

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

**PROPOSED HYDROPOWER STATION AND
ASSOCIATED INFRASTRUCTURE AT
BOEGOEBERG DAM ON THE ORANGE RIVER,
NEAR GROBLERSHOOP, NORTHERN CAPE.**

**DEA Reference No: 14/12/16/3/3/2/568
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**DRAFT LIFE-CYCLE ENVIRONMENTAL
MANAGEMENT PROGRAMME**

2 December 2013



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ABBREVIATIONS

CEMP	Construction Phase Environmental Management Programme
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DWA	Department of Water Affairs
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Assessment Reports
EMP	Environmental Management Programme
LEMP	Life-Cycle Environmental Management Programme
NEMA	National Environmental Management Act (No. 107 of 1998)
OHS	Occupational Health and Safety Act (No. 85 of 1998)
OEMP	Operational Phase Environmental Management Programme
SDEMA	Specification Data Environmental Management
SKA	Square Kilometre Array
SPEC EMA	Specification Environmental Management

1 OVERVIEW

This document represents the Life-Cycle Environmental Management Programme (LEMP) for the environmental management of the proposed 11 Megawatt (MW) hydropower station and associated infrastructures at Boegoeberg Dam on the Orange River, near Groblershoop in the Northern Cape.

1.1 Purpose of the LEMP

The LEMP has been included in the Environmental Impact Assessment Report (EIR) in order to provide a link between the impacts identified in the Environmental Impact Assessment (EIA) Process and the actual environmental management on the ground during project implementation and operation. The purpose of this document is to provide for environmental management throughout the following life-cycle stages of the proposed development:

- Planning and design,
- Pre-construction and construction,
- Operation, and
- Decommissioning.

Furthermore, this LEMP aims for alignment and optimisation of environmental management processes with conditions of authorisation that may arise, thereby ensuring that identified environmental considerations are efficiently and adequately taken into account during all stages of development.

1.2 Legal requirements of Environmental Management Programmes

In terms of the EIA Regulations (Regulation 543 of 18 June 2010) enacted in terms of the National Environmental Management Act (no. 107 of 1998) (as amended) (NEMA), the proposed project triggers the following:

- Activities 1 (i) and (ii), 9 (i, ii (a and b)), 10, 11 and 18 of Regulation R544 (18 June 2010);
- Activity 10 of Regulation R545 (18 June 2010); as well as
- Activity 4, 13, 14 and 16 of Regulation R546 (18 June 2010).

As the proposed project triggers listed activities in terms of Regulation R544, R545 and R546 it is necessary to submit an EIA to the Department of Environmental Affairs (DEA) for Environmental Authorisation (EA). Section 22(l) of the EIA Regulations require that a draft Life-cycle Environmental Management Programme (LEMP) is submitted as part of the EIR.

The contents of the EMP must meet the requirements outlined in Section 24N (2) and (3) of NEMA and Section 33 of the EIA Regulations. The EMP must address the potential environmental impacts of the proposed activity on the environment throughout the project life-cycle including an assessment of the effectiveness of monitoring and management arrangements after implementation. The Department requires that the EMP be submitted together with the EIR so that it can be considered simultaneously. Table 1 lists the requirements

of an LEMP as stipulated by Section 33 of the EIA Regulations R543. Table 2 lists the requirements of an LEMP as stipulated by Section 24N (2) and (3) of the NEMA.

Table 1: Section 33 of EIA Regulation R543 listing the requirements of an EMP

33.	<i>A draft environmental management programme must comply with section 24N of the Act and include –</i>
(a)	<i>details of –</i>
	<i>(i) the person who prepared the environmental management programme; and</i>
	<i>(ii) the expertise of that person to prepare an environmental management programme;</i>
(b)	<i>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 these Regulations, including environmental impacts or objectives in respect of—</i>
	<i>(i) planning and design;</i>
	<i>(ii) pre-construction and construction activities;</i>
	<i>(iii) operation or undertaking of the activity;</i>
	<i>(iv) rehabilitation of the environment; and</i>
	<i>(v) closure, where relevant.</i>
(c)	<i>a detailed description of the aspects of the activity that are covered by the draft environmental management programme;</i>
(d)	<i>an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);</i>
(e)	<i>proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;</i>
(f)	<i>as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures;</i>
(g)	<i>a description of the manner in which it intends to—</i>
	<i>(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;</i>
	<i>(ii) remedy the cause of pollution or degradation and migration of pollutants;</i>
	<i>(iii) comply with any prescribed environmental management standards or practices;</i>
	<i>(iv) comply with any applicable provisions of the Act regarding closure, where applicable;</i>
	<i>(v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;</i>
(h)	<i>time periods within which the measures contemplated in the environmental management programme must be implemented;</i>
(i)	<i>the process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;</i>
(j)	<i>an environmental awareness plan describing the manner in which—</i>
	<i>(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and</i>
	<i>(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;</i>
(k)	<i>where appropriate, closure plans, including closure objectives.</i>

Section 24N (2) and (3) of the NEMA listing the requirements of an LEMP are given in **Table 2**.

Table 2: Section 24N (2) and (3) of the NEMA listing the requirements of an LEMP

24N.(2)	<i>the environmental management programme must contain-</i>
(a)	<i>information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts or objectives in respect of –</i>
	<i>(i) planning and design;</i>

	(ii) <i>pre-construction and construction activities;</i>
	(iii) <i>the operation or undertaking of the activity in question;</i>
	(vi) <i>the rehabilitation of the environment; and</i>
	(vii) <i>closure, where relevant.</i>
(b)	<i>details of –</i>
	(i) <i>the person who prepared the environmental management programme; and</i>
	(ii) <i>the expertise of that person to prepare an environmental management programme</i>
(c)	<i>a detailed description of the aspects of the activity that are covered by the draft environmental management plan;</i>
(d)	<i>information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);</i>
(e)	<i>information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance.</i>
(f)	<i>as far as is reasonable practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and</i>
(g)	<i>a description of the manner in which it intends to-</i>
	(i) <i>modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;</i>
	(ii) <i>remedy the cause of pollution or degradation and mitigation of pollutants; and</i>
	(iii) <i>comply with any prescribed environmental management standards or practices.</i>
(3)	<i>the environmental management programme must, where appropriate-</i>
(a)	<i>set out time periods within which the measures contemplated in the environmental management programme must be implemented;</i>
(b)	<i>contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of prospecting or mining operations or related mining activities which may occur inside and outside the boundaries of the prospecting area or mining area in question; and</i>
(c)	<i>develop an environmental awareness plan describing the manner in which-</i>
	(i) <i>the applicant intends to inform his or her employees of any environmental risk which may result from their work; and</i>
	(ii) <i>risks must be dealt with in order to avoid pollution or the degradation of the environment.</i>

The Department of Environmental Affairs & Development Planning (DEA&DP)'s¹ *Guideline for Environmental Management Plans* (2005) aims to inform and guide the preparation and implementation of EMP's. The guideline defines EMPs as:

“an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the project are enhanced”.

The legislation hereby aims to ensure that effective environmental management is implemented throughout the life cycle of the project via the translation of EIA management actions into the LEMP.

Boegoeberg Hydro (Pty) Ltd (Boegoeberg Hydro) therefore has the responsibility to ensure that the proposed activity as well as the EIA process conforms to the principles of NEMA. In developing the EIA process, Aurecon South Africa (Pty) Ltd (Aurecon) has been cognisant of this need, and accordingly the EIA process has been undertaken in terms of NEMA.

¹ Please note that DEA&DP's guideline is used even though the proposed project is based in the Northern Cape, as DEA has not compiled a guideline on EMPs.

This LEMP aims to meet the EMP requirements as legislated by the NEMA Regulations as well as complying with the DEA&DP guideline document for an EMP². It should however be noted that no guideline or guidance exists in terms of best practice approach to LEMPs. This document should thus be seen in an iterative context allowing for amendments throughout the life-cycle of the project, allowing for adjustments as new information is made available.

The LEMP also aims to fulfil part of Principle 4 of the Equator Principles (EP)³. Principle 4 of the EP requires the borrower to develop an Action Plan (AP)⁴ to describe and prioritise the actions needed to implement mitigation measures. As the purpose of the LEMP is to ensure implementation of all proposed mitigation measures throughout the lifecycle of the project, it fulfils the following requirement of Principle 4 of the EP:

“The AP will describe and prioritise the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment.”

The following IFC Performance Standards are applicable as part of the EP:

- Performance Standard 1: Social & Environmental Assessment & Management System
- Performance Standard 2: Labor and Working Conditions
- Performance Standard 3: Pollution Prevention and Abatement
- Performance Standard 4: Community Health, Safety and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

This LEMP should be read in conjunction with the above-mentioned standards.

This document was compiled through incorporating general mitigation measures applicable to most developments, as well as specialist recommendations for mitigating impacts that were identified as being unavoidable for this specific project. These mitigation measures aim to reduce the significance of the identified impacts. The LEMP addresses socio-economic as well as biophysical impacts. In addition to recommendations from the EIA, the LEMP will also be updated to incorporate conditions of the EA.

1.3 Structure of the LEMP

As discussed above, the LEMP aims to address environmental management throughout the project life-cycle, from planning and design, through construction, to operation and potential decommissioning.

² Lochner, P. 2005. *Guideline for EMPs*. CSIR Report No ENV-S-C 2005-053 H. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

³ EP were developed by the Equator Principles Financial Institutions (EPFIs) in order to ensure that the projects they finance are developed in a manner that is socially responsible and reflect sound environmental management practices.

⁴The Action Plan may range from a brief description of routine mitigation measures to a series of documents (e.g., resettlement action plan, indigenous peoples plan, emergency preparedness and response plan, decommissioning plan, etc). The level of detail and complexity of the Action Plan and the priority of the identified measures and actions will be commensurate with the project's potential impacts and risks.

The LEMP has been structured to include the following sections:

- Chapter 2: Description of project
- Chapter 3: Summarising environmental management influencing the planning and design of the proposed project
- Chapter 4: Construction EMP based on identified impacts and mitigation measures from the EIR
- Chapter 5: Operational Framework based on identified impacts and mitigation measures from the EIR
- Chapter 6: Monitoring programmes
- Chapter 7: Decommissioning Phase
- Chapter 8: Conclusion

1.4 Expertise of Environmental Assessment Practitioners

Section 33 of EIA Regulations and Section 24N (2) and (3) of the NEMA requires that an EMP must include the details of the person(s) who prepared the EMP, and the expertise of that person to prepare an EMP. In this regard, the *Curriculum Vitae* of the Environmental Assessment Practitioners who compiled the LEMP are included in **Appendix A**.

2 BACKGROUND INFORMATION

This section outlines how environmental considerations have informed and been incorporated into the planning and design phases of the proposed hydropower facility. Detailed design is usually undertaken as part of the pre-construction phase as it is a costly undertaking which is generally only performed once all required authorisations have been obtained. Thus, the planning and design phases discussed are limited to those associated with the pre-authorisation phases. Mitigation measures have been recommended for the detailed design phase.

2.1 Project Description

Boegoeberg Hydro initially proposed to construct a 11MW hydropower facility on the farm Zeekoebaart (*Remainder of Farm no. 306 and Portion 1 of Farm no. 306*), approximately 26km south east of the town of Groblershoop in the Northern Cape.

The proposed facility would be a run-of-river hydropower scheme capable of producing approximately 11MW of electricity through two or three Kaplan turbines, each having equal capacity. Run-of-the-river facilities use conventional hydropower technology to produce electricity by using the natural flow and drop in elevation of a river and diverting the flow and passing it through turbines that spin generators. There would be no storage of water off-stream and the power station would thus be subject to seasonal river flows, and would not operate during low flow periods. It is estimated that the Boegoeberg hydropower facility would generate enough energy to power for, on average, 30,000 homes.

The run-of-river hydropower station, as proposed, would consist of the following main components:

- Intake infrastructure:
 - The existing Boegoeberg Weir
 - Off-take weir (below the normal water surface level) constructed in the Boegoeberg Weir pool to regulate flow into the water conveyance infrastructure and provide a physical barrier against the drawdown of water below agreed levels and ensure irrigation flows and environmental flows;
 - Inlet structure, which may contain up to two gates that close automatically to stop flow to the power chamber in the event of floods and in emergency situations;
- Temporary upstream and downstream caissons (coffer dams) will be required to exclude water from the works for the construction phase;
- Water conveyance infrastructure (i.e. canal or tunnel) to direct water from the river to the power chamber;
- Head pond/ forebay to temporarily store water so that flow to the power chamber is regulated, allowing a steady flow to the turbines. The headpond also allows for the extraction of sediment from the water (only required for the canal option);
- Power station intake structure/ penstock (only required for the canal option), comprising a sluice, gate or enclosed pipe intake structure which further assists in controlling the transfer of water to the power chamber;
- Power chamber to house the turbines and equipment used to generate electricity; and

- Outlet works/ tailrace to return the abstracted water back into the river, downstream of the power chamber.

Ancillary infrastructure includes access roads for use during construction and for maintenance purposes during operation, sediment basins, and transmission line for evacuating the energy produced by the hydropower station to the Eskom national grid, a switchroom, and transformer yard.

The following alternatives were assessed in the EIA:

- **Location alternatives** – Boegoeberg Dam, Farm 306 Zeekoebaart.
 - Only the current location of the proposed hydropower station was considered.
- **Activity alternatives**
 - Energy generation by means of a hydropower station; and
 - “No-go” alternative to hydropower energy production.
- **Site layout alternatives**
 - Two water conveyance pond alternatives, tunnel (preferred) or open canal;
- **Routing Alternatives**
 - Two Transmission line and road access alternatives.
- **Technology alternatives**
 - Kaplan hydropower turbines

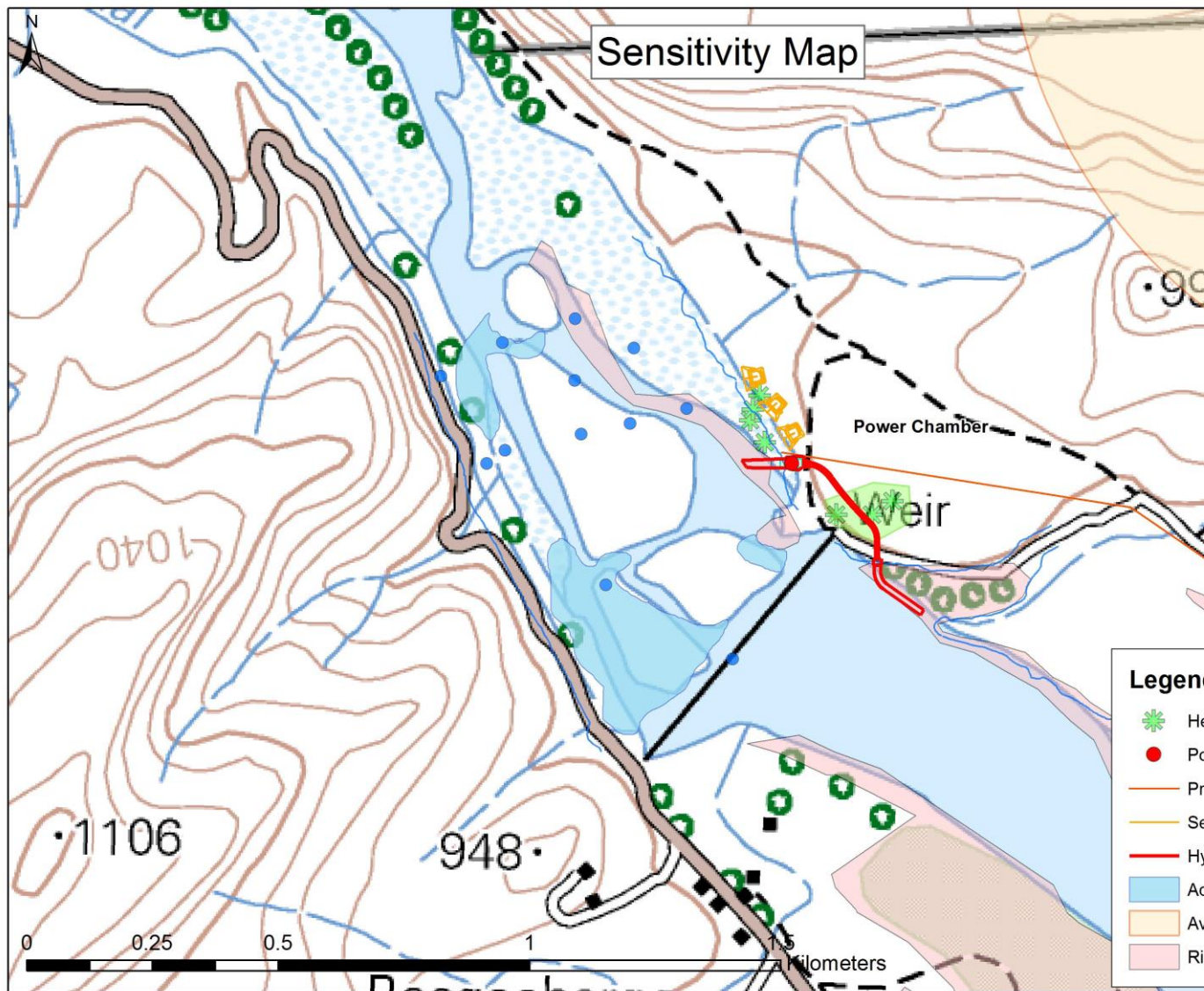
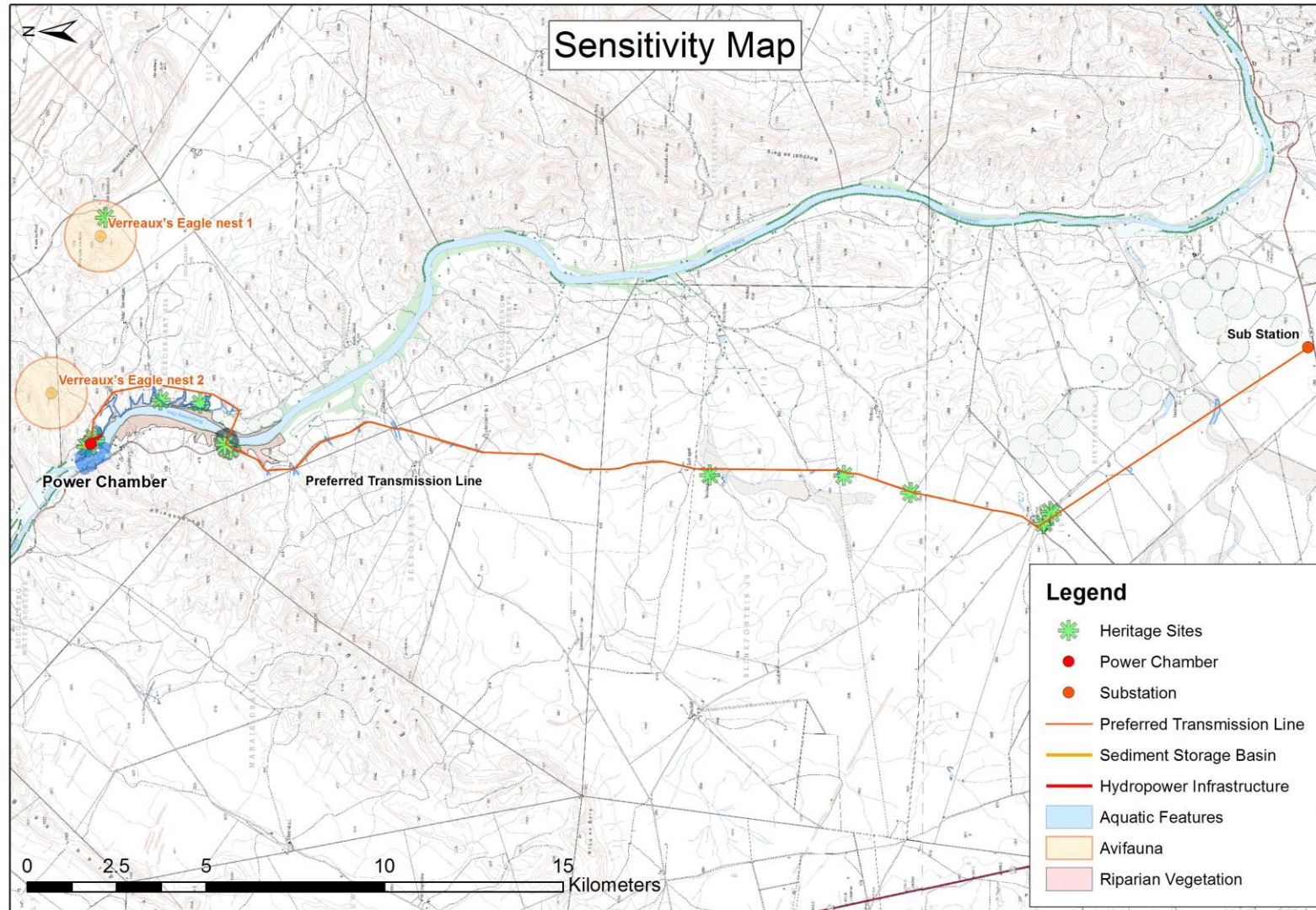
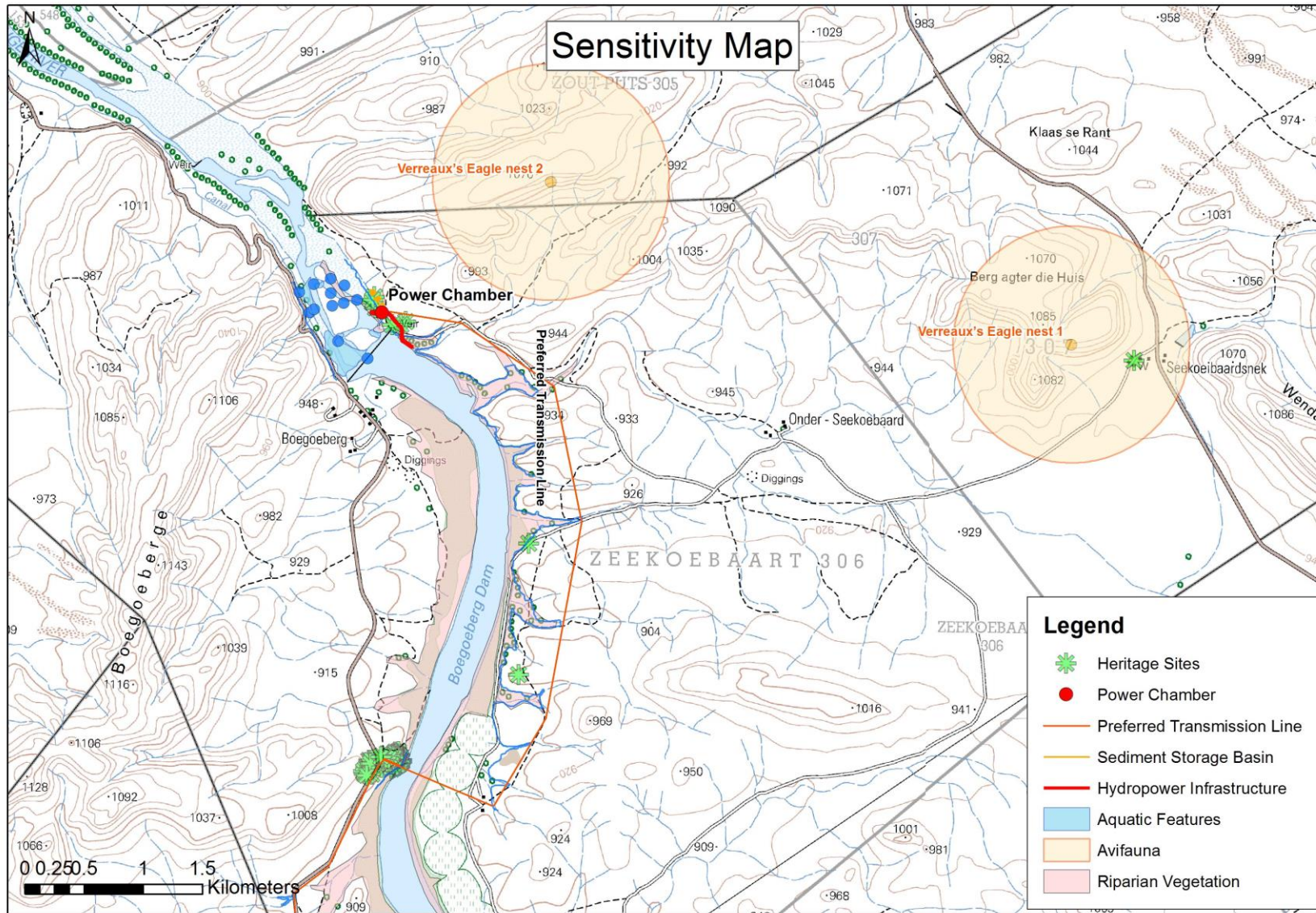


Figure 1.





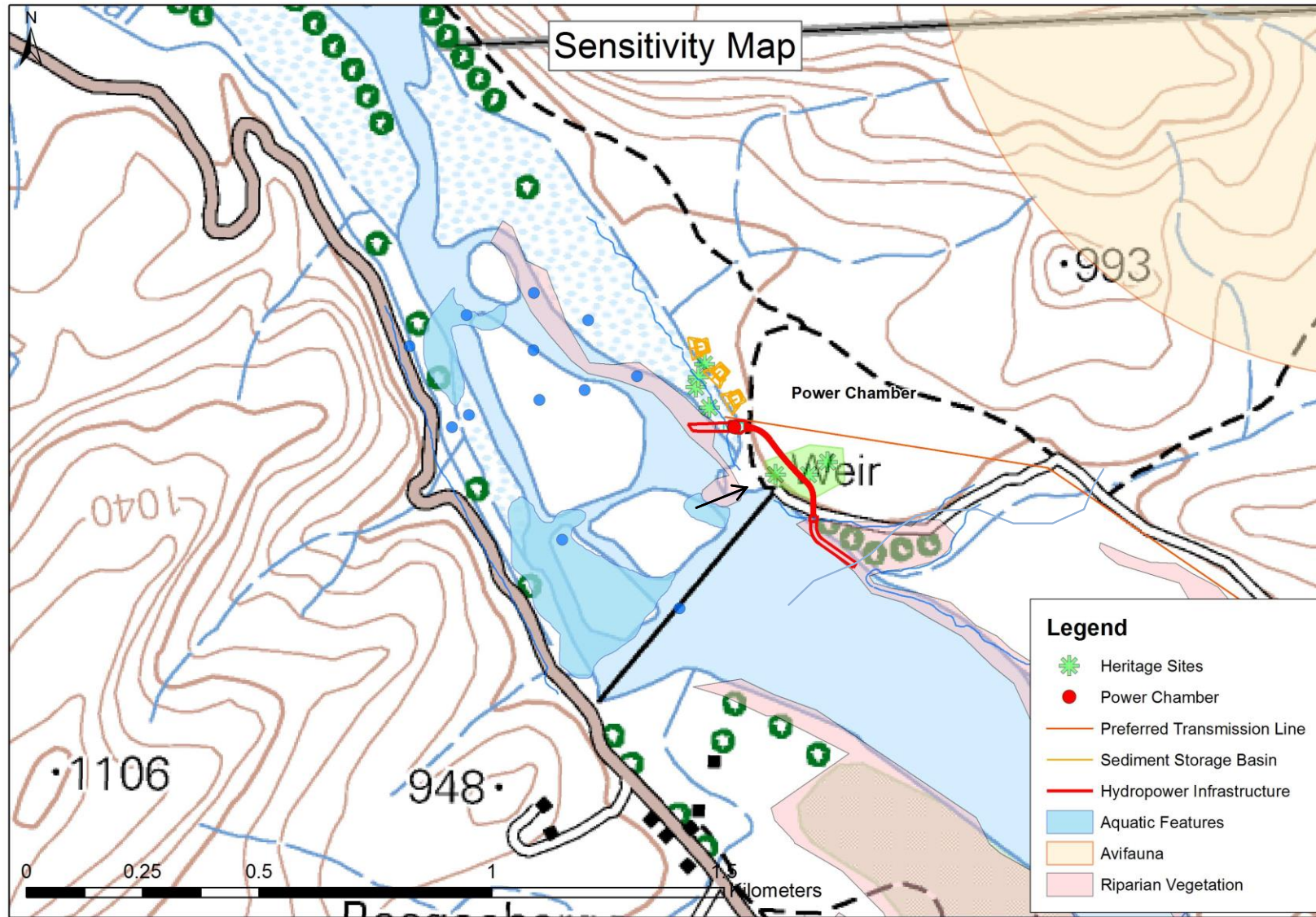


Figure 1: Sensitive ecological areas and the proposed project, including alternative layouts

3 PLANNING AND DESIGN

The design for the proposed development should respond to the identified environmental constraints and opportunities. The following mitigation measures related to the design for the proposed development have been recommended to reduce the environmental impacts.

3.1 Plans, policies, programmes and permits required for the planning and design phase

During the planning and design phase specific plans, policies, programmes and permits need to be compiled and obtained to be included in the LEMP. Table 3 below provides a quick reference list of these requirements.

Table 3: Plans and permits required for the planning and design phase

Planning phase	Plans, policies, programmes and permits required	Status
Flora	Plant rescue and protection plan	To be compiled and implemented during the planning and design phase by botanical specialist (to be appointed)
	Application for removal of <i>Boscia albitrunca</i> (Shepherds' Tree)	To be compiled and implemented during the planning and design phase by the developer
Roads	Traffic management plan and transport management plan	To be compiled during the planning and design phase and implemented during construction and operational phase by traffic specialist (to be appointed)
Services	Ensure that service level agreements are in place prior to the commencement of the construction phase	To be in negotiated during the planning and design phase by the developer
	Water Use Licence	To be compiled during the planning and design phase
	Waste Management Licence	To be compiled during the planning and design phase
Heritage	All South African fossil heritage is protected by law (South African Heritage Resources Act, 1999) and fossils cannot be collected, damaged or disturbed without a permit from SAHRA or the relevant Provincial Heritage Resources Agency	To be applied for by heritage specialist (to be appointed), if required

3.2 Site Specific Planning Mitigation Measures

The mitigation measures presented below have been extracted from the specialist studies undertaken for the project and the recommendations made in the EIR.

3.2.1 Botanical

The following mitigation measures are proposed to mitigate botanical impacts at planning stage:

- No provincially protected plant species were noted in the study that are likely to be damaged or removed. However, as a precautionary measure it is recommended that the Department of Environment Affairs and Nature Conservation, Northern Cape be given the opportunity to inspect the hydro-power site at an early stage prior to construction to ensure that if any permits are required they can be timeously obtained.

3.2.2 Avifauna

The following mitigation measures are proposed to mitigate avifaunal impacts at planning stage:

- Selecting power line route Alternative 1 is preferred.
- Minimising the length of any new power lines installed and burying lines wherever possible.
- For overhead lines, ensure that all new lines are marked with bird flight diverters along their entire length, and that all new power line infrastructure is adequately insulated and bird friendly in configuration. In situations where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line.
- Preferably use industry standard aviation balls to mark the power line where it crosses the Orange River, in addition to bird flight diverters, to ensure that the line is maximally visible to birds using the river course as a flyway.
- Use of bird flappers on power lines. Keep power lines as high as reasonably possible, where crossing the river, as birds tend to fly at levels close to the river.

3.2.3 Heritage

The following mitigation measures are proposed to mitigate heritage impacts at planning stage:

- Proposed pipes to carry draining water from the silt storage areas to the river must avoid the identified heritage resources in the area.

3.2.4 Palaeontology

None

3.2.5 Aquatic

- Construction camps should be fenced and set back at least 32m from any watercourse.
- Ensure correct design and reinforcing to prevent bank cutting, especially at high flows.
- Position transmission route so as not to occur with the riparian zone (except where direct crossing are required) of the Orange River.

3.2.6 Traffic

The following mitigation measures are proposed to mitigate traffic impacts at planning stage:

The route from Johannesburg and Upington to the site along the N10, N8 and DR3040 should be considered in more detail to confirm its geometric and structural ability to carry the anticipated abnormal load vehicles.

4 CONSTRUCTION PHASE EMP

The Construction EMP (CEMP) aims to address mitigation measures pertaining to the construction phase as identified during the course of the EIR. This section includes both General Specifications as well as Draft Specification Data, addressing general construction issues and issues that are not addressed by the General Specifications, respectively. It should be noted that the Draft Specification Data should be revised as required post authorisation to ensure that all relevant conditions of the EA have been addressed.

4.1 Construction EMP General Specifications

The complete General Specifications have been included in **Appendix B** and include the following sections:

- Scope
- Normative References
 - Supporting Specifications
- Definitions
- Requirements
 - Material
 - Material handling, use and storage
 - Hazardous substances
 - Shutter oil and curing compound
 - Bitumen
 - Plant
 - Ablution facilities
 - Solid waste management
 - Contaminated water
 - Site structures
 - Noise control
 - Lights
 - Fuel (petrol and diesel) and oil
 - Workshop, equipment maintenance and storage
 - Dust
 - Methods and procedures
 - Environmental awareness training
 - Construction personnel information posters
 - Site clearance
 - Site division
 - Site demarcation
 - "No go" areas
 - Protection of natural features
 - Protection of flora and fauna
 - Protection of archaeological and paleontological remains
 - Access routes/ haul roads
 - Cement and concrete batching
 - Earthworks
 - Pumping
 - Bitumen
 - Fire control
 - Emergency procedures
 - Community relations
 - Erosion and sedimentation control
 - Aesthetics
 - Recreation
 - Access to site
 - Crane operations
 - Trenching
 - Demolition
 - Drilling and jack hammering
 - Stockpiling
 - Site closure and rehabilitation
 - Temporary re-vegetation of the areas disturbed by construction
 - Temporary site closure
- Compliance with requirements and penalties
 - Compliance
 - Penalties
 - Removal from site and suspension of Works
- Measurement and Payment
 - Basic principles
 - General
 - All requirements of the environmental management specification
 - Work "required by the Specification Data"
 - Billed items
 - Method Statements: Additional work
 - All requirements of the environmental management specification

4.2 Project Specifications

The following section provides the Draft Specification Data which, along with the General Specifications, will be included in all contract documentation associated with the proposed project and will accordingly be binding on the Contractor.

Scope: The general principles contained within this Specification Data: Environmental Management (SDEMA) shall apply to all construction related activities. All construction activities shall observe any relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment.

Interpretations: This Specification contains clauses specifically applicable and related to the environmental requirements for the Boegoeberg hydropower facility.

Where any discrepancy or difference occurs between this SDEMA and the Specification: Environmental Management (Comprehensive), the provision of this Specification shall prevail.

Definitions:

For the purposes of this Specification the following definitions shall be added:

- **Maintenance Services Contractor:**
The Maintenance Services Contractor must ensure that, all of its sub-contractors, employees, etc., are fully aware of the environmental issues detailed in this LEMP. The Maintenance Services Contractor shall liaise closely with the Owner and the Environmental Control Officer (ECO) and must ensure that the works on site are conducted in an environmentally sensitive manner and fully in accordance with the requirements of the LEMP, at all times.
- **Civil Works Contractor:**
The Civil Works Contractor must ensure that the EM Contractor, all of its sub-contractors, employees, etc., are fully aware of the environmental issues detailed in this LEMP. The Civil Works Contractor shall liaise closely with the Owner, Site Engineer (SE) and the Environmental Control Officer (ECO) and must ensure that the works on site are conducted in an environmentally sensitive manner and fully in accordance with the requirements of the LEMP, at all times.
- **Owner:**
The Owner refers to the holder of the EA who will be responsible for the following tasks, but not limited to:
 - Ensure that the requirements as set out in this LEMP are adhered to and implemented;
 - Allocate the responsibilities assigned to the ECO to an independent suitably qualified individual prior to the start of construction activities on site; and
 - Provide the Civil Works Contractor, EM Contractor and all sub-contractors with a copy of this CEMP as part of tender contract documentation to allow the contractors to cost for its requirements within their respective construction contracts.

- **Environmental Control Officer:**

The Owner shall appoint a suitably qualified ECO to monitor the Contractor's compliance in terms of this LEMP and the conditions contained in the EA. The designation is reserved for a suitably qualified (National Diploma / Degree in Natural Science or an equivalent qualification), independent, environmental manager, with adequate environmental knowledge to understand and implement the LEMP. The duties of the ECO during construction phase will include but are not limited to:

 - i) Liaison with the Owner, Project Manager or Engineer and DEA;
 - ii) Monitoring of all of the contractor's activities for compliance with the various environmental requirements contained in the construction Specification;
 - iii) Monitoring of compliance with the EA related to the construction phase as issued by DEA as well as other relevant environmental legislation;
 - iv) Reviewing of the Civil Works Contractor's environmental Method Statement covering all other contractors;
 - v) Reviewing of the Maintenance Services Contractor's environmental Method Statement;
 - vi) Ensuring that the requisite remedial action is implemented in the event of non-compliance;
 - vii) Ensuring the proactive and effective implementation and management of environmental protection measures;
 - viii) Ensuring that a register of public complaints is maintained by the Owner and that any and all public comments or issues are appropriately reported and addressed;
 - ix) Routine recording and reporting of environmental activities on a weekly and monthly basis;
 - x) Recording and reporting of environmental incidents; and
 - xi) Overseeing and monitoring compliance with and implementation of the CEMP, OEMP and Rehabilitation Plan, including compliance with the relevant conditions contained in the EA.

- **Owners Engineer:**

The SE is responsible for ensuring that the contract is carried out to completion on time, in budget and that each contractor fulfils his obligations in terms of conditions contained in the EA.

- **Working area:**

The land and any other place on, under, over, in or through which the Works are to be executed or carried out, and any other land or place made available by the developer in connection with the Works. The Working Area shall include the site office, construction camp, stockpiles, batching areas, the construction area, all access routes and any additional areas to which the Owners Engineer permits access. The construction footprint must be kept to a minimum.

4.3 Plans, policies, programmes and permits required for the construction phase

During the construction phase specific plans, policies, programmes and permits need to be compiled and obtained to be included in the LEMP. Table 4 below provides a quick reference list of these requirements.

Table 4: Plans and permits required for the construction phase

Planning phase	Plans, policies, programmes and permits required	Status
Flora	Alien invasive management plan	To be compiled and implemented during construction phase (specialist to be appointed)
Flora	Re-vegetation and habitat rehabilitation plan	To be compiled and implemented during construction phase (specialist to be appointed)
Palaeontology	The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (e.g. museum or university collection)	To be applied for as required (specialist to be appointed)

4.4 Site Specific Construction Phase Mitigation Measures

4.4.1 Botanical

The following mitigation measures are proposed to mitigate botanical impacts at construction stage:

- Topsoil should be removed from the construction area and stockpiled accorded to best practice principles for future rehabilitation use.
- Cleared vegetation should be chipped, bagged and stored for application as mulch in rehabilitation work.
- Disturbed areas should be re-vegetated as far as possible. Flatten or mould disturbed areas to form uniform surfaces.
- Scarify the disturbed areas to break up any compaction due to vehicles.
- Restoration work should take in late summer to ensure that all rehabilitation areas are prepared before the end of February. The intention would be to benefit from the autumn rains (highest rainfall is in March).
- Replace topsoil from stockpile to depth of at least 100mm on the surface of disturbed areas.
- Spread chipped organic material over the topsoil as a mulch to enhance water-holding capacity of the soil.
- The areas being rehabilitated should be watered areas twice a week for two to three months to supplement rainfall and to encourage vegetative cover before the following winter.
- Trees such as *Searsia pendulina* and *Ziziphus mucronata* should be planted in strategic places e.g. at the construction camp site and in the vicinity of the tail-race to re-create groves of trees. These trees should be actively watered for at least three months after planting to promote establishment.

- No hydro-seeding using exotic or grasses non-native to the area should be permitted. The natural grass species have the capacity to quickly and successfully recolonise disturbed sites and this should be encouraged by watering as noted above.
- Ensure areas outside the site construction area and construction camp designated as 'No Go' areas are observed.
- Monitor roads for run-off and erosion into the adjacent veld in the event of heavy rain. Any negative impact such as erosion should be reported and remedial action taken.
- Any alien plants such as *Prosopis glandulosus* (mesquite) that could be stimulated by disturbance should be identified and action taken to remove and destroy these plants.

4.4.2 Avifauna

The following mitigation measures are proposed to mitigate avifaunal impacts at construction stage:

- Minimise the construction footprint of the development area, restricting construction time to a reasonable minimum, and minimising noise and disturbance associated with construction activities. Ideally, the bulk of the construction work should be done outside of the Verreaux's Eagle breeding season (approximately April/May to September/October).
- Minimise noise and disturbance associated with maintenance activities at the plant once it becomes operational.

4.4.3 Heritage

The following mitigation measures are proposed to mitigate heritage impacts at construction stage:

- The gravestone (ZKB2013/003) and stone cairn (ZKB2013/002) immediately downstream of the power station site should be temporarily cordoned off and carefully avoided throughout construction work.
- Excavation in the silts immediately below the weir should be carefully monitored by the ECO in case there are other burials, or should a cement headstone has been washed downstream from another location during floods.
- If the road passing the graveyard at ZKB2013/004 is to be used for access to the transmission route then the graves must be cordoned off and avoided during and after development (due to its generally sensitive location, erection of a permanent fence around this graveyard could be considered).
- The stone structures at BDW2013/001, on the platform at the top of the cliff (specifically the one near the road), should be avoided during and after construction. Careful placement of pylons will be required to ensure that these structures are spanned but care should be taken to avoid damage to them during construction.

Table 5: Co-ordinates of important heritage sites

Site Name	Co-ordinates	
ZKB2013/001	S29 02 22.5 E22 12 15.9	S29 02 23.4 E22 12 11.8
	S29 02 23.4 E22 12 14.4	
ZKB2013/002	S29 02 17.3 E22 12 05.4	
ZKB2013/003	S29 02 18.8 E22 12 06.5	
ZKB2013/004	S29 03 23.0 E22 12 55.1	
ZKB2013/005	S29 03 59.0 E22 12 52.4	
BDW2013/001	S29 04 26.8 E22 12 04.5	S29 04 23.2 E22 12 06.5
	S29 04 26.3 E22 12 04.4	S29 04 23.0 E22 12 06.8
	S29 04 26.0 E22 12 04.3	S29 04 23.7 E22 12 06.3
	S29 04 25.4 E22 12 04.8	S29 04 23.9 E22 12 06.4
	S29 04 23.1 E22 12 05.9	S29 04 27.1 E22 12 05.3
	S29 04 23.2 E22 12 06.1	S29 04 26.8 E22 12 06.8

4.4.4 Palaeontology

The following mitigation measures are proposed to mitigate palaeontological impacts at construction stage:

- During the construction phase all substantial bedrock excavations should be generally monitored for fossil remains by the responsible ECO. In particular, the ECO should be alerted to the possibility of fluvial gravels containing transported, disarticulated bones and teeth of fossil mammals.
- Should significant fossil remains such as vertebrate bones and teeth, shells, plant-rich fossil lenses or dense fossil burrow assemblages be exposed during construction, the ECO should safeguard these, preferably *in situ*, and alert the South African Heritage Resources Agency, SAHRA (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za) as soon as possible so that appropriate action can be taken by a professional palaeontologist at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy).
- All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013).
- Monitoring of all substantial bedrock excavations for fossil remains by ECO.
- Significant fossil finds to be safeguarded and reported to SAHRA for possible mitigation.

4.4.5 Aquatic

The following mitigation measures are proposed to mitigate aquatic impacts at construction stage (hydropower facility and roads):

- Minimise footprint by demarcation of impact zone (such as fencing / markers to limit access elsewhere).

- Ensure conservation of as much vegetation cover as possible during construction will also mitigate in the longer term.
- Minimise removal or disturbance of adult trees especially *A. erioloba* and *Searsia pendulina* specimens.
- Construction camps should be fenced and set back at least 32m from any watercourse.
- The collection of firewood by construction workers should be prohibited.
- Use erosion control measures to minimise erosion at excavation sites or aggregate storage sites. Construction activities should take place in dry season as far as possible.
- Keep construction activities and aggregate storage outside of riparian zones / drainage channels.
- Employ recognised best practices with respect to machinery washing and maintenance.
- Follow best practice procedures for discarding unused concrete; storage of hazardous materials; provision of sanitation facilities, erosion prevention, etc.
- Remove perennial alien species such as *Prosopis glandulosa* and *Sesbanea punicea* at sites disturbed or cleared by construction activities. Care should be taken not to introduce additional seed or propagules of alien species that may be present in aggregates brought to site. Vegetate areas that are not meant to stay clear as soon as possible after construction with a local indigenous species.
- Restrict unnecessary movement of people and plant in the riparian zone or drainage channels.
- Prevent unnecessary disturbance of substrates, fauna or flora.
- Employ recognised best practice to prevent spillage into the river, either directly or via soak aways.
- Use natural materials such as rock from site in the construction process of plant.
- Rehabilitate marginal and riparian vegetation after construction where necessary.
- Prohibit fishing from start. Ban the use of any fishing. Apply regulations firmly.

In addition, the following mitigation measures are proposed to mitigate aquatic impacts at construction stage (transmission lines):

- Employ recognised best practice to prevent spillage into the river, either directly or via soak aways.
- Use of natural materials such as rock from site in the construction process of plant.
- Rehabilitate marginal and riparian vegetation after construction where necessary.
- Minimise bank destabilisation, vegetation removal and erosion.

4.4.6 Traffic

None

4.5 Structure of the CEMP

Each activity identified in the EIA process comprises various aspects, which have associated impacts. These, along with the mitigation measures and performance indicators, are outlined in the table below.

Five main categories have been identified and tabled for the CEMP namely:

- **General**
- **Establishment of the construction camp**
- **Clearing of the site**
- **Construction of the hydropower facility and associated infrastructures**
- **Removal of the construction related debris, materials or equipment**

The information is summarised in Tables below illustrating the activity, aspect, impact, mitigation measure, performance indicators, resources, schedule and verification. These criteria are listed and explained below:

The following components are identified/ described:

- Activity: component/ activity of the project for which the impact has been identified.
- Aspect: the aspect of the above activity which will be impacted.
- Impact: the environmental impact identified and to be mitigated.
- Mitigation measure: measures identified for implementation in terms of environmental management to reduce, rectify or contain the identified environmental impact – mitigation is divided into the following:
 - Objective: desired outcome of mitigation measure.
 - Mechanism: method of achieving the objective.
- Performance indicators: outcomes that will indicate achievement of objective/s.
- Responsibility: party or parties identified for implementation of mitigation measure/s.
- Resources: available resources to aid implementation of mitigation.
- Schedule: timeframe in which identified impact and mitigation measure is anticipated to occur.
- Verification: party or parties identified as responsible for review and assessment of final outcome.

4.6 CEMP General

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Communication	Inability to communicate the environmental obligations effectively to responsible parties can result in unnecessary environmental degradation. It can also compromise the health and safety of employees.	<p>Objective: To ensure that the construction activities do not result in avoidable impacts on the environment by anticipating and managing the impacts.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) The contact details of the key construction team must be available to all relevant parties. 2) All site instructions pertaining to environmental matters issued by the Engineer are to be copied to the ECO. 3) All contractors, sub-contractors, employees, suppliers or agents etc. must be fully aware of the environmental management requirements detailed in this CEMP. 4) The Site Engineer and ECO must be informed immediately should environmental issues arise. 5) A copy of the EIR, CEMP and EA must be present at the construction site for easy reference to specialist recommendations. 	<p>No avoidable environmental impacts occurring due to miscommunication.</p> <p>The ECO is aware of decisions taken by the Site Engineer and contractors.</p>	ECO, Site Engineer and Contractor.	During the construction phase (from site establishment to contract completion).	ECO and Owner
2.	Training of workers	Without proper training the health and safety of workers will be at risk and preventable environmental impacts could occur.	<p>Objective: To provide health and safety training to construction workers to ensure a safe working construction site and to ensure that each employee are aware of the environmental impacts that could occur.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Temporary and permanent construction workers must undergo environmental awareness training and health and safety training as part of the induction training. 	<p>All employees adhere to the mitigation measures provided in this document.</p> <p>All operators of mechanical equipment are trained properly by the contractor.</p>	<p>Contractor and ECO</p> <p>The Civil Works Contractor shall supply the ECO with a monthly report indicating the number of employees that will be present on</p>	During the construction phase (from site establishment to contract completion).	ECO and the Owner

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			2) The following aspects need to be covered as a minimum: 3) The prevention of accidental spillage of hazardous chemicals and oil; 4) Disposal of waste; 5) The No-Go areas; 6) Litter control; 7) Identification of archaeological artefacts and whom to report it to; 8) The use of fire fighting equipment and Personal Protective Equipment (PPE); and 9) HIV/AIDS awareness. 10) Environmental posters and/ or translators can be used for training purposes. 11) Staff operating equipment (such as loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks. 12) Follow-up training courses must be attended throughout the construction period as deemed necessary by the ECO. 13) All new employees that spend more than one day a week on site are to attend the environmental education program within one week of commencement of work. 14) The collection of firewood by construction workers should be prohibited. 15) Restrict unnecessary movement of people and plant in the riparian zone or drainage channels. 16) Prohibit fishing from start. Ban the use of any fishing. Apply regulations firmly.	All workers have attended Environmental awareness training and health and safety training.	site during the following month.		
3.	Protection of fauna, flora and	Constructing a hydropower facility	Objective: To prevent unnecessary disturbance to natural vegetation.	No animals are injured.	ECO, Civil Works Contractor	During the construction	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
	avifauna	and transmission lines may have impacts on the fauna, flora and avifauna.	<p>Mechanism:</p> <ol style="list-style-type: none"> 1) A rehabilitation plan for the site will be compiled with the aid of a rehabilitation specialist and adhered to. 2) Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the working area and other associated infrastructure as well as to the footprint of the pylon structures and/or the servitude of the power line. 3) Areas outside the construction footprint should be fenced and access to these areas should be limited as much as possible. 4) Existing access roads must be used, where possible. 5) Service roads in the servitude must be properly maintained to avoid erosion impacts. 6) Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum. 7) Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. 8) Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used. 9) An on-going alien invasive monitoring programme will be implemented to detect and quantify any aliens that may become 	<p>No employees enter the no-go areas.</p> <p>No alien vegetation establishment.</p> <p>Invasive alien vegetation monitoring programme implemented.</p>		phase (from site establishment to contract completion).	

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>established and provide information for the management and monitoring of aliens.</p> <p>10) Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum.</p> <p>11) Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.</p> <p>12) Minimising the amount of fencing used to enclose the development areas, given that these may present a collision risk for collision-prone birds.</p> <p>13) Topsoil should be removed from the construction area and stockpiled accorded to best practice principles for future rehabilitation use.</p> <p>14) Cleared vegetation should be chipped, bagged and stored for application as mulch in rehabilitation work.</p> <p>15) Disturbed areas should be re-vegetated as far as possible. Flatten or mould disturbed areas to form uniform surfaces.</p> <p>16) Scarify the disturbed areas to break up any compaction due to vehicles.</p> <p>17) Restoration work should take in late summer to ensure that all rehabilitation areas are prepared before the end of February. The intention would be to benefit from the autumn rains (highest rainfall is in March).</p> <p>18) Replace topsoil from stockpile to depth of at least 100mm on the surface of disturbed areas.</p> <p>19) Spread chipped organic material over the topsoil as a mulch to enhance water-holding</p>				

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>capacity of the soil.</p> <p>20) The areas being rehabilitated should be watered areas twice a week for two to three months to supplement rainfall and to encourage vegetative cover before the following winter.</p> <p>21) Trees such as <i>Searsia pendulina</i> and <i>Ziziphus mucronata</i> should be planted in strategic places e.g. at the construction camp site and in the vicinity of the tail-race to re-create groves of trees. These trees should be actively watered for at least three months after planting to promote establishment.</p> <p>22) No hydro-seeding using exotic or grasses non-native to the area should be permitted. The natural grass species have the capacity to quickly and successfully recolonise disturbed sites and this should be encouraged by watering as noted above.</p> <p>23) Ensure areas outside the site construction area and construction camp designated as 'No Go' areas are observed.</p> <p>24) Monitor roads for run-off and erosion into the adjacent veld in the event of heavy rain. Any negative impact such as erosion should be reported and remedial action taken.</p> <p>25) Any alien plants such as <i>Prosopis glandulosus</i> (mesquite) that could be stimulated by disturbance should be identified and action taken to remove and destroy these plants.</p> <p>26) Minimise the construction footprint of the development area, restricting construction</p>				

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>time to a reasonable minimum, and minimising noise and disturbance associated with construction activities. Ideally, the bulk of the construction work should be done outside of the Verreaux's Eagle breeding season (approximately April/May to September/October).</p> <p>27) Minimise noise and disturbance associated with maintenance activities at the plant once it becomes operational.</p>				
4.	Stormwater runoff, erosion, and pollution of surface water and groundwater resources.	Contamination of stormwater runoff can impact on the surface and groundwater resources. The mismanagement of stormwater can furthermore result in erosion.	<p>Objective: Prevent stormwater from eroding the land and becoming contaminated.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Comply with regulations as set out in the storm water management plan to be implemented during construction. 2) Disturbed areas within the riparian zones and stream beds should be rehabilitated as soon as possible after construction has been completed and re-vegetated with suitable indigenous vegetation according to the approved rehabilitation plan. Where possible previously disturbed areas, such as existing roads or transmission line routes, should be utilised. 3) Contaminated runoff from the construction site should be prevented from entering the streams and river. 4) Invasive alien plant growth within the disturbed areas should be monitored and managed. 5) Run-off over the exposed areas should be mitigated to reduce the rate and volume of 	<p>Stormwater not contaminated by construction activities.</p> <p>Stormwater control measures are effective at regulating runoff from the site and erosion channels do not develop.</p> <p>Freshwater ecosystems are not unduly disturbed by construction activities within the drainage channels.</p>	<p>ECO and Civil Works Contractor</p> <p>ECO to inspect soils for erosion at regular intervals.</p>	<p>After site clearing has taken place up to the end of the construction phase.</p>	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>run-off and prevent erosion occurring on the site and within the freshwater features and drainage lines.</p> <p>6) Minimise duration and extent of construction activities in the river – construction of activities within the river itself should also preferably take place in the low flow season.</p> <p>7) Clearing of debris, sediment and hard rubble associated with the construction activities should be undertaken post construction to ensure that flow within the drainage channels are not impeded or diverted.</p> <p>8) Rehabilitate disturbed stream bed and banks and re-vegetate with suitable indigenous vegetation.</p> <p>9) All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded.</p> <p>10) Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.</p> <p>11) All materials on the construction sites should be properly stored and contained.</p> <p>12) Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 100m away from the river systems/ freshwater features and regularly serviced.</p> <p>13) The laydown area should be cleaned and rehabilitated after construction is complete.</p> <p>14) Initiate land rehabilitation and re-vegetation as soon as possible.</p> <p>15) Employ recognised best practices with</p>				

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>respect to machinery washing and maintenance.</p> <p>16) Follow best practice procedures for discarding unused concrete; storage of hazardous materials; provision of sanitation facilities, erosion prevention, etc.</p> <p>17) Employ recognised best practice to prevent spillage into the river, either directly or via soak aways.</p>				
5.	Visual impact	The proposed site is visible to the public and a construction site might have a negative visual impact on the sense of place.	<p>Objective: To protect the sense of place.</p> <p>Mechanism:</p> <p>1) Surface soil should be scraped off, conserved and used for rehabilitation. The remainder could be used for site development, and any surplus disposed of in a manner that appears natural. The top 50 - 100mm of naturally occurring substrate should be separated and then spread over finished levels.</p> <p>2) The laydown area should be screened with shade cloth and dust prevention mitigations needs to be implemented during use to prevent wind-blown dust.</p> <p>3) Should permanent site offices and structures be required, these should be limited to single-storey and they should be sited carefully to reduce visual intrusion. Colours should reflect shades of the surrounding vegetation and/or the ground. Roofs should be grey and non-reflective. Door and window frame colour should reference either the roof or wall colours.</p> <p>4) Litter is to be regarded as a serious offence</p>	No complaints from the public.	ECO, Site Engineer and Civil Works Contractor	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>and no contaminants are to be allowed to enter the environment by any means.</p> <p>5) Road construction and management must take run-off into consideration in order to prevent soil erosion.</p> <p>6) Access roads are to be kept clean, and measures taken to minimise dust from construction traffic on gravel roads.</p> <p>7) The footprint areas of all impact sites utilised in construction should be rehabilitated in during the construction phase, and not during operation. Disturbed areas should be restored as near as possible to previous natural vegetation.</p> <p>8) The fencing should be grey in colour and located as close as possible around the site.</p>				
6.	Impacts on local economy (employment) and social conditions	The activity might impact on the local economy.	<p>Objective: To ensure on-going sustainability of the local tourism / hospitality industry.</p> <p>Mechanism:</p> <p>1) It is recommended that the local employment policy, as stated by the developer, is implemented, audited and accompanied by a training programme.</p> <p>2) A local procurement policy should be adopted by the proponent to maximise the benefit to the local economy. The general contractor should be responsible to inform the subcontractors of the contact details for all the local businesses offering related goods and services.</p> <p>3) Implement a policy of "no employment at the gate" to prevent loitering.</p> <p>4) The site should be secured.</p>	Contribute to local community upliftment	Civil Works Contractor, ECO, Site Engineer	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			5) A comprehensive employee induction programme would cover land access protocols and fire management and issues such as HIV/ AIDS and Tuberculosis, as well as alcohol and substance abuse. The induction should also address a code of behaviour for employees that would align with community values.				
8.	Traffic	Increased volume of traffic both on and off site	<p>Objective: To ensure that increased traffic volume is managed efficiently to minimise associated impacts.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Comply with the traffic management plan and the transportation plan. 2) Ensure that road junctions have good sightlines. 3) Transport the materials in the least amount of trips as possible. 4) Implement traffic control measures where necessary. 5) Transport components overnight as far as possible. 6) Ensure that all drivers are aware of the "No-Go" areas, permissible roads, and where the offloading area is. 7) Impose speed limits on the construction site. 8) Manage site access to prevent congestion of vehicles and trucks. 9) Access of all construction and material delivery vehicles should be strictly controlled, especially during wet weather to avoid compaction and damage to the topsoil structure. 	Traffic is orderly, free flowing and controlled.	Civil Works Contractor and Site Engineer	During the construction phase (from site establishment to contract completion)	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			10) Roads not to be used shall be marked with a "NO ENTRY for construction vehicles" sign. 11) Access roads are to be kept litter free. 12) The Civil Works Contractor must ensure that there is ample space to off load the materials to prevent truck being delayed and interrupting the traffic flow.				
9.	Dust	Dust generated from the stripped surfaces, construction demolition, excavations and stockpiled materials can become a nuisance.	<p>Objective: To avoid nuisance impacts caused by dust as far as possible.</p> <p>Mechanism:</p> 1) The Civil Works Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the ECO and Site Engineer. 2) Water sprays to be applied at the area to be cleared should significant amounts of dust be generated. Moist topsoil will reduce the potential for dust generation when tipped onto stockpiles. 3) Ensure travel distance between clearing area and topsoil piles to be at a minimum. 4) Ensure exposed areas remain moist through regular water spraying during dry, windy periods. 5) Reshape all disturbed areas to their natural contours. 6) Cover disturbed areas with previously collected topsoil and replant native species. 7) Minimise the time that stripped areas are exposed. 8) Protect open soils against wind erosion. 9) Put in place procedures for effective cleaning of vehicles and inspection.	No complaints received from public and or site staff.	Civil Works Contractor and ECO	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>10) Material loads must be covered properly during transport and storage thereof.</p> <p>11) The Site Engineer shall be advised of the areas that the Contractor intends to use for the stockpiling of both natural and manufactured materials.</p>				
10.	Noise	The increase in traffic and operation of equipment may result in noise becoming a nuisance.	<p>Objective: To ensure that the construction phase are compliant to noise regulations.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Construction site yards, workshops, concrete batching plants, and other noisy fixed facilities should be located well away from noise sensitive areas. 2) Stationary noisy equipment such as compressors and pumps should be encapsulated in acoustic covers, screens or sheds where possible. Portable acoustic shields should be used in the case where noisy equipment is not stationary (i.e. angle grinders, chipping hammers). 3) Vehicles should avoid unnecessary use of the reverse gear to minimise annoyance caused by reverse sirens. Consideration of alternative safety measures may be necessary when taking such a measure. 4) All diesel powered equipment must be regularly maintained and kept at a high level of maintenance. This must particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment must serve as trigger for withdrawing it for maintenance. 	No complaints received from public and or site staff.	Civil Works Contractor and ECO	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			5) Truck traffic should be routed away from noise sensitive areas, where possible. 6) Noisy operations should be combined so that they occur where possible at the same time. 7) Instruction of employees on low-noise work methods, for example, the handling of structural steel and the use radiotelephony rather than shouting for communication. 8) Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum. 9) Construction activities are to be contained to reasonable hours during the day and early evening. 10) Night-time activities near noise sensitive areas should not be allowed. No construction should be allowed on weekends from 14h00 on Saturday afternoons to 06h00 the following Monday morning. The developer is to ensure that no noisy construction activities take place during holiday periods when the camp site on the southern banks is utilised more heavily. 11) With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents and owners on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities.				
11.	Impact on archaeological, cultural and historic sites	Heritage resources can be impacted on during the site clearance, earthworks and the	Objective: To ensure that no heritage resources as identified in the Heritage Impact Assessment report are disturbed and or destroyed. Mechanism:	No heritage resources are disturbed and SAHRA was contacted in the	ECO and Civil Works Contractor	During the construction phase (from site establishment to contract	

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		construction of the Hydropower Facility.	<ol style="list-style-type: none"> 1) If any human remains are encountered during the development they must be cordoned off and protected from further harm until they can be inspected and removed by an archaeologist under a permit issued for that purpose. 2) The ECO must be informed if archaeological resources are found on the surface or exposed by fresh excavations during construction activities. 3) No-Go areas identified by the Heritage Specialist must be demarcated and all site personal must be informed thereof. 4) The gravestone (ZKB2013/003) and stone cairn (ZKB2013/002) immediately downstream of the power station site should be temporarily cordoned off and carefully avoided throughout construction work. 5) Excavation in the silts immediately below the weir should be carefully monitored by the ECO in case there are other burials, or the cement headstone has been washed downstream from another location during floods. 6) If the road passing the graveyard at ZKB2013/004 is to be used for access to the transmission route then the graves must be cordoned off and avoided during and after development (due to its generally sensitive location, erection of a permanent fence around this graveyard could be considered). 7) The stone structures at BDW2013/001, on the platform at the top of the cliff (specifically the one near the road), should be avoided 	event of uncovering an archaeological artefact.		completion).	

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>during and after construction. Careful placement of pylons will be required to ensure that these structures are spanned but care should be taken to avoid damage to them during construction.</p> <p>8) All substantial bedrock excavations should be generally monitored for fossil remains by the responsible ECO. In particular, the ECO should be alerted to the possibility of fluvial gravels containing transported, disarticulated bones and teeth of fossil mammals.</p> <p>9) Should significant fossil remains such as vertebrate bones and teeth, shells, plant-rich fossil lenses or dense fossil burrow assemblages be exposed during construction, the ECO should safeguard these, preferably in situ, and alert the South African Heritage Resources Agency, SAHRA (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za) as soon as possible so that appropriate action can be taken by a professional palaeontologist at the developer's expense.</p> <p>10) Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy).</p> <p>11) All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (e.g.</p>				

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013).				
12.	Impact on municipal services	The proposed activity will require municipal services in terms of sewage, waste removal, and provision of water.	<p>Objective: To ensure that the !Kheis Municipality will be able to accommodate the proposed activity without jeopardising the security of services provided.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Ensure that service level agreements are in place prior to the commencement of the construction phase. 	Services can be provided for the proposed activity.	The Owner and Site Engineer	Prior to the commencement of the construction phase.	ECO
13.	Hazardous substances	Impact on soil and water.	<p>Objective: Secure safety, to avoid soil and water contamination</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) The Material Safety Data Sheet (MSDS) for any hazardous materials must be kept on site at all times. 2) Procedures detailed in the MSDS shall be followed in the event of an emergency situation. 3) Potentially hazardous substances shall be stored, handled and disposed of as prescribed by the Site Engineer. 4) An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage shall be compiled and implemented. This shall include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems. 	<p>Correct handling, use and storage of materials, including hazardous materials. MSDS are available for all hazardous substances stored on site.</p> <p>Appropriate hazardous waste spill kits are available on site.</p>	Civil Works Contractor monitored by the ECO	During Construction Phase (from site establishment to Contract Completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			5) Shutter oil and curing compound shall be stored and dispensed within a bunded area, and not located closer than 32 m from river banks / water courses / drainage lines. 6) Hazardous wastes e.g. mixed cement shall only be disposed at landfill sites registered for hazardous wastes. 7) All hazardous waste materials must be carefully stored as advised by the ECO, and then disposed of at a licensed landfill site. 8) All necessary precaution measures shall be taken to prevent soil or surface water pollution from hazardous materials used during construction. 9) No hazardous waste may be buried or burned under any circumstances. 10) The Civil Works Contractor must ensure that the other contactors, sub-contractors and employees are informed on how to responsibly dispose of any containers containing hazardous substances. 11) All major spills of any materials, chemicals, fuels or other potentially hazardous or pollutant substances must be cleaned immediately and the cause of the spill investigated. 12) Preventative measures must be identified and submitted to the ECO.				
14.	Solid waste management	The incorrect management of solid waste can result in the pollution of soil, groundwater and	Objective: To avoid soil and water contamination as well as windblown litter. Mechanism: 1) Provide adequate waste bins. 2) Set up system for regular waste removal to an approved facility.	No complaints from public. No windblown litter. No contamination of soil and or water.	Civil Works Contractor, ECO	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		the general environment. Windblown litter can also contribute to a negative visual impact.	<p>3) Minimise waste by sorting wastes into recyclable and non-recyclable wastes (an independent contractor can be appointed to conduct this recycling if practical).</p> <p>4) No waste may be buried or burned under any circumstances.</p> <p>5) An approved waste disposal contractor must be employed to remove and recycle waste oil, if practical.</p> <p>6) A housekeeping team should be appointed to regularly maintain the litter and rubble situation on the construction site.</p> <p>7) Littering by the employees shall not be allowed under any circumstances.</p> <p>8) Any windblown litter must be removed on a regular basis.</p> <p>9) The ECO shall monitor the neatness of the work sites as well as the Civil Works Contractor's construction camp.</p> <p>10) Waste containers and or skips should be maintained on site. These should be kept covered and arrangements made for them to be collected regularly to prevent vermin and odours. The storage of waste should not exceed the thresholds list in the National Environmental Management Waste Act</p> <p>11) A certificate of disposal to a registered landfill site shall be obtained the Civil Works Contractor and kept on file, if relevant.</p>	<p>No deceased animals due to windblown litter consumed.</p> <p>Certificate of disposal at approved waste site are available.</p>			

4.7 CEMP: Establishment of the construction camp

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Demarcate the construction camp	Without properly demarcating the site, the surrounding vegetation might be impacted on through trampling, compaction of the soil etc. Windblown litter might also become problematic	Objective: Prevent construction activities from impacting on surrounding vegetation. Mechanism: 1) The ECO and Site Engineer shall be advised of the area that the Civil Works Contractor intends using for the construction camp. 2) All construction camps are to be fenced off in such a manner that unlawful entry is prevented. 3) Signage shall be placed at all access points in compliance with all applicable occupational health and safety requirements. 4) Construction camps should be fenced and set back at least 32m from any watercourse	Temporary or permanent fencing in place.	Civil Works Contractor	Prior to the commencement of site clearance.	ECO, Site Engineer
2.	Stockpiling of equipment and materials	Storing materials wrongly can result in water and/ or soil contamination, dust and / or erosion.	Objective: Ensure that all materials and equipment stored do not cause environmental degradation. Mechanism: 1) The Site Engineer shall be advised of the areas that the Civil Works Contractor intends to use for the stockpiling of materials. 2) All construction equipment must be stored within this construction camp. 3) Materials should not be delivered to the site prematurely which could result in additional areas being cleared or affected. 4) Impervious surfaces must be provided where necessary.	No public complaints	Civil Works Contractor and ECO	During Construction Phase (from site establishment to Contract Completion).	ECO, Site Engineer
3.	Storage and handling of materials	The incorrect storage and handling of	Objective: To ensure that materials are handled and stored in a manner that environmental contamination and safety hazards are limited.	Correct handling, use and storage of materials, including	Civil Works Contractor monitored by the	During Construction Phase (from site	ECO, Site Engineer, Civil Works

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		materials pose a risk of environmental contamination and could jeopardise the safety of public and/ or site staff.	<p>Mechanism:</p> <ol style="list-style-type: none"> 1) Educate other contractors, sub-contractors and employees regarding specification requirements of the materials they handle. 2) Secure materials during transport. 3) Identify appropriate storage areas for stockpiling of materials, storage of hydrocarbons and storage of hazardous substances and ensure that these areas are appropriately prepared for their purpose. 4) Storage of materials must take into consideration the prevailing wind directions to reduce windblown dust. 5) Prevent and limit spillage of hazardous substances or substances with the potential to cause contamination of the environment. 6) Develop emergency protocols for dealing with spillages particularly where these pose a pollution risk or involve hazardous substances. 7) All oil changes must take place within a designated area on an impervious surface such as a concrete slab. 8) Contaminated runoff from the construction site should be prevented from entering freshwater systems. 9) Containers that contained toxic or harmful materials shall not be rinsed and re-used. 10) Such containers shall not be stored or disposed on site. These containers shall be destroyed to prevent re-use and disposed in accordance with the manufacturer's instructions at a permitted waste disposal facility. 	<p>hazardous materials.</p> <p>No incidents of environmental contamination.</p> <p>No accidents or incidents related to the handling of materials.</p> <p>No public complaints.</p>	ECO	establishment to Contract Completion).	Contractor.

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>11) Proper storage facilities which are bunded for the storage of oils, paints, grease, fuels, chemicals, and any hazardous materials to be used must be provided to prevent the soil and groundwater contamination.</p> <p>12) The wall of the bunded area shall be of earth or concrete, and shall be designed to be liquid tight and to withstand a full hydrostatic head of water. The volumetric capacity of the bunded area will be a minimum of 110% of the volume of the largest tank. Should more than one tank be enclosed in the bunded area, then the capacity should be calculated on the volume of all the tanks stored within the bunded area.</p> <p>13) All fuel storage areas must be roofed to avoid water contamination.</p> <p>14) Storage areas containing hazardous substances / materials must be clearly signposted.</p> <p>15) The concrete batching plant must be contained within a bunded area.</p> <p>16) Concrete mixing must only take place within designated areas.</p> <p>17) Ready mixed concrete must be utilised where possible.</p> <p>18) No stockpiling shall occur outside of the working area or within drainage channels.</p>				
4.	Ablution facility, recess area	The lack of adequate ablation facilities and recess areas can compromise the health of site staff and result in	<p>Objective: To minimise the potential environmental impacts associated with an influx of site staff.</p> <p>Mechanism:</p> <p>1) The Civil Works Contractor shall establish a sufficient recess area within the construction</p>	Adequate ablation facilities are in place.	Civil Works Contractor, Site Engineer and ECO	Prior to construction.	ECO, Site Engineer, Civil Works Contractor.

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		environmental degradation.	<p>camp.</p> <p>2) The recess area should include a food preparation area with adequate washing facilities and bins.</p> <p>3) The Civil Works Contractor and Site Engineer shall ensure that the recess area and ablution facilities are positioned so as to limit visual intrusion on neighbours or the greater environment.</p> <p>4) No littering may take place.</p> <p>5) A sufficient number of chemical toilets as required by the Construction Regulations of 2003 of the Occupational Health and Safety Act shall be provided by the Contractor in the construction camp area and at appropriate locations approved by the Engineer.</p> <p>6) Temporary/ portable toilets shall not be located within 100m of the drainage channels located on site or along the road reserve.</p> <p>7) All temporary/ portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause.</p>				

4.8 CEMP: Clearing of the site

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Demarcating the site to be cleared	Without properly demarcating the area to be cleared of vegetation might result in unnecessary vegetation removal.	<p>Objective: To keep the area to be cleared of vegetation to a minimum and avoid unnecessary impacts to surrounding vegetation.</p> <p>Mechanism:</p> <p>1) The site must be clearly demarcated with fencing or orange construction barrier to</p>	Only the area required for the construction of the hydropower facility are cleared	Civil Works Contractor and ECO	Prior to construction	ECO

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		The surrounding vegetation might also be impacted on through trampling, compaction of the soil and clearing etc.	<p>keep clearing activities to a minimum.</p> <p>2) No site staff are to be allowed in the area outside of the demarcated area to prevent trampling of surrounding vegetation.</p> <p>3) Minimise footprint by demarcation of impact zone (such as fencing / markers to limit access elsewhere).</p> <p>4) Keep construction activities and aggregate storage outside of riparian zones / drainage channels.</p>				
2.	No-Go areas No-Go areas are those areas which have been designated by specialists as sensitive environments which need to be conserved.	Without No-Go areas the free moving of site staff could result in impacts to the sensitive areas.	<p>Objective: Manage to prevent negative impacts on sensitive areas.</p> <p>Mechanism:</p> <p>1) All areas outside of the designated construction footprint shall be declared a "No-Go" area.</p> <p>2) No equipment shall be allowed outside the site and defined access routes, or within "no-go" areas, unless expressly permitted by the Site Engineer.</p> <p>3) The ECO and Site Engineer must establish a penalty system to manage any non-compliance.</p> <p>4) The ECO must keep record of any non-compliance.</p>	Comprehensive record, including photographic record, of compliance available.	Site Engineer and ECO	During Construction Phase (from site establishment to Contract Completion).	ECO
3.	Removal of vegetation	By not limiting the removal of vegetation to a minimum can result in the destruction or loss of sensitive areas which could	<p>Objective: To ensure that disturbance to sensitive areas or artefacts is minimised and minimise the extent of areas cleared</p> <p>Mechanism:</p> <p>1) The entire site shall only be cleared as required.</p>	<p>Limited extent of vegetation destroyed during construction activities.</p> <p>No topsoil contaminated.</p>	Civil Works Contractor and ECO	During the start of the construction period.	ECO

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		include indigenous vegetation, fauna, aquatic ecosystems or heritage resources.	<ol style="list-style-type: none"> 2) The top 100mm of the soil layer shall be stockpiled for rehabilitation purposes. The topsoil stockpiles need to be protected against erosion, contamination and the establishment of alien vegetation. 3) Topsoil shall be stored in areas demarcated by the ECO and Site Engineer and stockpiles shall not exceed 2m in height. 4) If heavy rains are expected activities should be put on hold to reduce the risk of erosion. 5) Wind screening should be undertaken to prevent soil loss from the site. 6) Rehabilitation of completed sections with appropriate local indigenous vegetation shall start immediately and bare soil shall be protected against wind while vegetation re-establishes (or as required by the rehabilitation specialist). A practical solution should be determined by the rehabilitation specialist. 7) Soil remaining after construction and rehabilitation activities has been completed, shall be dispersed evenly, as a very thin layer of soil. 8) Once construction is complete, disturbed areas shall be rehabilitated and maintained with appropriate local indigenous vegetation. 9) Ensure conservation of as much vegetation cover as possible during construction will also mitigate in the longer term. 10) Minimise removal or disturbance of adult trees especially <i>A. erioloba</i> and <i>Searsia pendulina</i> specimens. 11) Remove perennial alien species such as 				

ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		<p><i>Prosopis glandulosa</i> and <i>Sesbania punicea</i> at sites disturbed or cleared by construction activities. Care should be taken not to introduce additional seed or propagules of alien species that may be present in aggregates brought to site. Vegetate areas that are not meant to stay clear as soon as possible after construction with a local indigenous species.</p> <p>12) Prevent unnecessary disturbance of substrates, fauna or flora.</p>				

4.9 CEMP: Construction of the hydropower facility and associated infrastructures

ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION	
1.	Excavations for infrastructure	In order to construct the power chamber, canal and other infrastructure excavations will be required which might impact on the environment.	<p>Objective: To limit the impact to the environment caused by excavations.</p> <p>Mechanism:</p> <p>3) Any surplus materials from excavations that cannot be used on site during the construction phase are to be reused.</p> <p>4) Materials may be used in local construction activities.</p> <p>5) The ECO must be informed if historical artefacts are found on the surface or exposed by excavations.</p> <p>6) Trenches shall be appropriately demarcated and regularly monitored during operations to ensure that pedestrian (and vehicular) access to these areas is strictly prohibited.</p> <p>7) Use erosion control measures to minimise erosion at excavation sites or aggregate</p>	No heaps of materials left on site after the construction phase.	Civil Works Contractor, ECO	During Construction Phase (from site establishment to Contract Completion)	ECO

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			storage sites. Construction activities should take place in dry season as far as possible. 8) Minimise bank destabilisation, vegetation removal and erosion.				
2.	Construction of transmission lines	Transmission lines might result in negative environmental impacts	Objective: To construct the transmission lines whilst limiting environmental impacts Mechanism: 1) Demarcate the area proposed for transmission line construction in order to prevent site staff from damaging nearby vegetation. 2) All new powerlines should be adequately insulated and marked with bird flight diverters along their entire length.	No damage to vegetation adjacent to area proposed for transmission line construction. No significance changes are recorded in the number, distribution or breeding behaviour of priority avifauna species (bird monitoring programme).	Civil Works Contractor	During Construction Phase	ECO
3.	Dewatering		Objective: To prevent water contamination Mechanism: 1) The contractor shall ensure that none of the water pumped during any dewatering process is released into the aquatic environment without the consent of the Site Engineer. 2) The dewatering process which occurs on the construction site shall be conducted with the use of a sump. Water with high sediment loads should be pumped into a sump, which will allow sediment particles to settle. Upon which, the water shall be drained into the riverine environment, whereas the particulates shall be collected and disposed	Consent of Site Engineer received prior to releasing pumped water back to the system	Site Engineer	During Construction Phase	ECO

ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		of at a registered landfill site.				

4.10 CEMP: Removal of construction related debris, materials or equipment

ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1. Removal of equipment, materials and any temporary structures	If the construction camp is not decommissioned it can result in environmental degradation.	<p>Objective: To rehabilitate the impacted area to an acceptable state as close to the original state.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) All construction related structures are to be removed from site. 2) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc., and these shall be cleaned up. 3) All hardened surfaces within the construction camp area should be ripped and rehabilitated. 4) Surfaces are to be checked for waste products from activities such as concreting and cleared in a manner approved by the Site Engineer. 5) All rubble is to be removed from the site to an approved disposal site as approved by the Site Engineer. 6) Burying of rubble on site is prohibited. 7) Temporary fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Site Engineer. 8) The Civil Works Contractor must repair any damage that the construction works has 	The area impacted by the construction activities are rehabilitated and pose no threats to the environment.	Civil Works Contractor, Site Engineer and ECO	After the construction phase, before the operational phase can commence.	ECO

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			caused to neighbouring properties. 9) Rehabilitate and re-vegetate cleared areas with indigenous plant species. 10) Rehabilitate marginal and riparian vegetation after construction where necessary.				

4.11 Temporary site closure

If the site is closed for a period exceeding one week, the Civil Works Contractor, in consultation with the Site Engineer shall carry out the following checklist procedure.

Hazardous materials stores

- Outlet secure/ locked
- Bund empty (where applicable)
- Fire extinguishers serviced and accessible
- Secure area from accidental damage e.g. vehicle collision
- Emergency and contact details displayed
- Adequate ventilation

Safety

- All trenches and manholes secured
- Fencing and barriers in place as per the Occupational Health and Safety Act (No 85 of 1193)
- Emergency and Management contact details displayed
- Stockpiles wedged/ secured

Erosion

- Wind and dust mitigation in place
- Slopes and stockpiles at stable angle

Water contamination and pollution

- Cement/bitumen and materials stores secured
- Toilets empty and secured
- Refuse bins empty and secured
- Structures vulnerable to high winds secure.

4.12 Penalties

Penalties will be issued for the transgressions listed below. Penalties may be issued per incident at the discretion of the Site Engineer. Such penalties will be issued in addition to any remedial costs incurred as a result of non-compliance with the environmental specifications. The Site Engineer will inform the Civil Works Contractor of the contravention and the amount of the penalty, and will deduct the amount from monies due under the Contract. A penalty register shall be kept and shall be made available to the DEA on request.

Penalties for the activities detailed below, will be imposed by the Site Engineer on the Civil Works Contractor:

- a) Any employees, vehicles, plant, or items related to the Civil Works Contractor's operations (including those being undertaken by other contractors and sub-contractors) operating within the designated boundaries of a "no-go" area. R10 000

b)	Any mechanised excavation equipment related to the Civil Works Contractor's operations, or those of its sub-contractors, operating within the designated boundaries of a "no-go" area abutting the two streams.	R10 000
c)	Any vehicle driving in excess of designated speed limits.	R 1 000
d)	Persistent and un-repaired oil leaks from machinery.	R 3 000
e)	Persistent failure to monitor and empty drip trays timeously.	R 1 000
f)	Litter on site associated with construction activities.	R 1 000
g)	Deliberate lighting of illegal fires on site.	R 5 000
h)	Employees not making use of the site ablution facilities.	R 2 000
i)	Failure to implement specified noise controls	R 2 000
j)	Failure to empty waste bins on a regular basis.	R 1 000
k)	Inadequate dust control.	R 5 000
l)	A spillage, pollution, fire resulting from negligence on the part of the Contractor.	R10 000
m)	Any act, that in the reasonable opinion of the Site Engineer, constitutes a deliberate contravention of the requirements of these Specifications	R 5 000

For each subsequent similar offence the penalty shall be doubled in value to a maximum value of R 50 000.

The Site Engineer will determine what constitutes a transgression in terms of this clause, subject to the provisions of Clause 57(1) of the General Conditions of Contract. In the event that transgressions continue the Contractor's attention is drawn to the provisions of Sub-clause 55(1) of the General Conditions of Contract 2004 under which the Engineer may cancel the Contract.

4.13 Amendments to CEMP & Registers

Amendments to the CEMP must be submitted to and approved by the DEA before the changes are commenced with.

Furthermore, copies of the attendance registers for all environmental awareness training, complaints registers, penalty registers and method statements must be kept and made available to the DEA on request.

5 OPERATIONAL FRAMEWORK EMP

This section contains the Framework Operational EMP. It is important to note that this Framework OEMP has been compiled prior to authorisation of the proposed project and will be updated to include the conditions of the EA that will be issued by DEA as part of the EIA.

The information is summarised in tabular format below illustrating the activity, aspect, impact, mitigation measure, performance indicators, resources, schedule and verification. These criteria are listed and explained below:

The following components are identified/ described:

- **Activity:** component / activity of the project for which the impact has been identified;
- **Aspect:** the aspect of the above activity which will be impacted;
- **Impact:** the environmental impact identified and to be mitigated;
- **Mitigation measure:** measures identified for implementation in terms of environmental management to reduce, rectify or contain the identified environmental impact – mitigation is divided into the following:
 - Objective: desired outcome of mitigation measure,
 - Mechanism: method of achieving the objective;
- **Performance indicators:** outcomes that will indicate achievement of objective/s;
- **Responsibility:** party or parties identified for implementation of mitigation measure/s;
- **Resources:** available resources to aid implementation of mitigation;
- **Schedule:** timeframe in which identified impact and mitigation measure is anticipated to occur; and
- **Verification:** party or parties identified as responsible for review and assessment of final outcome.

5.1 Site specific Mitigation measures Operational Phase

5.1.1 Botanical

The following mitigation measures are proposed to mitigate botanical impacts at operational stage:

- Soil should be flattened and graded, i.e. no heaps of soil or piles of rock to be left.
- No deep ruts or channels are to be left.
- Any temporary access roads and the construction zone alongside the offtake channel and tailrace should be scarified to alleviate compaction by heavy vehicles and to aerate the soil to permit re-colonization by local flora.
- Attend to all recommended mitigation measures concerning vegetation and vegetation rehabilitation.

5.1.2 Avifauna

None

5.1.3 Heritage

None

5.1.4 Palaeontology

None

5.1.5 Aquatic

The following mitigation measures are proposed to mitigate aquatic impacts at operational stage:

- Ensure rehabilitation of vegetation after construction.
- Ensure environmental flows occur before intake comes into operation. Allow small and moderate flood requirements to pass over the Dam wall in keeping with final flow requirements (**Error! Reference source not found.**).
- Effective training and commitment to ensure capacity exists to ensure environmental flow requirements are not compromised.
- Annually contact the Endangered Wildlife Trust to see if bird flappers more effective at river crossings have been designed, and, where available, implement these for line sections crossing the river.
- Prevent clearing of vegetation where not necessary.
- Ensure integrity of fences around all access to open canal are maintained, to prevent drowning.
- Adhere to minimum flow requirements as determined by reserve (see **Error! Reference source not found.** for final flows).
- Monitor flows through the turbines at sub-daily resolution, and ensure adequate maintenance of turbines to promote consistency in operation as and when flows enter the intake.

5.1.6 Traffic

None

5.2 Operational EMP

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Environmental management documentation and procedures	No framework within which to locate the management of the operational phase. No procedures against which to assess environmental performance during the operational phase and thus no measure of compliance.	Objective: To ensure that the operation of the hydropower facility does not result in avoidable impacts on the environment, and that any impacts that do occur are anticipated and managed. Mechanism: 1) Appoint a suitably qualified ECO to monitor compliance (either independent or in-house) and conduct the environmental audit. 2) Audit the compliance with the requirements of the environmental specification contained within the OEMP.	Environmental impacts effectively monitored and managed during the operational phase. Comprehensive record of compliance and remedial actions available to the developer and the authorities	The Owner	Twice in the 1 st three years and then once every five years	ECO
2.	Environmental management of the operational phase	Positive impacts on socio-economic environment during operation	Objective: To ensure that the operation of the hydropower facility maximises positive impacts on the socio-economic environment. Mechanism: 1) Train local people for operation and maintenance of facility. 2) Employ local labour for the operational phase, where possible, and particularly for day to day operations and maintenance.	Consult annual skills and training records, employment records and proof of staff residency in the area prior to employment.	Maintenance Services Contractor	During Operational Phase (full lifetime) when the need arise to employ people.	ECO
3.	Protection of fauna, flora and avifauna	Constructing a hydropower facility may have impacts on fauna, flora and or avifauna.	Objective: To prevent unnecessary disturbance to natural vegetation. Mechanism: 1) The rehabilitation plan for the site should be implemented and adhered to during the operational phase. 2) An on-going monitoring programme should be implemented to detect and quantify any aliens	No animals are injured. No alien vegetation establishment. Invasive alien vegetation monitoring programme	Maintenance Services Contractor	Vegetation rehabilitation should be monitored reported on a monthly basis for four to six months post-construction.	The Owner and ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>that may become established and provide information.</p> <p>3) Invasive alien plant growth within the disturbed areas should be visually monitored at least every three months and any regrowth of invasive alien plants removed.</p> <p>4) Minimizing noise and disturbance associated with maintenance activities at the plant once it becomes operational for the management of aliens.</p> <p>5) .</p> <p>6) New aboveground lines should be fitted with bird flight diverters and marked along their entire length. High risk areas identified during the avifauna monitoring assessment shall be fitted at all times with bird flight diverters. .</p> <p>7) Soil should be flattened and graded, i.e. no heaps of soil or piles of rock to be left.</p> <p>8) No deep ruts or channels are to be left.</p> <p>9) Any temporary access roads and the construction zone alongside the offtake channel and tailrace should be scarified to alleviate compaction by heavy vehicles and to aerate the soil to permit re-colonization by local flora.</p> <p>10) Attend to all recommended mitigation measures concerning vegetation and vegetation rehabilitation. Ensure rehabilitation of vegetation after construction.</p> <p>11) Effective training and commitment to ensure capacity exists to ensure environmental flow requirements are not compromised.</p> <p>12) Annually contact the Endangered Wildlife Trust to see if bird flappers more effective at</p>	implemented.			

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>river crossings have been designed, and, where available, implement these for line sections crossing the river.</p> <p>13) Prevent clearing of vegetation where not necessary.</p> <p>14) Ensure integrity of fences around all access to open canal are maintained, to prevent drowning.</p> <p>15) Monitor flows through the turbines at sub-daily resolution as part of the operator monitoring programme, and ensure adequate maintenance of turbines to promote consistency in operation as and when flows enter the intake.</p>				
4.	Stormwater runoff, erosion, and pollution of surface water and groundwater resources.	Contamination of stormwater runoff can impact on the surface and groundwater resources. The mismanagement of stormwater can furthermore result in erosion.	<p>Objective: Prevent stormwater from eroding the land and becoming contaminated.</p> <p>Mechanism:</p> <p>1) A storm water management plan must be compiled by the engineer for the operation phase of the project. Storm water runoff from the constructed areas should also be visually monitored after large rainfall events to ensure that eroded areas do not develop, particularly within the drainage channels.</p> <p>2) Disturbed areas within the riparian zones and stream beds should be rehabilitated as soon as possible after construction has been completed and re-vegetated with suitable indigenous vegetation.</p>	<p>Stormwater not contaminated by operational activities.</p> <p>Stormwater control measures are effective at regulating runoff from the site and erosion channels do not develop.</p> <p>Freshwater ecosystems are not unduly disturbed by operation activities within the drainage channels.</p>	Maintenance Services Contractor	After site clearing has taken place up to the end of the construction phase.	The Owner and ECO
5.	Visual impact	The proposed site is visible to the public however the majority	<p>Objective: To protect the sense of place.</p> <p>Mechanism:</p>	No complaints from the public.	The Owner, Maintenance Services	During the operational phase.	The Owner and ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		of the construction site is masked and therefor the visual impact on sense of place will be reduced.	<ol style="list-style-type: none"> 1) Security and perimeter lighting must also be shielded so that no light falls outside the area needing to be lit. 2) Unnecessarily tall light poles are to be avoided. 		Contractor		
6.	Noise	The increase in traffic and operation of equipment may result in noise becoming a nuisance.	<p>Objective: To ensure that the operational phase are compliant to noise regulations.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Maintain noise complaints registered and ensure that any complaints are addressed in a timeous manner. The developer must implement a line of communication. 2) Good public relations are essential and the community involvement needs to continue throughout the project. 	No complaints received from public and or site staff	Maintenance Services Contractor	During the operational phase.	The Owner and ECO

6 MONITORING PROGRAMMES

Monitoring of revegetation:

- The progress of vegetation rehabilitation should be monitored reported on a monthly basis for four to six months post-construction. Measurable targets should be determined by a restoration practitioner give the characteristic of the local environment.
- Any alien invasive vegetation such as *Prosopis glandulosa* (mesquite) that appears in disturbed areas or near the hydro-power site, particularly along the banks of the Orange River, should be removed and destroyed.

7 DECOMMISSIONING

As the proposed hydropower station is to be constructed in response to the Renewable Energy Independent Power Producers Procurement Program it will have a Power Purchase Agreement issued by Eskom spanning a period of 20 years, which will be the operational period. However, as the entire infrastructure, such as roads, transmission, and power chamber, etc. would already be established and the energy source (water) is a renewable one, the proposed project could potentially continue to be operated beyond this. As such the facility will most likely be upgraded with the latest applicable technology and/ or existing infrastructure will be maintained for further use after the expiration of the initial Power Purchase Agreement.

However, should the facility be decommissioned, all components will have to be disassembled, removed and recycled as far as possible. Since the proposed hydropower facility comprises of inert materials (mostly concrete), the residual risks associated with decommissioning would be negligible. Roads which are no longer required after decommissioning should be scarified and the areas rehabilitated with the assistance of a rehabilitation specialist. Depending on the best available option at the time, any above ground structures must be demolished unless an alternative use is found for them. Decommissioning would have to be undertaken as per the environmental legislation relevant at that time and under the supervision of an independent ECO.

Materials will be recycled where appropriate, and any hazardous substances shall be removed and disposed of in terms of the requirements of the relevant legislation (e.g. Hazardous Substances Act, No. 15 of 1973) and SANS specifications.

A detailed decommissioning plan will be developed using the construction phase EMP as a guideline to facilitate the detailed decommission phase EMP.

8 CONCLUSION

In conclusion it should be noted that the LEMP should be regarded as a living document and changes should be made to the LEMP as required by project evolution, while retaining the underlying principles and objectives on which the document is based.

The LEMP has incorporated impacts and mitigation measures from the EIR as well as the principles of best practice in terms of environmental management. By identifying the potential impacts, mitigation measures, performance indicators, responsibilities, available resources, potential schedule and verification responsibility, the LEMP has provided a platform on which both the construction phase and the operational phase EMPs can be founded. The LEMP has ensured that the individual EMPs will be able to incorporate mitigation measures based on the project in its entirety as opposed to phase-specific measures.

APPENDIX A
CURRICULUM VITAE OF ENVIRONMENTAL
ASSESSMENT PRACTITIONERS

APPENDIX B
CONSTRUCTION EMP GENERAL SPECIFICATIONS
(COMPREHENSIVE)
