- ❑ An Effluent Monitoring Plan must be compiled and implemented on site.
- ❑ An Environmental Officer (EO) should be appointed and must be contractually bound to implement the monitoring plan and liaise with the authorities regarding the results
- ❑ Treated wastewater must be treated to meet the DWS Special Limits in terms of the output quality from the WWTW.
- ❑ Treated wastewater effluent must be tested and monitored in accordance with the DWS requirements. All data from monitoring must be kept on file at the WWTW.
- ❑ The results of all monitoring data should be available for inspection at all times.

8.12 Monitoring

- ❑ In terms of the National Water Act, 1998 (Act 36 of 1998), the Discharge of waste or water containing waste is a controlled activity for which a Licence or General Authorization must be obtained. The applicant/legal operator must ensure that wastewater (if applicable) is legally disposed by applying for a General Authorization, a License or exemption in terms of the Water Act.
- ❑ A wastewater monitoring program may be required, which must include monitoring of quantities disposed of (on a monthly basis) and compliance of treated wastewater quality after treatment but before disposal
- ❑ A monitoring programme, as well as a service and maintenance schedule, must be put in place to monitor the project for any infrastructural problems, e.g. cracks, leaks, etc.
- ❑ The monitoring and maintenance programme must include the following:
 - A regular maintenance schedule to maintain the WWTW and sanitation infrastructure.
 - A monitoring schedule for alien invasive plant species.
 - A regular monitoring schedule for damage to access roads.
 - A monitoring schedule for soil erosion.
- ❑ Written records of monitoring programmes are to be maintained.
- ❑ A photographic record must be maintained.

8.13 Liaison with Interested and Affected Parties

Liaison with stakeholders, including local communities and their representatives, is to be undertaken by the Employer as required and as appropriate. This must include liaison with land users, utility providers, neighbours, and relevant authorities. Complaints or queries received from stakeholders and actions taken to address complaints must be done in writing. Copies of all interactions and correspondence shall be kept as part of record keeping.

8.14 Registers

The Employer must have registers for the following:

- ❑ Emergency procedures.
- ❑ Maintenance activities.
- ❑ Monitoring activities.
- ❑ Environmental incidents.
- ❑ Complaints and actions taken.

Annexure 1

The following penalties for incidents of non-compliance shall apply:

Failure to demarcate working servitudes	R 1,000
Working outside of the demarcated servitude	R 2,500
Failure to strip topsoil with intact vegetation	R 2,500
Failure to stockpile topsoil correctly	R 2,500
Failure to stockpile or spoil materials in designated areas	R 2,000
Pollution of water bodies (including increased suspended solid loads)	R 5,000
Failure to control storm water runoff	R 5,000
Failure to prevent siltation of natural habitat outside of working servitudes	R 5,000
Failure to provide adequate sanitation	R 5,000
Unauthorised removal of indigenous woody vegetation	R 5,000 basic fine plus R 1,000 per shrub/tree
Failure to erect temporary fences	R 1,000
Failure to provide adequate waste disposal facilities and services	R 5,000
Failure to reinstate disturbed areas within the specified time frame	R 5,000
Failure to rehabilitate disturbed areas within the specified time frame	R 6,000
Failure to obey site protection measures	R 8,000
Failure to maintain demarcation tape	R 1,000
Fire – costs of runaway fires will be borne by the Contractor, should he/she be proven responsible for such fires	Costs to be borne by Contractor
Animal poaching	R 6,000
Medicinal plant and other plant removal	R 1,500
Any other contravention of the environmental specifications	R 5,000

In addition to a fine, the Contractor may be required to undertake the necessary rehabilitation/mitigation measures resulting from non-compliance. These will be as instructed by the Project Engineer, on the advice of the Environmental Manager.

ANNEXURE 2 PLANTING AND GRASSING

PLANTING

Transplanted Plants

Transplanting entails the removal of plant material and replanting the same plants in another designated position. The following are guidelines, which should be applied:

- ❑ All planting work is to be undertaken by a suitably qualified Sub-contractor, making use of the appropriate equipment.
- ❑ Where possible, transplant trees and shrubs during the winter (between April and September). Transplant deciduous trees before new growth appears.
- ❑ Prune back the plants to limit transpiration and spray foliage with an evapo-transpiration retardant liquid if they are evergreen.
- ❑ Aloes and bulbous plants may be transplanted at any time of the year.
- ❑ Trees to be transplanted must be carefully removed from the soil so as to retain as large a rootball as practically possible. Use the tree's droplines as an indicator: the larger the tree the larger the rootball (and subsequently the planting hole).
- ❑ Minimise disturbance of the soil and the remaining roots in the rootball during the lifting, moving and or transportation of all species.
- ❑ Wrap the rootball in hessian or in plastic sheeting to retain the soil and to keep the rootball moist.
- ❑ Unless otherwise specified by the ECO, excavate square holes of 800 mm x 800 mm x 800 mm on average for trees and 500 mm x 500 mm x 500 mm on average for shrubs.
- ❑ If impenetrable shale, rock, clay or a high water table are encountered, making the above hole sizes impossible, then seek advice from the ECO.
- ❑ Where local soil has poor drainage, broken rock (approximately 75 mm in diameter) must be placed to a depth of 150 mm at the bottom of the planting hole prior to planting and backfilling with a plant medium mixture approved by the ECO.
- ❑ Backfill planting holes with excavated material/topsoil, thoroughly mixed with weed free manure or compost (per volume about one quarter of the plant hole). Approval from the Environmental Manager should be obtained for the application of fertiliser (e.g. 2:3:2 fertiliser) and/or pesticides (e.g. ant and termite poison) where required.
- ❑ Plant trees and shrubs so that their stems or trunks are at the same depth as in their original position.
- ❑ Orientate trees and shrubs in the same direction as in their original position.
- ❑ Plant aloes and bulbs in similar soil conditions and to the same depth as in their original position.
- ❑ Stake all trees using three weather resistant wooden or steel stakes anchored firmly into the ground. Two of the three stakes are to be located on the windward side of the plant. Galvanised wire binding, 3 mm thick, covered with a 20 mm diameter plastic hosepipe must be tied tightly to the stakes, half to two thirds the height of the tree above the ground and looped around the trunk of the tree.
- ❑ Place stakes at least 500 mm apart and away from the stem and roots of the tree, so as not to damage the tree or its roots. This distance will depend upon the size of the tree planted and must be approved by the ECO before staking.
- ❑ Where necessary, protect newly planted trees against wind, and wild animals by means of fencing or sacking, as specified by the ECO.
- ❑ Water transplanted trees and shrubs as required until the plants are able to survive independently (i.e. depending on the rainfall).

- ❑ A raised circular 200 mm high subsoil berm, placed 500 mm (shrubs) to 750 mm (trees) from the plant's stem must be provided for watering. Do not simply leave the excavated plant hole partially backfilled for this purpose – the berm must be raised above the natural soil level.
- ❑ Add mulch to the surface area of the bermed basin.
- ❑ Water aloes and bulbs once directly after transplanting to settle the soil.
- ❑ Remove stakes and wire binds over time as plants become established.

Plants sourced from Nurseries

- ❑ All planting work is to be undertaken by a suitably qualified Sub-contractor, making use of the appropriate equipment.
- ❑ Plant all trees, shrubs and individual plants in positions as indicated by the ECO.
- ❑ Planting should preferably be done during the rainy season (October – March).
- ❑ Unless otherwise specified by the ECO, excavate square holes of 800 mm x 800 mm x 800 mm on average for trees and 500 mm x 500 mm x 500 mm on average for shrubs.
- ❑ If impenetrable shale, rock, clay or a high water table are encountered, making the above hole sizes impossible, then seek advice from the ECO.
- ❑ Where local soil has poor drainage, broken rock (approximately 75 mm in diameter) must be placed to a depth of 150 mm at the bottom of the planting hole prior to planting and backfilling with a plant medium mixture approved by the ECO.
- ❑ Backfill planting holes with excavated material/topsoil, thoroughly mixed with weed free manure or compost (per volume about one quarter of the plant hole). Approval from the Environmental Manager should be obtained for the application of fertilizer (e.g. 2:3:2 fertiliser) and/or pesticides (e.g. ant and termite poison) where required.
- ❑ As much of the soil from container plants as possible must be retained around the roots of the plant during planting.
- ❑ The plant must be planted into the specified hole size with the approved soil, compost and fertiliser mix used to refill the plant hole, which must cover all the roots and be well firmed down to a level equal to that of the surrounding *in situ* material.
- ❑ After planting, each plant must be well watered, adding more soil upon settlement if necessary.
- ❑ Stake all trees using three weather resistant wooden or steel stakes anchored firmly into the ground. Two of the three stakes are to be located on the windward side of the plant. Galvanised wire binding, 3 mm thick, covered with a 20 mm diameter plastic hosepipe must be tied tightly to the stakes, half to two thirds the height of the tree above the ground and looped around the trunk of the tree.
- ❑ Place stakes at least 500 mm apart and away from the stem and roots of the tree, so as not to damage the tree or its roots. This distance will depend upon the size of the tree planted and must be approved by the ECO before staking.
- ❑ Where necessary, protect newly planted trees against wind and wild animals by means of fencing or sacking, as specified by the ECO.
- ❑ Thoroughly water plants as required until the plants are able to survive independently (i.e. depending on the rainfall).
- ❑ A raised circular 200 mm high subsoil berm, placed 500 mm (shrubs) to 750 mm (trees) from the plant's stem must be provided for watering. Do not simply leave the excavated plant hole partially backfilled for this purpose – the berm must be raised above the natural soil level.
- ❑ Add mulch to the surface area of the bermed basin.
- ❑ Water aloes and bulbs once directly after transplanting to settle the soil.
- ❑ Remove stakes and wire binds over time as plants become established.

Seeds and Seedlings

- ❑ All planting work is to be undertaken by a suitably qualified Sub-contractor, making use of the appropriate equipment.
- ❑ Tree seedling material should be fresh and of local origin. Resist using plants from far afield as they may not be best suited to local climatic or soil conditions.
- ❑ Small seedlings are likely to transplant more successfully than large ones. These should be potted and kept under nursery conditions until they are large enough to plant out.

GRASSING

Sods

Sodding is defined as the laying of grass sods.

- ❑ All planting work is to be undertaken by a suitably qualified Sub-contractor, making use of the appropriate equipment.
- ❑ The soil should be uniformly wet to a depth of at least 150 mm before planting of grass sods.
- ❑ Protect sods against drying out: Keep these moist from the time of harvesting until final placement.
- ❑ Rake or spike the area to give a loose surface to a depth of 100 mm.
- ❑ Lay the first row of sods in a straight line, starting at the bottom of a slope, where possible.
- ❑ Place the next row of sods in the same way, tightly against the bottom row with the joints staggered, until the full area is covered with sods.
- ❑ Tightly butt sods together, taking care not to stretch or overlap sods.
- ❑ Where a good fit cannot be obtained, the intervening spaces may be filled with parts of sods or topsoil.
- ❑ On steep slopes the sods must be secured using timber stakes of at least 300 mm in length.
- ❑ After planting, water sods to prevent drying out.
- ❑ Irrigate as required until the grass is able to survive independently (i.e. depending on the rainfall).

Runners

- ❑ All planting work is to be undertaken by a suitably qualified Sub-contractor, making use of the appropriate equipment.
- ❑ Plant grass runners evenly by hand or by mechanical means at a rate of at least 400 runners per hectare
- ❑ Use only fresh runners, avoiding grass runners that have been allowed to dry out.
- ❑ Rake or spike the area to give a loose surface to a depth of 100 mm.
- ❑ The soil should be uniformly wet to a depth of at least 150 mm before planting of grass runners.
- ❑ After planting, runners must be given copious amounts of water and then allowed to dry. When dry they must be rolled with a light agricultural roller and then re-watered.
- ❑ Irrigate as required until the grass is able to survive independently (i.e. depending on the rainfall).

Hand Seeding

- ❑ All planting work is to be undertaken by a suitably qualified Sub-contractor, making use of the appropriate equipment.
- ❑ All seed supplied should be labelled in accordance with the Government Seed Act, 1961 (Act No. 20 of 1961).
- ❑ The soil should be loose and uniformly wet to a depth specified by the ECO, before any seeding commences.
- ❑ Halve the seed and fertiliser mixture as specified and apply evenly in two immediate successive applications perpendicular to each other.
- ❑ The seeded area must be raked over after seed application and well watered.
- ❑ Irrigate as required until the grass is able to survive independently (i.e. depending on the rainfall).

Hydroseeding

- ❑ All planting work is to be undertaken by a suitably qualified Sub-contractor, making use of the appropriate equipment.
- ❑ Hydroseeding entails adding a specified seed mix to slurry containing water and other approved materials to enhance plant growth potential. This mixture is applied by means of a spraying device onto the prepared areas to be seeded.
- ❑ All seed supplied should be labelled in accordance with the Government Seed Act, 1961 (Act No. 20 of 1961).
- ❑ The soil should be loose and uniformly wet to a depth specified by the ECO, before any hydroseeding commences.
- ❑ Add the specified seed mix and necessary fertiliser to the required amount of water and apply using an approved hydroseeding machine.
- ❑ Unless otherwise specified, the rate of application of the slurry will not be less than 30 cubic metres per hectare and will be applied in such a manner as to ensure even distribution of seed and fertiliser throughout.
- ❑ Additional ingredients to be added to the slurry may be specified.
- ❑ In certain cases, the specification may require that mulch be applied by hand to the area to be hydroseeded, prior to hydroseeding.
- ❑ If possible, keep the seedbed moist after hydroseeding, to ensure good germination.
- ❑ Irrigate as required until the grass is able to survive independently (i.e. depending on the rainfall).

ANNEXURE 3
CURRICULUM VITAE OF EAP