LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME – PROPOSED NGWADINI WEIR, ABSTRACTION WORKS AND PIPELINE IN KWAZULU-NATAL

ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

14/02/16/3/3/1/1884

MAY 2018

FINAL

PREPARED FOR: UMGENI WATER

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Title and Approval Page

Project Name:	Lower uMkhomazi Bulk Water Supply Scheme – Proposed Ngwadini Weir, Abstraction Works and Pipeline in KwaZulu-Natal
Report Title:	Environmental Management Programme
Authority Reference:	14/02/16/3/3/1/1884
Report Status:	Final
Applicant:	Umgeni Water

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Report Reference:	10579-20180406-Draft EMPr			R-PRO-REP|20170216

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Amendments Page

Date:	Nature of Amendment	Amendment Number:
19/02/2018	Draft EMPr for Public and Authority Review	01
18/05/2018	Final EMPr for decision-making	02

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List of Abbreviations

BA	Basic Assessment
BAR	Basic Assessment Report
BID	Background Information Document
BPEO	Best Practicable Environmental Option
CBA	Critical Biodiversity Areas
CFRD	Concrete faced rockfill dam
CLO	Community Liaison Officer
DAFF	Department of Forestry and Fisheries
DEA	Department of Environmental Affairs
DM	District Municipality
D'MOSS	Durban Metropolitan Open Space System
DMR	Department of Mineral Resources
DoT	Department of Transport
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act (Act No. 73 of 1989)
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance & Sensitivity
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
ESA	Ecological Support Areas
EWR	Ecological Water Requirements
FEPA	Freshwater Ecological Protection Area
FSL	Full Supply Line
FSA	Full supply water surface area
GN	Government Notice
HIA	Heritage Impact Assessment
IAPs	Interested and Affected Party
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature
IWULA	Integrated Water Use License Application
KZN	KwaZulu-Natal
KZN EDTEA	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs

LM	Local Municipality
LUBWSS	Lower uMkhomazi Bulk Water Supply Scheme
LUBWSS – WSS	Lower uMkhomazi Bulk Water Supply Scheme – Water Supply System
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
NEMA	National Environmental Management Act (Act No. 107 of 1998
NEMAQA	National Environmental Management: Air Quality Act (Act No. 39 of 2004)
NEMBA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEMPA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEMA: WA	National Environmental Management Waste Act (Act No. 56 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NOC	Non Overspill Crest
NWA	National Water Act (Act No. 36 of 1998)
OCS	Off-channel Storage
OHS	Occupational Health and Safety
PES	Present Ecological Status
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SIP	Strategic Integrated Project
WRC	Water Research Commission
WTP	Water Treatment Plant
WUL	Water Use License
WULA	Water Use License Application

1 PURPOSE OF THE DOCUMENT

This document serves as the Environmental Management Programme (EMPr) for the pre-construction, construction and operational phase activities for the proposed Ngwadini weir, abstraction works and pipeline in KwaZulu-Natal.

The EMPr contains all suitable mitigation measures proposed to manage (i.e. prevent, reduce, rehabilitate and/or compensate) the environmental impacts of the project. This document must be implemented during the pre-construction, construction and operational phase of the project.

An EMPr represents a detailed plan of action prepared to ensure that recommendations for enhancing positive impacts and/or limiting or preventing negative environmental impacts are implemented during the lifecycle of a project.

The scope of the Ngwadini weir, abstraction works and pipeline EMPr is as follows:

- Establish management objectives during the project lifecycle in order to enhance benefits and minimise adverse environmental impacts;
- Provide targets for management objectives, in terms of desired performance;
- Describe actions required to achieve management objectives;
- Outline institutional structures and roles required to implement the EMPr;
- Provide legislative framework; and
- Description of requirements for record keeping, reporting, review, auditing and updating of the EMPr.

The primary objectives of the EMPr are to:

- Provide mitigation measures to limit environmental impacts, and improve management of activities thereby reducing the probability of impacts occurring; and
- Define organisational and administrative arrangements for environmental management and monitoring of the work contract, including defining the responsibilities of staff and co-ordination, liaison and reporting procedures.

2 DOCUMENT ROADMAP

The information documented serves as the Draft EMPr for the proposed Ngwadini weir, abstraction works and pipeline. The EMPr is intended to meet all requirements as stipulated in Government Notice (GN) No. 982 of the 2014 EIA Regulations, as amended (07 April 2017), Appendix 4. **Table 1** presents the document's composition in terms of the aforementioned regulatory requirements.

Table 1: Document Roadmap

Chapter	Title	Correlation with Appendix 4 of G.N. No. 982	
1	**Purpose of the Document**	-	
2	**Document Roadmap**	-	
3	**Project Background and Motivation**	-	
4	**Project Location**	-	
5	**Project Description**	-	
6	**Environmental Assessment Practitioners**	1(a)	Details of – (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including curriculum vitae.
7	**Legislation and Guidelines Considered**	-	
8	**Roles & Responsibilities**	1(i)	An indication of the persons who will be responsible for the implementation of the impact management actions contemplated in paragraph (f).
9	**Monitoring**	1(g)	The method of monitoring the implementation of the impact management actions contemplated in paragraph (f).
		1(h)	The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f).
		1(k)	The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f).
		1(l)	A programme for reporting on compliance, taking into account the requirements as prescribed by the Regulations.
10	**Environmental Training & Awareness Creation**	1(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.
11	**Environmental Activities, Aspects and Impacts**	1(b)	A detailed description of the aspects of the activity that are covered by the final environmental management plan.

Chapter	Title	Correlation with Appendix 4 of G.N. No. 982	
12	**Sensitive Environmental Features**	1 (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.
13	**Impact Management**	1(d)	Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by the EIA Regulations, including environmental impacts or objectives in respect of – (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.
		1(e)	A description and identification of impact management outcomes required for the aspects contemplated in paragraph (d).
		1(f)	A description of proposed impact management sections, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) 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 provisions for rehabilitation, where applicable.
		1(j)	The time periods within which the impact management actions contemplated in paragraph (f) must be implemented.
		1(l)	A programme for reporting on compliance, taking into account the requirements as prescribed by the Regulations.
-		1(n)	Any specific information that may be required by the competent authority

3 PROJECT BACKGROUND AND MOTIVATION

3.1 Projected Water Requirements for the Middle and Upper South Coast

The information to follow was sourced from the Technical Feasibility Study (AECOM, 2016a).

The current water resources supplying the South Coast of KZN are insufficient to meet the projected water demands. The Upper and Middle South Coast are currently supplied by water from local rivers and dams, augmented by the Mgeni System. The Mgeni System is the main water source that supplies about six million people and industries in the eThekwini Municipality, uMgungundlovu District Municipality (DM), Msunduzi Local Municipality (LM), and a small portion of Ugu DM. These municipal areas comprise the economic powerhouse of the KZN.

Currently, Umgeni Water is pursuing the project further as a scheme for domestic water supply to the South Coast. Augmentation of the water resources supplying the South Coast is urgently needed to both relieve the load on the Umgeni Water supply system, and to meet growing water demands along the South Coast of KZN.

Recently, Ugu DM and the Department of Water and Sanitation (DWS) agreed on the Cwabeni Off-channel Storage (OCS) Dam as a solution for the Lower South Coast Area. As such, a dedicated augmentation for the Upper and Middle South Coast supply area (Hibberdene to Amanzimtoti) is required. Two main options are being investigated at a feasibility level; namely Desalination of Seawater, and the LUBWSS.

The LUBWSS is the recommended augmentation option to be implemented to supplement potable water supply to the existing Upper and Middle South Coast supply area. To determine the size of the proposed LUBWSS, the supply area and current and future water requirements had to be defined. The supply area extends from Amanzimtoti in the north to Hibberdene in the south, and covers both eThekwini and Ugu Municipalities (**Figure 1**).

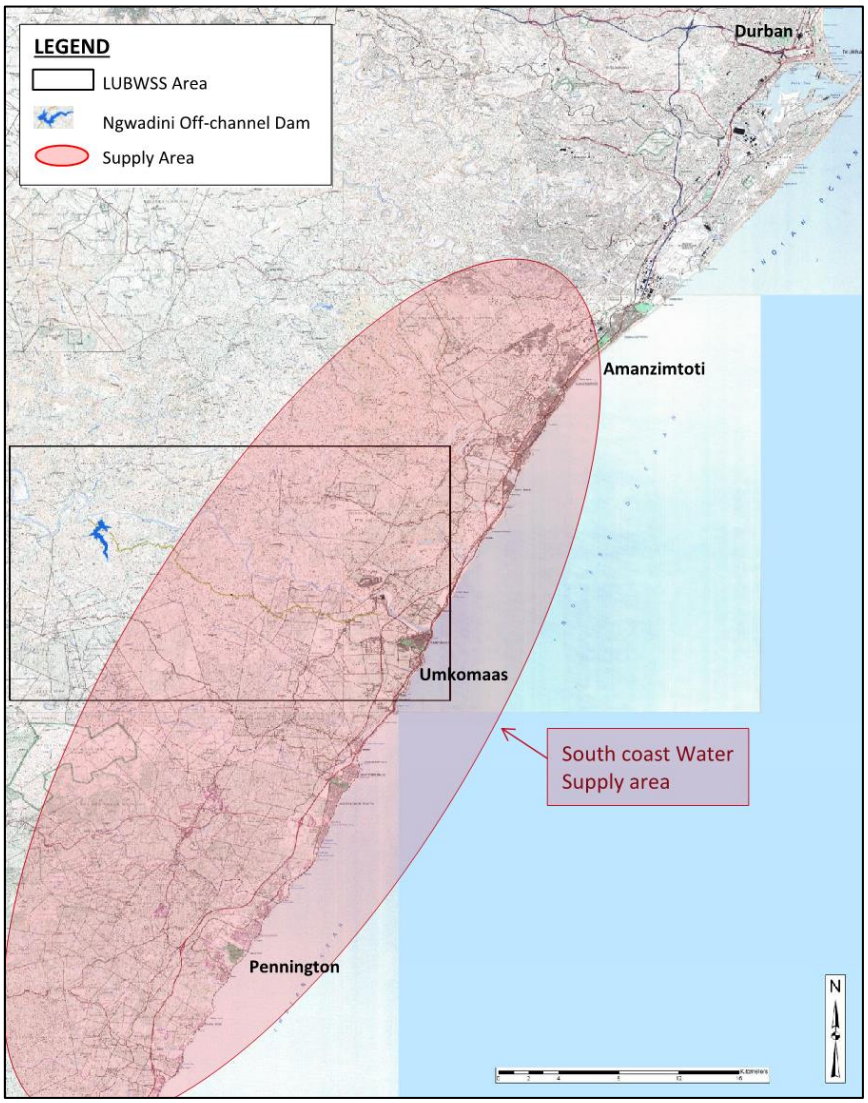


Figure 1: Map of the South Coast Water Supply area (AECOM, 2016a)

Water requirements for the Upper and Middle South Coast supply area in 2014 were 85Ml/d on average, with peaks up to 110Ml/d. This supply excludes an estimated 25Ml/d suppressed demand in the supply area, due to infrastructure constraints. Water requirement projection scenarios, taking into account the growth and development plans by the municipalities as well as Water Conservation and Water Demand Management measures, determined that the 30 year water demand projection will be between 155 to 205Ml/d for the supply area. The scenarios are as follows:

- **Scenario A (Low):** Growth projection with WC/WDM;
- **Scenario B (Medium):** WC/WDM and suppressed demands; and
- **Scenario C (High):** Suppressed demands and no WC/WDM savings.

Based on the medium growth scenario as the preferred planning scenario (**Figure 2**), the LUBWSS needs to be sized to provide an additional average volume of 100Ml/d (with a 130 Ml/d designed peak capacity), to meet the future 30-year demand projection.

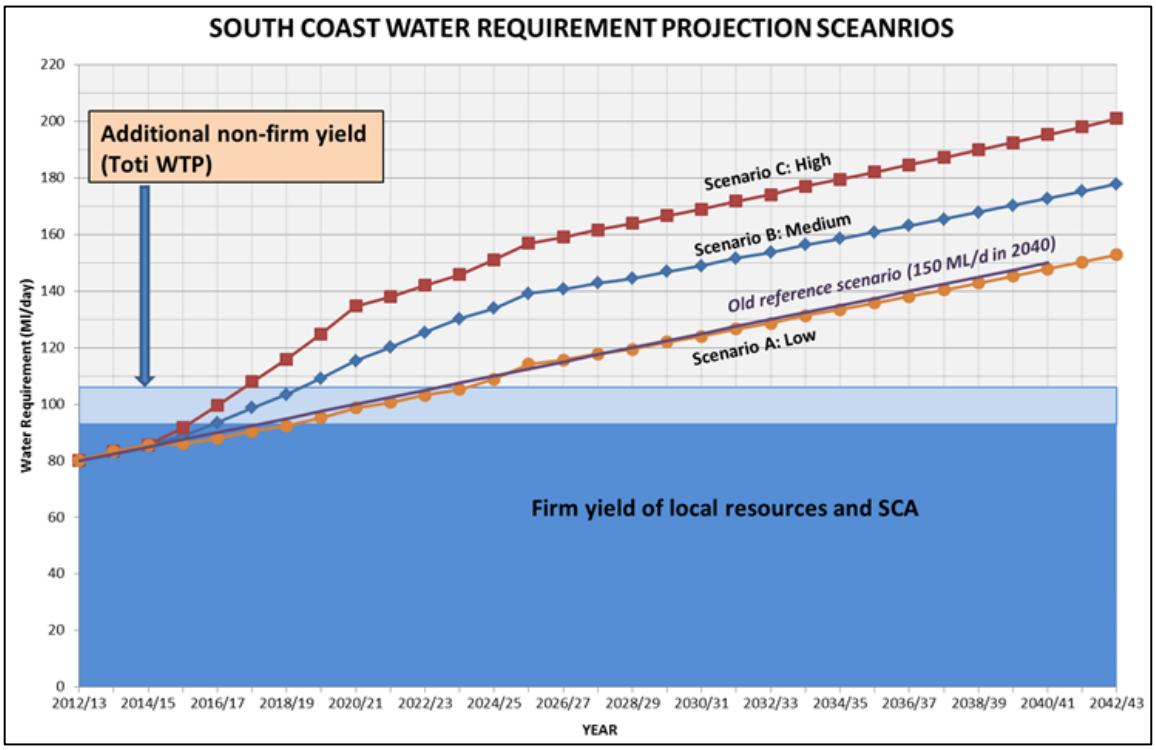


Figure 2: 30-year water demand projections and current water availability within the selected Upper and Middle South Coast supply area (AECOM, 2016a)

A Detailed Feasibility Study, which included preliminary design of components, has been completed for the LUBWSS by AECOM SA (Pty) Ltd. Of the options investigated, two scheme configuration options were carried forward to the feasibility investigation phase, and are defined as follows:

- **Scheme A:** Water supplied directly from the Ngwadini Dam to the water treatment plant (WTP) through a proposed 22km long pipeline; and
- **Scheme B:** The return of stored water to the river from Ngwadini Dam in the low flow periods and abstraction at the existing Goodenough weir and delivery to the WTP through a shorter 7km pipeline.

As the cost of the two schemes were considered similar, other factors including risk were focused on. While some risks can be mitigated or absorbed as a small cost increase, key risks are associated with impacts on water delivery timeframes due to the urgency of the project.

Based on the supply risks associated with Scheme A and Scheme B's increased flexibility for phasing and integrating with other regional schemes, Scheme B was selected as the preferred scheme to take forward to preliminary design. Initial supply from Scheme B's can commence before completion of the dam, but at lower levels of water assurance. Timeous implementation of Smithfield Dam upstream may mitigate the need for Ngwadini Dam for a lengthy period.

The proposed LUBWSS (**Figure 3**) consists of:

- The Ngwadini Weir and abstraction works to fill the Ngwadini Dam during summer periods of excess flow (*the scope of this report*);
- The Ngwadini OCS Dam, with a capacity of 10 million m^3, and outlet infrastructure to release water back into the river and augment low flow periods;
- A second abstraction downstream at the Goodenough Weir site to abstract the raw water for delivery to the WTP;
- A pump station to pump water from the Goodenough abstraction to the WTP via;
- A short rising main and 7km gravity main with;
- A break pressure tank that also serves as a raw water storage reservoir;
- Hydrocyclones before the pump station and WTP to remove sediments during periods of higher turbidity river flows and reduce the WTP residual ("sludge");
- A 100 Mℓ/d WTP in the town of Craigieburn; and
- A potable gravity water pipeline from the WTP to Quarry Reservoir, the potable water delivery and tie-in point on the South Coast Pipeline.

The overall LUBWSS layout is shown in **Figure 3**, inclusive of the Water Supply Scheme which is not included in the scope of this application. The overall layout for the Ngwadini Weir, abstraction works and pipeline (together with the OCS Dam) are shown in **Figures 4 – 5**.

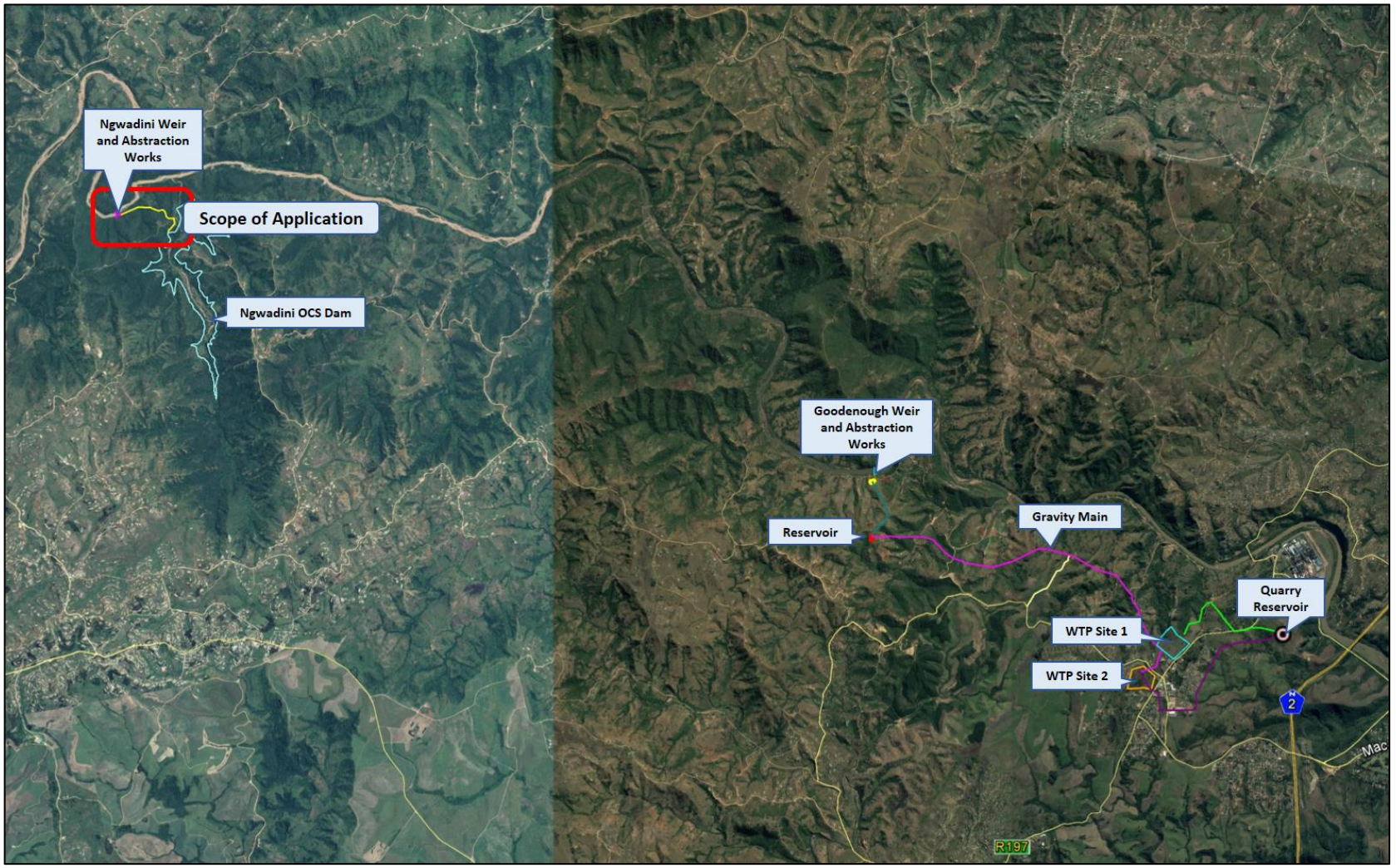


Figure 3: LUBWSS Layout

4 PROJECT DESCRIPTION

4.1 Project Description

The following Feasibility Study reports compiled by AECOM informed the project design of the LUBWSS:

- Lower uMkhomazi Bulk Water Supply Scheme Detailed Feasibility Study and Preliminary Design (AECOM, 2016a);
- Lower uMkhomazi Bulk Water Supply Scheme Feasibility Design of Ngwadini Dam, Ngwadini Abstraction Works and Goodenough Abstraction Work (AECOM, 2016b); and
- Environmental Screening Report for the uMkhomazi River System (AECOM, 2016c).

The overall LUBWSS consists of the proposed components listed in **Table 2**. The requirements in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998) are also explained. **The focus of this application will be the Ngwadini Weir, abstraction works, pipeline and access road**.

Table 2: LUBWSS Components and NEMA Requirements

No.	Project Component		NEMA Requirements
1	**Water Resource Development**	Ngwadini weir, abstraction works and pipeline to fill the Ngwadini OCS Dam during summer periods of excess flow.	Authorisation previously received in terms of the Environment Conservation Act (ECA) (Act No. 73 of 1989). However, confirmed in consultation with KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) that a new Basic Assessment process would need to be conducted due to changes in location and design. *This is the focus of this application*.
2		Ngwadini OCS Dam, with a capacity of 10 million m^3, and outlet infrastructure to release water back into the river and augment low flow periods.	Authorisation previously received in terms of ECA. However, confirmed in consultation with KZN EDTEA that an amendment to the authorisation would need to be applied for due to slight changes in design. Separate Amendment Application to be submitted to KZN EDTEA.
3	**Water Supply Scheme** – weir, abstraction works, conveyance infrastructure and WTP.		A Scoping and EIA process needs to be conducted. Separate Application to be submitted to DEA.

In 2008, SAPPI SAICCOR completed investigations and designs on the Ngwadini OCS dam to increase supply assurance for their industrial plant situated near the town of Umkomass in KZN. SAPPI SAICCOR, however, chose not to implement the dam and have handed over the project to Umgeni Water to implement for potable water supply.

4.1.1 Ngwadini OCS Dam

The Ngwadini Dam was re-designed for a concrete faced rockfill dam (CFRD) with a Full Supply Level (FSL) of 118m and associated full supply water surface area (FSA) of 0.71 km2. The CFRD was designed with a side channel spillway, with a chute and downstream flip bucket, as per the previous design; but the flood hydrology and associated spillway capacities and coffer dams revised in line with the latest best practices. The capacity and height of the dam were not changed from that for which an ROD has been granted; namely 10 million m3 storage and a 49m height dam to Non Overspill Crest (NOC) level, but refinements were made to various aspects of the existing dam design. Additional geotechnical drilling investigations were conducted to augment the previous work, and confirmed adequate founding conditions for the CFRD, as well as, sufficient quantity and quality of required construction material. This construction material is to be sourced from the side channel spillway, plunge pool and a proposed quarry to be established in the dam basin.

The outlet capacity was designed to release water back to the uMkhomazi River as a flow of 1.62m^3/s. To accommodate emergency draw down conditions, the dam was designed to empty from FSL to half depth in 60 days and the lowest outlet in 120 days with a velocity limit of 7 m/s. It is recommended that the Ngwadini Dam is categorised as a Category III dam, but this will be confirmed during the tender design phase.

SAPPI SAICCOR received the EA for the Water Resource Development components in 2008. An amendment to the EA for the Ngwadini OCS Dam needs to be applied for due to slight changes in design. A separate EA Amendment Application has been submitted to KZN EDTEA to authorise the Ngwadini OCS Dam.

The general layout of the proposed OCS Dam is provided in **Figure 6**.

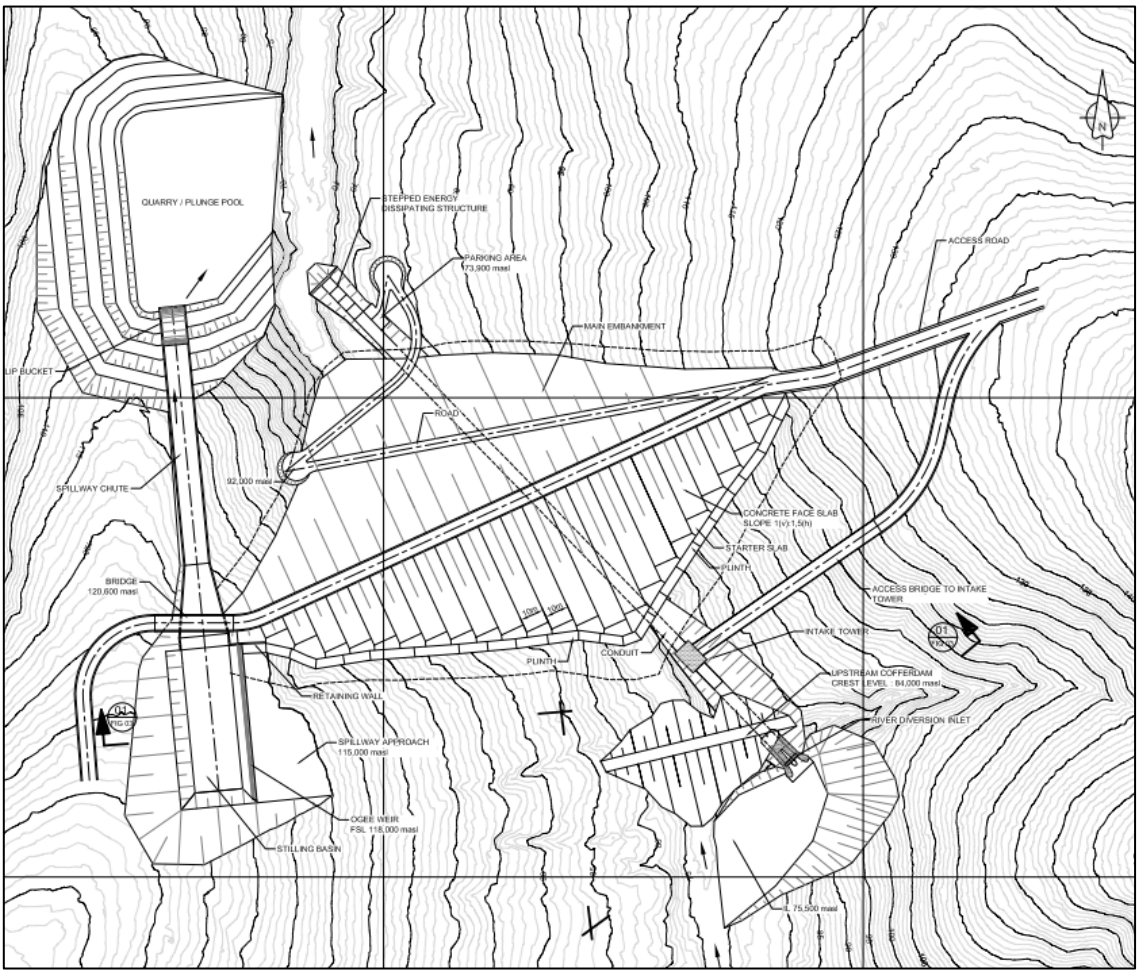


Figure 4: General Layout of the Ngwadini OCS Dam

4.1.2 Ngwadini Weir and Abstraction Works

The Ngwadini Abstraction Works, that will abstract and pump water from the uMkhomazi River to the Ngwadini OCS Dam on the Ngwadini River, was positioned and designed using a physical hydraulic model study. The chosen weir position was upstream of the previous positions considered during investigations for SAPPI SAICCOR, based on a combination of suitable hydraulic conditions on the outside of a bend, and good topography and geotechnical conditions. Therefore, Nemai Consulting was appointed by Umgeni Water to conduct a BA process for the Ngwadini Weir, abstraction works and the pipeline to fill the Ngwadini OCS Dam during summer periods of excess flow, as well as the associated access road.

The abstraction capacity required for the selected scheme configuration is 1m^3/s. However, for the sake of flexibility and future upgrades, the civil infrastructure was designed at 2.6 m^3/s.

The selected configuration of the Ngwadini Weir and abstraction works consists of the following (refer to **Figure 7**):

- A 3.5m high crump weir with low notch for gauging and to divert flows past the intake;
- A boulder trap external to the high wall;

- Three low-level slotted openings in the high wall to deliver water to;
- Two gravel traps;
- Four sand traps that also function as pumping canals;
- Radial or sluice gates are positioned at the downstream of each trap for flushing; and
- A dry well low lift pump station.

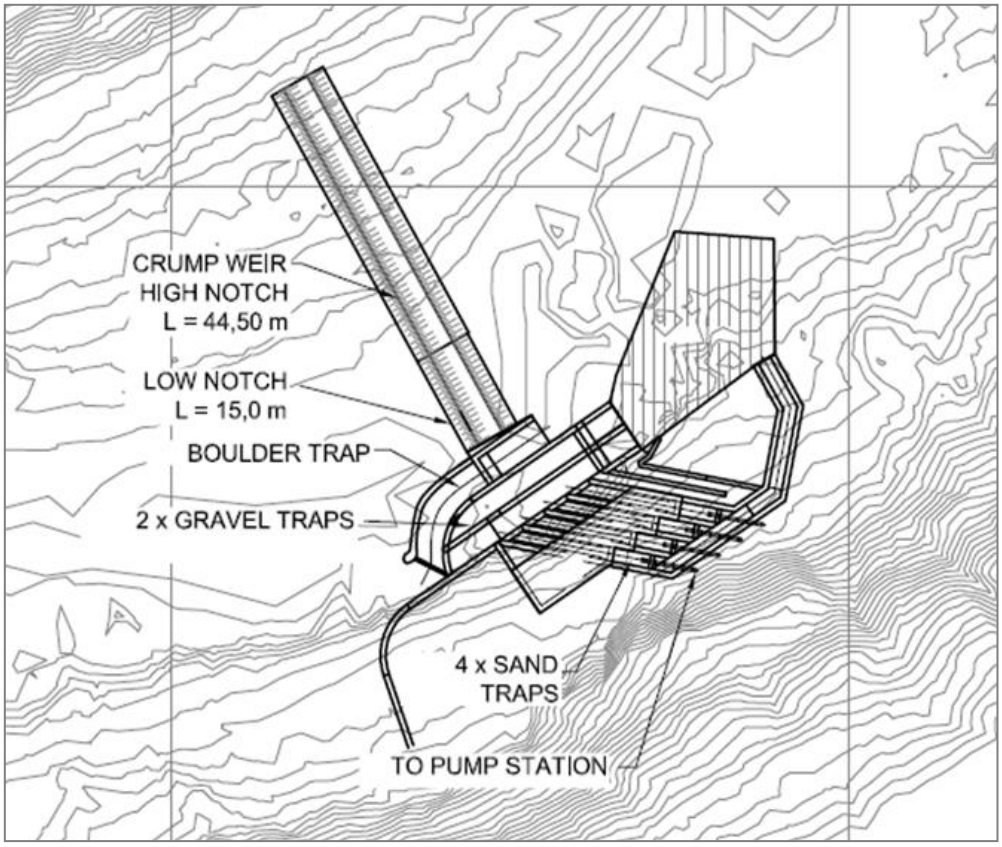


Figure 5: Ngwadini Abstraction Works Layout

The abstraction works was positioned in the river bed to be self-scouring. When necessary, the gates can be opened to flush the internal parts of the abstraction works. The preliminary design has taken into account a fishway, which should be refined in the detailed design, based on input from the Aquatic and Wetland Specialist.

4.1.3 Pipeline

A pipeline, approximately 1150m in length, will pump water from the Ngwadini weir and abstraction works to the Ngwadini OCS Dam (**Figure 8**). The construction servitude for the pipeline is 25m from the centreline on each side. Mild steel was selected for the LUBWSS pipelines.

Figure 6: Pipeline route from Ngwadini Abstraction Works to the Ngwadini OCS Dam

Details of the pipeline to fill the OCS Dam are provided in **Table 3**.

Table 3: Steel pipeline details

Pipeline	Full capacity of scheme designed			
	Flow (Mℓ/d in 18hours)	Velocity (m/s)	Length (m)	Diameter (mm)
To fill OCS dam	65 Mℓ/d	1.273 m/s	1150 m	DN1000

A number of river crossings were noted for the LUBWSS. Instead of making use of expensive bridge structures, reinforced concrete bedding and backfill was recommended for length of pipeline submerged under each river crossing. The typical section of the river crossing is included in **Figure 9**. Detailed design will need to confirm the river crossing approach and further investigate the smaller drainage line crossings.

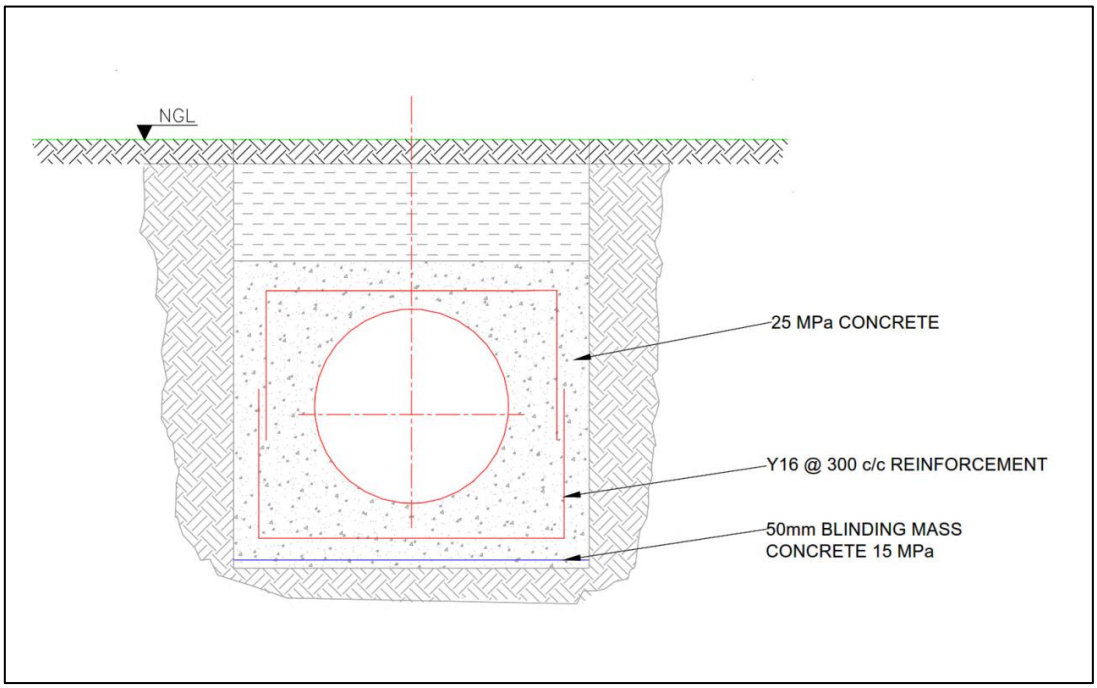


Figure 7: Proposed typical river crossing concrete encasement

4.1.4 Access Road

A new access road is required to access the Ngwadini weir and abstraction works, and the Ngwadini OCS Dam during the Construction and Operational Phases of the project (**Figure 10**). Most of the road will need to be constructed, while small sections are existing roads that require upgrading. The new sections of road to be constructed follows the contours around a steep and mountainous hill to access the Ngwadini weir and abstraction works. The access road approximately 1270m in length and approximately 8m in width. The construction servitude for the road is 12m from the edge of the road.

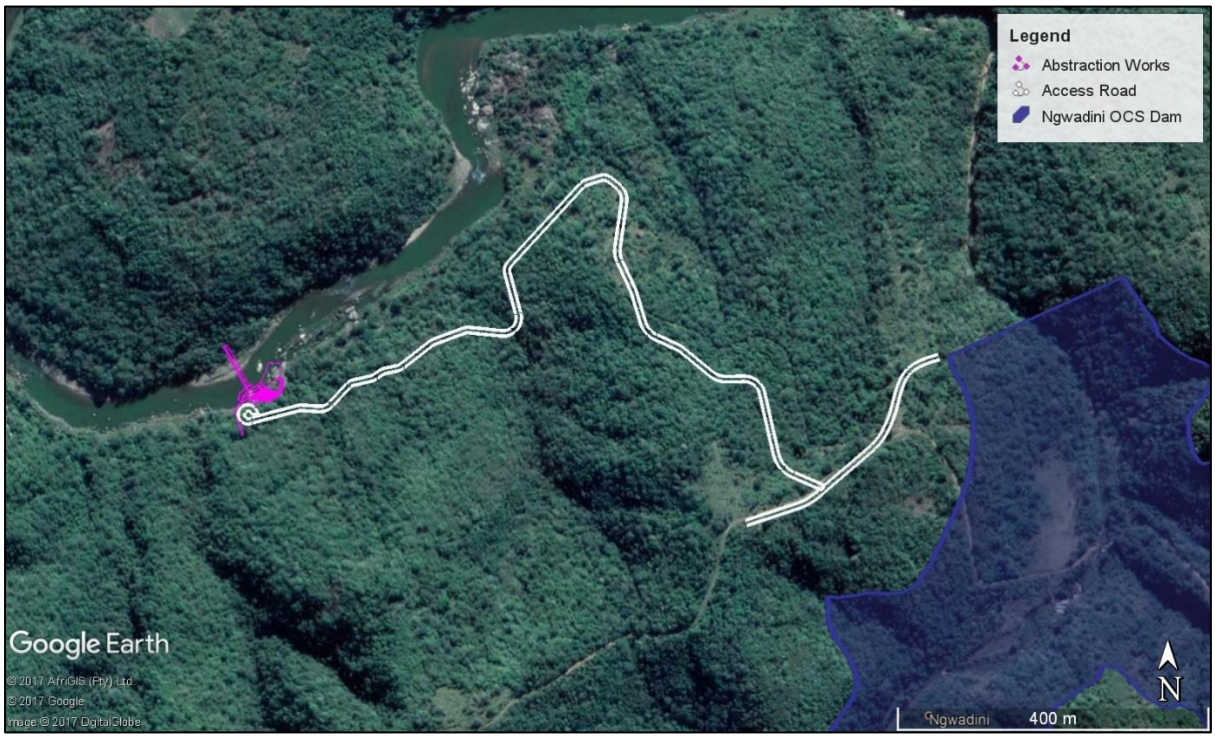


Figure 8: Proposed Access Road from the Ngwadini Abstraction Works to the Ngwadini OCS Dam

4.1.5 Associated Electrical Conveyance Infrastructure

The following information was extracted from the Lower Umkhomazi Bulk Water Supply Scheme: Detailed Feasibility Study and Preliminary Design: Bulk Electrical Services compiled by DNA Consulting Engineers and Project Managers in 2016.

Bulk electrical power is required at all the proposed Ngwadini weir and abstraction works. Spur lines would need to be constructed from the Eskom backbone to the Ngwadini weir and abstraction works.

The Feasibility Study confirmed that Eskom will be the electrical supplier for the LUBWSS and not the municipality. Eskom's existing supply networks are constrained and new bulk power infrastructure is required to deliver adequate power to the LUBWSS infrastructure sites.

Eskom has transmission networks (132kV – 275kV) in the area but not in close proximity**.** A 132kV and 275kV network infrastructure is available in the region. The closest 132kV line that has the available capacity and is not constrained is approximately 25km away along the coastal belt.

Eskom Distribution Networks (11kV – 22kV) are available in the area of the LUBWSS. Many of the networks in the area are constrained with insufficient power available to provide power for the proposed scheme.

The positions of infrastructure sites 1 to 5 that require electrical bulk supply from Eskom for the LUBWSS are provided in **Figure 11**.

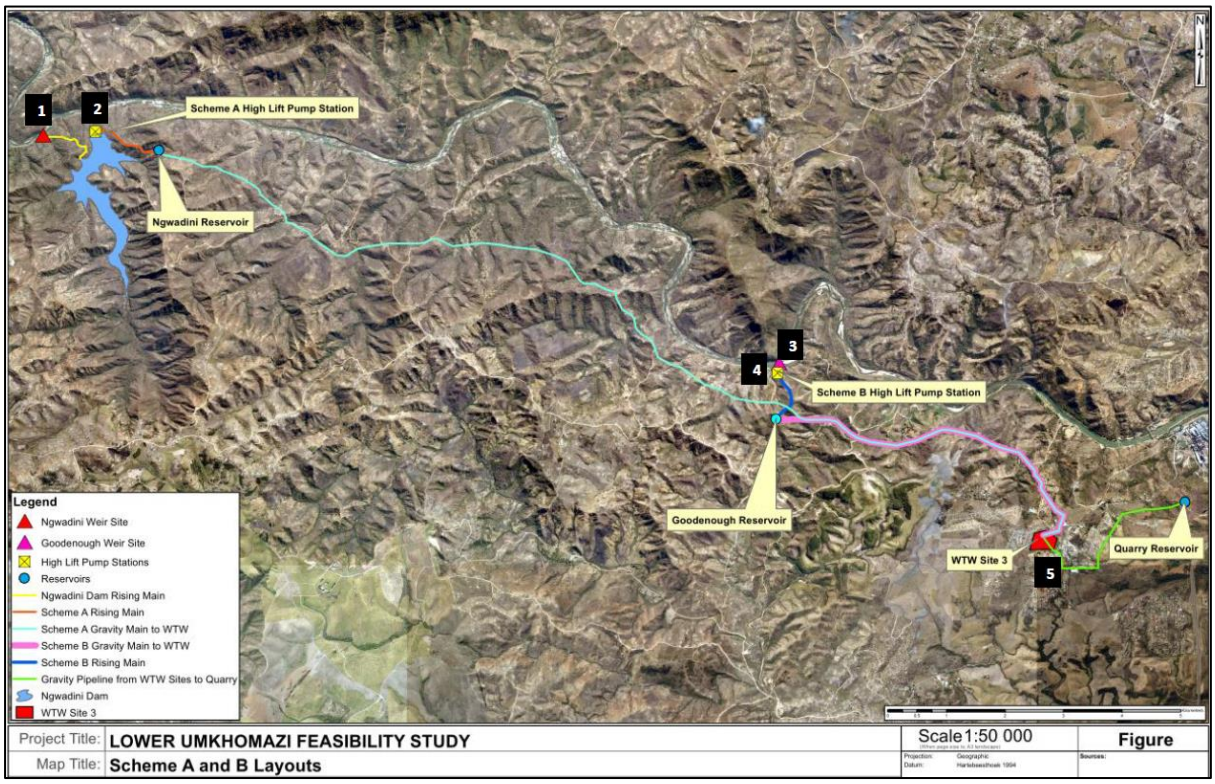


Figure 9: Bulk electrical supply points for the LUBWSS

A total of seven applications were made with Eskom for bulk power supplies in September 2015. Changes in loads and scheme options associated with the overall concept designs by AECOM did result in changes that need to be made on the Eskom applications. In consultation with Eskom, it was agreed that the current applications would remain and adjustments would be made on the applications during detailed design stage.

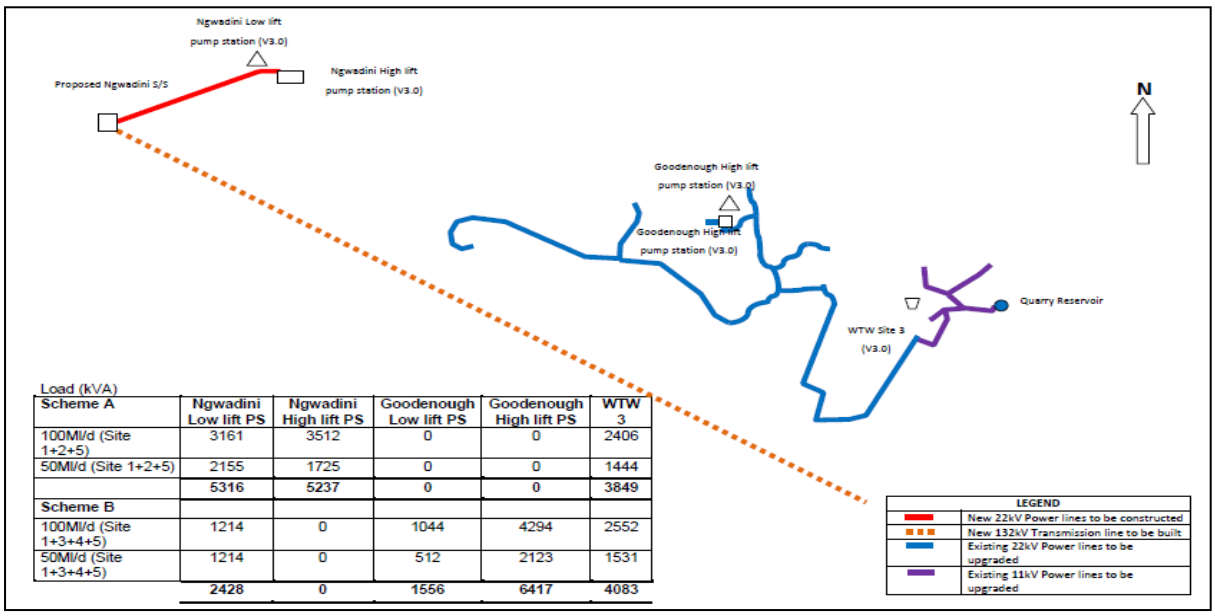
Based on analysis received from Eskom, there is no power supply available on the sites requested and it will therefore be necessary to extend the Eskom existing transmission and distribution networks to the various sites. There are 22kV and 11kV existing Eskom networks in the area.

Eskom has confirmed that they will need to construct a new substation (Ngwadini substation) in the area. This is on the condition that other consumers can be supplied off this new substation. Eskom cannot guarantee that such a substation will be built or if another alternative supply can be provided for the required full load.

As indicated by the Eskom Transmission Development Plan for 2013-2022, Eskom are currently ugrading and expanding their 132kV Transmission Network in the Umkomaas region. This has been confirmed by Eskom Planning.

Figure 12 below reflects the existing electricity infrastructure in relation to the proposed pump stations and WTPs for LUBWSS. For LUBWSS, a new 132kV transmission line is currently under construction to a proposed Ngwadini substation located in the proximity of the Ngwadini

OCS Dam. Power supplies to Goodenough pump stations and the WTPs is proposed to be fed off existing infrastructure that would need to be upgraded.



Load (kVA)

Scheme A	Ngwadini Low lift PS	Ngwadini High lift PS	Goodenough Low lift PS	Goodenough High lift PS	WTW 3
100Ml/d (Site 1+2+5)	3161	3512	0	0	2406
50Ml/d (Site 1+2+5)	2155	1725	0	0	1444
	5316	5237	0	0	3849
Scheme B					
100Ml/d (Site 1+3+4+5)	1214	0	1044	4294	2552
50Ml/d (Site 1+3+4+5)	1214	0	512	2123	1531
	2428	0	1556	6417	4083

Figure 10: Proposed electrical infrastructure

The new Eskom infrastructure required is a regional substation already identified in Eskom's long-term plans, and a 132kV transmission line.

The final total power required is 4000kVA for all key locations, including the Ngwadini abstraction works, Goodenough abstraction works, high lift pump station, and at the WTP. The new substation is required due to constrained local networks, and has already been identified as part of a regional solution. The substation is close to the Ngwadini Dam site and on private land.

Eskom will be responsible for the power supply and therefore apply for EA for the infrastructure.

4.2 Project Lifecycle

To adequately consider the impacts associated with the Ngwadini weir, abstraction works and pipeline project, the major activities during each phase of the project lifecycle are listed in the sub-sections to follow.

4.2.1 Pre-feasibility and Feasibility Phases

Major activities that form part of the Pre-feasibility and Feasibility Phases include:

- Assessment of base conditions;
- Technical, economic and environmental screening of alternatives;
- Surveying;

- Sizing and costing of infrastructure; and
- Geotechnical investigations.

4.2.2 Pre-Construction Phase

Major activities that form part of the pre-construction phase include:

- Negotiations and agreements with the affected landowners, stakeholders and authorities;
- Detailed engineering design;
- Detailed geotechnical investigations;
- Geophysical investigations;
- Survey and mark construction servitude;
- Survey and map topography for determination of post-construction landscape, rehabilitation and shaping (where necessary);
- Possible removal of trees within construction servitude;
- Possible further phases of heritage site investigation and fencing of heritage sites;
- Procurement process for Contractors;
- Selective improvements of access roads to facilitate the delivery of construction plant and materials;
- Arrangements for accommodation of construction workers;
- The building of a site office and ablution facilities;
- Permits if protected trees are to be cut, disturbed, damaged, destroyed or removed;
- Permits if heritage resources are to be impacted on and for the relocation of graves;
- Confirmation of arrangements with individual landowners and/or land users for managing and mitigating issues such as fencing and gate dimensions for traversing servitude, traversing patterns of livestock over servitude, access to livestock drinking points, security, opening and closing of gates and access to private property;
- Confirmation of the location and condition of all buildings, assets and structures within the servitude; and
- Determining and documenting the road conditions for all identified haul roads.

4.2.3 Construction Phase

General activities associated with the construction phase include the following:

- Site establishment;
- Relocation of infrastructure;
- Prepare access roads;
- Establish construction camp;
- Bulk fuel storage;
- Storage and handling of material;
- Construction employment;

- Site clearing;
- Excavation;
- Blasting;
- Establishment of and operations at crusher;
- Establishment of and operations at batching plant;
- Establishment of and operations at materials testing laboratory;
- Create haul roads;
- Concrete Works;
- Steel works;
- Mechanical and Electrical Works;
- Temporary river diversions for pipeline crossings;
- Electrical supply;
- Construction of weir and abstraction works;
- Construction of pipeline;
- Cut and cover activities;
- Stockpiling (sand, crushed stone, aggregate, etc.);
- Waste and wastewater management;
- Relocation of graves, protected species, etc.; and
- Reinstatement and rehabilitation of construction domain (as necessary).

The methodology for the installation of the pipeline is as follows:

- Site clearing.
- Remove topsoil in the area where construction will take place and stockpile separately for later re-instatement.
- Excavate pipe trench.
- Install and compact pipe bedding.
- Install pipe sections by means of side booms (special cranes) and weld joints.

Figure 11: Typical trench excavation and pipe installation activities

- Repair field joints and backfill and compact pipe trench in layers.
- Construct air and scour valves. Air valves, which are generally positioned at high points along the route, release air from the pipeline as it fills, allow air into the pipeline when it is draining and 'bleed' off air during normal operations. The scour valves serve to

drain water from the pipeline (typically during maintenance), and are located a low points along the route for drainage purposes. A detailed hydraulic analysis for the positioning of the valves will be performed as part of the detail design.

- Construct access chambers.

Figure 12: Typical examples of chambers (left - during construction; right – completed)

- Re-shape the impacted area to its original topography and replace stripped topsoil.

Figure 13: Typical views of reinstated (left) and rehabilitated (right) pipeline routes

- Install final Cathodic Protection measures.
- Install AC mitigation measures.
- Install pipeline markers (concrete posts) at changes in direction and at regular intervals along the route.
- Rehabilitation.

Watercourse crossings will generally consist of pipe sections encased in concrete in accordance with the relevant Umgeni Water criteria. The typical construction methodology for a river crossing is as follows:

- An earthen berm (coffer dam) and temporary bypass canal is constructed to divert the water around the construction site.
- The trench is excavated across the dry river channel

- A concrete bedding is constructed first, followed by the installation and restraining of the pipe to prevent flotation. Encasement is completed by the construction of further concrete lifts.
- Once the concrete has set, the temporary coffer dam is removed and the bypass canal backfilled to re-instate the flow.
- The impacted area is re-shaped to its original topography.
- The disturbed area is rehabilitated.
- If erosion of the disturbed river banks is a concern, suitable measures will be implemented to ensure the stabilisation of the river structure.

Figure 14: Typical river crossing showing concrete encased pipe section

4.2.4 Operation Phase

Key activities to be undertaken as part of the operation and maintenance include the following:

- Pipeline –
  - Create access track along pipeline servitude;
  - Conduct routine maintenance inspections of the project infrastructure;
  - Scouring of pipeline, where the water conveyed and stored within this system will be released into the receiving watercourses along the alignment from scour valves. A detail hydraulic analysis will be conducted to determine the optimum positioning of the scour valves;
  - Undertake maintenance and repair works, where necessary; and
  - Ongoing consultation with directly affected parties.
- Weir and Abstraction Works
  - Conduct routine maintenance inspections of the project infrastructure;
  - Undertake maintenance and repair works, where necessary; and
  - Ongoing consultation with directly affected parties.

4.2.5 Decommissioning Phase

Decommissioning is not considered applicable to the scheme. However, should decommissioning be required the activity will need to comply with the appropriate environmental legislation and best practices at that time.

4.3 Preliminary Implementation Programme

Various project packaging and delivery alternatives were considered. The packaging of the overall project was also explored to identify packages that can be lumped together for functionality purposes. Two packages were proposed:

- **Package 1 – Potable supply**: This package includes the Goodenough abstraction weir and works, high lift pump station, the rising and gravity main to and from the Goodenough Reservoir, the WTP, and the gravity main to Quarry Reservoir.
- **Package 2 – The water resource augmentation**: This package includes the Ngwadini abstraction weir and works, rising main to the dam, and the Ngwadini Dam.

Since there is an urgent need to augment water supply to the Upper and Middle South Coast by 2018, delivery mechanisms were explored with the primary focus on expedited project delivery time frames. For this purpose two delivery mechanisms are proposed, and for each of which a project program developed:

- A Design-Bid-Build approach and contract (current Umgeni Waters' standard).
- A Design-Build approach and contract which can reduce the need for two tender phases and cultivate innovation.

Neither delivery mechanism can have the scheme implemented by 2018, but the design-build approach can potentially reduce the time to first delivery of water from September 2021 to December 2019. This is based on the time frames of package 1. Package 1 can deliver water, albeit with a 10% risk, before Package 2, the water resource augmentation is completed. A Design-Build package is recommended for Package 1 to expedite first water delivery, and a design-bid-Build for Package 2. If selected as the preferred scheme for the South Coast, the implementation packages of the LUBWSS need to be confirmed, and the preferred delivery mechanism for each selected as soon as possible.

4.4 Resources Required for Construction and Operation

This section briefly outlines the resources that will be required to execute the project.

4.4.1 Water

During the construction stage, water will be required for various purposes, such as concrete batching, washing of plant and equipment in dedicated areas, dust suppression, potable use

by construction workers, etc. Water for construction purposes will be sourced directly from watercourses on site and groundwater (boreholes) will also be utilised. Water tankers will also supply water to the site. All water use triggered in terms of Section 21 of the NWA must comply with DWS's requirements.

4.4.2 Sanitation

Sanitation services along the pipeline route will be required for construction workers in the form of chemical toilets, which will be serviced at regular intervals by the supplier. A temporary septic field/ tank system will be provided at the site camps and site offices.

4.4.3 Waste

Solid waste generated during the construction phase will be temporarily stored at suitable locations (e.g. at construction camps) and will be removed at regular intervals and disposed of at approved waste disposal sites within each of the local municipalities that are affected by the project. All the waste disposed of will be recorded.

Construction-related wastewater, which refers to any water adversely affected in quality through construction activities and human influence, will include the following:

- Sewage;
- Water used for washing purposes (e.g. equipment, staff); and
- Drainage over contaminated areas (e.g. cement batching / mixing areas, workshop, equipment storage areas).

4.4.4 Electricity

Electricity will be obtained from diesel generators or temporary electricity connections during the construction phase. Electricity requirements for the operation of the scheme will be supplied by Eskom. A separate EIA will be conducted to seek approval for supplying electricity to the project. The power supply is discussed in detail in **Section 4.1.5**.

4.4.5 Construction Workers

The appointed Contractor will make use of skilled labour where necessary. In those instances where casual labour is required, Umgeni Water will request that such persons are sourced from local communities as far as possible.

4.4.6 Construction Site Camps

The location and number of the construction camps will in part depend on the number of construction packages. Preliminary locations for the following construction camp sites have been identified:

- Ngwadini abstraction, Ngwadini rising main and Ngwadini Dam site;
- Goodenough abstraction, high lift pump station, reservoir site and associate pipeline;

- WTP;
- The gravity main from Goodenough Reservoir to the WTP; and
- The gravity main form the WTP to Quarry reservoir.

The suggested locations for the construction camps are provided in **Figures 15** and **16**. No construction camp sites were identified within the dam basin due to the narrow, steep-sided dam basin. The construction camp locations will need to be reviewed further during the detailed design phase. Two site camps will be required at the Ngwadini Dam and abstraction site. One shall be used as a lay-down area and the other as a professional camp. Site dimensions are assumed to be 50 000m^2. Site camps near the Goodenough infrastructure and WTP are slightly smaller, at a suggested 18 000m^2. Lay-down areas along the pipeline route have been designed to vary between 18 000m^2 and 8 000m^2, depending on site topography.

Figure 15: Construction Camp Sites Section 1

Figure 16: Construction Camp Sites Section 2

5 ENVIRONMENTAL ASSESSMENT PRACTITIONER

Nemai Consulting was appointed as the independent Environmental Assessment Practitioner (EAP) to compile the BAR for the Ngwadini weir, abstraction works and pipeline. This section provides an overview of Nemai Consulting and the company's experience with EIAs, as well as the details and experience of the EAPs that form part of the project team.

Nemai Consulting is an independent, specialist environmental, social development and Occupational Health and Safety (OHS) consultancy, which was founded in December 1999. The company is directed by a team of experienced and capable environmental engineers, scientists, ecologists, sociologists, economists and analysts. The company has offices in Randburg (Gauteng), Durban (KwaZulu-Natal), and Cape Town (Western Cape).

The core members of Nemai Consulting that are involved with the project are captured in **Table 4** below.

Table 4: Project Team Core Members

Name	Qualification	Responsibility
Ms D. Naidoo	BSc – Eng (Chem)	Project Manager and Environmental Engineering

Name	Qualification	Responsibility
Mr D. Henning	MSc – Aquatic Health Ecology	Environmental Assessment Practitioner/Study Leader
Ms. S. Gerber	BSc (Hons) – Environmental Sciences	Environmental Assessment Practitioner

6 LEGISLATION AND GUIDELINES CONSIDERED

6.1 Overview of Legislation

The legislation that has possible bearing on the proposed project from an environmental perspective is captured in **Table 5** below. **Note:** *this list does not attempt to provide an exhaustive explanation, but rather represents an identification of the most appropriate sections from pertinent pieces of legislation*.

Table 5: Environmental statutory framework

Legislation	Relevance
Constitution of the Republic of South Africa (Act No. 108 of 1996)	Chapter 2 – Bill of Rights. Section 24 – environmental rights.
National Environmental Management Act (Act No. 107 of 1998)	Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment). Section 28 – Duty of care and remediation of environmental damage. Environmental management principles. Authority – DEA.
GN. R. 982 of amended 2014 EIA Regulations (07 April 2017)	Purpose – regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to EIA, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.
GN. No. R. 983 of amended 2014 EIA Regulations (07 April 2017) (Listing Notice 1)	Process for undertaking Basic Assessment / Scoping and EIA process.
GN. No. R. 984 of amended 2014 EIA Regulations (07 April 2017) (Listing Notice 2)	Activities that need to be assessed through a Basic Assessment process.
GN. No. R. 985 of amended 2014 EIA Regulations (07 April 2017) (Listing Notice 3)	Activities that need to be assessed through a Scoping and EIA process.
National Water Act (Act No. 36 of 1998)	Chapter 3 – Protection of water resources. Section 19 – Prevention and remedying effects of pollution. Section 20 – Control of emergency incidents. Chapter 4 – Water use. Chapter 12 – Safety of dams Authority – DWS.
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	Protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural landscapes.

Legislation	Relevance
	Authority –DEA.
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	Air quality management. Section 32 – dust control. Section 34 – noise control. Authority – DEA.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	Management and conservation of the country's biodiversity. Protection of species and ecosystems. Authority – DEA.
National Environmental Management: Waste Act (Act No. 59 of 2008)	Chapter 5 – licensing requirements for listed waste activities (Schedule 1). Authority – Minister (DEA) or MEC (provincial authority)
Occupational Health & Safety Act (Act No. 85 of 1993)	Provisions for Occupational Health & Safety. Authority – Department of Labour.
National Heritage Resources Act (Act No. 25 of 1999)	Section 34 – protection of structure older than 60 years. Section 35 – protection of heritage resources. Section 36 – protection of graves and burial grounds. Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m2 in extent. Authority – Amafa aKwaZulu-Natali.
KZN Heritage Act (Act No. 04 of 2008)	Conservation, protection and administration of both the physical and the living or tangible heritage resources of KZN. Authority – Amafa aKwaZulu-Natali.
Conservation of Agricultural Resources Act (Act No. 43 of 1983)	Control measures for erosion. Control measures for alien and invasive plant species. Authority – Department of Forestry and Fisheries (DAFF) and Department of Agriculture.
National Forestry Act (Act No. 84 of 1998)	Section 15 – authorisation required for impacts to protected trees. Authority – DAFF.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Permit required for borrow pits. Authority – Department of Mineral Resources (DMR).
National Road Traffic Act (Act No. 93 of 1996)	Authority – Department of Transport (DoT).
Tourism Act of 1993	Authority – South African Tourism Board.
KwaZulu-Natal Nature Conservation Management Act (Act No. 09 of 1997).	Institutional bodies for nature conservation in KZN. Establish control and monitoring bodies and mechanisms. Authority – Ezemvelo KZN Wildlife.
Kwazulu-Natal Planning and Development Act (Act No. 06 of 2008)	Directs and regulates planning and development in KZN. An application may be required before land may be used or developed for a particular purpose. All developments need to be in accordance with the municipality's planning scheme. Authority – Municipality
Integrated Coastal Management Act (Act No. 24 of 2008)	Management of uMkomaas Estuary. Authority – DEA.
Spatial Planning and Land Use Management Act (Act No.16 of 2013)	Directs and regulates planning and development in South Africa. Govern planning permissions and approvals, sets parameters for new developments and provides for different lawful land uses in South Africa. Authority – DEA.

6.2 The Constitution (Act No. 108 of 1996)

The Constitution of the Republic of South Africa, Act No. 108 of 1996, is the supreme law of the land and provides amongst others the legal framework for legislation regulating coastal management in general. It also emphasises the need for co-operative governance. In addition, the Environmental clause in Section 24 of the Constitution provides that:

"Everyone has the right –

a) To an environment which is not harmful to their health or wellbeing;

b) To have the environment protected for the benefit of present and future generations through reasonable legislation and other measures that:

I. Prevent pollution and ecological degradation;
II. Promotes conservation;
III. Secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development".

The Constitution provides the overarching framework for sustainable development.

6.3 The National Environmental Management Act (Act No. 107 of 1998)

The proposed Ngwadini weir, abstraction works and pipeline in terms of NEMA, and the BAR was undertaken in accordance with the 2014 EIA Regulations, as amended (07 April 2017).

The 2014 EIA Regulations, as amended, consist of the following:

- EIA Procedures - Government Notice No. R. 982;
- Listing Notice 1 - Government Notice No. R. 983;
- Listing Notice 2 - Government Notice No. R. 984; and
- Listing Notice 3 - Government Notice No. R. 985.

The proposed development triggered activities under Listing Notices 1 and 3 and thus a BA process needs to be undertaken. The listed activities are fully explained in context of the project in **Table 6**.

Table 6: Listed activities triggered by the proposed project

<table>
<tr><th>Listed Activity</th><th>Listed Activity Description per project</th></tr>
<tr><td>GN 983 – Activity 9

The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water—
(i) with an internal diameter of 0,36 metres or more; or
(ii) with a peak throughput of 120 litres per second or more;</td><td>Details of the pipeline to fill the OCS Dam are provided below:
<table>
<tr><th rowspan="2">Pipeline</th><th colspan="4">Full capacity of scheme designed</th></tr>
<tr><th>Flow (Mℓ/d in 18hours)</th><th>Velocity (m/s)</th><th>Length (m)</th><th>Diameter (mm)</th></tr>
</table></td></tr>
</table>

Listed Activity	Listed Activity Description per project
	To fill OCS dam | 65 Mℓ/d | 1.273 m/s | 1150 m | DN1000
GN 983 – Activity 12 The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs— (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; —	Various infrastructure within 32m from watercourse(s) and within a watercourse, including: • Weir and abstraction works (uMkhomazi River); • Pipeline; and • Access roads.
GN 983 – Activity 19 The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;	Construction of various infrastructure within watercourse(s), including: • Weir and abstraction works; and • Access road. This will result in the excavating, dredging and infilling within a watercourse of more than 10m^3.
GN 983 – Activity 24 The development of a road— (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;	The new access road to be constructed will be 8m in width where no reserve exists.
GN 983 – Activity 30 Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	The proposed developments will fall within areas of KZN ESA areas. In addition, multiple plant species of conservation of importance was identified on site by the Ecological Specialist.
GN 985 – Activity 4(d)(xi) The development of a road wider than 4 metres with a reserve less than 13,5 metres. d. KwaZulu-Natal xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;	The proposed developments will fall within areas of KZN ESA areas.
GN 985 – Activity 14(d)(viii) The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs— (a) within a watercourse;	The construction of various infrastructure will occur within watercourse(s) or within 32m of a watercourse, including: • Weir and abstraction works; • Pipeline; and • Access road. The proposed developments will fall within areas of KZN ESA areas within a watercourse and within 32m from a watercourse.

Listed Activity	Listed Activity Description per project
(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; d. KwaZulu-Natal viii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;	

6.4 The National Environmental Management: Waste Act (Act No. 59 of 2008)

The National Environmental Management Waste Act (Act No. 56 of 2008) (NEM: WA) regulates waste management in order to protect the health and environment of South African citizens. This is achieved through pollution prevention, institutional arrangements and planning matters, national norms and standards and the licensing and control of waste management activities.

The list of waste management activities that have or are likely to have a detrimental effect (GN No. 921 of 29 November 2013) contains activities listed in Categories A and B that would require licensing from the provincial or national authorities and activities contained in Category C which would require meeting the requirements of various Norms and Standards.

The purpose of the Norms and Standards for the Storage of Waste is to provide a uniform approach to the management of waste storage facilities, ensure best practice is the management of waste storage facilities and provide minimum standards for the design and operation of new and existing waste storage facilities.

The Norms and Standards require registration of new storage facilities. They also provide details on the management of all storage facilities in terms of access control and notices, operation, general requirements of waste storage containers, minimum requirements for above ground storage facilities and minimum requirements for below ground storage facilities.

The Norms and Standards also require that training be undertaken and an emergency preparedness plan be compiled. In addition, specific monitoring and inspections need to be undertaken as well as internal and external audits.

The following should be noted with regards to waste management during the Construction Phase:

- Temporary waste storage facilities will remain below the thresholds contained in the listed activities under Schedule 1 of NEM: WA; and
- The Environmental Management Programme (EMPr) will make suitable provisions for waste management, including the storage, handling and disposal of waste.

6.5 The National Water Act (Act No. 36 of 1998)

The National Water Act (Act No. 36 of 1998) (NWA) regulates the water resource of South Africa and aims to achieve the sustainable use water for the benefit of all users. Water is considered a scarce commodity and should therefore be adequately protected. Amongst others, the act deals with the protection of water sources, water uses, water management strategies and catchment management, dam safety and general powers and functions, as well as water quality.

The purpose of the act is to ensure that South Africa's water resources are protected, used, developed, conserved, managed and controlled, and for achieving this purpose, to establish suitable institutions and to ensure that they have appropriate community, racial and gender representation.

Section 21 of the NWA provides information on what water uses require approval (i.e. Water Use License Applications or WULAs). These include:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in a stream flow reduction activity;
e) Engaging in a controlled activity;
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

Any development within a regulated area of a watercourse, namely the riparian habitat, 1:100 year floodline, wetland systems or a 500m radius of a wetland will require an authorisation from DWS.

As the proposed development occurs within a regulated area of a watercourse and involves abstraction of water, an Integrated WULA (IWULA) is required in terms of Sections 21 (a), (b), (c) and (i) of the NWA (**Table 4**).

Table 7: Explanation of the relevant NWA Section 21 Activities

Section 21	Description of Water Use	Relevance to Project
21 (a)	Taking water from a water resource	Abstraction from the uMkhomazi River at the Ngwadini Weir and Abstraction Works.
21 (b)	Storing water	Storage of water in the Ngwadini OCS Dam.
21 (c)	Impeding or diverting the flow of water in a watercourse	Construction activities within the regulated area of any watercourse. This includes encroachments into the regulated areas of watercourses by the following project infrastructure – weir, abstraction works and watercourse crossings (pipelines and access roads).
21 (i)	Altering the bed, banks, course or characteristics of a watercourse	

6.6 The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)

The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA) sets out the requirements with which applicants for prospecting rights, mining rights and mining permits must comply in Sections 16, 22 and 27 of the MPRDA. The MPRDA aims "to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources; and to provide for matters connects therewith"**.**

No Mining Permits are required for the proposed development as borrow pit material (e.g. soil, gravel or sand) will be sourced from a commercial source.

6.7 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA) was promulgated for the management and conservation of South Africa's biodiversity through the protection of species and ecosystems and the sustainable use of indigenous biological resources.

The main implication of this act is the protection of biodiversity.

The proposed development falls within Ecological Support Areas (ESAs), and traverses watercourses, therefore NEMBA needs to be considered.

6.8 The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)

The aim of the National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEMPA) is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural seascapes. The purpose of a Protected Environment is amongst others to protect a specific ecosystem outside a special

nature reserve world heritage site or nature reserve and also to ensure the use of the natural resources in the area is sustainable.

The proposed development does not occur within a Protected Area.

6.9 National Forest Act (Act No. 84 of 1998)

In terms of the National Forests Act (Act 84, 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 DAFF.

6.10 National Heritage Resources Act (Act No. 25 of 1999)

The National Heritage Resources Act (Act No. 25 of 1999) was promulgated for the protection of National Heritage Resources and the empowerment of civil society to conserve their heritage resources.

The proposed developments will trigger certain categories as listed below that require a Heritage Impact Assessment (HIA) in terms of Section 38 of the National Heritage Resources Act. These categories are:

- Any development or other activity which will change the character of a site
  - Exceeding 5 000 m^2 in extent; or
  - Involving three or more existing erven or subdivisions thereof; or
  - Involving three or more erven or divisions thereof which have been consolidated within the past five years;
  - The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority; or
  - Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

The Act also makes provision for General Protections, which apply automatically to certain categories of heritage resources such as archaeological and paleontological sites, cemeteries and graves, and structures older than 60 years.

As the pipeline and access road exceed 300m, a Phase 1 HIA is required. The HIA compiled will be submitted to Amafa aKwaZulu-Natali for comment and approval.

6.11 The National Environmental Management: Air Quality Act (Act No. 39 of 2004)

The National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEMAQA) provides for the setting of national norms and standards for regulating air quality monitoring, management and control and describes specific air quality measures so as to protect the environment and human health or well-being by:

- Preventing pollution and ecological degradation; and
- Promoting sustainable development through reasonable resource use.

It also includes the establishment of national ambient dust fall out levels that may be relevant to the construction.

There will be dust impacts associated with the construction phase of the project. Therefore, no authorisation in terms of NEMAQA is required. However, NEMAQA needs to be considered to decrease ambient dust impacts associated with construction activities.

6.12 The Occupational Health and Safety Act (Act No. 85 of 1993)

The Occupational Health and Safety Act (Act No. 85 of 1993) provides for the health and safety of people at work as well as the health and safety of persons using plant and machinery.

This act will need to be taken into account should the proposed development be approved.

6.13 Policy, Programmes, Guidelines and Plans

6.13.1 Guidelines

The following guidelines were considered during the preparation of the Scoping Report:

- Integrated Environmental Management Information Series, in particular Series 2 – Scoping (DEAT, 2002);
- Guideline on Alternatives, EIA Guideline and Information Document Series (DEA&DP, 2010a);
- Guideline on Need and Desirability, EIA Guideline and Information Document Series (DEA&DP, 2010b);
- Integrated Environmental Management Guideline Series 5: Companion to the EIA Regulations 2010 (DEA, 2010a);
- Integrated Environmental Management Guideline Series 7: Public Participation in the EIA Process (DEA, 2010b); and
- Guidelines for Involving Specialists in the EIA Processes Series (Brownlie, 2005).

6.13.2 Regional Plans

The following regional plans will be considered during the execution of the EIA:

- National Development Plan;
- KZN Provincial Biodiversity Plan;
- Durban Metropolitan Open Space System;
- eThekwini Municipality Durban's Systematic Conservation Assessment;
- Municipal Spatial Development Frameworks (SDF);
- Municipal Integrated Development Plans (IDP); and
- Relevant provincial, district and local policies, strategies, plans and programmes.

7 ROLES AND RESPONSIBILITIES

A high-level outline of the institutional arrangements for the implementation of the EMPr during the pre-construction, construction and operational phases of the project, as well as the conditions of the EA, is provided in **Figure 17**.

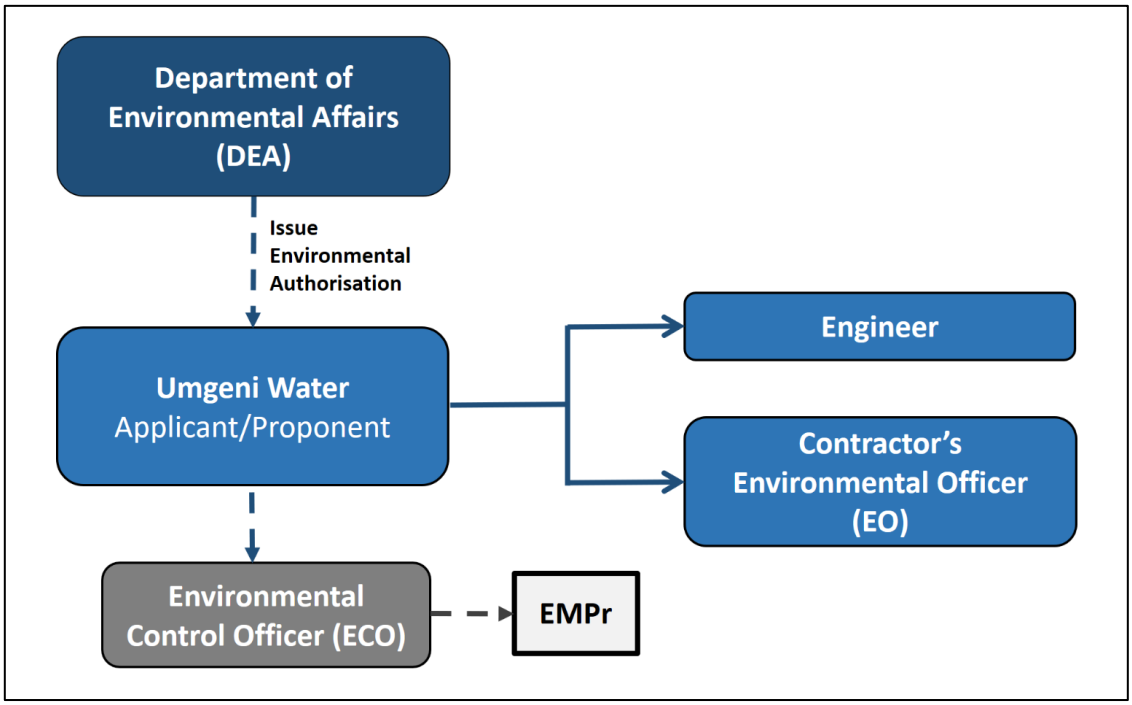


Figure 17: Institutional arrangements: roles and responsibilities

7.1 Department of Environmental Affairs (DEA)

DEA are the mandated authority in terms of the NEMA that determine whether authorisation can be issued for the project, following a decision-making process.

DEA also fulfils a compliance and enforcement role with regards to the authorisation. The Department may perform random inspections to checks compliance. DEA will also review the monitoring and auditing reports compiled by the Environmental Control Officer (ECO).

7.2 Project Proponent

Umgeni Water are the applicant in terms of National Environmental Management Act (No. 107 of 1998). Umgeni Water are also the Project Proponent for all components of the work related to the development and is ultimately responsible for the development and implementation of the EMPr and ensuring that the conditions in the EA are satisfied. The liability associated with environmental non-compliance rests with the Project Proponent.

7.3 Project Manager

The Project Manager has over-all responsibility for managing the Contractors and for ensuring that the environmental management requirements are met. During the construction phase, the Project Manager will be the proponent's (or implementing agent's) construction manager. During the operations phase it is expected that this role will be fulfilled by the operations manager.

The Project Manager will be on site and the responsibilities of this party will include the following (amongst others):

- Overseeing of all environmental matters and compliance with all environmental requirements and authorisations; and
- Act as the interface between the ECO and the other project role players.

7.4 Environmental Control Officer (ECO)

The ECO is a competent (minimum of 3 years' experience) and independent representative. The ECO will undertake weekly inspections of the site and at least 6 monthly full compliance auditing against the EMPr and EA. The audit reports will be submitted to the project manager, and DEA for their records, and also be made available to the relevant authorities, on their request.

The ECO will check the following:

- The record of environmental incidents (spills, impacts, legal transgressions, etc.) as well as corrective and preventive actions taken;
- The public complaints register in which all complaints are recorded, as well as actions taken; and
- Results from the environmental monitoring programme (air, noise, water quality).

Further duties of the ECO will be the following:

- Monitoring of compliance with the EMPr and the Project Specification.
- Make recommendations on how to best apply the environmental requirements on site and advise the Chief Resident Engineer on the site instructions required to facilitate effective environmental compliance.
- Participate in the quality management system by issuing non-conformances when there are areas of the project environmental requirements that are not being met.

7.5 Contractor's Environmental Officer (EO)

The primary role of the competent EO is to coordinate the environmental management activities of the Contractor on site.

Specific responsibilities of the EO, who will be on site, will include the following:

- Aiding the Contractor to comply with all the project's environmental management requirements;
- Assisting the Contractor in compiling Method Statements;
- Facilitating environmental activities and environmental awareness training of relevant persons on site;
- Exercise an internal compliance management system on behalf of the Contractor;
- Inspect the site as required to ensure adherence to the management actions of the EMPr and the Method Statements;
- Provide inputs to the regular environment report to be prepared by the ECO (as required);
- Liaise with the construction team on issues related to implementation of, and compliance with the EMPr;
- Maintain a record of environmental incidents (such as spills, impacts, legal transgressions) as well as corrective and preventive actions taken; and
- Maintain a public complaints register in which all complaints are recorded, as well as action taken.

8 MONITORING

Monitoring is required to ensure that the receiving environment at the study area is suitably safeguarded against the identified potential impacts, and to ensure that the EMPr requirements are adequately implemented and adhered to during the construction phase.

8.1 Compliance Monitoring

Compliance monitoring will commence in the pre-construction phase, where those conditions in the EA that need to be adhered to prior to project implementation will need to be checked and recorded. Compliance monitoring will be completed at the end of the defects liability period to check the performance of rehabilitation measures and whether the related objectives have been met.

The ECO will undertake weekly monitoring against the requirements stipulated in the EMPr and EA.

Compliance monitoring with the EA and EMPr must be conducted in accordance with Regulation 34 of GN No. R 982 (07 April 2017) in terms of the following:

1. The holder of an EA must, for the period during which the EA and EMPr, remain valid -
    a. Ensure that the compliance with the conditions of the EA and EMPr is monitored; and
    b. Submit environmental monitoring reports to DEA.
2. The environmental monitoring report must-
    a. Be prepared by an independent person with the relevant environmental monitoring expertise;
    b. Provide verifiable findings, in a structured and systematic manner, on-
        i. The level of performance against and compliance of an organization or project with the provisions of the requisite EA or EMPr; and
        ii. The ability of the measures contained in the EMPr, to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity;
    c. Contain the information set out in Appendix 7 of GN No. R 982 (07 April 2017); and
    d. Be conducted and submitted to DEA at intervals as indicated in the EA.

A document handling system must be established to ensure accurate updating of EMPr documents, and availability of all documents required for the effective functioning of the EMPr. Supplementary EMPr documentation could include:

- Method Statements;
- Site instructions;
- Emergency preparedness and response procedures;
- Record of environmental incidents;
- Non-conformance register;
- Training records;
- Site inspection reports;
- Monitoring reports;
- Auditing reports; and

- Public complaints register (single register for maintained for overall site).

The Contractor shall also develop and submit a Site Layout Plan illustrating the planned site layout, access routes, storage facilities, site camp area, parking areas, etc. This Site Layout Plan must first be approved by the Applicant and ECO prior to site establishment activities commencing.

9 ENVIRONMENTAL TRAINING AND AWARENESS CREATION

Training aims to create an understanding of environmental management obligations and prescriptive measures governing the execution of the project. It is generally geared towards project team members that require a higher-level of appreciation of the environmental management context and implementation framework for the project.

Awareness creation strives to foster a general attentiveness amongst the construction workforce to sensitive environmental features and an understanding of implementing environmental best practices. The various means of creating environmental awareness during the construction phase of the project may include:

- Induction course for all workers before commencing work on site;
- Refresher courses (as and when required);
- Daily toolbox talks, focusing on particular environmental issues (task- and area specific);
- Courses must be provided by suitably qualified persons and in a language and medium understood by the workers;
- Erect signage and barricading (where necessary) at appropriate points in the construction domain; and
- Place posters containing environmental information at areas frequented by the construction workers (e.g. eating facilities).

Training and awareness creation will be tailored to the audience, based on their designated roles and responsibilities. Records will be kept of the type of training and awareness creation provided, as well as containing the details of the attendees.

10 ENVIRONMENTAL ACTIVITIES, ASPECTS AND IMPACTS

In order to establish best management practices and prescribe mitigation measures, the following project-related information needs to be adequately understood:

- **Activities** associated with the proposed project;

- **Environmental aspects** associated with the project activities;
- **Environmental impacts** resulting from the environmental aspects; and
- The nature of the surrounding **receiving environment**.

10.1 Project Activities

For the purposes of effective and efficient monitoring, the aspects of construction are outlined separately for pre-construction, construction and operational phases. In order to understand the impacts related to the project it is necessary to unpack the activities associated with the project life-cycle, as shown below:

Table 8: Activities associated with the Pre-construction Phase

PRE-CONSTRUCTION PHASE	
Project Activities	
1.	Applicant to appoint ECO
2.	Negotiations and agreements with the individual affected landowners and stakeholders
3.	Detailed engineering design
4.	Detailed geotechnical design
5.	Site survey
6.	Procurement of contractors
7.	Mark construction servitude
8.	Pre-construction photographic records
9.	Development and approval of method statements
10.	Development and approval of construction plans
11.	Development of employment strategy
12.	Construction site planning, access and layout
Environmental Activities	
1.	Undertake a walkdown survey of the project footprint by the relevant environmental specialists to identify sensitive environmental features
2.	Conduct Phase 2 HIA
3.	Develop Search, Rescue and Relocation Plan
4.	Demarcation of buffers around sensitive areas
5.	Diligent compliance monitoring of the EA, EMPr and other relevant environmental legislation
6.	Barricading and installing barriers around buffer areas identified in specialist studies
7.	Ongoing consultation with landowners and affected parties
8.	Establish baseline water quality data for river crossings based on aquatic and wetland studies

Table 9: Activities associated with the Construction Phase

CONSTRUCTION PHASE	
Project Activities	
1.	Site establishment (including site camp and labour camp)
2.	Fencing of the construction area
3.	Registration of the servitude
4.	Pegging of central line and overall footprint
5.	Site clearing

6. Delivery of construction material
7. Transportation of equipment, materials and personnel
8. Storage and handling of material
9. Cut and cover activities
10. Stockpiling (sand, crushed stone, aggregate, etc.)
11. Stormwater control mechanisms
12. Management of topsoil and spoil
13. Waste and wastewater management
14. Traffic control measures
15. Bulk earthworks
16. Site security
17. Electrical supply
18. Construction of the weir, abstraction works and pipeline
19. Road surface finishes
20. Concrete works
21. Temporary river diversion for weir and pipeline crossings
22. Landscaping
Environmental Activities
1. Reinstatement and rehabilitation of construction domain
2. Control of invasive plant species
3. Diligent compliance monitoring of the EA, EMPr and other relevant environmental legislation
4. Conduct environmental awareness training
5. Implement EMPr
6. Ongoing consultation with landowners and affected parties
7. Ongoing search, rescue and relocation of red data, protected and endangered species, medicinal plants, heritage resources and graves (based on area of influence of the construction activities) – permits to be in place
8. Ongoing monitoring for red data, protected and endangered species, medicinal plants, heritage resources and graves (based on area of influence of the construction activities)

Table 10: Activities associated with Operational Phase

OPERATIONAL PHASE
Project Activities
1. Servitude access arrangements and requirements
2. Routine maintenance inspections of the Ngwadini weir, abstraction works and pipeline
3. Repair and maintenance works of Ngwadini weir, abstraction works and pipeline
4. Operation of the scheme
Environmental Activities
1. Ongoing consultation with landowners and affected parties
2. Erosion monitoring programme
3. Management of sensitive areas or buffered areas
4. Management of vegetation clearance
5. Stormwater management
6. Pollution control measures
7. Control of invasive plant species
8. Satisfy EWR

10.2 Environmental Aspects

Environmental aspects are regarded as those components of an organisation's activities, products and services that are likely to interact with the environment and cause an impact. **Tables 11, 12** and **13** provide the environmental aspects that have been identified for the proposed project, are linked to the project activities (note that only high level aspects are provided).

Table 11: Environmental aspects associated with the Pre-Construction Phase

ENVIRONMENTAL ASPECTS
Pre-construction Phase
1. Insufficient construction site planning and layout
2. Poor consultation with landowners, affected parties, stakeholders and authorities
3. Site-specific environmental issues not fully understood
4. Inadequate environmental and compliance monitoring
5. Absence of relevant permits
6. Lack of barricading of sensitive environmental features
7. Poor waste management
8. Absence of ablution facilities

Table 12: Environmental aspects associated with the Construction Phase

ENVIRONMENTAL ASPECTS
Construction Phase
1. Poor consultation with landowners and affected parties
2. Inaccurate walk-down survey
3. Inadequate environmental and compliance monitoring
4. Lack of environmental awareness creation
5. Construction starting without or inadequate search and rescue
6. Indiscriminate site clearing
7. Poor site establishment
8. Poor management of access and use of access roads
9. Inadequate provisions for working on steep slopes
10. Poor transportation practices
11. Poor traffic management
12. Disturbance of topsoil
13. Disruptions to existing services
14. Inadequate storage and handling of material
15. Inadequate storage and handling of hazardous material
16. Erosion

ENVIRONMENTAL ASPECTS
Construction Phase
17. Poor maintenance of equipment and plant
18. Poor management of labour force
19. Pollution from ablution facilities
20. Inadequate management of construction camp
21. Poor waste management practices – hazardous and general solid, liquid
22. Poor management of pollution generation potential
23. Poor management of water
24. Damage to significant fauna and flora
25. Environmental damage of sensitive areas
26. Disruption of archaeological and culturally significant features (if encountered)
27. Dust and emissions
28. Noise nuisance due to construction activities
29. Influence to resource quality of the affected rivers from river diversions
30. Poor reinstatement and rehabilitation

Table 13: Environmental aspects associated with the Operational Phase

Operational Phase
1. Poor consultation with landowners, affected parties, stakeholders and authorities
2. Inadequate environmental and compliance monitoring
3. Inadequate management of access, routine maintenance and maintenance works
4. Inadequate management of vegetation
5. Not satisfying the EWR

10.3 Potential Significant Environmental Impacts

Environmental impacts are the change to the environment resulting from an environmental aspect, whether desirable or undesirable. Refer to **Table 14** and **15** for the potential significant impacts associated with the preceding activities and environmental aspects for the pre-construction, construction and operational phase.

Table 14: Potential significant environmental impacts during Construction Phase

Feature	Impact
Geology and Soil	• Unsuitable geological conditions • Impacts associated with the sourcing of construction material and loss of topsoil • Soil erosion (land clearance and construction activities) • Soil pollution e.g. hydrocarbon and cement spillages • Compaction and erosion of removed and stockpiled soils • Soil contamination from incorrect storage/handling/disposal of hazardous waste • Soil contamination through spillages and leakages • Soil contamination due to mismanagement and/or incorrect storage of hazardous chemicals • Poor stormwater management during construction
Topography	• Visual impacts during construction • Crossing topographic features (watercourses) • Erosion of affected areas
Geohydrology	• Groundwater pollution due to spillages and poor construction practices
Surface Water	• Increased stormwater runoff • Water leakages and wastage
Flora	• Loss of sensitive vegetation and habitat • Damage and loss of vegetation of conservation significance • Proliferation of exotic vegetation in disturbed areas • Damage to vegetation in surrounding areas • Destruction of potential red list plants during site clearing and construction • Disturbance of sensitive plant species if relocated
Fauna	• Loss of habitat through site clearing and construction • Illegal killing or hunting of mammals • Killing of snakes during construction phase due to poor environmental education procedures • Potential illness and/or death of fauna due to pollution and/or littering • Damage / clearance of habitat of conservation importance • Loss of fauna species of conservation significance • Obstruction to animal movement corridors
Air Quality	• Excessive dust levels • Greenhouse gas emissions
Transportation	• Construction-related traffic • Increase in traffic on the local road network • Damage to roads by heavy construction vehicles • Risks to road users
Noise	• Localised noise increase • Noise nuisance
Aesthetics	• Reduction in visual quality of area
Safety and Security	• Safety risk to landowners and surrounding communities

Feature	Impact
Waste Management	• Waste generated from site preparations (e.g. plant material) • Domestic waste • Surplus and used building material • Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags) • Disposal of excess spoil material (soil and rock) generated as part of the bulk earthworks • Land, air and water pollution through poor waste management practices
Socio – Economic	• Generation of employment opportunities for local community (positive) • Contribution to local economy (positive) • Conflicted land uses • Nuisance from noise and dust • Safety and security
Heritage Resources	• Damage to heritage resources
Water Users	• Water quality deterioration and disturbance to flow caused by construction activities may adversely affect downstream water users • Water abstracted from watercourses for construction purposes
Riparian Habitat	• Loss of riparian and instream vegetation within construction domain • Destabilisation of channel morphology at river • Wetland/aquatic habitat unit destruction • Soil erosion
Aquatic Ecology	• Disruptions to aquatic biota community due to water contamination, alteration of flow and disturbance to habitat during construction (particularly relevant to construction activities that take place instream or in close proximity to watercourses) • Alteration of habitat • Loss of aquatic-dependent biodiversity
Water Quality	• Inflow of contaminated storm water • Release of contaminants from equipment and concreting activities • Water quality impacts due to spillages and poor construction practices • Water quality impacts due to siltation and pollution
Flow Regime	• Alteration of flow • Affect aquatic biodiversity

Table 15: Potential significant environmental impacts for Operational Phase

Feature	Impact
Topography	• Visual impacts from disturbed area and infrastructure • Crossing topographic features (watercourses) • Erosion of affected areas
Water	• Damage to weir and abstraction works from major flood events • Negative impact to estuary • Poor monitoring and control of sediment releases back into the river

Feature	Impact
Flora	• Encroachment by exotic species through inadequate eradication programme
Aesthetics	• Visibility of weir and abstraction works to visual receptors • Inadequate reinstatement and rehabilitation of construction footprint
Socio – Economic	• Generation of employment opportunities for local community (positive) • Sustained economic and social beneficiation from the continued supply of electricity (positive) • Safety and security issues through improper access control during inspections and maintenance activities • Use of local road network for operation and maintenance purposes

11 SENSITIVE ENVIRONMENTAL FEATURES

Analyses of the nature and profile of the receiving environment identified several potential sensitive environmental features as indicated in the sensitivity maps found in **Appendix A** of the BAR. Cognisance must be taken of the following sensitive environmental features that should be afforded additional care and protection.

By conduction of the comparative analysis, the best practicable environmental option (BPEO) was found to be the following:

- Abstraction Works Layout Option 2.

Within the context of the project area, cognisance must be taken of the following sensitive environmental features, attributes and aspects, for which mitigation measures are included in the BAR and EMPr (**Figure 18**):

- The existing structures and infrastructure in the area, including the road network.
- The proposed development site falls entirely within the KZN ESA.
- One protected species recorded along the pipeline route was *Sclerocarya birrea* subsp*. caffra* (Marula tree).
- A number of Specially Protected Indigenous Plants (Natal Nature Conservation Ordinance, 15 of 1974) were identified on site.
- One plant species of conservation concern was observed in the study area, namely *Hypoxis hemerocallidea* (Star flower/African potato).
- The riparian habitats were investigated for any signs or indications that the water system may be inhabited by Otters and only scats of Cape Clawless Otter (*Aonyx capensis*) were recorded on the proposed development site.

- An abandoned house close to the remains of another structure was located. Close to the abandoned house, a potential grave site was found with a border made of rocks roughly cemented together.
- South-west of the proposed dam wall and falling within the buffer of the proposed access road is the grave of a member of the Mbele clan.
- Two FEPA systems of some importance (AB rating) were identified within the assessment boundary.
- Two channelled valley bottom systems with several drainage lines are affected by the proposed development.

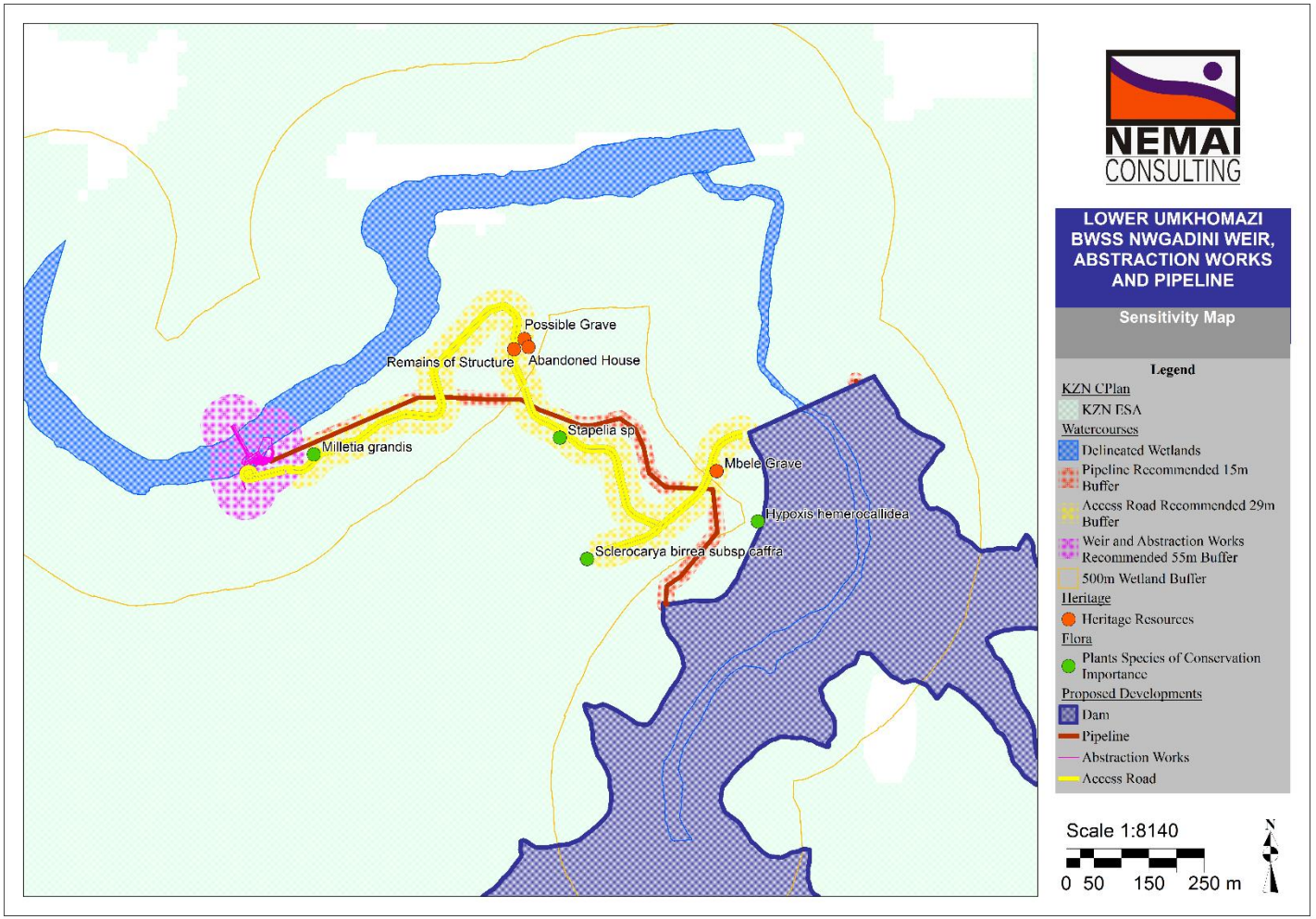


Figure 18: Sensitivity Map

12 IMPACT MANAGEMENT

The impact assessment carried out for each environmental impact that may result from the proposed project, forms the basis for determining which management measures are required to prevent or minimise these impacts. The management measures are furthermore a means by which the mitigation measures, determined in the impact assessment are translated to action items required to prevent or keep those impacts that cannot be prevented within acceptable levels.

Mitigation should strive to abide by the following hierarchy (1) prevent; (2) reduce; (3) rehabilitate; and/or (4) compensate for the environmental impacts.

Figure 19: Mitigation hierarchy

12.1 Environmental Principles

The following principles should be considered at all times during the pre-construction, construction and operational phase activities.

The environment is considered to be 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, during the execution of a project to minimise the impact on affected parties.
- 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, etc.
- Every effort should be made to minimise, reclaim and/or recycle “waste” material.

12.2 Pre-construction Phase

The planning or pre-construction phase largely entailed conducting the necessary specialist studies, determining the site layout and carrying out the requisite environmental processes to obtain authorisation.

General requirements during the pre-construction phase include the following:

- Design to consider and incorporate environmental requirements.
- Define and communicate roles and responsibilities for the implementation of the EMPr.
- Develop and implement an environmental awareness programme.
- Compile and implement an employment strategy for construction labour.

12.2.1 Specialist Environmental Investigations

Management Objective:

- Identify sensitive and protected environmental features identified as part of the BA process.

Target:

- All sensitive and protected environmental features to be identified in the construction domain (all the components of the project).
- Obtain relevant approvals prior to relocation of red data, protected and endangered flora and fauna species, medicinal plants, heritage resources and graves.

Management Actions:

- Suitable specialist(s) to identify sensitive environmental features (including watercourses, fauna, and flora) where special care needs to be taken and implement suitable mitigation measures to safeguard these features (e.g. barricading, signage and awareness creation).
- Baseline studies should be undertaken to be completed as soon as possible before implementation commences in order to provide a benchmark against which impacts resulting from the construction and operation of the project can be measured. Aspects to be included are water quality, terrestrial ecology, air quality and noise.
- Given that construction activities will expose workers and landowners to excessive noise rating levels, it is recommended that a baseline noise survey also be conducted as soon as possible following commencement of site activities – in accordance with the requirements of the Noise Induced Hearing Loss Regulations (OHS Act 85 of 1993) and SANS 10083:2004.
- A Search, Rescue and Relocation Plan must be developed that takes into consideration species of conservation concern such as the identified Hypoxis hemerocallidea plant species.

- A permit to remove Specially Protected Indigenous Plants (Natal Nature Conservation Ordinance, 15 of 1974) will need to be obtained from Ezemvelo KZN Wildlife. The removal should occur during the summer months and with due care, preferably by a qualified botanist or similarly qualified individual. The plants should be relocated into areas with the same aspect, soil conditions and elevation to ensure that the relocations are successful.
- A Permit to either cut, destroy, disturb and /or transplant the protected Marula tree must be obtained from DAFF.
- Given that the species of conservation importance were observed, it is important that a walk-down survey be conducted for plant species of conservation importance and threatened species which may occur on the project area and are addressed through a search and rescue plan.
- Riparian habitat provides migratory corridors and in order to protect habitat for the detected African/Cape Clawless Otter, a buffer around riparian habitats is recommended.
- The recommended buffer zones should be strictly adhered to, with exception of the activities required to traverse a watercourse. Any supporting aspects and activities not required to be within the buffer area should adhere to the buffer zone.

Responsibilities:

- Applicant to appoint suitably qualified specialists.
- Specialists to execute the management actions.

Monitoring Requirements:

- Approval by relevant environmental authorities.

12.2.2 Construction Site Planning and Layout

Management Objective:

- Appropriate planning and layout of construction site to ensure environmental protection.

Target:

- No impacts to sensitive environmental features as a result of construction site planning and layout.

Management Actions:

- Based on the recommendations of the walk-down survey, the Ngwadini developments that fall within the demarcated sensitive areas shall be re-aligned to avoid the certain sensitive environmental features identified.
- Conduct a pre-construction survey of the area to be affected by the development. This must include site investigations with photographic records.

- Suitable specialist(s) to identify sensitive environmental features (including watercourses, fauna, and flora) where special care needs to be taken and implement suitable mitigation measures to safeguard these features (e.g. barricading, signage and awareness creation).
- Before construction commences, all sensitive habitats must be clearly demarcated with fencing or orange mesh netting. These sensitive areas are to be defined in accordance with recommendations from the appointed specialists including a botanist, zoologist and an archaeologist. Barricading measures to be utilised should not restrict the movement of the fauna in the area.
- During site preparation, special care must be taken during the clearing of the works area where organic material will be stored separately from the topsoil and spoil material to ensure for the protection thereof. This topsoil must be re-used during the rehabilitation phase when landscaping is done.
- During site preparation, topsoil and subsoil are stripped separately from each other and must be stored separately from spoil material for use in the rehabilitation phase. It should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater.
- Records of all environmental incidents must be maintained and a copy of these records must be made available to authorities on request throughout the project execution.
- Indigenous plants naturally growing along the routes, but that would be otherwise destroyed during clearing for development purposes should be incorporated into landscaped areas.
- Vegetation clearing should be kept to a minimum, and this should only occur where it is absolutely necessary and the use of a brush-cutter is highly preferable to the use of earth-moving equipment.
- No access to no-go areas without the permission of the Project Manager.
- Determining and documenting the road conditions for all identified haul roads.
- Develop and implement an environmental awareness plan.
- The appointment of an ECO.
- Records of all environmental incidents must be maintained and a copy of these records be made available to DEA on request throughout the project execution.
- Prior to establishment of the site camp(s), the Contractor shall produce a plan showing the positions of all buildings, lay down yards, batch plants, vehicle wash areas, vehicle repair area, and infrastructure for approval by the Resident Engineer.
- Project Management shall allocate a laydown area for Contractor-supplied items. At all times, the Contractor shall be responsible for the safe and adequate storage of all materials and equipment on site which he is to install, whether they are supplied by himself or others. The safe handling, unloading and loading of material receipts and dispatches at site or storage areas shall be the Contractors' responsibility.
- Cognisance must be taken of adjacent landowners in terms of the site layout. Ablution facilities or eating areas should ideally not be located directly adjacent to the site boundary

where houses/offices as situated in a close proximity where odour or noise may become a nuisance.

- The Contractor to develop method statements and a Site Layout Plan to be approved by the Project Manager prior to construction taking place. The plan must show the following (as relevant), as a minimum:
    - Buildings and structures;
    - Contractors' camp and lay down areas;
    - Site offices;
    - Roads and access routes;
    - Gates and fences;
    - Essential services (permanent and temporary water, electricity and sewage);
    - Rubble and waste rock storage and disposal sites;
    - Solid waste storage and disposal sites;
    - Site toilets and ablutions;
    - Topsoil stockpiles;
    - Construction materials stores;
    - Vehicle and equipment stores;
    - Sensitive environmental features; and
    - Any other activities, facilities and structures deemed relevant.
- eThekwini Electricity's main records (held in the drawing office at eThekwini Electricity Headquarters, 1 Jelf Taylor Crescent) must be consulted for the presence of underground electrical services. In addition should any overhead line and/or servitude be affected, the specific permission of the Head: Electricity must be sought regarding the proposed development.
- The relocation of MV/LV electrical services, if required in order to accommodate the proposed development, will be carried out at the expense of the applicant.
- eThekwini Water and Sanitation must be contacted for records of existing sewer services in the area. The relocation of any of these services, should it be necessitated by the proposed project, will be to the expense of the applicant. Should there be a requirement to tie into the Municipalities wastewater network, then Bulk Sewer Clearance must be applied for and the applicant must contact eThekwini Water and Sanitation in this regard.

Responsibilities:

- Proponent – acquire servitude and permits.
- Project Manager and ECO – monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Approved site plan.
- Barricading and signage.

- Records of awareness creation.
- Plant rescue and protection.

12.2.3 Environmental Awareness Creation

Management Objective:

- Ensure that the Contractor, construction workers and site personnel are aware of the relevant provisions of the EMPr, EA and other relevant permits.

Target:

- All construction workers and employees to have completed appropriate environmental training.
- A record of environmental training undertaken to be kept on site.

Management Actions:

- The Contractor must arrange that his employees and those of his sub-contractor go through the project specific environmental awareness training courses before the commencement of construction and as and when new staff or sub-contractors are brought on site.
- The contractor's site staff including foremen and site management staff shall attend an environmental awareness training course on the conditions of the EMPr provided by the ECO and a signed attendance register shall be kept available for confirmation. This will be a once of training session.
- Environmental training provided by the Contractor is compulsory for all employees and structured in accordance with their relevant rank, level and responsibility, as well as the Environmental Specification as they apply to the works and site.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- ECO to conduct once-off EMPr training with Contractor’s Supervisory Staff.
- Contractor to conduct Environmental induction training with all its staff.

Monitoring Requirements:

- Records of environmental training and awareness creation.

12.2.4 Ongoing Consultation with Affected Parties

Management Objective:

- Establish and maintain a record of all complaints and claims against the project and ensure that these are timeously and effectively verified and responded to.
- Adhere to agreements made with affected landowners regarding communication.

Target:

- All complaints and claims are to be acknowledged within five (5) working days and are to be responded to within 10 working days of receipt, unless additional information and/or clarification are required.
- No deviations from agreements made with landowners and affected parties.

Management Actions:

- Establish lines of communications with landowners, affected parties, and the surrounding community.
- Establish processes and procedures to effectively verify and address complaints and claims received.
- Complaints or liaison with landowners, affected parties, and the surrounding community with regards to environmental aspects, compensation or disturbance to activities or animals, must be recorded, reported to the correct person and a record of the response is to be entered in the complaints register.
- Provide the relevant contact details to affected parties, adjacent landowners, and community members for queries/raising of issues or complaints.
- Continued liaison with authorities with regards to compliance with the EA.
- Access points to construction site, especially in areas where landowners will be affected must be communicated with the affected landowners and an agreement must be reached with them in terms of access roads.
- Liaison with landowners/farm managers is to be done prior to construction in order to provide sufficient time for them to plan agricultural activities. If possible, construction should be scheduled to take place within the post-harvest, pre-planting season when fields are lying fallow.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.

12.3 Construction Phase

12.3.1 Site Clearing

Management Objective:

- Manage environmental impacts associated with site clearing.

- Ensure that only areas that are specifically required for the construction purposes are cleared.

Target:

- No damage is caused to sensitive environmental features outside of the demarcated construction areas, including structures and infrastructure.

Management Actions:

- Restrict site clearing activities to construction area/domain.
- Clearing of vegetation to be conducted in a phased manner (where possible), with due consideration of the search and rescue activities.
- A Method Statement to be developed, which will provide the details of how site clearing will be executed.
- Maintain barricading around sensitive environmental features.
- Avoid any disturbance to demarcated sensitive environmental features.
- The contractor has to clear the site of all inert waste and rubble, including surplus rock, foundations and batching plant aggregates.
- The site shall be cleared of all litter/waste prior to any construction related activities and the waste shall be disposed of at a registered waste disposal facility.
- During site preparation, topsoil and subsoil are to be stripped separately from each other and must be stored separately from spoil material for use in the rehabilitation phase. It should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater.
- Vegetation clearing must be kept to an absolute minimum, and must be within footprints of the servitude, laydown area, construction camp or roads to be used. Mitigation measures must be implemented to reduce the risk of erosion and the invasion of alien species.

Responsibilities:

- Project Manager and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

- No clearing outside of construction domain.
- Intact barricading.
- Public complaints register.
- Contractor’s method statement.

12.3.2 Site Establishment

Management Objective:

- Minimise environmental impacts associated with site establishment.

Target:

- No damage to the environment outside construction area during site establishment.
- No access or encroachment into no-go areas.
- No justifiable complaints regarding general disturbance and nuisance received from affected landowners and the surrounding community.

Management Actions:

- The Contractor is to produce a site plan for the approval by the Project Manager/Engineer prior to the establishment of the site, which aims to identify construction activities, facilities and structures in relation to sensitive environmental features. This plan will serve as a spatial tool that facilitates the execution of the construction phase with due consideration of sensitive environmental features.
- Locate construction camp outside of sensitive environmental features.
- Cognisance must be taken of affected landowners in terms of the site layout. Ablution facilities or eating areas should ideally not be located directly adjacent to the site boundary where houses/offices as situated in close proximity where odour or noise may become a nuisance.
- Ensure noise levels are within their lawfully acceptable limits as per SANS 10103.
- Facilities and structures shall be located with due cognisance of the terrain and geographical features of the project site.
- Positioning of the storage and laydown areas should aim to minimise visual impacts.
- Control the movement of all vehicles and plant (including suppliers), such that they remain on designated routes and comply with relevant agreements.
- Maintain barricading around sensitive environmental features until the cessation of construction works.
- Minimise disturbance from lighting of the construction camp and site.
- The extent of the site should by all means be limited, to avoid any additional clearance of vegetation.
- The Contractor shall ensure that the Contractors camp and working areas are kept clean and tidy at all times.
- The Contractor shall comply with all safety requirements enforced; these include emergency evacuation procedures, fire preventative measures, etc.
- The Contractor shall supply firefighting equipment in proportion to the fire risk presented by the type of construction and other on-site activities and materials used on site. This

equipment shall be kept in good operating order. This particularly applies to welding activities, etc.

- The contractor is to provide designated safe smoking areas.
- Every precaution should be taken, to prevent pollution of air, soil, ground and surface water as a result of construction or associated activities at the construction site.
- Fuel, lubricants, transmission and hydraulic fluids shall only be stored in the designated areas that comply with the OHS Act.
- Restrict development footprint to absolute minimum area necessary.
- A copy of the EA must be kept at the property where the activity will be undertaken. The EA must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertakes work at the property.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Contractor's method statement.
- Public complaints register.
- Site plan.

12.3.3 Management of Construction Camp and Eating Areas

Management Objective:

- Minimise environmental impacts associated with the construction camp and eating areas.

Target:

- No environmental contamination associated with the construction camp.
- Minimise visual impact associated with the construction camp.
- No complaints regarding the construction camp.

Management Actions:

- Construction camp to be screened to minimise the visual impact, where practicable.
- The Contractor shall provide designated covered eating areas for all staff. Eating areas to be cleaned on a daily basis and shall provide adequate temporary shade. Employees shall not be allowed to sit in the surround road reserves during lunchtime to eat.
- Open uncontrolled fires will be forbidden at the site camp. Rather, 'contained' cooking mechanisms will be used.
- Eating areas shall be designated and demarcated.

- Refuse bins must be placed at all eating areas.
- All waste storage containers to be labelled for the specific waste type to be contained.
- The feeding, or leaving of food for animals, is strictly prohibited.
- Sufficient vermin/weatherproof bins will be present in this area for all waste material.
- Provide safe potable water for food preparation, drinking and bathing.
- Dishwashing facilities will be provided to ensure that wastewater is disposed of appropriately.
- Failure to comply with the general code of conduct, or the rules and procedures implemented at the construction camp will result in disciplinary actions.
- Prohibit the felling of trees for firewood.
- Provide medical and first aid facilities at the camp area.
- The Contractor should employ personnel on site responsible for preventing and controlling of litter. Promote good housekeeping with daily clean-ups on site.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Contractor's method statement.
- Waste disposal certificates.

12.3.4 Management of Ablution Facilities

Management Objective:

- Minimise environmental impacts associated with ablution facilities.

Target:

- No environmental contamination associated with ablution facilities.
- Minimise visual impact associated with ablution facilities.

Management Actions:

- Provide sufficient ablution facilities (e.g. mobile / portable / VIP toilets) at the construction camp and along construction sites, which conform to all relevant health and safety standards and codes.
- No pit latrines, french drain systems or soak away systems shall be allowed along the pipeline servitude. The location of conservancy tanks is to be approved by the Applicant.
- A sufficient number of toilets shall be provided to accommodate the number of personnel working in any given area. Toilets may not be further than 100m from any working area.

Toilet facilities supplied by the Contractor for the workers shall occur at a maximum ratio of 1 toilet per 15 workers, with separate toilets for men and woman.

- All staff to use the provided toilets at all times.
- All temporary/portable/mobile toilets shall be secured to the ground to prevent them from toppling over due to wind or any other cause.
- Separate changing facility must be provided separately for each sex.
- Ablutions are to be cleaned/emptied on a regular basis, before they are full and contaminate the environment.
- The entrances to the toilets will be adequately screened from public view.
- Sanitary hygiene bins will be provided for female staff.
- The Contractor will ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed service provider removes the contents from site.
- Toilet paper shall be provided.
- Should shower facilities be provided on site, the following controls must be imposed:
    - Positioning of the shower, and specifically its discharge point, will be carried out to ensure that erosion and build-up of detergents does not occur.
    - All discharge from the shower and other washing facilities must be managed to prevent environmental contamination.
    - Use of the shower facilities must be limited to staff or authorised persons only.
- Chemical/temporary toilet facilities must be provided during the construction phase; and their use must not cause any pollution to any water resources as well as pose a health hazard. In addition, these toilets must be situated out of the 1: 100-year flood line of any watercourse and 500m away from the wetland.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Maintenance register for ablution facilities.
- Disposal certificates and service slips.
- Contractor's method statement.

12.3.5 Management of Workshop and Equipment

Management Objective:

- Minimise environmental impacts associated with workshops and equipment use**.**

Target:

- No environmental contamination associated with workshops and equipment use*.*

Management Actions:

- Vehicles must be maintained and serviced according to the manufacturers' standards
- Daily checklists must be completed by drivers and operators before the vehicles and equipment are used.
- Vehicles and equipment must be turned off when not in use.
- Maintenance of equipment and vehicles will be performed in such a manner so as to avoid any environmental contamination (e.g. use of drip trays).
- Leaking equipment will be repaired immediately or removed from the site.
- Suitable storage and disposal of hydraulic fluids and other vehicle oils.
- All diesel powered equipment and vehicles used in construction activities must be suitably serviced, maintained and repaired in order to minimise the emission of diesel particulate matter and reduce subsequent worker exposure to this carcinogenic substance.
- All vehicles and equipment will be kept in good working order and serviced regularly. Leaking equipment will be repaired immediately or removed from the site.
- Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use.
- No washing of plant may occur near a watercourse. Plant to be washed in dedicated areas.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Recorded evidence of spillages.
- Vehicle and equipment checklists
- Training register.
- Contractor's method statement.

12.3.6 Fencing and Barricades

Management Objective:

- To ensure and assist with controlled fencing and barricades in the working environment.
- Minimise disturbance to animals.

Target:

- Provide a clearly demarcated and safe working area.
- No fauna to be trapped in trenches.

- No unauthorised access to private property.
- No impact in buffer zone areas.

Management Actions:

- No pedestrian or vehicular access shall be allowed outside fenced off areas.
- The entire construction site to be fenced and screened off. The Contractor shall erect such fencing when and where required and re-erect and maintain fencing and screening material as necessary. Temporary fencing shall remain in position either until it is replaced by permanent fencing or until completion of the works.
- Any private fences damaged by the Contractor shall be repaired as soon as possible at his/her cost, and shall be of the standard of the original fence.
- All fences erected for construction purposes (e.g. fences around camp sites, fencing around trenches, etc.) should be inspected on a daily basis to detect whether any damage has occurred. Damaged fences/barricading to be repaired immediately.
- Fences should be constructed to meet the following requirements:
    - The fence should be straight and vertical;
    - All the straining posts should be firmly and vertically anchored;
    - All the posts should extend to the same height above ground level by corresponding to the terrain form;
    - The straining posts and droppers should not be too far apart – the closer they are, the firmer the fence;
    - Each wire strand should be firmly attached to the standards or line posts at a specific height above ground level and should be a certain distance apart from each other;
    - The droppers should be neatly and evenly spaced between the standards. The wire strands should be firmly attached to maintain the proper space between the strands and to prevent vertical movement; and
    - Comply with Nature and Environmental Conservation Ordinance (Act No. 19 of 1974) with regards to the accommodation of relevant large mammal species.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Agreements with landowners.

12.3.7 Management of Labour Force

Management Objective:

- Ensure suitable management of labour force to prevent security-related issues.
- Optimise the use of local labour.
- Provide a work environment that is conducive to effective labour relations.

Target:

- No complaints from landowners and the surrounding community regarding trespassing or misconduct by construction workers.
- Compliance to relevant statutory requirements.

Management Actions:

- Prevent trespassing of construction workers onto private property.
- Workers should be provided with identity cards and should wear identifiable clothing.
- Make suitable provision for transport and/or accommodation of workforce.
- Creating nuisances and disturbances in or near communities shall be prohibited.
- Machine / vehicle operators shall receive clear instructions to remain within demarcated access routes and construction areas.
- Designated and demarcated smoking areas should be provided, with special bins for discarding of cigarette butts.
- Create opportunities for the employment of women.
- Use local labour as far as possible, where necessary (e.g. unskilled labour).
- Develop a community labour agreement with targets for employment and for progression.
- Training of labour to benefit individuals beyond completion of the project.
- Local people should be employed to increase support for the project and reduce the potential for criminal activities.
- No unauthorised entry other than the designated construction areas.

Responsibilities:

- Proponent – employment targets.
- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Labour-related targets.

12.3.8 Management of Health and Safety

Management Objective:

- Provide and maintain a safe and healthy working environment to construction workers and the public.

Target:

- Approved Health and Safety Plan.
- No reportable health and safety incidents.
- Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993), Construction Regulations (2014) and other relevant regulations.

Management Actions:

- The Contractor must submit a Health and Safety Plan, prepared in accordance with the Health and Safety Specification, for the Health and Safety Agent's approval prior to the commencement of work.
- The Contractor shall ensure compliance to the requirements of the Health and Safety Specification and approved Health and Safety Plan throughout construction.

Health –

- The Construction Regulations (OHS Act 85 of 1993) require that all contractors conduct an initial health risk assessment of their workers activities prior to initiating any work on site.
- Ready access to drinking water must be provided at all work locations.
- Issuing of appropriate protective wear (jackets, hats and gloves).
- The Health Department had the following comments:
    - Fuel and chemicals must be contained and stored correctly to avoid water or river contamination.
    - Ensure management of waste water and safe disposal of solid waste.
    - Monthly chemical water sampling must be conducted during construction processes.
    - Protective clothing of SABS approved shall be provided.
    - All precautionary measures to minimize noise to the acceptable standards are maintained in terms of noise Control Regulations.
    - Ablution facilities must be provided for workers at the construction site and along the pipeline route.
    - All waste generated during the construction phase shall be disposed of at an approved landfill site and records kept.
    - Air quality impacts during the construction phase must be suitably monitored.

Safety –

- First aid officers should be trained on site (levels 1 to 3) to deal with construction related injuries.
- When working in the area of encroachment is prevalent all open excavated trenches and foundations should be clearly marked and secured to keep people and fauna from falling in.
- Storage areas, assembling areas where construction material is stored on site should similarly be secured.

- The Principal Contractor must establish site access rules and implement and maintain these throughout the construction period. Access control must, amongst other, include the rule that non-employees will not be allowed on site unaccompanied.
- Access by non-construction staff into any construction related sites should be restricted and clearly indicated as such by signposts.
- Maintain access control to prevent access of the public to the construction areas.
- The requirements of the Occupational Health and Safety Act (Act 85 of 1993) and related regulations shall be adhered to.
- Speed limits shall be enforced in all areas, including public roads and private properties. All drivers of the construction teams shall be sensitised to this effect and courteous behaviour is expected from everybody in this regard.
- Fencing and barriers will be in place in accordance with the Occupational Health and Safety Act (Act No. 85 of 1993) and comply with the provisions of the Fencing Act (Act No. 31 of 1963).
- Applicable notice boards and hazard warning notices will be put in place and secured. Night hazards will be indicated suitably (e.g. reflectors, lighting, and traffic signage).
- Emergency contact details will be prominently displayed.
- All construction personnel must be clearly identifiable. All employees must also be issued with employee cards for identification purposes.
- All workers will be supplied with the required Personal Protective Equipment as per the Occupational Health and Safety Act (Act No. 85 of 1993).
- Appropriate signage must be posted to this effect and all employees on site must be instructed to ensure that non-employees are protected at all times. All non-employees entering the site must receive induction into the hazards and risks of the site and the control measures to be observed.
- All complaints and/or problems related to impacts on man-made facilities and activities must be promptly addressed by the Contractor and documented.

Responsibilities:

- Umgeni Water.
- Project Manager and ECO – to monitor compliance.
- Dedicated Occupational Health and Safety system to be implemented by Contractor's Safety Officer. To be monitored and audited by the Client's Safety Agent, in terms of the Construction Regulations (2014).
- Contractor to implement management actions.

Monitoring Requirements:

- Occupational Health and Safety system – audited by Safety Agent at least on a monthly interval.

12.3.9 Management of Emergency Procedures

Management Objective:

- Minimise environmental impacts associated with emergency procedures.

Target:

- No site fires to be caused by construction activities and workers.
- Approved emergency response procedures, where relevant.
- Emergency preparedness.

Management Actions:

- Implement the Emergency Preparedness Response Plan (**Appendix H3** of the BAR).

Fire –

- Comply with the National Veld and Forest Fire Act (No. 101 of 1998).
- Proper emergency response procedure to be in place for dealing with fires.
- Burning of waste is not permitted.
- Suitable precautions will be taken (e.g. suitable fire extinguishers, water bowsers, welding curtains) when working with welding or grinding equipment.
- Firefighting equipment to be strategically positioned throughout the site.
- All fire control mechanisms (firefighting equipment) shall be serviced annually and inspected monthly.
- All staff on site will be made aware of general fire prevention and control methods, and the name of the responsible person to alert to the presence of a fire.
- No fires are allowed on site, unless in dedicated areas approved by the Project Manager.
- Dedicated smoking areas to be provided. Cigarette butts may not be disposed of onsite.
- No internal or external access roads shall be obstructed.

Accidental Leaks and Spillages –

- Proper emergency response procedure to be in place and communicated to designated persons for dealing with spills and leaks.
- Ensure that the necessary materials and equipment for dealing with spills and leaks are available on site in the form of a Spill Kit/s.
- Remediation of the spill areas will be undertaken to the satisfaction of the Project Manager and ECO.
- In the event of a hydrocarbon spill, the source of the spillage will be isolated and contained. The area will be cordoned off and secured. The Contractor will ensure that there is always a supply of an appropriate absorbent material readily available to absorb, breakdown and where possible, encapsulate a minor hydrocarbon spillage.
- All staff on site will be made aware of actions to be taken in case of a spillage.

- Provide contact details of person to be notified in a case of spillages – signage to be displayed at strategic points within the construction domain (e.g. workshop, fuel storage area, hazardous material containers).
- Construction vehicles and mobile plant to be maintained in a safe operating condition to prevent any possible hydrocarbon leakages resulting in spillages.
- Drip trays to be positioned underneath the hydrocarbon substance containment components of all stagnant construction vehicles and mobile plant.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Approved Emergency Response Plan.
- Training and awareness creation records.
- Signage displayed.
- Contractor's method statement.

12.3.10 Management of Access and Traffic

Management Objective:

- Ensure that all construction vehicles use only dedicated access routes to construction sites.
- Ensure that the community have reasonable access to the land during construction.
- Ensure proper access control.
- Prevent unlawful access to construction domain.
- Adhere to agreements made with landowners and community members regarding access.
- Ensure the safety of all road users by implementing proper signage and traffic control measures.
- Limit construction-related nuisance to service nodes.

Target:

- No reports of construction vehicles using other unauthorised routes.
- No transporting of unsafe loads. Permits are to be obtained for abnormal loads.
- No speeding on site.
- No accidents.

Management Actions:

- Undertake negotiations and confirm arrangements with the affected landowners regarding the use of traffic arrangements.

- Ensure appropriate traffic safety measures are implemented.
- The Contractor must comply with all driving, vehicle, licensing and driver ability requirements.
- Permission required from the Project Manager for the movement of any vehicles and/or personnel outside of designated working areas.
- No new access roads shall be developed by the Contractor other than those determined or approved by the Engineer.
- Contractor to ensure safe access for affected landowners on all roads.
- Wet suppression of unpaved areas should be applied during dry windy periods, using a water cart and/or fixed sprinklers.
- Chemical suppression can also be used in conjunction with wet suppression. This involves the use of chemical additives in the water, which help to form a crust on the surface and bind the dust particles together. Chemical stabilisation reduces watering requirements, but any savings can be offset by the cost of the additives. Repeat treatments are usually required at intervals of 1-4 weeks. The method is best suited to permanent site roads and usually not cost-effective on temporary roads, which are common in construction sites.
- Provide hard-standing areas for vehicles and regularly inspect and clean these areas.
- The Contractor shall organise the site in such a manner that pedestrians and vehicles can move safely and without risks to health, including sufficient and suitable traffic routes and safe walkways with relevant signage.
- Access roads to be maintained in a suitable condition.
- Suitable erosion protective measures to be implemented for access roads during the construction phase.
- Traffic safety measures (e.g. traffic warning signs, flagmen) to be implemented.
- Clearly demarcate all access roads.
- All reasonable precautions must be taken during construction to avoid severely interrupting the traffic flow on existing roads, especially during peak periods.
- Before any work can start, the Local Traffic Department must be consulted about measures to be taken regarding pedestrian and vehicular traffic control and where required relevant way-leaves must be obtained.
- The Contractor shall arrange his activities so that construction traffic and equipment do not unnecessarily obstruct public traffic or force it to a complete standstill. The flow of public traffic shall always take precedence and the Contractor shall not stop or delay public traffic to make way for construction traffic.
- All construction access roads shall be clearly demarcated. Vehicle loads shall be secured such that no loads or part thereof fall from the vehicle and damage other road users.
- A Traffic Management Plan with regards to road closure, road deviation etc. encountered during construction must be submitted to the eThekwini Transport Authority.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Signage displayed and maintained.
- Public complaints register.
- Contractor's method statement.

12.3.11 Management of Waste

Management Objective:

- Minimise environmental impacts associated with waste.
- Apply waste management principles of prevent, minimise, recycle or re-use, with disposal as a last option.

Target:

- No littering on construction site.
- Maintain a clean and tidy construction site.
- 100% record of all waste generated and disposed at waste disposal facilities.
- Valid disposal certificates for all waste disposed.
- Provision of adequate waste containers that are easily accessible and maintained.
- Waste bins to be removed and cleaned weekly.

Management Actions:

- Waste management activities must comply with the National Environmental Management: Waste Act (Act No. 59 of 2008).
- Vermin/weatherproof bins will be provided in sufficient numbers and capacity to store domestic waste. These bins must be kept closed to reduce odour build-up and emptied regularly to avoid overfilling and other associated nuisances.
- Where possible, waste must be separated at source (e.g. containers for glass, paper, metals, plastics, organic waste and hazardous wastes).
- Provide waste skips at the construction areas. These skips should be sufficient in number, the skip storage area should be kept clean, skips should be emptied and replaced before overflowing or spillage occurs.
- Ensure daily site clean-ups to prevent the build-up of litter
- The Contractor will ensure that no burying, dumping or burning of waste materials, vegetation, litter or refuse occurs. All waste will be disposed of at suitable licensed disposal sites, based on the waste type (general versus hazardous).
- Ensure that solid waste is transported to avoid waste spills en-route.

- The following requirements shall be incorporated into the waste management programme:
  - Solid Waste:
    - Littering on site and the surrounding areas is prohibited.
    - Clearly marked litterbins must be provided on site. The Contractor must monitor the presence of litter on the work sites as well as the construction campsite.
    - All bins must be cleaned of litter regularly.
    - All waste removed from site must be disposed at a municipal/permitted waste disposal site.
    - Excess concrete, building rubble or other material must be disposed of in areas designated specifically for this purpose and not indiscriminately over the construction site.
    - The entire works area and all construction sites must be swept of all pieces of wire, metal, wood or other material foreign to the natural environment.
    - Contaminated soil must be treated and disposed of at a permitted waste disposal site, or be removed and the area rehabilitated immediately.
    - Waste must be recycled wherever possible.
    - Removal and disposal of solid waste to a permitted waste disposal site is required and this is the responsibility of the Applicant.
    - Contaminated materials are to be disposed of at a permitted hazardous landfill site.
    - All waste generated from the proposed activity must be disposed of in a suitable manner so as not to cause any water pollution or health hazard.
    - The recycling of suitable material (i.e. glass, paper, plastic, etc.) is encouraged by this Department.
  - Liquid Waste
    - The Contractor must install and maintain mobile toilets at work sites.
    - The Contractor must provide adequate and approved facilities for the storage and recycling of used oil and contaminated hydrocarbons. Such facilities must be designed and sited with the intention of preventing pollution of the surrounding area and environment.
    - All vehicles must be regularly serviced in designated area within the Contractors camp such that they do not drip oil. Where required, vehicles will be serviced in bunded areas and drip trays will be provided.
    - All chemical spills must be contained and cleaned up by the supplier or professional pollution control personnel. Run-off from wash bays must be intercepted.
    - Projects of this nature may result in the generation of small volumes of water containing waste. For this instance, the following is applicable:
      - Water containing waste must not be discharged into the natural environment.

- Measures to contain the water containing waste and safe disposal of it must be implemented.

- Hazardous Waste:
  - No hazardous materials must be disposed of in the veld or anyplace other than a registered landfill for hazardous material. Hazardous waste must be stored in containers with tight lids that must be sealed and must be disposed at an appropriately permitted hazardous waste disposal site. Such containers must not be used for purposes other than those originally designed for.
  - The Contractor must maintain a hazardous material register.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Waste register.
- Recycling targets.
- Disposal certificates.
- Contractor's method statement.

12.3.12 Management of Storage and Handling of Non-Hazardous Material

Management Objective:

- Effective and safe management of materials on site, in order to minimise the impact of non-hazardous materials on the environment.

Target:

- No pollution due to handling, use and storage of non-hazardous material.

Management Actions:

- Materials to be suitably stored to prevent environmental contamination and visual impacts. Storage requirements to be determined based on chemical qualities of material and Material Safety Data Sheets (MSDS).
- Where required, stored material to be protected from rain and run-off to avoid environmental contamination.
- Materials to be appropriately transported to avoid environmental contamination. Loose loads (e.g. sand, stone chip, refuse, paper and cement) to be covered.
- Suitable remedial measures, depending on the nature of the contaminant and the receiving environment, to be instituted for spillages.

- Materials to be suitably used to prevent environmental contamination.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Evidence of spillages.
- MSDS register.
- Contractor's method statement.

12.3.13 Management of Storage and Handling of Hazardous Material

Management Objective:

- Ensure the protection of the natural environment and the safety of personnel on site, by the correct management and handling of hazardous substances.

Target:

- No pollution due to handling, use and storage of hazardous material.
- In the event of a spill, appropriate containment, clean up and disposal of contaminated material. Spills to be cleaned within 24 hours.

Management Actions:

- Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), the Occupational Health and Safety Act (Act No. 85 of 1993), relevant associated Regulations, and applicable SANS and international standards. Where required, the Contractor shall ensure he obtain the necessary authorisation/s or permit/s for the storage of hazardous chemical substances, including flammable substances.
- A copy of the MSDS for each hazardous chemical substance stored or used on site must be available on site and communicated to the relevant persons who might be exposed to the hazards thereof.
- Storage and use of hazardous materials will be strictly controlled to prevent environmental contamination, and must adhere to the requirements stipulated on the MSDS.
- Where flammable liquids are being used, applied or stored the workplace must be effectively ventilated.
- No person may smoke in any place in which flammable liquid is used or stored.
- Install an adequate number of firefighting equipment in suitable locations around the flammable liquids store.
- Where flammable liquids are decanted, the metal containers must be bonded or earthed.

- No flammable material (e.g. paper, cleaning rags or similar material) may be stored together with flammable liquids.
- Staff that will be handling hazardous materials must be trained to do so.
- Any hazardous materials (apart from fuel) must be stored within a lockable store with a impermeable floor. Suitable ventilation to be provided.
- All storage tanks containing hazardous materials must be placed in bunded containment facilities provided with impermeable surfaces. The bunded facility must be able to contain at least 110% of the total volume of the stored hazardous material.
- Fully stocked spill kits must be available for the clean-up of hazardous material spillages.
- Provide secondary containment where a risk of spillage exists.
- Drip trays to be placed under parked construction vehicles, equipment and other receptacles of hazardous material to prevent spillages.
- In the event of spillages of hazardous substances, the appropriate clean up and disposal measures are to be implemented.
- Spill reporting procedures to be displayed at all locations where hazardous substances are being stored.
- Hazardous materials will be disposed of at registered sites or handed to registered hazardous waste disposal facilities for disposal / recycling.
- Proper and timeous notification of any pollution incidents associated with hazardous materials.
- Hazardous chemical substances containers be clearly labelled with the contents and main hazardous category e.g. “Flammable” or “Corrosive”.
- Storage of material, chemicals, fuels, etc. must not pose a risk to the surrounding environment and this includes surface and groundwater. Such storage areas must be located outside the 1:100 year floodline of any watercourse and must be fenced to prevent unauthorised access into the area. Temporary bunds must also be constructed around chemical or fuel storage areas to contain possible spillages.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Evidence of spillages.
- MSDS register.
- Training register.
- Disposal certificates.
- Contractor’s method statement.

12.3.14 Management of Pollution Generation Potential

Management Objective:

- Ensure that all possible causes of pollution are mitigated as far as possible to minimise impacts to the surrounding environment.

Target:

- No complaints regarding pollution.
- No measurable signs of pollution.
- Noise – Comply with SANS 10103:2008.

Management Actions:

General –

- No waste of a solid, liquid or gaseous nature shall be emitted from the site without approval by the Engineer.
- Accidental pollution incidents shall be reported to the ECO immediately. The pollution incident to be cleaned-up by the Contractor or a nominated clean-up organization immediately.

Soil –

The following requirements for soil pollution management shall apply:

- Topsoil should be temporarily stockpiled, separately from (clay) subsoil and rocky material, when areas are cleared. If mixed with clay sub-soil the usefulness of the topsoil for rehabilitation of the site will be lost.
- Stockpiled topsoil should not be compacted and should be replaced as the final soil layer. No vehicles are allowed access onto the stockpiles after they have been placed.
- Topsoil stockpiles must not be contaminated with oil, diesel, petrol, waste or any other foreign matter, which may inhibit the later growth of vegetation and microorganisms in the soil.
- All cut and fill surfaces need to be stabilized with appropriate material or measures when major civil works are complete.
- Erosion and donga crossings must be dealt with as river crossings. Appropriate soil erosion and control procedures must be applied to all embankments that are disturbed and destabilized.
- All equipment must be inspected regularly for oil or fuel leaks before it is operated. Leakages must be repaired on mobile equipment or containment trays placed underneath immobile equipment until such leakage has been repaired.
- Soil contaminated with oil must be appropriately treated and disposed of at a permitted landfill site or the soil can be regenerated using bio-remediation methods.

- Channelling water into existing surface drainage system must reduce runoff.

Noise –

- The provisions of SANS 10103:2008 will apply to all areas at the perimeter of the site, within audible distance of residents.
- Working hours to be agreed upon with Project Manager, to minimise disturbance to affected landowners and community members.
- No amplified music will be allowed on the site. The use of radios, tape recorders, compact disc players, television sets etc. will not be permitted unless at a level that does not serve as an intrusion to adjacent landowners.
- Construction activities generating output levels of 85 dB or more will be confined to the hours during normal working hours.
- The Contractor will take preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to minimise complaints regarding noise and vibration nuisances from sources such as power tools.
- Cognisance must be taken of adjacent landowners in terms of the site layout. Ablution facilities or eating areas should ideally not be located directly adjacent to the site boundary where houses/offices as situated in a close proximity where odour or noise may become a nuisance.
- Noise control measures must be implemented. All noise levels must be controlled at the source. All employees must be given the necessary hearing protection equipment. Interested and affected parties must be informed of the excessive noise factors.
- The Contractor must inform all adjacent landowners of any after-hour construction activities and any other activity that could cause a nuisance e.g. the application of chemicals to the work surface. Normal working hours must be clearly indicated to adjacent landowners.

Dust –

- Appropriate dust suppression measures or temporary stabilising mechanisms to be used when dust generation is unavoidable (e.g. dampening with water, chemical soil binders, straw, brush packs, chipping), particularly during prolonged periods of dry weather. Dust suppression to be undertaken for all bare areas, including construction area, access roads, borrow pits, site yard, etc.
- Fine materials must be covered during transportation
- Speed limits to be strictly adhered to.
- The Contractor will take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, and pre-notification of affected parties).
- Where bulk hauling of spoil material is required to or from the site the Contractor must ensure loading bays of trucks used are covered with tarpaulins to prevent dust along driving routes to and from site.

Lights –

- Prior to construction the position and type of lighting will be planned to ensure unnecessary light pollution will be eliminated.
- All lighting installed on site must not lead to unacceptable light pollution to the surrounding community and natural environment (e.g. use of down-lights).

Erosion –

- Protect areas of the construction site that are susceptible to erosion through suitable measures (e.g. watering, planting, retaining structures, commercial anti-erosion compounds).
- Particular care must be taken to prevent carrying of sediment onto roadways and watercourses.
- Any erosion channels caused by construction activities to be suitably stabilised and rehabilitated.
- All efforts to prohibit ponding on surface and ensure stormwater runoff is channelled from the site must be made. The method used will be appropriate to the expected stormwater flows and the topography and geology of the site.
- Soil erosion control on site must be prevented at all times, i.e. pre-, during- and postconstruction activities.
- Erosion control measures to be implemented in areas sensitive to erosion such as near water supply points, edges of slopes, etc. These measures could include the use of sand bags, hessian sheets, retention or replacement of vegetation.

Cement and Concrete Batching –

- Cement mixing to take place on an impervious surface (e.g. cement mixing pit).
- Batching operations to take place in a designated area, which will be kept clean at all times.
- Location of batching plant to be approved by the Project Manager, with due consideration of the relevant management measures.
- Ensure separation of clean and dirty water from batching plant.
- Wastewater from batching operations to be suitably disposed of.
- Waste concrete and cement sludge to be removed on a regular basis (to prevent overflowing) and to be disposed of at a suitable facility.
- Unused cement bags will be stored in an area not exposed to the weather and packed neatly to prevent hardening or leakage of cement.
- Used cement bags will be stored so as to prevent windblown dust and potential water contamination. Used bags will be disposed of adequately at a licenced waste disposal facility.
- Limit concrete batching to single sites where possible.

- Concrete transportation will not result in spillage.
- Cleaning of equipment and flushing of mixers will not result in pollution, with all contaminated wash water entering the waste water collection system.
- Suitable screening and containment will be in place to prevent windblown contamination from cement storage, mixing, loading and batching operations.
- All contaminated water and fines from exposed aggregate finishes will be collected and stored in sumps and will be adequately disposed of.
- All visible remains of excess concrete will be physically removed on completion of the plastering or concrete pouring and disposed of in an acceptable manner.
- Any spilled concrete to be cleaned up immediately.

In practice all wastes arising from construction activities are to be handled; transported and disposed of in accordance with the relevant regulations. All efforts should be made to minimise, reclaim or recycle waste, and failing that, dispose of it in a manner licensed by the government for that purpose.

Pollution control –

- Remove from site all pollution containment structures.
- Remove from site all temporary sanitary infrastructure and waste water disposal systems. Take care to avoid leaks, overflows and spills and dispose of any waste in the approved manner.

Sewage –

- The Contractor shall provide sanitation facilities at all camps, offices, workshops and construction sites for staff and visitors.
- No form of secondary pollution should arise from the disposal of sewage and refuse. Any pollution problem arising from the above development is to be addressed immediately by the Applicant.

Wastewater –

- All runoff from fuel depots, workshops, truck washing areas and wash water from concrete vehicles and other equipment shall be collected and directed through oil traps before discharging into a watercourse.
- The Contractor shall provide suitable retention and filtration structures (which shall be properly maintained) for the collection of wastewater.

Solid waste –

Definition: "Refuse" refers to all construction waste (such as rubble, cement bags, waste cement, timber, can, other containers, wire and nails), household and office waste.

- Refuse shall be collected and stored in demarcated, fenced areas in skips and/or bins. The fenced areas or containers should be designed to prevent refuse from being blown out by wind and should be strategically and conspicuously placed throughout the site.
- Wherever possible, waste that is recyclable is to be recycled.
- Refuse which cannot be recycled shall be disposed of at a landfill site approved by the ECO. Refuse may not be burned nor buried on site.
- Construction rubble shall be disposed of in demarcated spoil dumps or at disposal sites approved by the ECO.

Hazardous substances –

The Contractor must ensure that:

- Employees receive the necessary information and training to be able to use and store hazardous chemical substances safely.
- Employees obey lawful instructions regarding:
    - The wearing and use of protective equipment.
    - The use and storage of hazardous chemical substances.
    - The prevention of the release of hazardous chemical substances.
    - The wearing of exposure monitoring and measuring equipment.
    - The cleaning up and disposal of materials containing hazardous chemical substances.
    - Housekeeping, personal hygiene and the protection of the environment.
- The risk assessments required in terms of Construction Regulations (2014) include employee exposure to hazardous chemical substances and that the necessary measures be taken to protect persons from being detrimentally affected by hazardous chemical substances present or used in the workplace.
- Suppliers provide the necessary information in the form of a material safety data sheet regarding a hazardous chemical substances required to ensure the safe use and storage of that substances.
- An up-to-date list is kept on site of hazardous chemical substances stored and used together with the material safety data sheet of the hazardous chemical substances.
- Hazardous chemical substances containers be clearly marked with the contents and main hazardous category e.g. “Flammable” or “Corrosive” and the reference number of the hazardous chemical substances on the list indicated above.
- Hazardous chemical substances, for example asbestos dust, are not cleared by using compressed air but should be vacuumed.
- No person eats or drinks in a hazardous chemical substances workplace.
- Hazardous chemical substances waste is disposed of safely in terms of hazardous waste disposal requirements.

Responsibilities:

- Project Manager and ECO – to check.
- Contractor to implement management actions.
- Contractor to conduct environmental monitoring for air quality (dust), noise and water quality.

Monitoring Requirements:

- Public complaints register.
- Evidence of pollution.
- Contractor's method statement.
- Disposal certificates.
- Proof of notification of affected landowners.

12.3.15 Management of Topsoil

Management Objective:

- Ensure suitable removal, storage, transportation of topsoil for reuse during rehabilitation.

Target:

- Adequate volume of recovered topsoil from disturbed areas to be stored for future use.
- No visual evidence of erosion from topsoil stockpiles.
- No visual evidence of erosion from areas where topsoil has been reinstated.

Management Actions:

- Topsoil from the construction camp should be stored for post-construction rehabilitation and landscaping work and should not be disturbed more than is absolutely necessary.
- The Contractor shall calculate the quantity of topsoil required for rehabilitation and landscaping and ensure sufficient topsoil is stored and preserved for such purpose. The depth of topsoil to be replaced shall be approved by the landscape architect.
- Topsoil should also be stored in such a way that does not compromise its plant-support capacity.
- Determine the average depth of the topsoil prior to excavations.
- Identify suitable areas to store topsoil.
- Stockpiled topsoil should not be compacted and should be replaced as the final soil layer. No vehicles are allowed access onto the stockpiles after they have been placed.
- Remove topsoil from areas to be affected by construction activities.
- Topsoil to be adequately protected from contamination from construction activities and by aggregate, cement, concrete, fuels, litter, oils, domestic and industrial waste.
- Protect stored topsoil from compaction.
- Wind and water erosion-control measures to be implemented to prevent loss of topsoil.
- Do not store topsoil in drainage lines or areas exposed to strong winds or heavy rain.

- Following the construction phase, the topsoil should be used in rehabilitation and landscaping of affected areas and landscaping around the development.
- Protect topsoil in order to avoid erosion loss on steep slopes.
- An ecologically-sound stormwater management plan must be implemented during construction and appropriate water diversion systems put in place.
- Vehicles and construction workers should under no circumstances be allowed outside the site boundaries to prevent impact on the surrounding vegetation.
- Where possible, natural vegetation must not be cleared and encouraged to grow.
- All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation.
- Disturbance of vegetation must be limited only to areas of construction.
- Prevent contamination of natural grasslands by any pollution.
- Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site.
- Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent further spread into the ridge.
- Avoid translocating stockpiles of topsoil from one place to sensitive areas in order to avoid translocating soil seed banks of alien species.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Contractor's method statement.
- Specialist studies.

12.3.16 Management of Excavations

Management Objective:

- Minimise environmental impacts associated with excavations.

Target:

- No damage to sensitive environmental features outside construction area during excavations.

Management Actions:

- Construction activities to remain within the designated construction areas.
- Subsoil and overburden should be stockpiled separately to be returned for backfilling in the correct soil horizon order.

- Suitable barricading to be erected around open excavations/trenches, as per the Construction Regulations (2014). Provide signage as a warning of open excavations.
- Divert runoff away from excavations, where necessary.
- Trench lengths will be kept as short as practically possible.
- Trench walls are to be stabilised using battering, shoring and bracing or similar techniques depending on the stability of the trench sides (where relevant).
- Inspect open trenches at least daily basis to ensure that animals have not become trapped. Such animals will be safely removed and released, where possible. Special equipment for handling of venomous snakes should be available on site to ensure safe removal.
- Filling of trenches to make provision for subsidence.
- Sub soil drainage system to be in place in order to ensure no seepage of groundwater into the trenches.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Barricading of excavations.
- Excavation register.
- Contractor's method statement.

12.3.17 Management of Visual Aspects

Management Objective:

- Minimise impacts to the aesthetics/visual quality.
- Ensure that the visual appearance of the construction site is not an eyesore the adjacent areas.

Target:

- No complaints regarding impacts to visual quality.

Management Actions:

- Advertising and lighting will be in accordance with relevant standards.
- Lighting must not constitute an eyesore/hazard to users of the road and the surrounding community.
- Lighting will be sufficient to ensure security but will not constitute 'light pollution' to the surrounding areas.
- The site will be shielded/screened to minimise the visual impact, where practicable.

- Where practicable, development designs to compliment the natural surroundings in order to preserve a sense of place.
- On-going housekeeping to maintain a tidy construction area.
- Discourage the unnecessary usage of high voltage lights during through-night construction. Lighting should be kept to an acceptable minimum and designed in position and height to minimise negative impact on surrounding landowners.
- The extent of unnecessary damage to natural surrounds must be kept to a minimum.
- The use of permanent signage and project construction signs should be minimised and visually unobtrusive.
- It must be ensured, wherever possible, that existing natural vegetation is to be retained during the construction and operational phases of the project and incorporated into the concurrent site rehabilitation especially in line of sight from sensitive receptors.
- Erosion, which may lead to high levels of visual contrast and further detract from the visual environment, must be prevented throughout the lifetime of the project by means of putting soil stabilisation measures in place where required and through concurrent rehabilitation.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Contractor's method statement.

12.3.18 Management of Flora

Management Objective:

- Preserve protected flora species outside of construction areas.
- Control alien plants and noxious weeds.

Target:

- No unpermitted disturbance to protected flora species.
- Ongoing eradication of alien plants and noxious weeds.

Management Actions:

- Comply with the requirements of the National Environmental Management: Biodiversity Act (No. 10 of 2004), National Forests Act (No. 84 of 1998) and National Veld and Forest Fire Act (No. 101 of 1998).

- Indigenous plants naturally growing on the proposed development area, but that would be otherwise destroyed during clearing for development purposes should be incorporated into landscaped areas.
- Vegetation clearing should be kept to a minimum, and this should only occur where it is absolutely necessary and the use of a brush-cutter is highly preferable to the use of earth-moving equipment.
- Rehabilitate all disturbed areas as soon as the construction is completed within the proposed development area.
- Ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm and this can be achieved through provision of appropriate awareness to all personnel.
- Vehicles and construction workers should under no circumstances be allowed outside the site boundaries to prevent impact on the surrounding vegetation.
- Where possible, natural vegetation must not be cleared and encouraged to grow.
- Disturbance of vegetation must be limited only to areas of construction.
- Prevent contamination of natural areas by any pollution.
- Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent further spread.
- No storage of building materials or rubbles are allowed in the sensitive areas, such as the riparian habitats.
- Avoid translocating stockpiles of topsoil from one place to sensitive areas in order to avoid translocating soil seed banks of alien species.
- The most significant way to mitigate the loss of habitat is to limit the footprint within the natural habitat areas remaining.
- No structures should be built outside the area demarcated for the development.
- Although it is unavoidable that sections of the road access and pipeline routes will need to traverse areas of potential sensitivity, the development should be constructed in such cases so as to avoid further impact to these areas.
- All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation.
- Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills and then compliance monitored by an appropriate person.
- Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks.
- Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use.
- Implement suitable erosion control measures.

- During construction, the construction area and immediate surroundings should be monitored regularly for emergent invasive vegetation.
- Promote awareness of all personnel.
- The establishment of pioneer species should be considered with the natural cycle of rehabilitation of disturbed areas, which assists with erosion control, dust and establishment of more permanent species. This can be controlled during construction phase and thereafter more stringent measures should be implemented during the rehabilitation and post rehabilitation.
- Larger exotic species that are not included in the Category 1b list of invasive species could also be allowed to remain for aesthetic purposes.
- All alien seedlings and saplings must be removed as they become evident for the duration of construction phase
- Manual / mechanical removal is preferred to chemical control.
- Topsoil should be stored in such a way that it does not compromise its plant-support capacity.
- Topsoil from the construction activities should be stored for post-construction rehabilitation work and should not be disturbed more than is absolutely necessary.
- Protect topsoil in order to avoid erosion loss on steep slopes.
- Protect topsoil from contamination by aggregate, cement, concrete, fuels, litter, oils, domestic and wastes.
- An ecologically-sound storm water management plan must be implemented during construction and appropriate water diversion systems put in place.
- Vehicles and construction workers should under no circumstances be allowed outside the site boundaries to prevent impact on the surrounding vegetation.
- Where possible, natural vegetation must not be cleared and encouraged to grow.
- All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation.
- Disturbance of vegetation must be limited only to areas of construction.
- Prevent contamination of natural grasslands by any pollution.
- Areas cleared of vegetation must be re-vegetated with indigenous plants local to the area prior to contractor leaving the site.
- Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent their spread.
- No unauthorised vehicles should be allowed to drive through the site during the construction activities.
- No dumping of any form is permitted.
- No damage and/or removal/trapping/snaring of indigenous plant or animal material for cooking and other purposes will be allowed.
- All areas to be affected by the proposed development will be rehabilitated by indigenous vegetation.

- Construction activities should be restricted to the development footprint area and then the compliance in terms of footprint can be monitored by ECO.
- All areas to be affected by the proposed project will be rehabilitated after construction and all waste generated by the construction activities will be stored in a temporary demarcated storage area, prior to disposal thereof at a licensed registered landfill site.
- As much vegetation growth as possible should be promoted within the proposed development site in order to protect soils and to reduce the percentage of the surface area which is left as bare ground. In this regard special mention is made of the need to use indigenous vegetation species as the first choice during landscaping. In terms of the percentage of coverage required during rehab and also the grass mix to be used for rehab, the EMPr will be consulted for guidance. However, the plant material to be used for rehabilitation should be similar to what is found in the surrounding area.
- Ecological sensitive areas and their appropriate buffers must be protected and should not be degraded by the activities arising from the proposed development.

Responsibilities:

- Proponent – acquire permits
- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Permits.
- Encroachment of alien invasive plants and noxious weeds.
- Successful rehabilitation.
- Contractor's method statement.

12.3.19 Management of Fauna

Management Objective:

- Ensure the protection of animals

Target:

- No direct/indirect harm to animals from construction activities.

Management Actions:

- Comply with the requirements of the National Environmental Management: Biodiversity Act (No. 10 of 2004), Natal Nature Conservation Ordinance 15 of 1974 and Animal Protection Act (No. 71 of 1962).
- Riparian habitat provides migratory corridors and in order to protect habitat for the detected African/Cape Clawless Otter, a buffer around riparian habitats is recommended.

- Any fauna (mammal and reptile) that becomes trapped in the trenches or in any construction or operational related activity may not be harmed and must be rescued and relocated by an experienced person.
- Training of construction workers to recognise threatened animal species will reduce the probability of fauna being harmed unnecessarily.
- The contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase.
- Vehicles must adhere to a speed limit, 30-40 km/h is recommended for light vehicles and a lower speed for heavy vehicles.
- All construction and maintenance vehicles must stick to properly demarcated and prepared roads. Off-road driving should be strictly prohibited.
- No fires should be allowed at the site
- No trapping or any other method of catching of any animal or bird may be performed on site
- No dogs or other domestic pets should be allowed at the site.
- The most significant way to mitigate the loss of habitat is to limit the footprint within the natural habitat areas remaining.
- No structures should be built outside the area demarcated for the development.
- Although it is unavoidable that sections of the road access and pipeline routes will need to traverse areas of potential sensitivity, the development should be constructed in such cases so as to avoid further impact to these areas.
- All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation.
- Any fauna (mammal, reptile and amphibian) that becomes trapped in the trenches or in any construction or operational related activity may not be harmed and must be rescued and relocated by an experienced person.
- Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent their spread.
- No unauthorised vehicles should be allowed to drive through the site during the construction activities.
- No trapping or any other method of catching of any animal may be performed on site.
- Illegal hunting is prohibited.
- No dumping of any form is permitted.
- No damage and/or removal/trapping/snaring of indigenous plant or animal material for cooking and other purposes will be allowed.
- All areas to be affected by the proposed development will be rehabilitated by indigenous vegetation.
- Construction activities should be restricted to the development footprint area and then the compliance in terms of footprint can be monitored by ECO.
- Animals residing within the designated area shall not be unnecessarily disturbed.

- During construction, refresher training must be conducted to construction workers with regards to littering and poaching.
- The Contractor and his/her employees shall not bring any domestic animals onto site.
- Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes.
- The disturbance of fauna should be minimized.
- Animals residing within the designated area shall not be unnecessarily disturbed.

Responsibilities:

- Proponent – acquire permits (if applicable)
- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Permits (if applicable).
- Contractor's method statement.

12.3.20 Management of Archaeological and Cultural Features

Management Objective:

- To have no adverse impact on the historical inheritance of the area.
- To avoid damage to or destruction of previously unknown or excavated archaeological artefacts during construction.
- The preservation and appropriate management of new findings should these be discovered during construction.

Management Target:

- No archaeological and cultural resources or graves to be damaged during construction.

Management Actions:

- If, during excavation for and construction of the weir and abstraction works, there are chance finds of heritage resources (for example, graves, fossils) then work must stop immediately and a heritage specialist called to site to inspect the find and decide the way forward. No work may be undertaken until the heritage specialist allows this.
- If any heritage resources are to be altered, removed or destroyed, then the correct permits must be obtained from Amafa prior to any action been undertaken.
- It is recommended that a Phase 2 HIA is undertaken when the pipeline route and access road are cleared of vegetation in order that the presence (or not) of heritage resources, including graves, is confirmed.

- For any chance finds of heritage resources, all work must cease in the area affected and the Contractor will immediately inform the Project Manager. A registered heritage specialist / palaeontologist must be called to site for inspection. Amafa must be informed about any finds.
- The heritage specialist will assess the significance of the heritage resource/s found and provide guidance on the way forward.
- Permits must be obtained from Amafa if heritage resources are to be removed, destroyed or altered.
- The following monitoring procedure should be followed in terms of chance fossil finds:
    - When excavations begin the rocks must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, plants, insects, bone, and coal) should be put aside in a suitably protected place. This way the construction activities will not be interrupted.
    - Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones. This information will be built into the EMPr's training and awareness plan and procedures.
    - Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
    - A qualified palaeontologist should visit the site to inspect the selected material and check the dumps where feasible. The frequency of inspections should be dependent on the finding of any potentially important fossil material.
    - Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site an Amafa and/or SAHRA permit must be obtained. Annual reports must be submitted to Amafa and SAHRA as required by the relevant permits.
    - If no fossils are found and the excavations have finished then no further monitoring is required.
- All heritage resources found close to the construction area must be protected by a 10m buffer in which no construction can take place. The buffer material (danger tape, fencing, etc.) must be highly visible to construction crews.
- Under no circumstances may any heritage material be destroyed or removed from site unless under direction of a heritage specialist.
- Should any remains be found on site that is potentially human remains, the South African Police Service (SAPS) should also be contacted. Members of the SAPS may not remove remains until the necessary permits have been obtained.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Permits (if applicable).
- Contractor's method statement.

12.3.21 Management of Water on site

Management Objective:

- Minimise environmental impacts associated with storm water as well as water services for construction workers.
- Minimise stormwater runoff from the site onto neighbouring roads.
- Minimise water use through recycling and water efficient practices.

Target:

- No visual evidence of erosion caused by wastewater or stormwater practices.
- No environmental contamination associated with wastewater or stormwater practices.

Management Actions:

- All construction activities and discharges to comply with the National Water Act (Act No. 36 of 1998).
- Adequate sedimentation control measures must be implemented where excavations or disturbance of drainage lines of a wetland may take place.
- All fuel, chemical, oil, etc. spills must be confined to areas where the drainage of water can be controlled. Use appropriate structures and methods to confine spillages such as the construction of berms and pans, or through the application of surface treatments that neutralise the toxic effects prior to the entry into a watercourse.
- Oil absorbent fibres must be used to contain oil spills in water.
- Water shall not be pumped directly from excavations into municipal stormwater drains. Such water must first be pumped into a filtration structure e.g. silt sock, to filter through prior to release.
- During construction through a wetland, the majority of the flow of the wetland should be allowed to pass downstream.
- Vehicular traffic across wetland areas must be avoided.
- No dumping of foreign material in streams, rivers and/or wetland areas is allowed.
- No fires or open flames are allowed in the vicinity of the wetland, especially during the dry season.
- No swimming, washing (including vehicles and equipment), fishing or related activity is permitted in a wetland or river without written permission from the Applicant.
- No disturbances to nesting, breeding and roaming sites of animals in or adjacent to wetland areas and sensitive areas.

- During the construction stage, water will be required for various purposes, such as concrete batching, washing of plant and equipment in dedicated areas, dust suppression, potable use by construction workers, etc. Water tankers will supply water to the site.
- Manage stormwater from construction site to avoid environmental contamination and erosion.
- Establish a dedicated vehicle maintenance area and wash-bay, where suitable storm water management measures are in place to prevent pollution.
- Manage stormwater from construction site to avoid environmental contamination and erosion.
- Stormwater runoff from workshops, vehicle maintenance area, wash-bays and other potential pollution sources shall be collected and treated in hydrocarbon separation pits/tanks before discharged to drains and waterways.
- Measures must be taken to divert unpolluted water and runoff away from the site.
- Ensure proper storage of material (including fuel, paint) that could cause water pollution.
- Ensure proper storage and careful handling of hazardous substances with spill prevention materials at hand.
- Reduce sediment loads in water from dewatering operations. All dewatering should be done through temporary sediment traps (e.g. straw bales, silt socks). These are to be serviced regularly and removed when no longer in use. Materials can be re-used.
- It is imperative there is proper management of stormwater on the site during and after construction.
- After construction, the site should be contoured to ensure free flow of runoff and to prevent ponding of water.
- Drainage must be controlled to ensure that runoff from the project area will not culminate in off-site pollution or result in damage to properties downstream of any stormwater discharge.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Water monitoring programme – discharges.
- Disposal certificates
- Contractor’s method statement.

12.3.22 Management of Watercourses

Management Objective:

- Ensure that the watercourses (including affected rivers, natural channels, and drainage lines) are protected and incur minimal negative impact to resource quality (i.e. flow, water quality, riparian habitat, morphology, and aquatic biota).
- Existing water use entitlements not to be affected.

Target:

- Minimise the habitat unit destruction and potential loss of wetland/aquatic-dependent biodiversity.
- Unaltered downstream flow regime.
- Ecological category not to be influenced by construction activities.

Management Actions:

- General –
    - Limit the amount of disturbances to local construction site only and confine most major construction to the dry season.
    - Implement an adequate water, sediment and biological monitoring programme together in the form of a management action plan.
    - Comply with the 2006 RDS requirements.
    - The recommended buffer zones should be strictly adhered to during the construction phase of the project, with exception of the activities and structures required to traverse a watercourse. This includes structures such as culverts for drainage lines and the weir structure itself. Any supporting aspects and activities, such as laydown and mixing yards, not required to be within the buffer area should adhere to the buffer zone.
    - In order to protect wetland areas for the abstraction works construction, a buffer zone of 55m was proposed. It is noted that the buffer zone is only applicable to secondary activities such as laydown yards and stockpiles.
    - The required buffer is then 29m and 15m for the construction and operational phases respectively.
    - The proposed pipeline required buffer is 15m for the construction and operational phases.
- Maintenance of Connectivity

The following fishway concepts should be adhered to in the preferred option:

- The fishway should have water passing through it during both high flows and low flows to encourage fish to make use of the fishway no matter the flow levels;
- The fishway should cater for both rheophilic (fastmoving water) and anti-rheophilic (slow moving water) fish species. This can be achieved through having several different flow velocity areas across the fishway;
- It is recommended that a rough stone surface be cast into the fishway channel floor to cater for climbing and crawling species;

- Rocks used for the fishway should have flat sides with rounded edges (typical of quarried rock) rather than rounded rocks, as they provide a variety of water velocity and depths that easy for fish to navigate;
- Pools or depressions of varying sizes and depths should be created at random throughout the length and width of the fishway and should be placed behind large rocks to create lower velocity resting areas (eddies) for fish. The more pools incorporated in the design, the more successful the fishway will be; and
- Additional guidelines for fishway design include:
  - Channel slope (gradients) – between 1/8 and 1/10 is recommended for South African fish;
  - Fishway entrance – furthest point upstream that the fish can penetrate, usually in a suitable pool (low turbulence with sufficient depth) located at the base of the low level weir;
  - Fishway exit – located in a quiet area, sheltered, low velocity to prevent fish from being swept downstream and to afford protection from predators;
  - the invert level of the exit (i.e. water inflow) should be lower than that of the weir overflow to ensure the low flows are directed down the fishway;
  - Depth of pool - small fish (20 to 200 mm in length: at least 300 mm to reduce predation and limit turbulence;
  - Larger fish (>200 mm): at least 500 mm can be deeper to reduce turbulence, if necessary;
  - Length of pool – at least 2.5 times the length of the largest fish catered for;
  - Drop height between pools/rock levels – maximum of 100 mm to cater for small fish;

- Mitigation for Altered Hydrology
- The Ecological Water Requirements (EWR) stipulated in DWS (2014) should be strictly adhered to for the proposed project. The EWR site 3 on the uMkhomazi River system is located approximately 7km downstream of the proposed weir. The table below (**Table 16**), presents the EWR for EWR site 3 on the uMkhomazi.

Table 16: Ecological Water Requirements (DWS, 2014)

Month	Low Flows		High Flows	
	Drought (90%) (m^3/s)	70% (m^3/s)	Daily Average (m^3/s)	Duration (Days)
Oct	2.249	3.076		
Nov	3.198	4.100	45	6

Month	Low Flows		High Flows	
	Drought (90%) (m^3/s)	70% (m^3/s)	Daily Average (m^3/s)	Duration (Days)
Dec	3.909	6.048	45	6
Jan	5.557	7.905	75	7
Feb	6.606	9.845	75	7
Mar	7.796	9.922	45	6
Apr	6.645	8.915		
May	4.736	6.412		
Jun	3.009	4.063		
Jul	1.659	2.980		
Aug	1.420	2.341		
Sep	1.647	2.651		

- A water bar diverts water flowing down a surface (e.g. road) to one side. This reduces the volume of water that flows down the surface and the subsequent erosion that occurs;
- During the excavation of watercourses, flows should be diverted around active work areas where required. Water diversion must be temporary and re-directed flow must not be diverted towards any stream banks that could cause erosion;
- Construction areas should be demarcated and watercourses marked as “restricted” in order to prevent the unnecessary impact too and loss of these systems;
- Storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion;
- Prevent uncontrolled access of vehicles through the wetlands that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas;
- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the water resources. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds; and
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.

- Mitigation for Impaired Water Quality Protection
    - Storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion;
    - Laydown yards, camps and storage areas must be beyond the water resource areas and associated buffers where applicable;
    - During construction contractors used for the project must have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
    - As much material must be pre-fabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site;
    - All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
    - All chemicals and toxicants during construction must be stored in bunded areas;
    - All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
    - Cofferdams are temporary structures used to displace water and provide dry access to usually submerged areas (such instream construction and maintenance of bridges etc). They can also be built to prevent water coming into contact with high impact zones (e.g. construction and mining sites) and reduce the amount of sedimentation and pollution;
    - Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
    - Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems;
    - No dumping of construction material on-site may take place; and
    - All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.
- Mitigation for Erosion and Sedimentation
    - Storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion;
    - During the excavation of watercourses, flows should be diverted around active work areas where required. Water diversion must be temporary and re-directed flow must not be diverted towards any stream banks that could cause erosion;
    - All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the water resources. All stockpiles must be protected

from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
    - A water bar diverts water flowing down a surface (e.g. road) to one side. This reduces the volume of water that flows down the surface and the subsequent erosion that occurs;
    - Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching; and
    - Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.
- Mitigation for Alien Invasive Plants
    - Quarterly vegetation rehabilitation surveys need to be conducted of the vegetation within the project footprint; and
    - An alien invasive plant management plan needs to be compiled and implemented prior to construction to control and prevent the spread of invasive aliens.
- An aquatic monitoring programme is recommended by the Aquatic and Wetland Specialist. Details pertaining to this monitoring programme are provided below in **Table 17**.

Table 17: Aquatic Biomonitoring Programme

Component	Details
Survey Period	Annual monitoring during the low flow period (April-October) for a period of 5 years through construction and into operation.
Survey Location	A site upstream, adjacent and downstream of the abstraction works should be surveyed.
Survey Method	The techniques applied in this study should be utilised. Alternatively, other approved methods can be adapted.

- Mitigation for Release of Sediment
    - The release of sediment back to the river facilitates the impacts the project will have on sediment load within the river and estuary. The placement of 5 814 ton/a additional sediment in the river by flushing at Ngwadini and 29 673 ton/a sediment at Goodenough is supported.
    - Flushing of sediments should only be carried out during small floods and not under normal or low river flow conditions.
    - It is recommended to investigate and implement the exploitation of other sources of sand, instead of sandmining

- As mitigation measure, consideration should be given to apply long settlers at the proposed Ngwadini abstraction works to settle out smaller grain sizes (fine sand and silt), which could be flushed back to the river during floods.
- To further minimize the impact of the abstraction works on the river and to assist restoration of the sediment balance, flushing of boulder traps and gravel traps should be of a short duration, of non-cohesive sediment and aerated, and only during floods.
- If the settler at the Goodenough weir is to return the flushed sediment, this should be done during floods even though relatively short settlers typically cannot trap the washload. Provision should be made in the design of the rising main to the WTP to ensure that the velocity in the pipe is higher than the scour velocity for the washload.

Responsibilities:

- Project Manager and ECO – to monitor compliance.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Water monitoring programme – discharges.
- Disposal certificates.
- Contractor's method statement.

12.3.23 Management of Estuary Impacts

Management Objective:

- Ensure that the uMkhomazi Estuary is protected and incurs minimal negative impact to resource quality (i.e. flow, water quality, riparian habitat, morphology, and aquatic biota).

Target:

- Minimise the habitat unit destruction and potential loss of biodiversity.
- Downstream water quality to remain within acceptable ranges, as determined through baseline monitoring.
- Ecological category not to be influenced by construction activities.

Management Actions:

- To achieve the REC for the estuary, namely ensuring that minimum freshwater flow at the head of the estuary should not drop below 1.2 m^3/s.
- Limit time taken to complete construction activities in the uMkhomazi River.
- Constrain spatial extent of impacts to the minimum required.
- Redirect water flow downstream of weir.
- Return sediment to system guided by an appropriate management scenario.

- It is recommended that projected water requirements for the Lower uMkhomazi Bulk Water Supply Scheme (LUBWSS) should be achieved through implementation of one of the flow scenarios identified in the Mvoti to Umzimkulu Classification study (DWS 2014) that enabled the uMkhomazi estuary to achieve the Recommended Ecological Category (REC) for the system of a "B" (viz. MK21, MK22, MK23, and MK42). The Mvoti to Umzimkulu Classification study (DWS 2014) also included a number of additional non-flow related environmental offset interventions that should be implemented in conjunction with the recommended flow scenario. While it is recognised that most of these interventions are not within the power of Umgeni Water to implement these are nonetheless included here for completeness:
  - Remove sandmining from the upper reaches below the Sappi Weir to increase natural function, i.e. restore intertidal area;
  - Restoration of vegetation upper reaches and along the northern bank, e.g. remove aliens and allow disturbed land to revert to natural land cover (is already on upwards trajectory);
  - Curb recreational activities in the lower reaches through zonation and improve compliance;
  - Reduce/remove castnetting in the mouth area through estuary zonation or increase compliance; and
  - Relocate upstream, or remove, the Sappi Weir to restore upper 15% of the estuary.
- Detailed baseline and long-term monitoring requirements to ascertain impacts of changes in freshwater flow to the uMkhomazi estuary and any improvement or reductions therein are listed in Mvoti to Umzimkulu Classification study (DWS 2014) and are replicated in **Tables 18** and **19** below. Ultimate responsibility for implementing these monitoring activities resides with the Department of Water and Sanitation (DWS). However, given that Umgeni Water will be the primary recipients of the water abstracted from the uMkhomazi River, they should be expected to fund the baseline (Year 1) monitoring costs at least (**Table 19**).

Table 18: Recommended baseline monitoring requirements

Ecological Component	Monitoring Action	Temporal Scale (Frequency And When)	Spatial Scale (No. Stations)
Hydrodynamics	Record water levels	Continuous	At bridge
	Measure freshwater inflow into the estuary	Continuous	Above the estuary
	Aerial photographs of estuary (spring low tide)	Every 3 years	Entire estuary
Sediment dynamics	Bathymetric surveys: Series of cross-section profiles and a longitudinal profile collected at fixed 500 m intervals, but in more detailed in the mouth (every 100m). The vertical accuracy should be about 5 cm.	Every 3 years	Entire estuary

Ecological Component	Monitoring Action	Temporal Scale (Frequency And When)	Spatial Scale (No. Stations)
	Set sediment grab samples (at cross section profiles) for analysis of particle size distribution (PSD) and origin (i.e. using microscopic observations)	Every 3 years (with invert sampling)	Entire estuary (6 stations)
Water quality	Measurements of organic content and toxic substances (e.g. trace metals and hydrocarbons) in sediments along length of the estuary, where considered an issue (must also include sediment grain size analysis of samples).	Every 3 - 6 years	Focus on sheltered, depositional areas
Microalgae	▪ Record relative abundance of dominant phytoplankton groups, i.e. flagellates, dinoflagellates, diatoms and blue-green algae. ▪ Chlorophyll-a measurements taken at the surface, 0.5 m and 1 m depths, under typically high and low flow conditions using a recognised technique, e.g. HPLC. ▪ Intertidal and subtidal benthic chlorophyll-a measurements.	Monthly sampling for 2 years (seasonal trends)	Entire estuary (5 stations)
Fish	Record species and abundance of fish, based on seine net and gill net sampling. The data will establish Zone specific baselines and provide a measure of natural variability. They should be based on replicate sampling of stations and wet and dry seasons.	Late spring, summer and two winter survey every year for 3 years	Entire estuary (9 stations) (increase to 12 to include Zone D)
Birds	Undertake counts of all water associated birds, identified to species level.	A series of monthly counts for a yea	Entire estuary (3 sections)

Table 19: Recommended long-term monitoring requirements for the uMkhomazi estuary

Ecological Component	Monitoring Action	Temporal Scale (Frequency And When)	Spatial Scale (No. Stations)
Hydrodynamics	Record water levels	Continuous	At bridge
	Measure freshwater inflow into the estuary	Continuous	Above the estuary
	Aerial photographs of estuary (spring low tide)	Every 3 years	Entire estuary
Sediment dynamics	Bathymetric surveys: Series of cross-section profiles and a longitudinal profile collected at fixed 500 m intervals, but in more detailed in the mouth (every 100 m). The vertical accuracy should be about 5 cm.	Every 3 years	Entire estuary
	Set sediment grab samples (at cross section profiles) for analysis of PSD and origin (i.e. using microscopic observations).	Every 3 years (with invert sampling)	Entire estuary (6 stations)
Water quality	Water quality (e.g. system variables, nutrients and toxic substances) measurements on river water entering at the head of the estuary.	Monthly continuous	DWS WQ monitoring station(U1H006)
	Longitudinal salinity and temperature profiles ((and any other in situ measurements possible e.g. pH, DO, turbidity) collected during high and low tide at: End of low flow season (i.e. period of maximum	Seasonally every year	Entire estuary (9 stations)

Ecological Component	Monitoring Action	Temporal Scale (Frequency And When)	Spatial Scale (No. Stations)
	seawater intrusion/closed mouth). Peak of high flow season (i.e. period of maximum flushing by river water).		
	Water quality parameters (i.e. system variables, and inorganic nutrients) taken along the length of the estuary (at least surface and bottom samples).	Coinciding with biotic surveys or when significant change in quality expected	Entire estuary (9 stations)
	Measurements of organic content and toxic substances (e.g. trace metals and hydrocarbons) in sediments along length of the estuary, where considered an issue (must also include sediment grain size analysis of samples).	Every 3 - 6 years	Focus on sheltered, depositional areas
Microalgae	Record relative abundance of dominant phytoplankton groups, i.e. flagellates, dinoflagellates, diatoms and blue-green algae. Chlorophyll-a measurements taken at the surface, 0.5 m and 1 m depths, under typically high and low flow conditions using a recognised technique, e.g. HPLC, fluoroprobe. Intertidal and subtidal benthic chlorophyll-a measurements,	Summer and winter survey every 3 years	Entire estuary (5 stations)
Macrophytes	Map the area covered by the different macrophyte habitats during a field survey. Compile a species list and check for expansion of invasive plants, reed, sedge and grass areas.	Summer survey every 3 years	Entire estuary
Invertebrates	Record species and abundance of zooplankton, based on samples collected across the estuary at each of a series of stations along the estuary; Record benthic invertebrate species and abundance, based on subtidal and intertidal core samples at a series of stations up the estuary, and counts of hole densities; Measures of sediment characteristics at each station	Winter/low flow survey every year	Entire estuary (6 stations) include extra upper station if weir removed
Fish	Record species and abundance of fish, based on seine net and gill net sampling.	Late spring/ summer and winter survey every year. Repeated within season if any Ecospec is not met	Entire estuary (9 stations) (increase to 12 to include Zone D)
Birds	Undertake counts of all water associated birds, identified to species level.	Winter and summer surveys every year Coordinated Waterbird Counts (CWAC)	Entire estuary

Responsibilities:

- Project Manager and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Aquatic monitoring survey
- Water monitoring programme – discharges.
- Disposal certificates
- Contractor's method statement.

12.3.24 Management of Rehabilitation and Landscaping

Management Objective:

- Adequate reinstatement and rehabilitation of construction areas
- Conduct concurrent or progressive rehabilitation of areas affected by construction activities that are situated outside of the construction footprint.

Target:

- Complete site clean-up.
- Reinstate and rehabilitate areas disturbed by construction activities that are located outside of the construction area.
- Landscaping of the finished development to complement the surrounding area.

Management Actions:

Removal of structures and infrastructure

- After the construction phase, the area disturbed outside of the pipeline servitude must be rehabilitated by appropriate landscaping, levelling, topsoil dressing, land preparation, alien plant eradication and vegetation establishment.
- Clear and completely remove from site all construction plant, equipment, storage containers, temporary fencing, temporary services, and fixtures.
- Ensure that all access roads utilised during construction which are outside of the development site and not earmarked for use during the operational phase, are returned to a state no worse than prior to construction.

Inert waste and rubble

- Clear the site of all inert waste and rubble, including surplus rock, foundations and batching plant aggregates. After the material has been removed, the site shall be re-instated and rehabilitated.
- Remove from site all domestic waste and dispose of in the approved manner at a registered waste disposal site.

Hazardous waste and pollution control

- Remove from site all pollution containment structures.

- Remove from site all temporary sanitary infrastructure and wastewater disposal systems. Take care to avoid leaks, overflows and spills and dispose of any waste in the approved manner.
- Comply with relevant provisions under the following EMPr sections: *Management of Storage and Handling of Hazardous Material, Management of Water, Management of Waste, Management of Pollution Generation Potential*.

Landscaping

- In general, no slopes steeper than 1(V):3(H) are permitted in cut-and-fill areas, unless otherwise specified by the Project Manager.
- Programme the backfill of excavations so that subsoil is deposited first, followed by the topsoil. Compact in layers for best results.
- Monitor backfilled areas for subsidence (as the backfill settles) and fill depressions using available material.
- Ensure that no excavated material or stockpiles are left on site and that all material remaining after backfill is landscaped or removed from site and disposed of at a suitable licensed waste disposal site.
- Rehabilitate construction camp according to DWAF's Integrated Environmental Management Series No.6: Environmental Best Practice Specifications (Construction).

Topsoil replacement and soil amelioration

- Execute top soiling activity prior to the rainy season or any expected wet weather conditions.
- Execute topsoil placement only after all construction work has ceased.
- Replace and redistribute stockpiled topsoil together with herbaceous vegetation, overlying grass and other fine organic matter in all disturbed areas of the construction site, including temporary access routes. Replace topsoil to the original depth.
- Place topsoil 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 areas of similar quality.
- The suitability of substitute material will be determined by means of a soil analysis addressing soil fraction, fertility, pH and drainage.
- Do not use topsoil suspected to be contaminated with the seed of alien vegetation (e.g. black wattle). Alternatively, the soil is to be appropriately treated.
- Ensure that stormwater run-off is not channelled alongside the gentle mounding, but that it is taken diagonally across it.
- Shape remaining stockpiled topsoil not utilised elsewhere in an acceptable manner so as to blend in with the local surrounding area.

- Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed and there should be an on-going monitoring program to control and/or eradicate newly emerging invasives.
- Machines should remove the stone material and transported to another location and re-used if it is required, removed correctly to a licensed facility.
- The geotextile base material, and other foreign material should also then removed during rehabilitation.

Ripping and scarifying

- Rip and/or scarify all areas following the application of topsoil to facilitate mixing of the upper most layers. Whether ripping and/or scarifying is necessary will be determined based on the site conditions immediately before these works begin.
- Rip and/or scarify all disturbed (and other specified) areas of the construction site, including temporary access routes and roads, compacted during the execution of the works.
- Rip and/or scarify along the contour to prevent the creation of down-slope channels.
- Do not rip and/or scarify areas under wet conditions, as the soil will not break up.
- The area should be ripped to an appropriate depth (at least 300mm) to remove any minor compaction.

Planting

- The areas that have been denuded and disturbed as a result of the construction on site must be vegetated with indigenous vegetation as soon as possible.
- No exotic plants may be used for rehabilitation purpose, only indigenous plants of the area may be utilised.
- All planting work is to be undertaken by suitably experienced personnel, making use of the appropriate equipment.
- Transplant trees and shrubs into designated positions.
- Establish further specifications for transplanted plants.
- Plant all trees, shrubs and individual plants in designated positions.
- Planting should preferably be done during the rainy season.
- After planting, each plant must be well watered, adding more soil upon settlement if necessary.
- Establish further specifications for nursery plants.
- 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 will large ones. These should be potted and kept under nursery conditions until they are large enough to plant out.

Grassing

- Suitably trained personnel must undertake grassing by making use of the appropriate equipment and grass species as specified by the terrestrial ecologist.
- Sodding may be done at any time of the year, but seeding must be done during the summer when the germination rate is better.
- Hydroseeding with a winter mix will only be specified where regrassing is urgent, and cannot wait for the summer.
- Establish further specifications for sods, runners and hand seeding.

Maintenance

- Monitor the re-growth of invasive vegetative material for at least one year after construction.
- Revegetation must match the vegetation type, which previously existed, unless otherwise indicated by a suitable specialist.
- For planted areas that have failed to establish, replace plants with the same species as originally specified.

12.4 Operational Phase

12.4.1 General Environmental Management

Note that where any activity and aspect associated with the operational phase of the project coincides with the receiving environment and activities of the construction phase (see **Section 13.3**), the same management requirements will apply.

12.4.2 Vegetation

- Cordon off areas that are under rehabilitation as no-go areas.
- Control invasive plant species and noxious weeds by means of extraction, cutting or other approved methods.
- Establish further specifications for maintenance.

12.4.3 Fauna

- The disturbance of fauna should be minimized.
- Animals residing within the designated area shall not be unnecessarily disturbed.
- Proper access control to be maintained.
- The contractor may under no circumstances interfere with any animal or livestock without the landowner being present. This includes the moving of livestock where they interfere with maintenance activities.
- Ensure that suitable fencing is erected to ensure that livestock does not wander into dangerous areas.

- Maintenance workers and machinery to remain inside servitude areas. All labourers to be informed of disciplinary actions for the wilful damage to plants and animals.

12.4.4 Energy

- Use passive design strategies to minimise energy consumption of the buildings.
- Ensure energy efficient infrastructure lighting is used (streetlights, traffic lights etc. uses LED).
- Ensure that a renewable energy strategy is followed, where the facility should generate as much as it uses.

12.4.5 Waste Management

- Develop and implement a waste management system, based on the waste management hierarchy of reduce, re-use, recycle, treatment and disposal.
- A minimum if 70% of the waste must be recycled in the precinct and buildings.
- All occupants must be encouraged to apply best practice in terms of waste management.
- Recycling facilities to be provided on site (bins for organic, plastic, tins, paper, garden waste and composting).

12.4.6 Water Use and Conservation

- A watercourse monitoring program will be implemented to ensure that all affected watercourses are adequately rehabilitated.
- Measures will be implemented to minimise the loss of water at any point.
- Introduce water recycling methods (rainwater harvesting) where possible.
- Ensure efficient fitting and fixtures.

12.4.7 Spillages

- Spillages of hazardous material (e.g. hydrocarbons) to be appropriately cleaned.
- Large spillages of hazardous material (>15litres depending on the nature of the material and the receiving environment), to be cleaned and remediated by a competent service provider.
- Hazardous waste to be appropriately disposed of.

12.4.8 Stormwater Management

- Implement a stormwater management plan for the development. No ponding of water should be allowed on the development.
- Prevent water quality deterioration of the receiving watercourses from stormwater discharges.

- Prevent erosion associated with stormwater runoff.
- No illegal discharges into the stormwater system to be allowed.