DUVHA POWER STATION ASH DAM, RAW AND ASH WATER RETURN DAMS SEEPAGE INTERCEPTION DRAINS IN MPUMALANGA PROVINCE

BASIC ASSESSMENT REPORT

OCTOBER 2019

DRAFT

PREPARED FOR: ESKOM HOLDINGS SOC LTD

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Title and Approval Page

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Amendments Page

Date:	Nature of Amendment	Amendment Number:
10 October 2019	Draft BAR for Public and Authorities Review	00

Executive Summary

INTRODUCTION

Nemai Consulting was appointed by Eskom Holdings SOC Ltd to undertake the Basic Assessment process for the proposed seepage interception drains, located in the Duvha Power Station, in accordance with the National Environmental Management Act (Act No. 107 of 1998) and the 2014 Environmental Impact Assessment Regulations, as amended (07 April 2017).

BASIC ASSESSMENT PROCESS

The proposed Duvha Power Station seepage interception drains entail certain activities that require authorisation in terms of National Environmental Management Act (Act No. 107 of 1998). The process for seeking authorisation is undertaken in accordance with the 2014 Environmental Impact Assessment Regulations (Government Notice No. R. 982, R. 983, R. 984 and R. 985), as amended (07 April 2017), promulgated in terms of Chapter 5 of National Environmental Management Act (Act No. 107 of 1998).

Based on the types of activities involved which include activities listed in Government Notice No. R. 983 and R. 985 of the 2014 Environmental Impact Assessment Regulations, as amended (07 April 2017); the requisite environmental assessment for the project is a **Basic Assessment Process**.

PROJECT OVERVIEW

The Duvha Power Station produces wet ash that gets pumped into an Ash Dam. The settled water is then decanted to a Low Level Ash Water Return Dam, before it is pumped back to the station for reuse. A groundwater study revealed that the Ash Dam is experiencing water seepage towards the Witbank Dam, leading to groundwater contamination and possible contamination of the Witbank Dam. Polluted seepage is also emanating from the Low Level Ash Water Return Dam and High Level Ash Water Return Dam.

The construction of subsoil groundwater seepage interception drains at the Ash Dam, Low Level Ash Water Return Dam and High Level Ash Water Return Dam, as well as a Raw Water Dam, is proposed to mitigate seepage from the Ash Dam and prevent contamination of the Witbank Dam.

SPECIALIST STUDIES

The following Specialist Studies were as part of the Basic Assessment Process:

1. Terrestrial Ecological Assessment Report;

2. Aquatic and Wetland Baseline and Impact Assessment;
3. Phase 1 Heritage Impact Assessment; and
4. Desktop Palaeontological Impact Assessment.

Summaries of these specialist studies are included in the Basic Assessment Report.

IMPACT ASSESSMENT

This Basic Assessment Report focuses on the pertinent environmental impacts that could potentially be caused by the proposed Duvha Power Station seepage interception drains during the pre-construction, construction and operational phases of the project.

The impacts and the proposed management measures are discussed on a qualitative level and thereafter quantitatively assessed by evaluating the nature, extent, magnitude, duration, probability and ultimately the significance of the impacts. The assessment considered impacts before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

The proposed mitigation of the impacts associated with the project includes specific measures identified by the technical team and environmental specialists, stipulations of environmental authorities and environmental best practices. The Environmental Management Programme provides a comprehensive list of mitigation measures for specific elements of the project, which extends beyond the impacts evaluated in the body of the Basic Assessment Report.

PUBLIC PARTICIPATION

The Basic Assessment Report provides a full account of the public participation process that was followed for the proposed project.

A Registration Period took place from 07 June 2017 to 30 June 2017. A 30-Day Authority and Public Review of the Draft Basic Assessment Report will take place from **10 October 2019 to 08 November 2019**. A copy of the report will be placed at public venues within the study area, and an electronic copy of the Draft Basic Assessment Report will be available on the Nemai Consulting website (https://www.nemai.co.za/documents.html) and on the Eskom website(https://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment_Impact_Assessments.aspx).

In addition, hardcopies of the report will be submitted to commenting and decision-making authorities.

ENVIRONMENTAL CONCLUSIONS AND RECOMMENDATIONS

Attention is drawn to specific sensitive environmental features (with an accompanying sensitivity map) for which mitigation measures are included in the Basic Assessment Report and Environmental Management Programme.

An Environmental Impact Statement is provided and critical environmental activities that need to be executed during the project lifecycle are also presented.

With the selection of the best practicable environmental option, the adoption of the mitigation measures included in this report, and the dedicated implementation of the Environmental Management Programme, it is believed that the significant environmental aspects and impact associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions. In conclusion, it is recommended that the proposed development of the Duvha Power Station seepage interception drains should be authorised.

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List of Abbreviations

BA	Basic Assessment
BAR	Basic Assessment Report
BID	Background Information Document
BPEO	Best Practicable Environmental Option
CBA	Critical Biodiversity Areas
CLO	Community Liaison Officer
DALRRD	Department of Agriculture, Land Reform and Rural Development
DEFF	Department of Environment. Forestry and Fisheries
DHSWS	Department of Human Settlements, Water and Sanitation
DM	District Municipality
DMRE	Department of Mineral Resources and Energy
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance & Sensitivity
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
ESA	Ecological Support Areas
FEPA	Freshwater Ecological Protection Area
GN	Government Notice
HIA	Heritage Impact Assessment
IAPs	Interested and Affected Party
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature
LM	Local Municipality
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
NEMA	National Environmental Management Act (Act No. 107 of 1998
NEMAQA	National Environmental Management: Air Quality Act (Act No. 39 of 2004)
NEMBA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEMPA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEMA:WA	National Environmental Management Waste Act (Act No. 56 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act (Act No. 36 of 1998)
OHS	Occupational Health and Safety
PES	Present Ecological Status

SANBI	South African National Biodiversity Institute
WUL	Water Use License
WULA	Water Use License Application

1 PURPOSE OF THE DOCUMENT

Nemai Consulting was appointed by Eskom Holdings SOC Ltd to undertake the Basic Assessment (BA) Process for the proposed Duvha Power Station seepage interception drains in Mpumalanga Province in accordance with the National Environmental Management Act (Act No. 107 of 1998) (NEMA) 2014 Environmental Impact Assessment (EIA) Regulations, as amended (07 April 2017).

The document serves as the Draft Basic Assessment Report (BAR) for the proposed Duvha Power Station seepage interception drains.

According to GN No. R. 982 of the 2014 EIA Regulations, as amended (07 April 2017), the objective of the BA Process is, through a consultative process:

(a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;
(b) identify the alternatives considered, including the activity, location, and technology alternatives;
(c) describe the need and desirability of the proposed alternatives;
(d) through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine−
    (i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
    (ii) the degree to which these impacts−
        (aa) can be reversed;
        (bb) may cause irreplaceable loss of resources; and
        (cc) can be avoided, managed or mitigated; and
(e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to−
    (i) identify and motivate a preferred site, activity and technology alternative;
    (ii) identify suitable measures to avoid, manage or mitigate identified impacts; and
    (iii) identify residual risks that need to be managed and monitored.

The Draft BAR will be made available to IAPs for a 30-Day Review Period from **10 October 2019 to 08 November 2019**. All comments that are received will be assessed in the Final BAR and will also be noted in the Comments and Response Report. The Final BAR will then

be submitted to the Department of Environment, Forestry and Fisheries (DEFF) (previously the Department of Environmental Affairs), the Competent Authority in respect to this proposed development.

2 DOCUMENT ROADMAP

The BAR is intended to meet all requirements as stipulated in Appendix 1 of Government Notice (GN) No. R. 982 of the 2014 EIA Regulations, as amended (07 April 2017). In order to provide clarity to the reader, a document roadmap is provided in terms of the aforementioned regulatory requirements (**Table 1**).

Table 1: Document Roadmap

Chapter	Title	Correlation with GN No. 982 – Appendix 1	
1.	Purpose of the Document	–	–
2.	Document Roadmap	–	–
3.	Project Overview	3(1)(b, c and d)	(b) the location of the activity, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties; (c) a plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale; or, if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or on land where the property has not been defined, the coordinates within which the activity is to be undertaken; (d) a description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for; and a description of the activities to be undertaken including associated structures and infrastructure;
4.	Alternatives		
5.	Environmental Assessment Practitioner	3(1)(a)	(a) Details of – (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including curriculum vitae.
6.	Legislation and Guidelines Considered	3(1)(e)	(e) a description of the policy and legislative context within which the development is proposed including- (i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and

Chapter	Title	Correlation with GN No. 982 – Appendix 1	
			(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;
7.	Basic Assessment Process	–	–
8.	Assumptions and Limitations	3(1)(o)	(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;
9.	Need and Desirability	3(1)(f)	(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;
10.	Timeframes	3(1)(q)	(q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;
11.	Financial Provisions	3(1)(s)	(s) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;
12.	Resource Use and Process Details	-	-
13.	Public Participation Process	3(1)(h)	(h) a full description of the process followed to reach the proposed preferred alternative within the site, including: (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;
14.	Environmental Attributes	3(1)(h)	(h) a full description of the process followed to reach the proposed preferred alternative within the site, including: (iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
15.	Summary of Specialist Studies	3(1)(k and m)	(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report; (m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr;
16.	Impact Assessment	3(1)(h, i and j)	(h) a full description of the process followed to reach the proposed preferred alternative within the site, including: (v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and

Chapter	Title	Correlation with GN No. 982 – Appendix 1	
17.	Impact Management		probability of potential environmental impacts and risks associated with the alternatives; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) the outcome of the site selection matrix; (x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and (xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity; (i) a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures; (j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be avoided, managed or mitigated;
18.	Analysis of Alternatives	3(1)(g, k, l, m, n, and p)	(g) a motivation for the preferred site, activity and technology alternative; (k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report; (l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment; (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives; (m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management objectives,

Chapter	Title	Correlation with GN No. 982 – Appendix 1	
19.	Conclusions and Recommendations		and the impact management outcomes for the development for inclusion in the EMPr; (p) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;
20.	Oath of Environmental Assessment Practitioner	3(1)(r)	(r) an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties;
N/A		3(1)(t)	Where applicable, any specific information required by the Competent Authority.
N/A		3(1)(u)	Any other matters required in terms of sections 24(4)(a) and (b) of the Act.

3 PROJECT OVERVIEW

3.1 Project Description

Duvha Power Station generates 3600MW consisting of 6x600MW units and has been in operation for a period of 40 years. The power station gets its water supply from the Komati Water Scheme (KWS) and from the Witbank Dam.

The Duvha Power Station produces wet ash that gets pumped into an Ash Dam. The settled water is then decanted to a Low Level Ash Water Return Dam (LLAWRD), before it is pumped back to the station for reuse. A groundwater study revealed that the Ash Dam is experiencing water seepage towards the Witbank Dam, leading to groundwater contamination and possible contamination of the Witbank Dam. Polluted seepage is also emanating from the LLAWRD and High Level Ash Water Return Dam (HLAWRD).

A solution is required to prevent the groundwater seepage as Duvha Power Station's Water Use License (WUL) states that "Any water containing waste or any substance which causes or is likely to cause pollution of a water resource must be prevented from entering any water resource, either by seepage or natural flow." Department of Water and Sanitation (now the Department of Human Settlements, Water and Sanitation (DHSWS)) thus instructed Eskom to mitigate and prevent groundwater pollution. The construction of subsoil groundwater seepage interception drains at the Ash Dam, LLAWRD and HLAWRD, as well as a Raw Water

Dam, is proposed to mitigate seepage from the Ash Dam and prevent contamination of the Witbank Dam.

Seepage interception drains are deemed to be the only possible solution to prevent contamination of Witbank Dam. The advantage of the system is that the seepage water will be pumped and re-used by the power station, and thus polluting of the Witbank Dam will be avoided or reduced.

In order to limit groundwater seepage from the existing Ash Dam, as well as the HLAWRD and LLAWRD, it is proposed to construct cut-off interceptor drains along sections of the perimeter of each of these dams and to convey the intercepted water to designated discharge points where water will be pumped back to the dams. The seepage interception drains will be constructed with manholes and perforated pipes. A float level switch to pump the water back to the dam will have to be installed and the process will continue as a cycle. This same system will be used for the LLAWRD and HLAWRD.

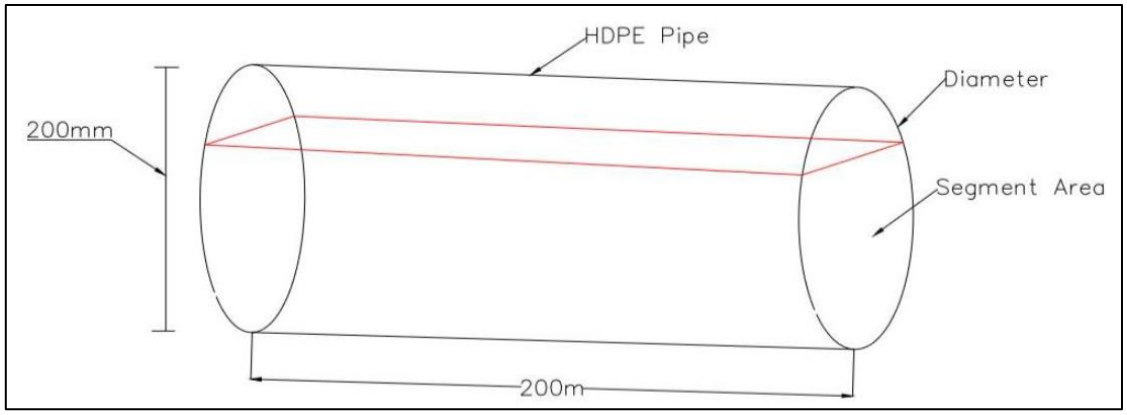

Figure 1: Cross-section of the HDPE collector pipe to be embedded into the ground

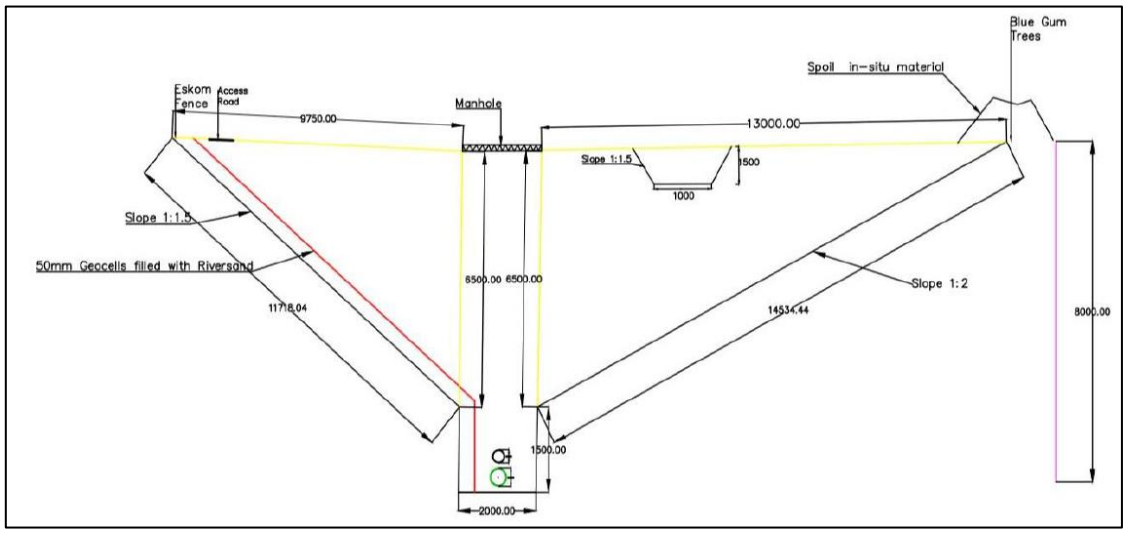

Figure 2: Conceptual design of seepage interception drain

The benefit of installing the 8.0m deep seepage interception drain is that the polluted groundwater will not seep towards Witbank Dam. Additional surface water flow will be intercepted by the open trench and sent to the LLAWRD which will then be used by the power station for operation purposes. The construction of the cut-off trench will also indicate that Eskom is implementing measures to comply with the requirement of NWA to not pollute the environment.

3.2 Project Location

Eskom propose to install seepage interception drains in four areas in the Duvha Power Station, Mpumalanga Province (**Figures 3** and **4**). The Duvha Power Station is located in the Emalahleni Local Municipality and the Nkangala District Municipality. The seepage drains are located on the Remaining Extent of Farm Duvha Kragstasie 337 JS. The Ash Dam is located 1.7km east of the Witbank Dam.

In addition to the drains, three temporary construction camp sites are proposed near the drain servitudes. **Figure 5** shows the cut-off trenches in within the proposed servitudes.

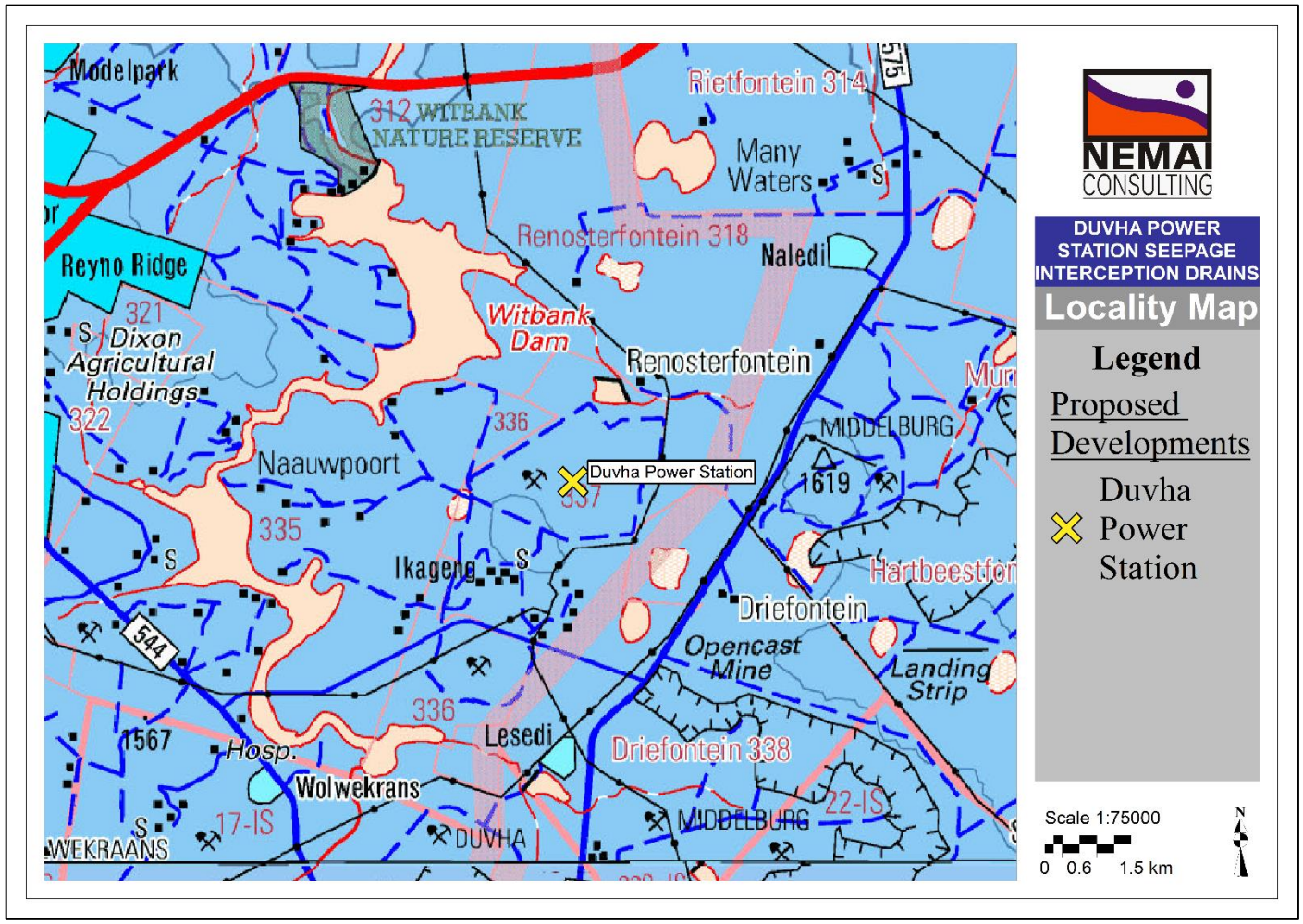

Figure 3: Regional Locality Map

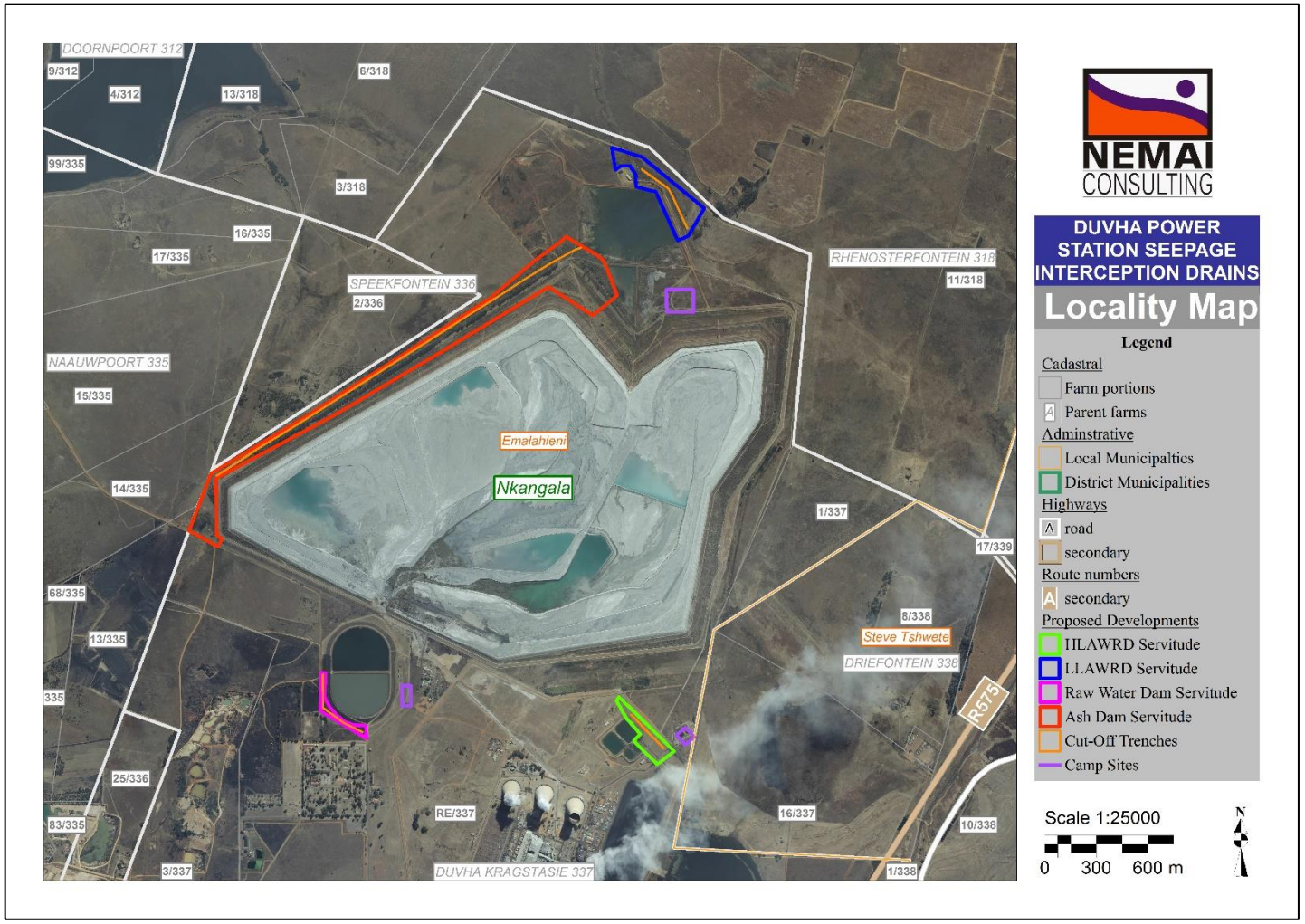

Figure 4: Locality Map

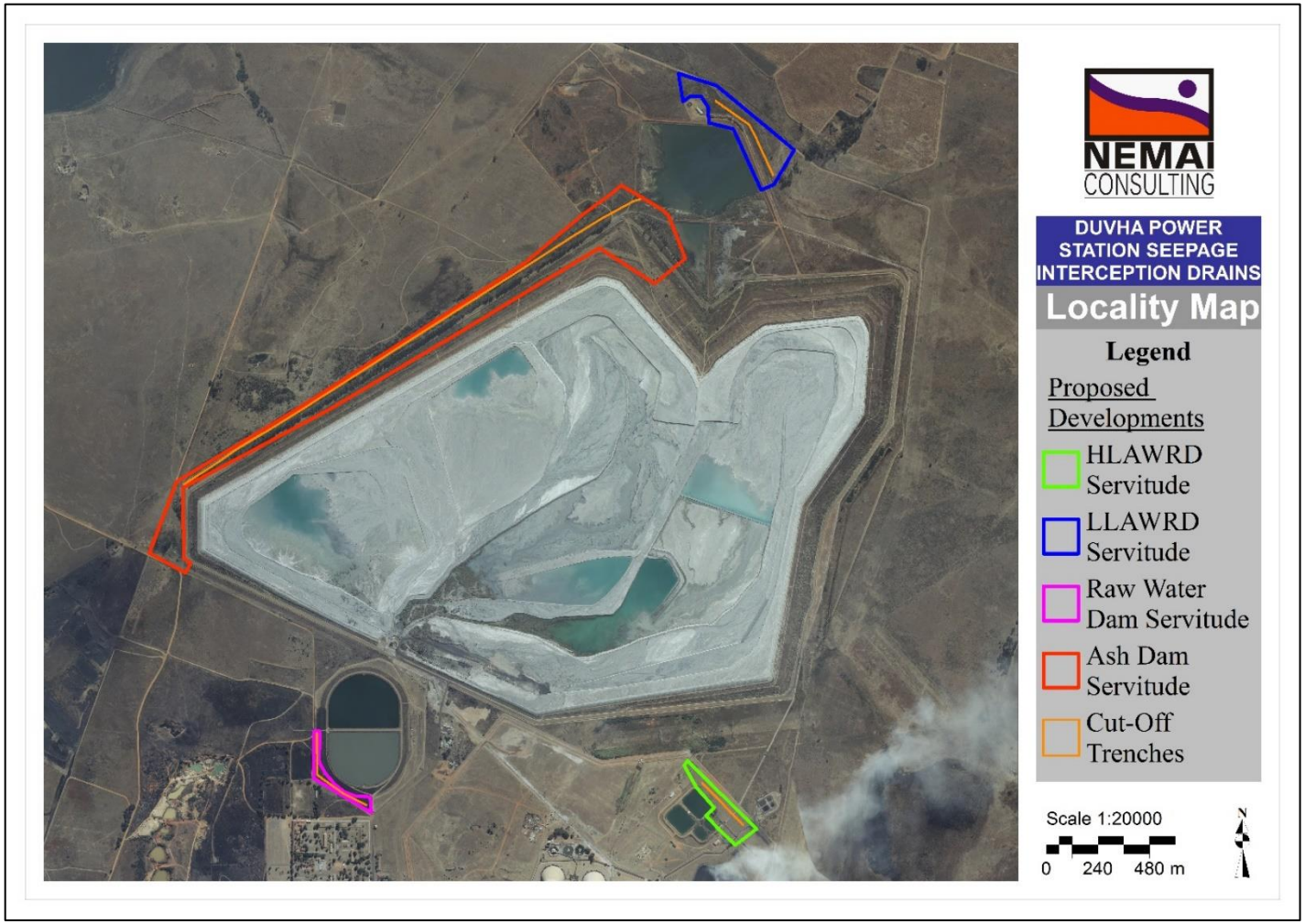

Figure 5: Locality Map indicating the cut-off drains within the servitudes

3.3 Project Lifecycle

To adequately consider the impacts associated with the Duvha Power Station seepage interception drains, the major activities during each phase of the project lifecycle are listed in the sub-sections to follow.

3.3.1 Pre-feasibility and Feasibility Phases

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

- Assessment of base conditions;
- Technical, economic and environmental screening of alternatives;
- Surveying;
- Sizing and costing of infrastructure; and
- Geotechnical investigations.

3.3.2 Pre-Construction Phase

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

- Negotiations and agreements with the affected stakeholders and authorities;
- Detailed engineering design;
- Detailed geotechnical investigations;
- Geophysical investigations;
- Survey and mark construction servitude;
- Survey and map topography for determination of post-construction landscape, rehabilitation and shaping (where necessary);
- Possible removal of trees within construction servitude;
- Possible further phases of heritage site investigation and fencing of heritage sites;
- Procurement process for Contractors;
- The building of a site office and ablution facilities (chemical or portable toilets);
- Permits if protected trees are to be cut, disturbed, damaged, destroyed or removed;
- Permits if heritage resources are to be impacted on and for the relocation of graves;
- Confirmation of the location and condition of all structures within the servitude; and
- Determining and documenting the road conditions for all identified haul roads.

3.3.3 Construction Phase

General activities associated with the construction phase include the following:

- Site establishment;
- Establish construction camp;
- Bulk fuel storage;

- Storage and handling of material;
- Construction employment;
- Site clearing;
- Excavation;
- Establishment of and operations at crusher;
- Establishment of and operations at batching plant;
- Establishment of and operations at materials testing laboratory;
- Create haul roads;
- Concrete works;
- Steel works;
- Mechanical and electrical works;
- Electrical supply;
- Construction of seepage interception drains;
- Cut and cover activities;
- Stockpiling (sand, crushed stone, aggregate, etc.);
- Waste and wastewater management;
- Relocation of protected species, etc.; and
- Reinstatement and rehabilitation of construction domain (as necessary).

3.3.4 Operation Phase

Key activities to be undertaken includes operational activities associated with the maintenance and control of the seepage interception drains.

3.3.5 Decommissioning Phase

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

4 ALTERNATIVES

4.1 Introduction

The 2014 EIA Regulations, as amended (07 April 2017) require that feasible project specific alternatives are identified (including the "do nothing" option). Alternatives are defined as different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

- property on which or location where the activity is proposed to be undertaken;
- type of activity to be undertaken;

- design or layout of the activity;
- technology to be used in the activity; or
- operational aspects of the activity; and
- the option of not implementing the activity.

By conducting the comparative analysis, the Best Practicable Environmental Option (BPEO) can be selected with technical and environmental justification. NEMA defines BPEO as the alternative that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term".

4.2 Alternatives considered during Concept Design

Duvha Power Station requested Eskom Group Technology Engineering (GTE) to provide mitigation measures to control and prevent the seepage of the polluted groundwater emanating from the north side of the Ash Dam, as well as from the LLAWRD and HLAWRD that, if left unattended, could contaminate the Witbank Dam. Construction of seepage interception drains was considered the best solution to prevent the groundwater pollution. Four design options were considered for the construction of the seepage interception drains. **Table 2** below provides the advantages and disadvantages of the design options considered.

Table 2: Design options considered to prevent contamination of Witbank Dam

Design Option	Advantage	Disadvantage
Option 1: **Provision of an HDPE Class C Liner on top of Duvha's Ash Dam**	• The installation of a Class C liner will prevent water seeping into the ground.	• Placing of a Class C liner on top of the Ash Dam will require it to be drained and dried out before it can be lined, which will lead to the close down of the station as there will be no dam to place the wet ash from the station; • Settlement of the loosely placed ash will rupture the liner; and • The liner cost will be orders of magnitude higher than a cut-off drain.
Option 2: **Open Cut-off Trench**	• The seepage water will drain by gravity to the LLAWRD and be re-used by the power station; and	• The cut-off trench will have stability issues as the material is deemed very wet and unstable; and

Design Option	Advantage	Disadvantage
	• The open cut-off trench will be cheaper than installing a subsoil drain.	• The open trench will be very deep (~8m) and poses a safety risk.
Option 3: **Closed Subsoil Cut-off Drain**	• The seepage water will drain by gravity to the LLAWRD and be re-used by the power station; and • The subsoil drain will not pose a safety risk.	• The subsoil cut-off drain will be more expensive than an open trench.
Option 4: **Do nothing**	• There will be no additional operational costs on the power station	• The station will not be compliant with the environmental legislation.

To allow categories to be ranked in order of importance, Eskom GTE assigned a rank to each category to ensure that one category carried more weight in deciding the best option. **Table 3** provides the ranking assigned to each category considered important in deciding on the best design option.

Table 3: Ranking assigned to each category

Category	Rank
Construction (lead time)	1
Cost to construct	2
Effect/impact on the environment	3
Safety of construction works	4

How the rank was allocated:

- Safety of construction works – Ranked 4 with the highest points as the safety of employees is considered to be the most important factor when rating options
- Effect/impact on the environment – Ranked 3 with the second highest points as the conservation and protection of the environment is considered important when selecting options
- Cost to construct – Ranked 2 as the cost to construct will not lead to loss of workers lives on site. Rank 2 is considered averagely important for the selection of the options.
- Construction (lead time) – Ranked 1 with the lowest points as the time period to construct is important for the selection of the options to complete the project.

In order to calculate the best option to proceed with, the category rankings and the weight were multiplied. The higher score results in the best option. **Table 4** provides the project scoring matrix which indicates the option

Table 4: Project Scoring Matrix

	Weight	Rank	Option 1 HDPE Class C Liner	Option 2 Open Cut-off Trench	Option 3 Closed Cut-off Trench	Option 4 Do Nothing
Construction (lead time) 1	0-2 years 2-4 years 4-6 years 6-above years	4 3 2 1	1 x 1 = 1	1 x 3 = 3	1 x 3 = 3	N/A
Cost to construct 2	No cost Least cost Average cost High cost	4 3 2 1	2 x 1 = 2	2 x 3 = 6	2 x 2 = 4	N/A
Effect/impact on the environment 3	Lowest effect Average effect Bad effect Worse effect	4 3 2 1	3 x 4 = 12	3 x 3 = 9	3 x 3 = 9	3 x 1 = 3
Safety of construction works 4	Highly safety Average safety Least safety No safety	4 3 2 1	4 x 3 = 12	4 x 1 = 4	4 x 3 = 12	4 x 4 = 16
Total			27	22	28	19

- Option 1 – HDPE Class C Liner:
  Option 1 would involve the containment of water within the Ash Dam. This would result in the Duvha Power Station to shut down as the Ash Dam is only available to collect the wet ash. Therefore, the power station would need to be shut down to line the dam. Construction (lead time) would take the longest to construct of the options as the Ash dam would need to be drained and then lined. Cost to construct would also be high as the lining for the dam may need for the clay to be imported, as well as the draining of the dam which would raise costs. The weight for effect/impact on the environment was low as the lining of the dam would contain the contaminated wet ash and thus the risk

of seepage and groundwater contamination would be low. Safety of construction workers was weighted average safety due to the potential accidents on site. Overall, the total score for Option 1 is 27.

- Option 2 – Open Cut-off Trench:
  Option 2 would involve excavating a trench and then leaving it uncovered after the interception drains are constructed. Construction (lead time) would not take as long as Option 1 due to it involving excavation, construction of the drains and then leaving the trench uncovered. The cost to construct was weighted to have the least cost as the trench would be excavated and then left uncovered. This option resulted in no safety for construction workers as the workers may fall into the open trench. In addition, the trench will not be closed after construction, which would result in a long-term safety risk for Duvha Power Station workers. The effect on the environment was weighted as average as there still may be contaminated water seepage from the dams. The total score for Option 2 is 22.
- Option 3 – Closed Cut-off Trench:
  Option 3 would involve excavating a trench, constructing the interception drains, and then covering the constructed drains. Construction (lead time) would not take as long as Option 1 due to it involving excavation, construction of the drains and then covering the drains with in-situ material. The cost to construct was weighted as average as the trench would be excavated and then covered again, which would increase costs. The safety to construction workers was weighted as average as there was a risk of workers falling into the trench during construction, however, as the trench would be closed after construction, there would be no risk to the workers at Duvha Power Station.
- Option 4 – Do Nothing:
  Option 4 involves not addressing the seepage of the polluted groundwater emanating from the north side of the Ash Dam, as well as from the LLAWRD and HLAWRD. For this option, Construction (lead time) and Cost to construct is not applicable as there will be no construction. Safety to construction workers was weighted the highest safety ranking as there will be no construction and therefore no risk to construction workers safety. Effect/impact on the environment of this option was weighted the worse effect as the seepage of contaminated groundwater will thus continue if the situation is not rectified. This resulted in a total score of 19 for Option 4.

Based on the rankings, **Option 3: closed cut-off trench** is deemed the best and only option for the Duvha Power Station interception seepage drains. Option 1 is unacceptable from a station availability point of view and Option 3 is therefore used for the Concept Design of the seepage interception drains.

4.3 Preferred Alternative

Based on the ranking exercise undertaken by Eskom GTE, the closed cut-off trench is the best option to proceed with. Therefore, the only alternatives assessed for the project will be the preferred activity and the no-go alternative.

4.4 No-go Alternative

The no-go alternative implies that the project will not proceed and thus the seepage interception drains will not be constructed. This would result in the Duvha Power Station Ash Dam, LLAWRD and HLAWRD continuing to experience seepages toward the Witbank Dam, leading to more groundwater contamination and future contamination of Witbank Dam. In addition, Duvha Power Station will not be compliant with the NWA.

5 ENVIRONMENTAL ASSESSMENT PRACTITIONER

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

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

The core members of Nemai Consulting that are involved with the project are captured in **Table 5** below, and their respective Curricula Vitae are contained in **Appendix F**.

Table 5: Project Team Core Members

Name	Qualification	Responsibility
Ms. S. Gerber	BSc (Hons) – Environmental Sciences	Environmental Assessment Practitioner
Ms. J. Davis	BSc (Hons) – Geography	Project Manager
Mr. C. van der Hoven	BSc (Hons) – Environmental Sciences	Public Participation

6 LEGISLATION AND GUIDELINES CONSIDERED

6.1 Overview of Legislation

The legislation that has possible bearing on the proposed project from an environmental perspective is captured in **Table 6** below. **Note:** *this list does not attempt to provide an exhaustive explanation, but rather represents an identification of the most appropriate sections from pertinent pieces of legislation*.

Table 6: Environmental Statutory Framework

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

Legislation	Relevance
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	Air quality management. Section 32 – dust control. Section 34 – noise control. Authority – DEFF
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	Management and conservation of the country's biodiversity. Protection of species and ecosystems. Authority – DEFF
National Environmental Management: Waste Act (Act No. 59 of 2008)	Chapter 5 – licensing requirements for listed waste activities (Schedule 1). Authority – Minister (DEFF) or MEC (provincial authority)
Occupational Health & Safety Act (Act No. 85 of 1993)	Provisions for Occupational Health & Safety. Authority – Department of Employment and Labour (DEL).
National Heritage Resources Act (Act No. 25 of 1999)	Section 34 – protection of structure older than 60 years. Section 35 – protection of heritage resources. Section 36 – protection of graves and burial grounds. Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m^2 in extent. Authority – Mpumalanga Provincial Heritage Resource Authority (MPHRA).
National Forestry Act (Act No. 84 of 1998)	Section 15 – authorisation required for impacts to protected trees. Authority – DEFF.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Permit required for borrow pits. Authority – Department of Mineral Resources and Energy (DMRE).
National Road Traffic Act (Act No. 93 of 1996)	Authority – Department of Transport (DoT).
Spatial Planning and Land Use Management Act (Act No.16 of 2013)	Directs and regulates planning and development in South Africa. Govern planning permissions and approvals, sets parameters for new developments and provides for different lawful land uses in South Africa. Authority – DEFF.

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

The proposed Duvha Power Station seepage interception drains in terms of NEMA, and the BAR was undertaken in accordance with the 2014 EIA Regulations, as amended (07 April 2017).

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

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

The proposed development triggered activities under Listing Notices 1 and 3 and thus a **BA Process** needs to be undertaken. The listed activities are fully explained in context of the project in **Table 7**.

Table 7: Listed activities triggered by the proposed project

Notice No.	Activity No.	Activity Description	Project Relevance
GN 983	12 (ii)(a and c)	The development of- (ii) infrastructure or structures with a physical footprint of 100 square metres or more where such development occurs- (a) within a watercourse (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse	As the Ash Dam servitude and LLAWRD servitude will have a physical footprint of 10 square metres or more within a watercourse, this activity will trigger.
	19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	The Ash Dam servitude and LLAWRD servitude fall within a watercourse, therefore this activity will trigger.
	27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.	The four drain servitudes and three temporary construction camp sites fall within terrestrial threatened ecosystems, namely the Rand Highveld Grassland and the Eastern Highveld Grassland, as well as fall within CBA Optimal areas. As the drains and camp sites will clear an area of indigenous vegetation larger than 1 hectare, this activity will trigger.
GN 985	12 (f)(i and ii)	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. (f) In Mpumalanga (i) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; (ii) Within critical biodiversity areas identified in bioregional plans.	The four drain servitudes and three temporary construction camp sites fall within terrestrial threatened ecosystems, namely the Rand Highveld Grassland and the Eastern Highveld Grassland, as well as fall within CBA Optimal areas. As the drains and camp sites will clear an area of indigenous vegetation larger than 300 square metres within the Mpumalanga Province, this activity will trigger.

Notice No.	Activity No.	Activity Description	Project Relevance
	14 (ii)(a and c)(f)(i) (ff)	The development of – (ii) infrastructure or structures with a physical footprint of 10 square meters or more; where such development occurs – (a) within a watercourse (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; (f) In Mpumalanga (i) Outside urban areas: (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	The Ash Dam servitude, LLAWRD servitude, and the Raw Water Dam servitude fall within CBA Optimal areas. As Ash Dam servitude, LLAWRD servitude, and the Raw Water Dam servitude will have a physical footprint of 10 square metres or more within a watercourse in the Mpumalanga Province outside the urban edge, this activity will trigger.

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

NWA regulates the water resource of South Africa and aims to achieve the sustainable use water for the benefit of all users. Water is considered a scarce commodity and should therefore be adequately protected. Amongst others, the act deals with the protection of water sources, water uses, water management strategies and catchment management, dam safety and general powers and functions, as well as water quality.

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

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

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in a stream flow reduction activity;
e) Engaging in a controlled activity;
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

In terms of Section 21 (c) and (i) of the NWA, any development within 500m of a wetland or within the 1:100 year floodline / "Riparian Zone" (whichever is greatest) of a watercourse requires a WULA.

As the proposed developments occurs within a regulated area of a watercourse, a WULA is required in terms of Sections 21 (c) and (i) of the NWA (**Table 8**). A process of acquiring a WUL has commenced.

Table 8: Explanation of the relevant NWA Section 21 Activities

Section 21	Description of Water Use	Relevance to Project
21 (c)	Impeding or diverting the flow of water in a watercourse	The Ash Dam and the Low Level Ash Water Return Dam seepage interception drains traverse delineated wetlands within the Duvha Power Station. The High Level Ash Water Return Dam falls within 500m of the delineated wetlands. Only the Raw Water Dam does not traverse or fall within 500m of a wetland.
21 (i)	Altering the bed, banks, course or characteristics of a watercourse	

The requisite documentation to satisfy DHSWS's requirements for the Water Use Authorisation process will be compiled. In addition, a Riparian Habitat and Wetland Delineation Impact Assessment has been conducted and is summarised in **Section 15.2**.

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

The National Environmental Management Waste Act (NEM:WA) (Act No. 59 of 2008) regulates waste management in order to protect the health and environment of South African citizens. This is achieved through pollution prevention, institutional arrangements and planning matters, national norms and standards and the licensing and control of waste management activities. The latest list of waste management activities that have or are likely to have a detrimental effect (GN No. 921 of 29 November 2013) contains activities listed in Categories A and B that would require licensing from the provincial or national authorities and activities contained in Category C which would require meeting the requirements of various Norms and Standards. **No authorisation will be required in terms of the NEM:WA**, as the project will not include any of the listed waste management activities.

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

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

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

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

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

No threatened species were observed on the sites, but one plant species of conservation concern was noted, namely *Hypoxis hemerocallidea* (Star flower/African potato) and this species is listed as *Declining.*

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

The aim of the National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEMPA) is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural seascapes. The purpose of a Protected Environment is amongst others to protect a specific ecosystem outside a special nature reserve world heritage site or nature reserve and also to ensure the use of the natural resources in the area is sustainable. The proposed development does not occur within a Protected Area.

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

In terms of the National Forests Act (Act 84, 1998), trees in natural forests or protected tree species (as listed in Government Gazette Notice 1012 of 27 August 2004) may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under licence granted by the DEFF.

A Permit is required from DEFF if any protected tree species are to be to either cut, destroy, disturb and/or transplant within the proposed development.

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

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

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

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

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

As the seepage interception drains exceed 5 000 m^2 in size, a Phase 1 HIA is required to be submitted to MPHRA. A HIA has been conducted and is summarised in **Section 15.4**.

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

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

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

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

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

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

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

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

7 BASIC ASSESSMENT PROCESS

7.1 Environmental Assessment Triggers

The proposed Duvha Power Station seepage interception drains entail certain activities that require authorisation in terms of NEMA. Refer to **Section 6** for further discussion on the legal framework.

The process for seeking authorisation is undertaken in accordance with the 2014 EIA Regulations (GN No. R. 982, R. 983, R. 984 and R. 985), as amended (07 April 2017), promulgated in terms of Chapter 5 of NEMA.

Based on the types of activities involved which include activities listed in GN No. R. 983, R. 984, and R. 985 of the 2014 EIA Regulations (as amended), the requisite environmental assessment for the project is a BA Process.

7.2 Environmental Assessment Authorities

In terms of the Regulations, the lead decision-making authority for the environmental assessment is the DEFF, as the project proponent is Eskom Holdings SOC Ltd.

7.3 BA Process

7.3.1 Formal Process

An outline of the BA Process for the proposed Duvha Power Station seepage interception drains is provided in **Figure 6**.

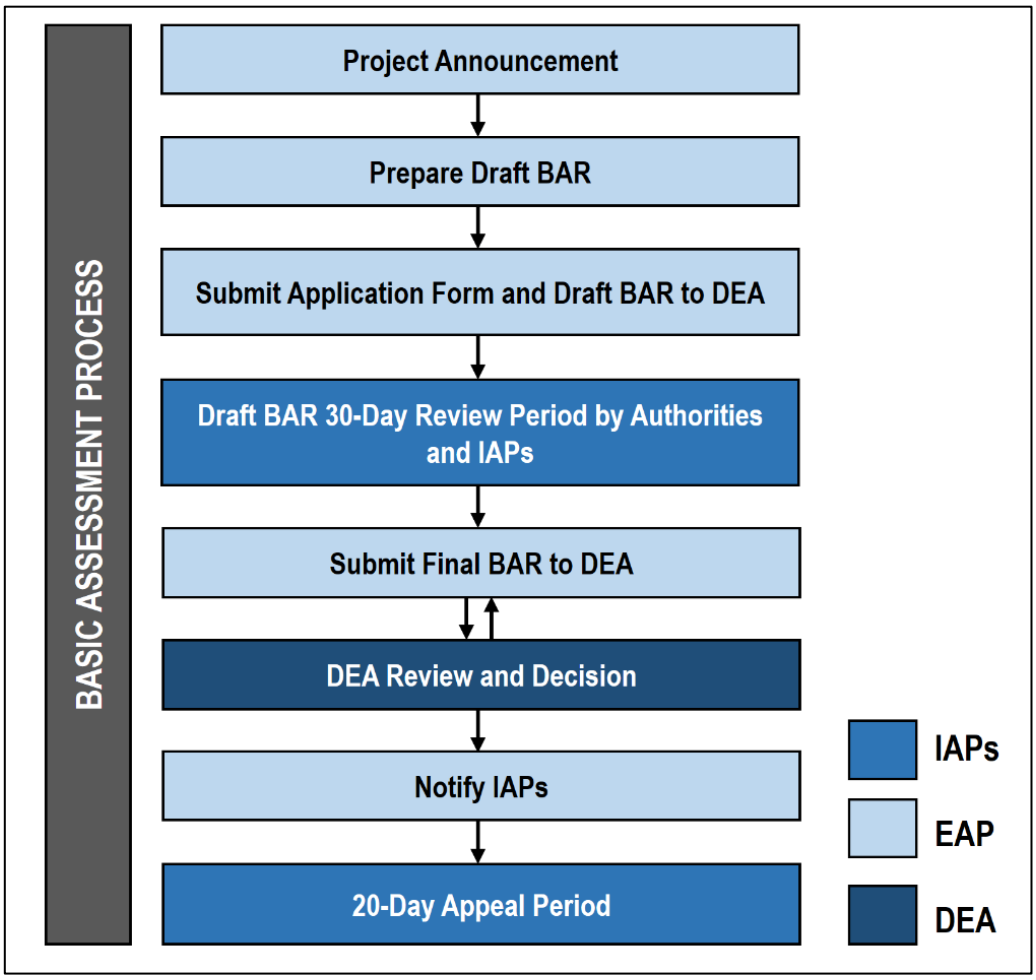

Figure 6: BA Process

7.3.2 Landowner Consent

According to Regulation 39(1) of GN No. R 982 of the 2014 EIA Regulations (as amended), if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land.

As the proposed development falls within the Duvha Power Station owned by the applicant, Eskom Holdings SOC Ltd, landowner consent and landowner notification are not required.

7.3.3 Application Form

An Application Form, in terms of Regulation 16 of GN No. R. 982 of the 2014 EIA Regulations (as amended), will be submitted to DEFF together with the Draft BAR.

7.3.4 Public Participation and Review of BAR

The Draft BAR will be made available to Interested and Affected Parties (IAPs) for a 30-Day Review Period. All comments received will be taken into account in the Final BAR and will also be noted in the Comments and Response Report.

More detail on the Public Participation Process is provided in **Section 13**.

8 ASSUMPTIONS AND LIMITATIONS

The following assumptions were made during the BA Process:

- The detailed engineering design will be finalised at a later stage.
- The findings of the Impact Assessment are informed by the Specialist reports which are assumed to be accurate; and
- The mitigation measures provided in the EMPr will be implemented and it assumed that the measures are adequate and will successfully enhance positive impacts while limit the negative impacts.

9 NEED AND DESIRABILITY

In terms of 3(1)(f) of Appendix 1 of GN No. R. 982 of the amended 2014 EIA Regulations (07 April 2017), this section discusses the need and desirability of the project. The format contained in the Guideline on Need and Desirability (DEA&DP, 2009) has been used in **Table 9**.

Table 9: Need and Desirability

No.	Question	Response
NEED ('timing')		
1.	Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority? (i.e. is the proposed development in line with the projects and programmes identified as priorities within the IDP).	There is no mention of this project in the SDF and IDP for the municipalities as the proposed developments will occur within the existing Duvha Power Station in order to address the potential contamination of the Witbank Dam.
2.	Should development, or if applicable, expansion of the town/area concerned in terms of this land use	The proposed interception drains fall within the existing Duvha Power Station boundary which is

No.	Question	Response
	(associated with the activity being applied for) occur here at this point in time?	designated for industrial uses. Therefore, the drains are not in conflict with the desired state of the land.
3.	Does the community/area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate)	The need from the activity is due to water seepage from the ash dam which may lead to groundwater contamination and possible contamination of the Witbank Dam. The construction of subsoil groundwater seepage interception drains is proposed to mitigate seepage from the ash dam and prevent contamination of the Witbank Dam.
4.	Are the necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	The proposed interception drains fall within the existing Duvha Power Station; therefore, the appropriate services capacity is available.
5.	Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services)?	The proposed project will not impact on the infrastructure planning of the municipality. All proposed components of the project will take place within the existing Duvha Power Station property.
6.	Is this project part of a national programme to address an issue of national concern or importance?	It is intended to address potential contamination issues within the Duvha Power Station property and therefore is not part a national programme.
DESIRABILITY (‘placing’)		
7.	Is the development the best practicable environmental option (BPEO) for this land/site?	As the proposed project aims to construct seepage interception drains in order for the Duvha Station to comply with relevant environmental legislation and minimise groundwater contamination. In addition, the drains will be constructed within an existing Eskom power station, there will be minimal environmental impacts. The project will likely have a positive environmental impact as the motivation for the project is to comply with the power station’s existing WUL and with NWA. Therefore, the proposed project is the best practicable environmental option for the dams.
8.	Would the approval of this application compromise the integrity of the existing approved municipal IDP and Spatial Development Framework (SDF) as agreed to by the relevant authorities?	It is not anticipated that the proposed project will contradict or be in conflict with the municipal IDPs and SDFs.
9.	Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified	The proposed developments would not compromise the existing environmental management priorities for the area as the interception drains fall within the existing Duvha Power Station.

No.	Question	Response
	in terms of sustainability considerations?	
10.	Do location factors favour this land use (associated with the activity applied for) at this place? (this relates to the contextualisation of the proposed land use on this site within its broader context).	The proposed developments favour the land use as it occurs within the existing Duvha Power Station.
11.	How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?	See compilation of significant environmental issues associated with the proposed project contained in **Section 16**.
12.	How will the development impact on people's health and wellbeing (e.g. i.t.o. noise, odours, visual character and sense of place, etc)?	Potential impacts during the construction phase include noise and increased levels of dust, as well as impacts to flora and fauna, heritage resources, and watercourses in the area. See compilation of significant environmental issues associated with the proposed project contained in **Section 16**. These impacts will be managed through the EMPr contained in **Appendix G**.
13.	Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	The project will not result in unacceptable opportunity costs.
14.	Will the proposed land use result in unacceptable cumulative impacts?	There will be no change in land use for the proposed development. However, cumulative impacts are discussed in **Section 16**.

10 TIMEFRAMES

In terms of 3(1)(q) of Appendix 1 of GN No. R. 982 of the amended 2014 EIA Regulations (07 April 2017), this section discusses the period for which the EA is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised. These proposed timeframes are provided in **Table 10**.

Table 10: Timeframes

Requirement	Proposed Timeframe
Environmental Authorisation	2019
Pre-Construction	2021
Construction	2022
Post Construction Monitoring	2026

The timeframes will be confirmed after the design phase and when the project is in execution phase. These timeframes are usually determined after EA is obtained.

11 FINANCIAL PROVISIONS

In terms of 3(1)(s) of Appendix 1 of GN No. R. 982 of the amended 2014 EIA Regulations (07 April 2017), this section discusses details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.

The estimated cost of the seepage drain construction is R101 000 000.00 (One hundred and one Million Rands only).

12 RESOURCE USE AND PROCESS DETAILS

12.1 Waste, Effluent, Emission and Noise Management

12.1.1 Solid waste management

Will the activity produce solid construction waste during the construction/initiation phase?	YES **X**	[redacted]
If yes, what estimated quantity will be produced per month?	1m^3	

How will the construction solid waste be disposed of (describe)?

The construction will take place for about 36 months therefore approximately 36 m^3 will be generated. General waste generated through construction activities will be collected, sorted and disposed of at suitably licensed disposal facilities.

Where will the construction solid waste be disposed of (describe)?

All construction waste will be collected, sorted and disposed of at suitably licensed disposal facilities.

Will the activity produce solid waste during its operational phase?	[redacted]	NO **X**
If yes, what estimated quantity will be produced per month?		
How will the solid waste be disposed of (describe)?		

[redacted]

Has the municipality or relevant service provider confirmed that sufficient air space exists for treating/disposing of the solid waste to be generated by this activity?	[redacted]	NO **X**

Where will the solid waste be disposed if it does not feed into a municipal waste stream (describe)?

Solid waste will be incorporated into the existing waste streams at Duvha.

Note: If the solid waste (construction or operational phases) will not be disposed of in a registered landfill site or be taken up in a municipal waste stream, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Can any part of the solid waste be classified as hazardous in terms of the relevant legislation?	NO **X**

If yes, inform the competent authority and request a change to an application for scoping and EIA.

Is the activity that is being applied for a solid waste handling or treatment facility?	NO **X**

If yes, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Describe the measures, if any, that will be taken to ensure the optimal reuse or recycling of materials:

12.1.2 Liquid effluent (other than domestic sewage)

Will the activity produce effluent, other than normal sewage, that will be disposed of in a municipal sewage system?	NO **X**
If yes, what estimated quantity will be produced per month?	
If yes, has the municipality confirmed that sufficient capacity exist for treating / disposing of the liquid effluent to be generated by this activity(ies)?	
Will the activity produce any effluent that will be treated and/or disposed of on site?	NO **X**
If yes, what estimated quantity will be produced per month?	

If yes describe the nature of the effluent and how it will be disposed.

No effluent, other than normal sewage will be produced by the activities. The Contractor will use chemical portable toilets that will be hired from and serviced by a reputable and registered service provider, and toilet waste will be disposed at a suitable authorised waste water treatment facility by the service provider.

Note that if effluent is to be treated or disposed on site the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Will the activity produce effluent that will be treated and/or disposed of at another facility?		NO **X**

If yes, provide the particulars of the facility:

Facility name:			
Contact person:			
Postal address:			
Postal code:			
Telephone:		Cell:	
E-mail:		Fax:	

Describe the measures that will be taken to ensure the optimal reuse or recycling of waste water, if any:

12.1.3 Liquid effluent (domestic sewage)

Will the activity produce domestic effluent that will be disposed of in a municipal sewage system?	YES **X**	
If yes, what estimated quantity will be produced per month?	$1m^3$	
If yes, has the municipality confirmed that sufficient capacity exist for treating / disposing of the domestic effluent to be generated by this activity(ies)?		NO **X** A registered service provider will be used to supply and service chemical toilets on site.
Will the activity produce any effluent that will be treated and/or disposed of on site?		NO **X**

If yes describe how it will be treated and disposed of.

12.1.4 Emissions into the atmosphere

Will the activity release emissions into the atmosphere?	NO **X**
If yes, is it controlled by any legislation of any sphere of government?	
If yes, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.	
If no, describe the emissions in terms of type and concentration:	
Only construction related emissions (machine operation exhaust fumes).	

12.2 Water Use

Indicate the source(s) of water that will be used for the activity

Municipal **X**	

The proposed activity will not require water during operation. Municipal water will be used during construction phase where required. Duvha Power Station has existing water services available.

If water is to be extracted from groundwater, river, stream, dam, lake or any other natural feature, please indicate the volume that will be extracted per month:	
If Yes, please attach proof of assurance of water supply, e.g. yield of borehole, in the appropriate Appendix	
Does the activity require a water use permit from DHSWS?	YES **X**
If yes, list the permits required	
The applicant is applying in terms of Chapter 4 under the National Water Act (NWA) (Act No.36 of 1998) for Section 21 (c) and (i) water use authorisation for construction within wetlands and within 500m of a wetland. The Water Use License Application (WULA) is being undertaken separately.	

If yes, have you applied for the water use permit(s)?	YES **X** The WULA is currently being undertaken via the online EWULAA system	
If yes, have you received approval(s)? (attached in appropriate appendix)		NO **X**

12.3 Power Supply

Please indicate the source of power supply e.g. Municipality / Eskom / Renewable energy source

Auxiliary power will be used as construction will be undertaken inside Eskom boundary.

If power supply is not available, where will power be sourced from?

12.4 Energy Efficiency

Describe the design measures, if any, that have been taken to ensure that the activity is energy efficient:

Describe how alternative energy sources have been taken into account or been built into the design of the activity, if any:

13 PUBLIC PARTICIPATION PROCESS

13.1 Public Participation

The purpose of the public participation process for the proposed development includes:

- Providing IAPs with an opportunity to obtain information about the project;
- Allowing IAPs to express their views, issues and concerns with regard to the project;

- Granting IAPs an opportunity to recommend measures to avoid or reduce adverse impacts and enhance positive impacts associated with the project; and
- Enabling the project team to incorporate the needs, concerns and recommendations of IAPs into the project, where feasible.

The public participation process that was followed for the proposed project is governed by NEMA and GN No. R. 982 of the 2014 EIA Regulations, as amended. Details of the process are provided below. All Public Participation material can be referred to in **Appendix E**.

13.2 Identification of IAPs and Compilation of IAP Database

A database of IAPs, which includes authorities, different spheres of government (national, provincial and local), parastatals, ward councillors, stakeholders, landowners, interest groups and members of the general public, was prepared for the project and is contained in **Appendix E7**. This database will be maintained and updated as necessary during the course of the BA Process.

13.3 Landowner Notification

According to Regulation 39(1) of GN No. R 982 of 4 December 2014 (as amended), if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land.

The proposed seepage interception drains are located within the Duvha Power Station which is owned by the Applicant, Eskom Holdings SOC Ltd.

13.4 Project Announcement

The notification process undertaken is detailed in the sections to follow:

13.4.1 Background Information Document (BID)

BIDs (**Appendix E1**) and Reply Forms were distributed to the IAPs contained in the IAP Database. BIDs contained a brief background and description of the project, as well as the 30-Day Registration Period and the BA process. The BID served to notify IAPs of the project and the details on how to register as an IAP.

Proof of initial notification is provided in **Appendix E4**.

13.4.2 Onsite Notices

Onsite notices were placed at strategic points within the study area. Notification of the proposed development and details on how to register as an IAP were provided on the site notice. Details of the locations of the onsite notices and accompanying photographs are contained in **Appendix E2**.

13.4.3 Newspaper Notice

A newspaper advertisement was placed in The Herald to notify the public of the proposed seepage interception drains and the 30-Day Registration Period. The advert was published on 02 June 2017.

Proof of this advertisement is provided in **Appendix E3**.

13.5 Review Process for the Draft BAR

13.5.1 Notification

A newspaper advertisement will be published in the Herald to notify the public of the 30-Day Review Period of the Draft BAR.

Proof of this advertisement will be provided in the Final BAR.

Emails and SMS's will be sent to all registered IAPs to notify them of the 30-Day Review Period of the Draft BAR. In addition, the Draft BAR will be made available on the Nemai Consulting website.

13.5.2 30-Day Public Review Period

In accordance with GN No. R. 982 of the amended 2014 EIA Regulations (07 April 2017), IAPs were granted an opportunity to review and comment on the Draft BAR. Hardcopies of the document were placed at the public venues provided in **Table 11**. The 30-Day Review Period will take place from **10 October 2019 to 08 November 2019**.

Table 11: Location of Draft BAR for Review

Venue	Address	Contact Details
Emalahleni Main Library	28 Hofmeyer Street, Witbank, Emalahleni	013 690 6231

13.5.3 30-Day Authority Review Period

Hardcopies of the Draft BAR will also be provided to the key regulatory and commenting authorities, which include the following:

- DEFF;

- DHSWS: Mpumalanga;
- Department of Forestry and Fisheries (DAFF): Mpumalanga
- Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA);
- Nkangala District Municipality;
- Emalahleni Local Municipality;
- DALRRD: Mpumalanga Offices; and
- Municipal Ward Councillor for Ward 19.

Proof of notification to commenting authorities of the review period and all proof of deliveries of the Draft BAR to all organs of states will be available in the Final BAR.

13.5.4 Comments and Responses Report

The Comments and Responses Report, which summarises the salient issues raised by IAPs and the project team's response to these matters, is contained in **Appendix E6**. The issues listed in the Comments and Response Report were identified from completed Reply Forms, emails, and other correspondence received to date.

14 ENVIRONMENTAL ATTRIBUTES

The environmental attributes associated with the proposed Duvha Power Station seepage interception drains include the geographical, physical, biological, social, economic and cultural aspects of the environment. The following significant environmental attributes are focused on in this report:

- Land use and Land Cover;
- Topography;
- Geology, Soils and Geohydrology;
- Surface Water;
- Flora;
- Fauna;
- Socio – Economic Environment;
- Air Quality;
- Noise;
- Historical and Cultural Features;
- Existing Structures and Infrastructure; and
- Aesthetic Qualities.

The sensitive environmental features, attributes and aspects, for which mitigation measures are included in the BAR and EMPr, are further discussed in **Section 16** and **Section 17**.

14.1 Land Use & Land Cover

Eskom propose to install seepage interception drains in four areas in the Duvha Power Station, Mpumalanga Province. The Duvha Power Station is located in the Emalahleni Local Municipality and the Nkangala District Municipality. The seepage drains are located on the Remaining Extent of Farm Duvha Kragstasie 337 JS. The Ash Dam is located 1.7km east of the Witbank Dam.

The surrounding area land use includes the Duvha Power Station and associated infrastructure extending southward; vacant land to the west and immediate north; and some agricultural practices to the north and east of the project area. The Tweefonteinspruit runs west of the site into the Witbank Dam, which is situated northwest of the project area. The R575 road, to the east, is the nearest main road to the project area. The existing structures and infrastructure are indicated in **Figure 7** below.

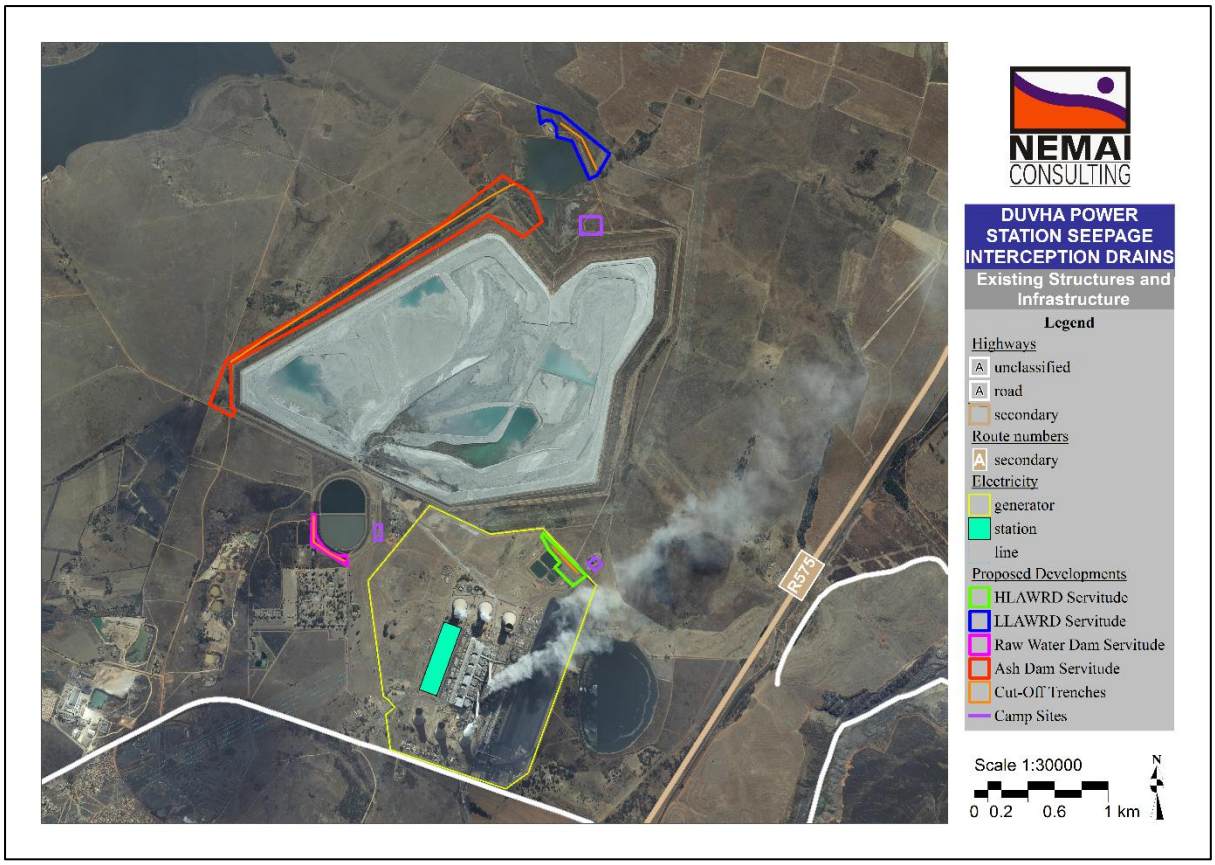

Figure 7: Existing Structures and Infrastructure Map

14.2 Topography

The natural surface topography is characterised by gently undulating hills with the Witbank Dam located in a valley formed where the hills display steeper gradients (**Figure 8**). The Raw Water Dam is located at a position where the natural topography forms a local maximum. From the Raw Water Dam surface runoff drains in all directions, but predominantly to the west and south-west.

Drainage in the vicinity of the Ash Dam occurs to the north, north-east and north-west where a number of non-perennial rivers originate in local topographic depressions. These non-perennial rivers all flow into the Witbank Dam.

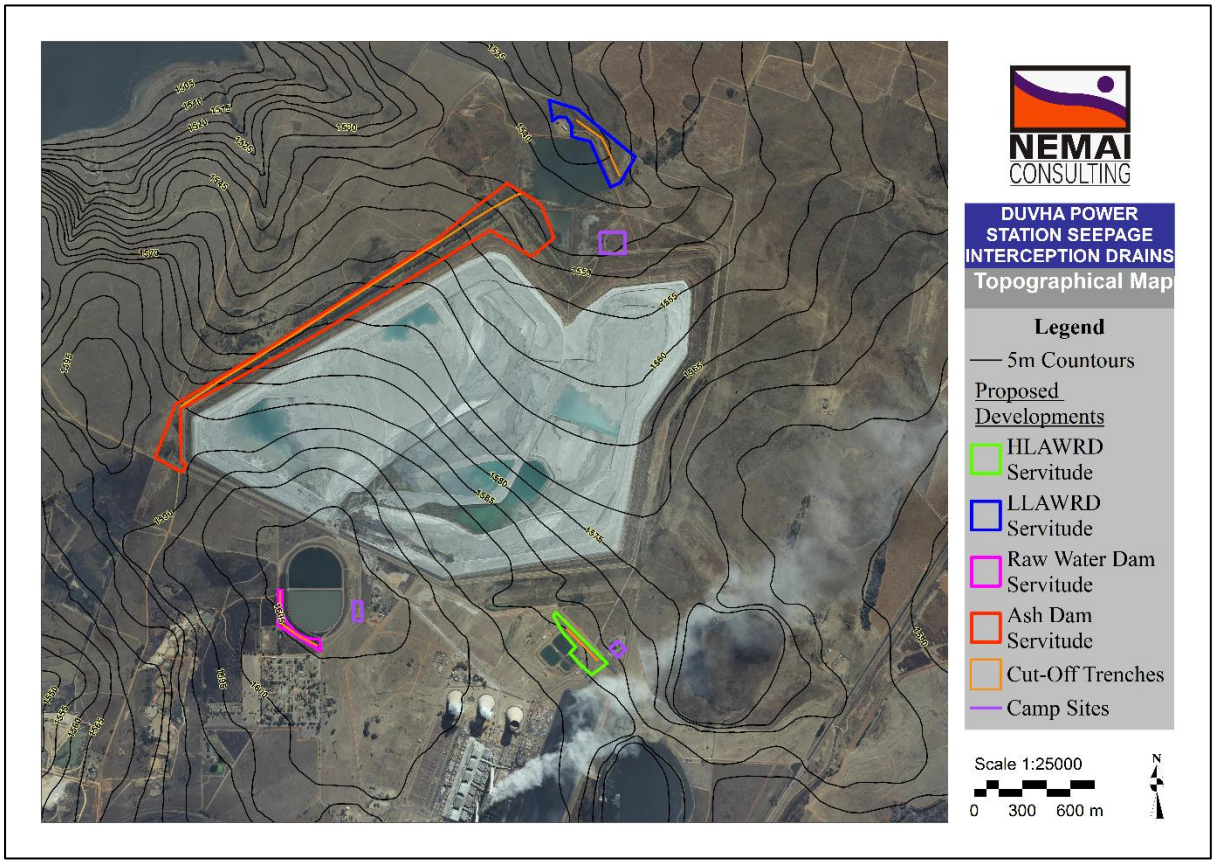

Figure 8: Topographical Map

14.3 Groundwater, Soil, and Geological Stability of the Site

a) Is the site located on any of the following?

	YES	NO
Shallow water table (less than 1.5m deep)	X	
Dolomite, sinkhole or doline areas		X

Seasonally wet soils (often close to water bodies)	YES X	
Unstable rocky slopes or steep slopes with loose soil		NO X
Dispersive soils (soils that dissolve in water)		NO X
Soils with high clay content (clay fraction more than 40%)		NO X
Any other unstable soil or geological feature		NO X
An area sensitive to erosion		NO X

b) are any caves located on the site(s) NO X

Latitude (S): **Longitude (E):**

c) are any caves located within a 300m radius of the site(s) NO X

Latitude (S): **Longitude (E):**

d) are any sinkholes located within a 300m radius of the site(s) NO X

Latitude (S): **Longitude (E):**

Duvha Power Station is located near the contact between sedimentary rocks of the Karoo Supergroup and older extrusive volcanic rocks of Vaalium age in the form of rhyolites. The Karoo rocks that occur in the vicinity of the power station belong to the Ecca Group and predominantly consist of shales, sandstones, conglomerates and coal deposits.

The Ash Dam and Low Level Ash Water Return Dam are almost completely underlain by rhyolites, with the contact between the rhyolites and the Karoo rocks running approximately parallel to the south-western border of the Ash Dam. Drilling results have shown that the contact occurs more to the south and that it in fact runs underneath the Raw Water Dam. The power station itself, as well as the High Level Ash Water Return Dams, Sewage Plant and Emergency Pan, occurs on Karoo sedimentary rocks. A large intrusive diabase body occurs to the north of the Low Level Ash Water Return Dam and partially underlies the return water dam.

The soil types associated with the site include undifferentiated shallow soils and freely drained, structureless soils (**Figure 9**).

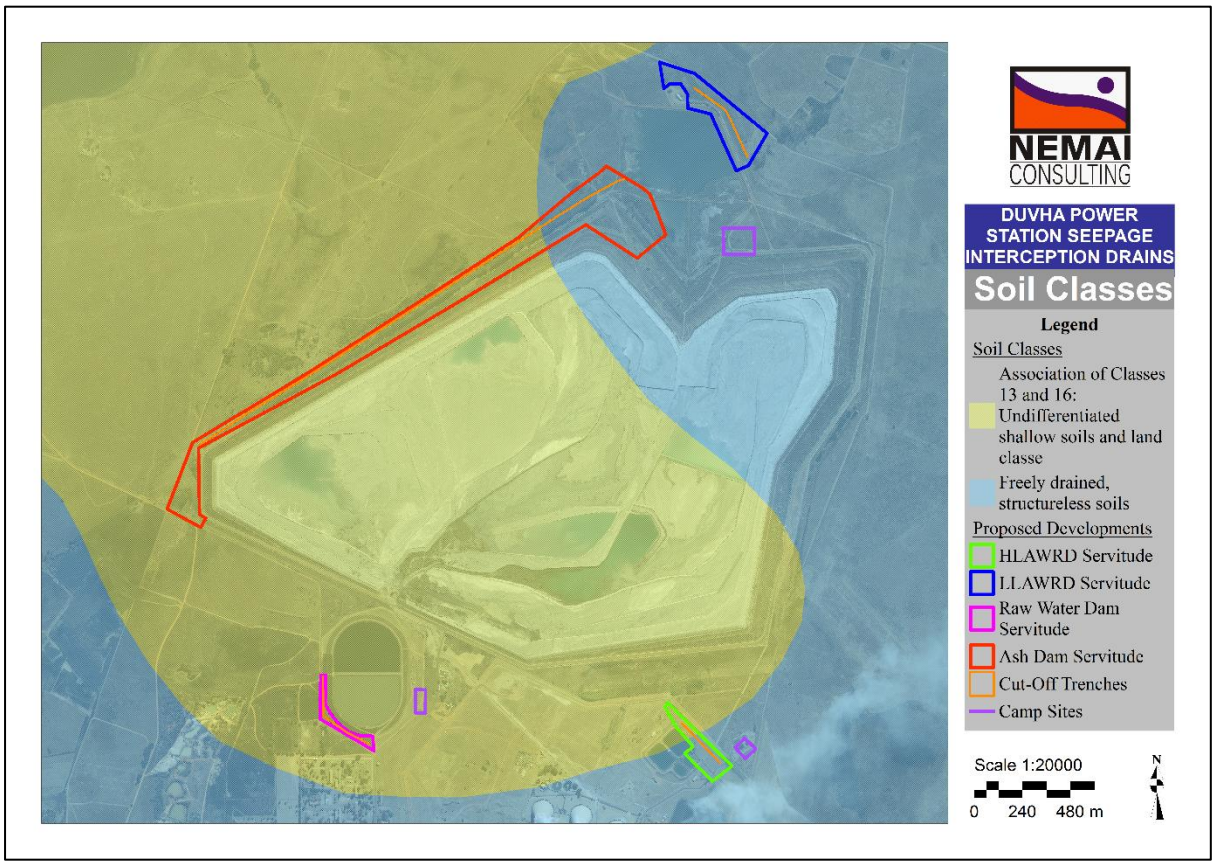

Figure 9: Soil Map

14.4 Agriculture

Cultivated lands can be found to the north and east of the site, and there exists evidence of historic agriculture practice within the Duvha Power Station property in the form of old lands. While the soils in the area may be suitable for agriculture, the sites for the proposed drains fall within the Duvha Power Station property, and as a National Key Point, these areas are not available for agricultural development.

14.5 Surface Water

A number of watercourses at desktop level were identified within the Duvha Power Station study area, including perennial and non-perennial rivers, and NFEPA wetlands (**Figure 10**). The Olifantsrivier and Witbank Dam is located north west of the study area. The area is located in the Highveld aquatic ecoregion. It falls within the B11G quaternary catchment of the Olifants Water Management Area (WMA 2).

The main watercourses draining the quaternary catchment are the Tweefonteinspruit and the Noupoort River that drain toward the Olifants (North) River, with Witbank Dam having been constructed at the confluence of these three rivers within the WMA.

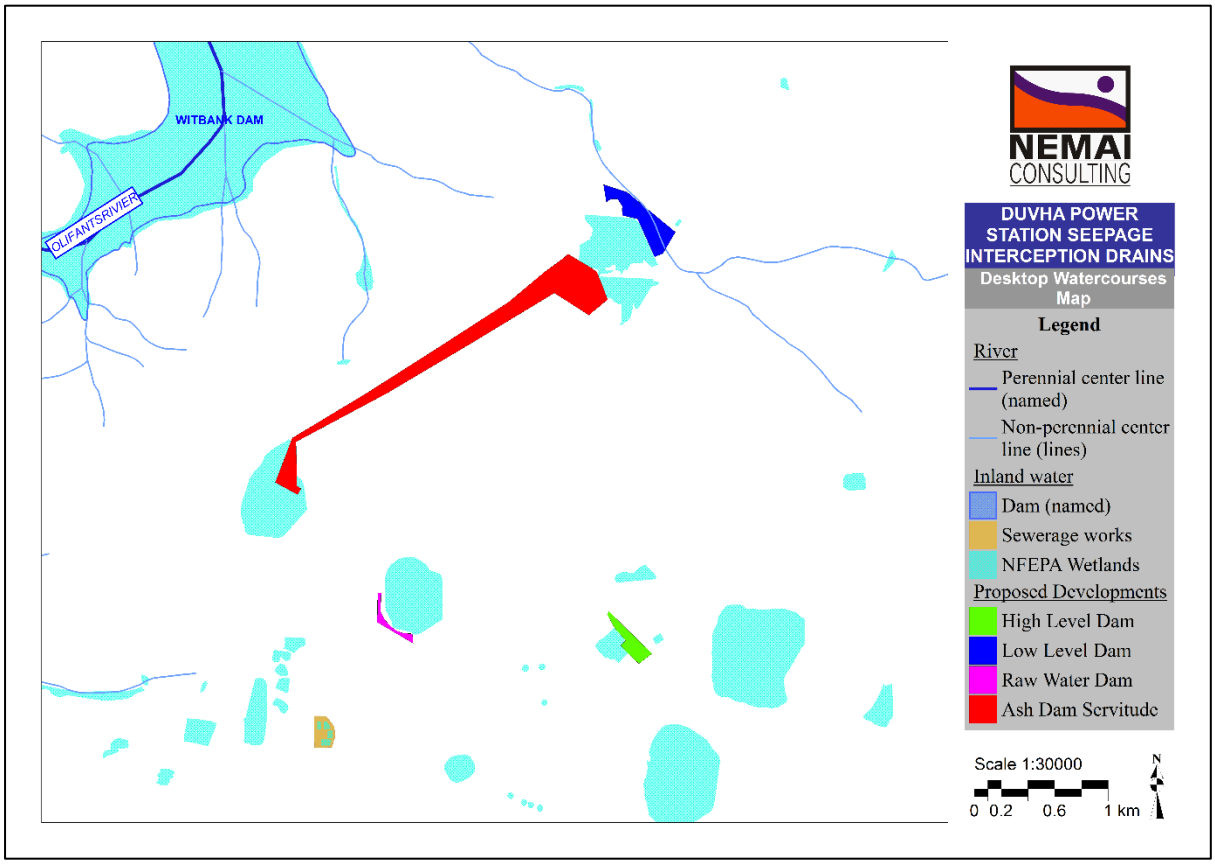

Figure 10: Desktop Watercourses Map

The following information was extracted from the Riparian Habitat and Wetland Delineation Impact Assessment (The Biodiversity Company, 2017):

A National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) (V3.0, 1 arcsec resolution) Digital Elevation Model (DEM) was obtained from the United States Geological Survey (USGS) Earth Explorer website. Basic terrain analysis was performed on this DEM using the SAGA GIS software that encompassed a slope and channel network analyses in order to detect catchment areas and potential drainage lines respectively. The DEM and channel network data provides an indicating of the direction hydrology across the catchment, and the risks posed by the proposed drains to obstructing flow through the wetlands.

The grey hatched areas in **Figures 11** and **12** are the delineated wetlands taken from Riparian Habitat and Wetland Delineation Impact Assessment (The Biodiversity Company, 2017).

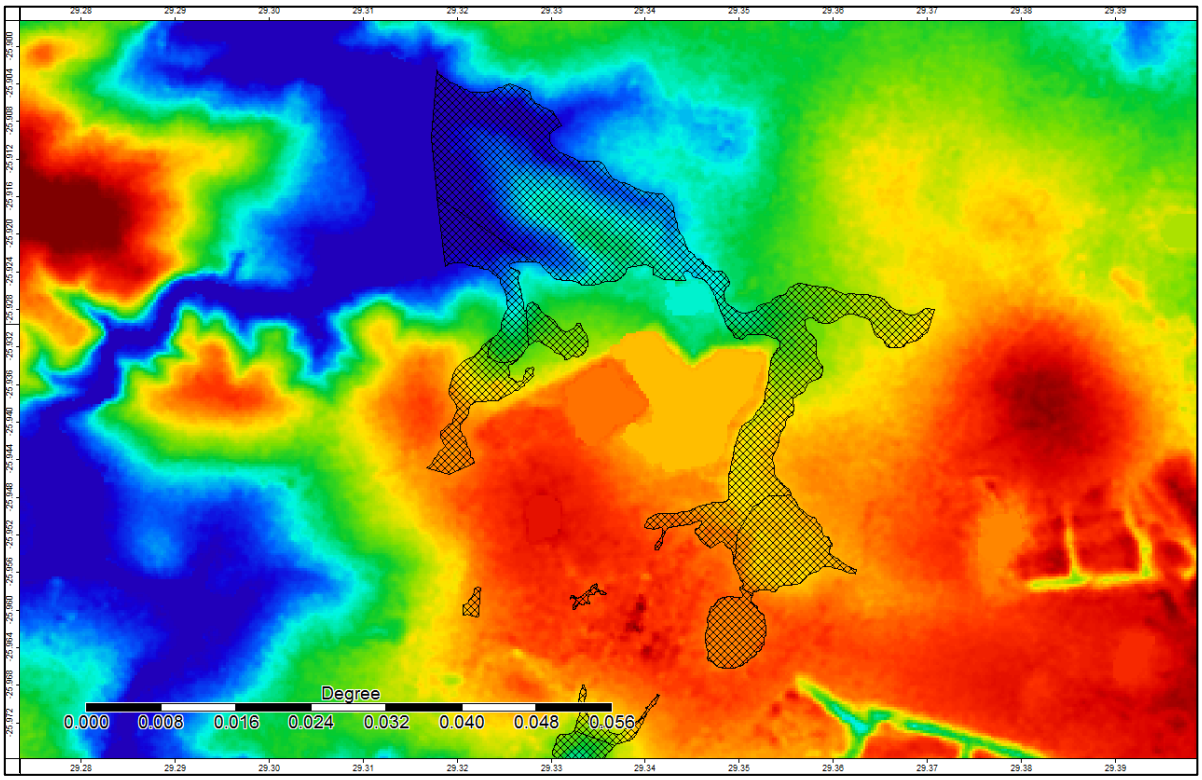

Figure 11: The DEM processed for the project area

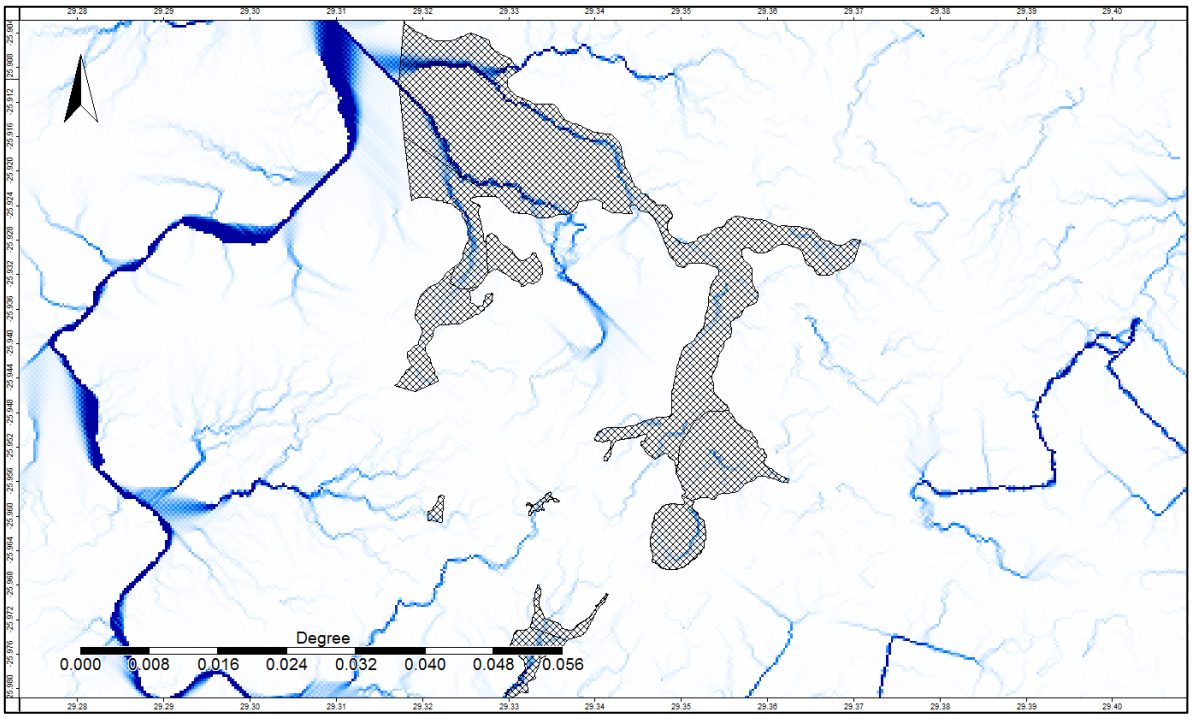

Figure 12: The channel flow network identified for the project area

14.6 Flora, and Fauna

The proposed seepage interception drain sites fall within the grassland biome, within the endangered Eastern Highveld Grassland and Rand Highveld vegetation units. These vegetation types on site have already undergone major transformation mostly by serious alien plant infestation and mining activities, with little or no remnants of these vegetation types remaining on sites. At the time of the specialist visit, the general aspect on the sites were one of severe degradation, primarily on account of anthropogenic disturbance at the site. As a consequence of the high levels of disturbance, the dominant habitat structure comprised primarily of weeds and/or alien invasive plant species. Even though the vegetation types and threatened ecosystems are listed as endangered and vulnerable respectively, the study area has been highly transformed and disturbed due to ash dams.

The proposed development sites occur within areas consisting of gum trees, grasslands and are situated near ash dams. Grasses on the proposed sites include species such as *Cynodon dactylon* and *Eragrostis curvula*. The herb layer is dominated by species such as *Berkheya setifera, Conyza bonariensis* and *Verbena bonariensis*. The tree layer is mostly dominated by *Eucalyptus* species. Alien invasive plant species within the study area were observed to occur in clumps, scattered distributions or as single individuals on site. Species such as *Cirsium vulgare, Datura stramoinum, Solanum mauritianum,* and *Solanum sisymbrofilium* (Category 1b*)* were common in the study sites. During the field survey, no threatened species were observed on site but only one plant species of conservation concern was noted, namely *Hypoxis hemerocallidea* (Star flower/African potato)).

During the field assessment, mammal species diversity was very low and this could be attributed to anthropogenic disturbances observed on sites such as habitat transformation and mining activities. No Red Data mammal species were recorded on sites. The canals/ash dams, stands of *Eucalyptus* trees and patches of grasslands should provide natural habitats for bird species, however no Red Data bird species were observed on the study sites, although sightings of the Southern Bald Ibis (*Geronticus calvus*), listed as Vulnerable, have been recorded near the High level dam servitude. Only one reptile species was noted on site, this being the Montane Speckled Skink (*Trachylepsis punctatissima*). It is not considered to be of significant importance from a conservation perspective. From the field results, it is evident that transformation of land was responsible for the low number of observations. The non-perennial river on the proposed Low level dam servitude site holds water on a temporary basis and is likely an important breeding habitat for most of the frog species which occur in the region. During the field assessment, only one frog species was recorded, namely Queckett's River Frog (*Amietia quecketti*).

Are there any rare or endangered flora or fauna species (including red list species) present on the site	[redacted]	**NO X**

If YES, specify and explain:

[redacted]

Are there any special or sensitive habitats or other natural features present on the site?	**YES X**	[redacted]

If YES, specify and explain:

According to the Terrestrial Ecological Impact Assessment (Appendix D1) the four proposed ash dam seepage interception drain sites fall within the grassland biome and have been categorised as Eastern Highveld Grassland and Rand Highveld Grassland vegetation units, of which both are listed as endangered. Even though the vegetation types and threatened ecosystems are listed as endangered and vulnerable respectively, the proposed sites have been highly transformed and disturbed due to ash dams, alien plant infestation and mining activities. According to the Mpumalanga Biodiversity Conservation Plan, the proposed development sites fall within the "*CBA Optimal"*, "*Heavily modified"* and *"Moderately modified- Old lands"* (**Figure 13**). During the field survey, no threatened species were observed on sites but only one plant species of conservation concern was noted, namely *Hypoxis hemerocallidea* (Star flower/African potato) and this species is listed as *Declining.* No Red Data mammal species were recorded on site.

According to the Wetland Delineation and Impact Assessment (Appendix D2) during the field survey, seven (7) hydro-geomorphic (HGM) units were delineated for the area, four of which were considered in the study. These included two channelled valley bottom wetlands, and two hillslope seep zone wetlands.

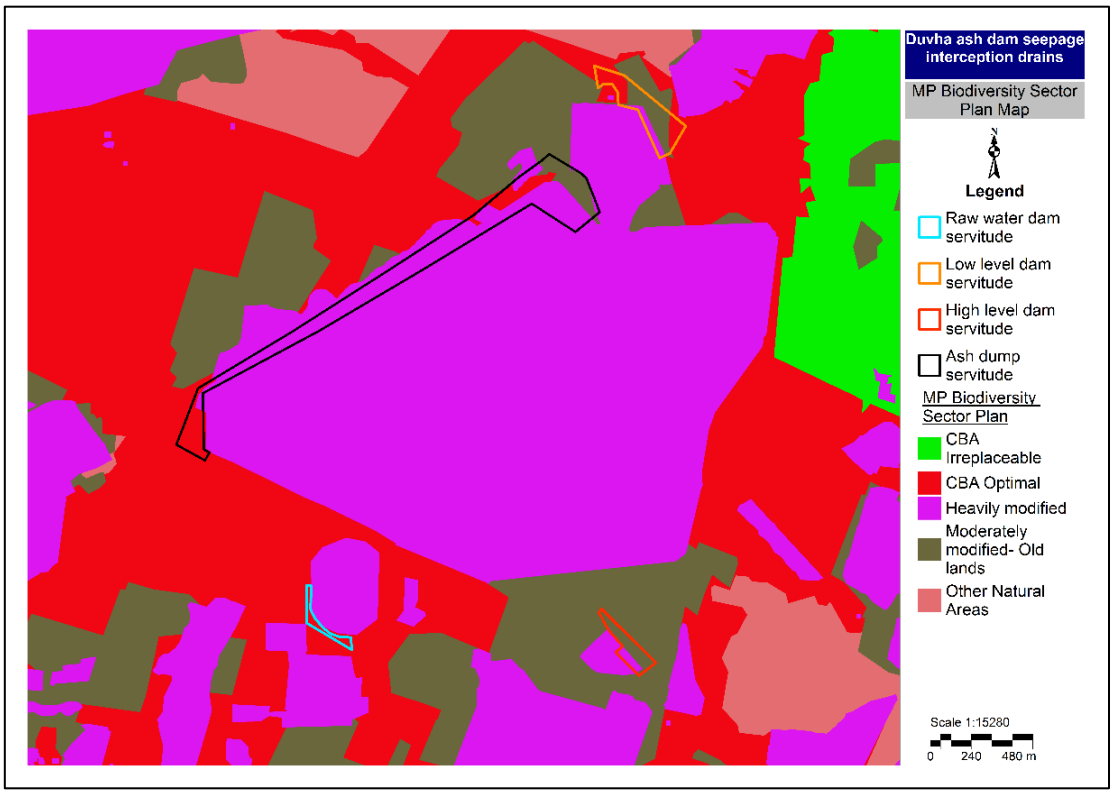

Figure 13: Mpumalanga Biodiversity Sector Plan Map in relation to the proposed development sites

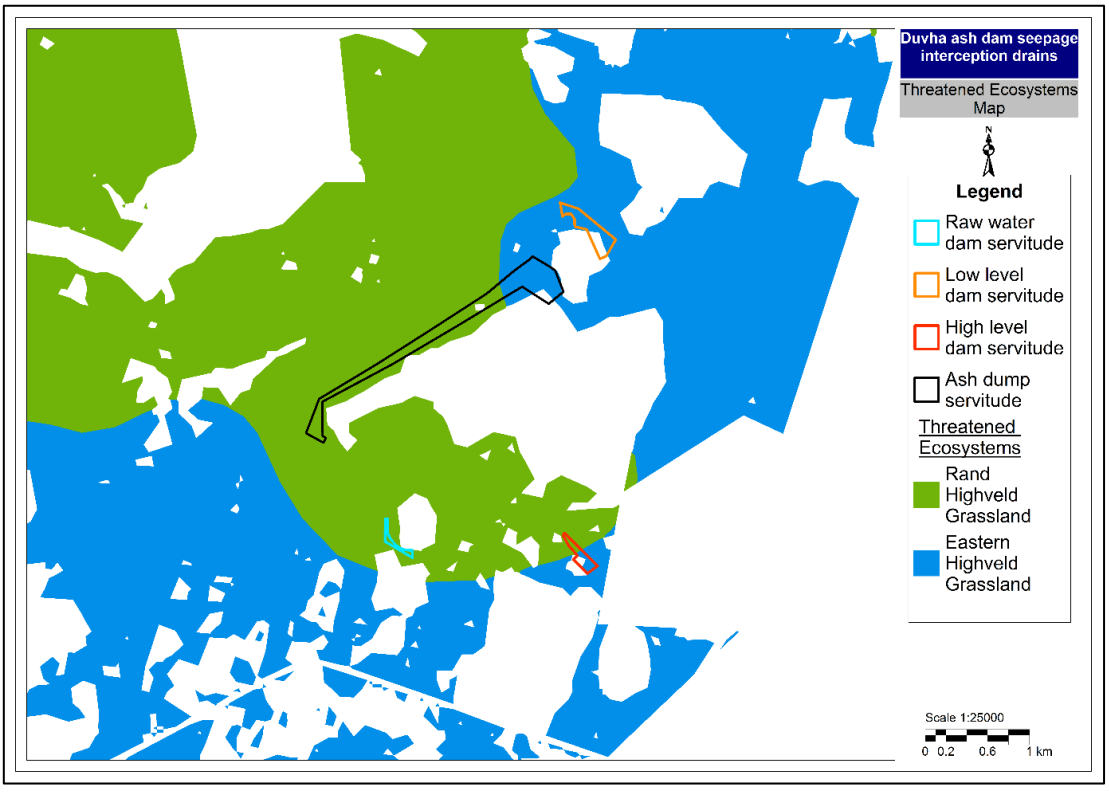

Figure 14: Terrestrial Threatened Ecosystem occurring on the proposed development sites

The proposed sites are located within the 2529CD Quarter Degree Square (QDS) in terms of the 1:50 000 grid of South Africa. SANBI used this grid system as a point of reference to determine any Red Data plant species or any species of conservation importance occurring in South Africa. This can be used to determine the list of species which could potentially occur within an area. The full details and list of Red Data species can be found within the Terrestrial Ecological Impact Assessment (Appendix D1).

14.7 Socio-Economic Environment

As the proposed development is taking place within an existing, built-up power plant, with the closest settlement, Speekfontein, being 5 km from the project area, and the nearest town to the project area is Witbank.

The Emalahleni Local Municipality (ELM) is the second largest Local Municipality in the Nkangala DM and covers a geographical area of 2 678 km². The municipality has the highest population among the six (6) local municipalities that form part of the Nkangala DM with 356 911 people. There are 119 874 households in the ELM, which equates to one third of the district's number of households. The population of the ELM is predominantly concentrated in urban areas with Witbank (Emalahleni) and Middleburg being the largest towns in the municipality. The urbanised structure of the population is indicative of the labour concentrated around intense mining and manufacturing industries or other sources of employment. The settlement of Speekfontein had approximately 1642 households in 2011 with an average household size of 2.3 persons.

According to the Census 2011, the ELM has a large youthful population between the age group of 0-14 constituting 25 % of the entire population. The working age between 15-64 age groups constitutes 71 % of the total population and the elderly (over 65) accounts for 4 % of the population. In terms of gender differentiation there is a slight imbalance between male and females. The Census 2011 revealed that approximately 53 % of the population are males with 47 % being females.

Approximately 30 % of employment in Emalahleni is in the informal economy (Census, 2011). Informal trading activities allow for job creation and help to absorb the population in need of an income but who would otherwise be economically idle. Approximately 13 % of the households in Emalahleni earn no income, while approximately 19 % of households in Speekfontein Settlement (Masakhane SP) earn no income. Nearly half of the households (49 %) in ELM earn less than R38, 400 per annum, while for the District, Province and country these represent 60 %, 67 %, and 63 % respectively. These low income levels are largely a reflection of unemployment levels.

14.8 Air Quality, Noise, and Aesthetics

Air quality in the area has been impacted on by large scale industry, mining, and power stations (such as Duvha itself). The main noise pollution source in the vicinity would be attributed to the Duvha Power Station operational noise. The visual aesthetics of the immediate area has been impacted on by the Duvha Power Station and associated infrastructure.

14.9 Cultural and Historical Features

Originally (1880-1914) the early residents of Witbank area were mainly stock farmers as there was no market for agricultural produce. Crops were restricted to the needs of the local families. Early travellers in the area, such as Thomas Baines, as far back as 1872 mentioned the coal used by local residents as fuel. Evidence has also been found that at first the African people, and later the Voortrekkers, mined coal from the outcrop, especially in the riverbeds, and transported it by ox-wagon to the Witwatersrand.

Actual systematic mining at Witbank only started in 1896 when Samuel Stanford, together with the Neumann Group, established the company Witbank Colliery Limited, and sank the first shaft on the farm Witbank. Earlier the farm was generally known as Swartbosch although the official name was Leraatsfontein. It was given the name Witbank because it was not so cumbersome and because of the large quartz rock which, in the words of Thomas Baines," loomed like a wagon tent in the distance." The town Witbank was laid out in 1903 by Witbank Colliery Limited and in the same year Samuel Stanford erected the first wood and iron building, consisting of a shop and hotel. Witbank Colliery Limited controlled the town until 9 April 1906 when a health committee was appointed. On 13 May 1910 a village council was elected and on the 8 November 1914 the town was granted municipal status. The mining of coal did not initially result in a population increase. But with the advent of the railway line between Pretoria and Lourenco Marques (now Maputo) the mining industry was firmly placed on an economic basis, and thereafter the population increased considerably (http://global.britannica.com/EBchecked/topic/646020/Witbank).

During the seventies the demand for electricity in South Africa increased at an average of nine percent per year. In response to this demand, ESKOM had to virtually double its generating capacity. Against this background, construction of Duvha power station started in November 1975 on a farm called Speekfontein just outside Witbank. Duvha was one of South Africa's largest fossil fired power stations, and was often referred to as the "flagship" of the ESKOM fleet. The combined generating capacity of the six units is 3 600 MW, enough power to supply a city three times the size of Johannesburg with electricity. The availability of coal and water makes this area ideally suited for the establishment of power stations. When Duvha was completed the smoke-stacks were the tallest freestanding concrete structures in the Southern

Hemisphere each 300 metres tall (July 1992). Unit 1 went into commercial service on 18 August 1980, Unit 2 on 1 October 1980, Unit 3 on 16 September 1981, Unit 4 on 1 July 1982, Unit 5 on 31 March 1983 and Unit 6 on 22 February 1984 (http://www.eskom.co.za/sites/heritage/Pages/Duvha.aspx).

A Heritage Impact Assessment (HIA) (Appendix D3) was undertaken and no heritage sites were identified inside the proposed area to be impacted on during the construction of the drains. However, two heritage sites were identified just outside the boundary of one of the study areas. These include the remains of a demolished farmstead, most likely of recent to modern date (of Low heritage significance), and a burial ground, consisting of 11 graves, (of High heritage significance).

The proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province is primarily underlain by the metamorphic sediments of the Selons River Formation (Rooiberg Group) and a small area in the south is located in the Vryheid Formation of the Ecca Group (Karoo Supergroup). According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS), the Palaeontological Sensitivity of the metamorphic sediments of Selons River Formation is zero while the Vryheid Formation has a Very High Palaeontological Sensitivity (Almond and Pether 2008, SAHRIS website). To date, no fossil vertebrates have been collected from the Vryheid formation. The occurrence of fossil insects are rare, while palynomorphs are diverse. Non-marine bivalves and fish scales have also been reported from this formation. Trace fossils are abundantly found but the diversity is low. The mesosaurid reptile, Mesosaurus has been found in the southern parts of the basin but may also be present in other areas of the Vryheid formation.

15 SUMMARY OF SPECIALIST STUDIES

15.1 DEFF Environmental Screening Tool

DEFF gazetted that the submission of a report generated from the national web based environmental screening tool, as contemplated in Regulation 16(1)(b)(v) of the 2014 EIA Regulations, as amended, published in GN No. R.982, will be compulsory from 05 October 2019 when submitting an application for Environmental Authorisation in terms of regulation 19 and 21 of the 2014 EIA Regulations, as amended.

The report generated provides the environmental sensitivities on site and also identifies which specialist studies will be required as part of the BA or Scoping and EIA Process.

The notice also states the following:

"It is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the site situation."

An Environmental Screening was generated for the Duvha Power Station seepage interception drains and indicated that the following specialist studies were required:

- Agricultural Impact Assessment;
- Archaeological and Cultural Heritage Impact Assessment;
- Palaeontology Impact Assessment (PIA);
- Terrestrial Biodiversity Impact Assessment;
- Aquatic Biodiversity Impact Assessment;
- Hydrology Assessment;
- Geotechnical Assessment;
- Health Impact Assessment; and
- Socio-Economic Assessment.

The Environmental Screening Report generated via the DEFF environmental screening tool is provided in **Appendix H2**.

Table 12 below provides an overview of the Specialist Studies not conducted for the project, as well as a motivation for why the studies were not undertaken:

Table 12: Specialist Studies that were not undertaken through the BA Process

Specialist Study	Motivation
Agricultural Impact Assessment	As the proposed development is taking place within an existing, built-up plant, there will be no agricultural land impacted as a result of the project.
Health Impact Assessment	As the proposed development is taking place within an existing, built-up plant, there will be no additional health impacts to surrounding areas associated with the project.
Socio-Economic Assessment	As the proposed development is taking place within an existing, built-up plant, with the closest town, Reyno Ridge, being 8.5km from the site, there will be no impact to the social environment.

There are general mitigation measures provided in the EMPr to prevent impacts to the aspects identified as sensitive by the DEFF screening tool.

Therefore, the following Specialist Studies were undertaken as part of the BA process:

1. Terrestrial Ecological Impact Assessment;
2. Aquatic and Wetland Baseline and Impact Assessment;
3. Phase 1 HIA; and
4. Desktop PIA.

In addition, a Geohydrological Study, which includes a hydrology and geotechnical assessment, is provided in **Appendix H3**.

15.2 Terrestrial Ecological Impact Assessment

15.2.1 Details of the Specialist

Specialist	
Organisation:	Nemai Consulting
Name:	Mr. Avhafarei Phamphe
Qualifications:	MSc (Botany)
Affiliation (if applicable):	• Professional Natural Scientist-Ecological Science (Reg No. 400349/12) with South African council for Natural Scientific Professions (SACNASP) • Professional member of South African Institute of Ecologists and Environmental Scientists (SAIEES) • Professional member of South African Association of Botanists (SAAB)

15.2.2 Main Findings

A Terrestrial Ecological Assessment was undertaken as part of the BA process in order to assess the impacts that the proposed construction activities will have on the receiving environment. The objective of this study was to identify sensitive species and their habitats on the four proposed sites. The current ecological status and conservation priority of vegetation on the four sites were assessed.

According to the data from South African National Biodiversity Institute (SANBI), Eastern Highveld Grassland and Rand Highveld Grassland threatened terrestrial ecosystems were recorded on the proposed sites and these ecosystem types have a vulnerable status. Even though the vegetation types and threatened ecosystems are listed as endangered and vulnerable respectively, the proposed sites have been highly transformed and disturbed due to ash dams, alien plant infestation and mining activities. According to the Mpumalanga Biodiversity Conservation Plan, the proposed development sites fall within the "*CBA Optimal"*, "*Heavily modified"* and *"Moderately modified- Old lands".*

During the field survey, no threatened species were observed on sites but only one plant species of conservation concern was noted, namely *Hypoxis hemerocallidea* (Star flower/African potato) (**Figure 15**) and this species is listed as *Declining.* It is therefore recommended that prior to construction, this species must be rescued and relocated to a safer place with suitable survival and growth-enabling conditions. Following construction activities, the species can be re-established at the sites. The distribution of *Hypoxis hemerocallidea* plant species in the proposed development sites is shown in **Figure 16**.

Figure 15: Star flower/African potato recorded in the study area

Figure 16: The distribution of Hypoxis hemerocallidea recorded on site

Large areas surrounding the study sites have resulted in increased habitat modification and transformation and are all causal factors in the alteration and disappearance of reptile diversity in the area. Only one reptile species was noted on site, this being the Montane Speckled Skink (*Trachylepis punctatissima*). This species is found in a variety of habitats, wet and dry, from grassland and savanna to shrubland, including rock outcrops. It is not considered to be of significant importance from a conservation perspective.

The non-perennial river on the proposed Low level dam servitude site holds water on a temporary basis and is likely an important breeding habitat for most of the frog species which occur in the region. During the field assessment, only one frog species was recorded, namely Queckett's River Frog (*Amietia quecketti*). It is a common species found on the banks of slow-flowing streams or other permanent bodies of water in a wide range of wetland habitats in grassland, savannah and forest fringe. It frequently inhabits garden ponds and water features.

15.2.3 Conclusions and Recommendations

The establishment of pioneer species should be considered with the natural cycle of rehabilitation of disturbed areas, which assists with erosion control, dust and establishment of more permanent species. This can be controlled during construction phase and thereafter more stringent measures should be implemented during the rehabilitation and post rehabilitation. Larger exotic species that are not included in the Category 1b list of invasive species could also be allowed to remain for aesthetic purposes. The proposed development should proceed subject to the above, and mitigation measures must be employed to minimise potential impacts from the project activities.

15.3 Riparian Habitat and Wetland Delineation Impact Assessment

15.3.1 Details of the Specialist

Specialist	
Organisation:	The Biodiversity Company
Name:	Mr. Andrew Husted
Qualifications:	MSc (Aquatic Health)
Affiliation (if applicable):	• Professional Natural Scientist – Ecological Science, Environmental Science and Aquatic Science (Reg number: 400213/11) with South African council for Natural Scientific Professions (SACNASP)

15.3.2 Main Findings

The Biodiversity Company was commissioned to conduct a wetland assessment as part of the BA and WULA process for the proposed Seepage Interception Drains for the Duvha Power Station. A single dry season survey was conducted in early June 2017. A baseline wetland assessment was completed by EnviRoss CC in February 2017 which has been considered to supplement the requirements of this study.

The baseline study competed by EnviRoss (2017) identified and delineated seven (7) hydro-geomorphic (HGM) units for the area, these were labelled A to G. **Figure 17** presents the HGM units that are considered to be applicable for this project, due to the potential risks posed by the proposed seepage drains. The HGM units that have been considered for the study are as follows:

- HGM B – Channelled valley bottom;
- HGM C – Hillslope seep zone;
- HGM D – Channelled valley bottom; and
- HGM E – Hillslope seep zone.

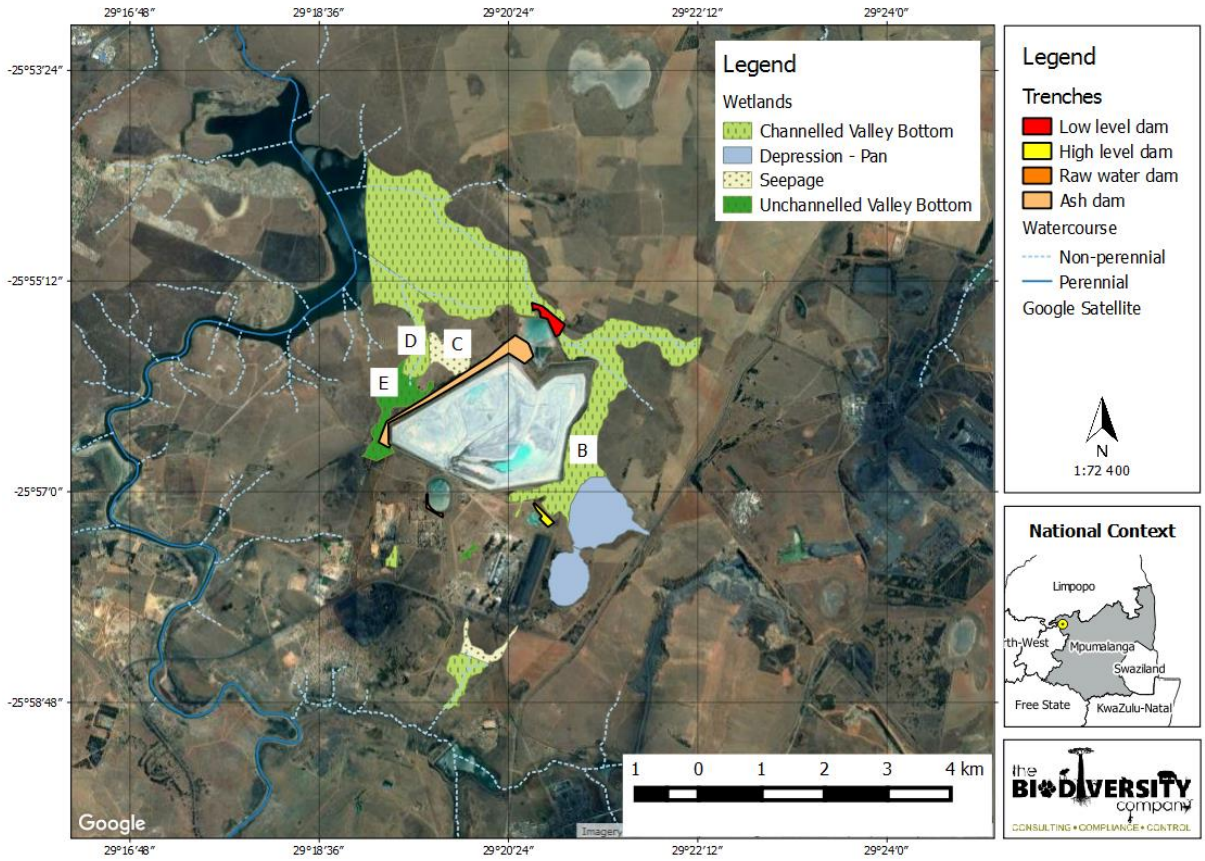

Figure 17: The HGM units considered for this risk assessment (The Biodiversity Company, 2017)

EnviRoss (2017) concluded that all the wetlands within the project area are Moderately modified (Class C). Owing to the method that was implemented for the study, the ecological status of HGM C was not determined.

- These ratings are largely driven by the impacts that occur within the local catchment (agriculture and the ash dam facility) as well as within the wetland units themselves, such as landscaping, excavated channels and impoundments.
- Vegetation structures are generally good, although cattle activity and grazing within the wetland units have influenced the overall integrity of this feature.

- Geomorphological and hydrological characteristics are generally linked as channel formation generally drives erosion features and sediment transport and deposition.
- Channel excavations that artificially drain wetland units (decrease retention time of the water within the wetland unit) and small-scale impoundments that increase this retention time are the main drivers of unit transformation.
- Water seepage from the ash dam generally is high in salts and other toxicants. Agriculture within the local catchment means that runoff water that enters into the wetlands will be high in nutrients and toxicants (from agro-chemicals) and sediments that will increase the turbidity of the water.
- Overall, however, the wetland units were seen to be largely functional and no wetland units were singled out as particularly problematic. This is largely due to the wetland units themselves being self-regulating and remaining relatively undisturbed. This is largely due to vegetation units that are generally healthy.

It is worth noting that the drain proposed for the raw water dam will not have a direct impact on the delineated wetland areas, and the risks posed by the drain for this dam are expected to be low. In addition to this, there is no preferential flow path that stems from the raw water dam to a wetland area. As a result of this, no risk assessment was conducted for the raw water dam. **Table 13** presents an expected risk scenario for each drain, and a discussion with reference to any local wetland areas likely to be affected by the project.

Table 13: Expected level of risk and discussions (The Biodiversity Company, 2017)

Dam	Level of risk	Discussion	Illustration
Raw water dam	No direct impacts posed by the drain.	No wetlands are within 500m of the proposed drain, and the expected level of risk is low (or negligible).	
High level dam	No direct impacts posed by the drain.	The drain is proposed to be constructed in an already disturbed / developed area. The drain can be designed to enable the polishing of water and allow discharge into the adjacent wetland area.	
Ash dam	Direct impacts posed by the drain.	The south-west portion of the drain will encroach into an unchanneled valley bottom area.	
Low level dam	Direct impacts posed by the drain.	The drain will be constructed in a channelled valley bottom wetland, with the position of the drain likely to pose a risk to the hydrology across the system due to possible flow obstructions.	

15.3.3 Conclusions and Recommendations

The construction of seepage interception drains is proposed for four (4) dams. The drain proposed for the raw water dam will not have a direct impact on the delineated wetland areas, and the risks posed by the drain for this dam are expected to be low. In addition to this, there is no preferential flow path that stems from the raw water dam to a wetland area. As a result of this, no risk assessment was conducted for the raw water dam.

Direct impacts to the watercourses are a key consideration for the risk assessment, these are for the areas that will be excavated to accommodate the seepage drains. Indirect risks that have also be considered for the project, and which are considered to be secondary risks includes aspects such as impaired water quality seepage and altered hydrology.

A number of moderate risks (prior to mitigation) were identified for the **High level dam**. The proposed drain will not be constructed within a wetland, but adjacent (up-slope) to a channelled valley bottom wetland. Owing to the fact that there will be no direct impact to a wetland area for the proposed drain, and also taking into account the prescribed mitigation measures, all Moderate risks were re-allocated a Low risk.

A number of moderate risks (prior to mitigation) were identified for the **Ash dam**. The proposed drain is predominantly aligned with an existing gravel access road, lined by *Eucalyptus* trees. The majority of the area proposed for the drain is considered to be considerably disturbed or altered, with only a small portion of the unchanneled valley bottom wetland area being constructed within. Approximately 3ha of the wetland (measuring 54.2ha) will be lost, reflecting a 5.5% wetland loss of this HGM unit.

Owing to the fact that only 5.5% of the wetland HGM unit will be lost in order to intercept dam seepage, with the likely area to be lost already in a modified state and partially sustained by storm water input, and also taking into account the prescribed mitigation measures, all Moderate risks were re-allocated a Low risk.

A number of moderate risks (prior to mitigation) were identified for the **Low level dam**. The proposed drain is approximately 8.6ha, with 6ha (70%) of the drain to be constructed in a channelled valley bottom wetland. The most notable (and ecological damning) risk posed by the drain is that drain will intercept / obstruct the movement of water across the system. The loss of wetland area is unavoidable for this drain, and the hydrology of the system will be altered due to the construction of the drain in the system.

Owing to the fact that approximately 70% of the drain will be constructed in a moderately modified and well-functioning wetland system, the risks associated with a number of aspects remain Moderate despite the recommended mitigation measures.

The baseline study determined that this wetland unit functions as a well-established wetland system that offers all of the goods and services of a natural wetland of its kind.

15.4 Phase 1 HIA

15.4.1 Details of the Specialist

Specialist	
Organisation:	PGS Heritage (Pty) Ltd
Name:	Wouter Fourie
Qualifications:	BA (Hons) (Cum laude) – Archaeology and Geography BA – Archaeology, Geography and Anthropology
Affiliation (if applicable):	• Professional Archaeologist – Association of Southern African Professional Archaeologists (ASAPA) – Professional Member • Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP) • CRM Accreditation (ASAPA) – o Principal Investigator – Grave Relocations o Field Director – Iron Age o Field Supervisor – Colonial Period and Stone Age o Accredited with Amafa KZN

15.4.2 Main Findings

No heritage sites were identified inside the study area. However, two heritage sites were identified just outside the boundary of one of the study areas. These include the remains of a demolished farmstead, most likely of recent to modern date (**DUV 001** of Low heritage significance), and a burial ground, consisting of 11 graves, (**DUV 002** of High heritage significance). The demolished remains of four separate buildings at DUV 001 seem to have been constructed of modern materials. The boundary wall is stone and cement. The foundation is modern brick. The estimated extent is approximately 75m in diameter. The site is located just outside the north-west boundary of the Ash Dam drain servitude area, approximately 100m away (Refer to **Figures 18** and **19**).

Figure 18: View of DUV001, showing the foundation of one of the buildings

Figure 19: DUV001, showing boundary wall and remains of structure outside the wall

The identified site DUV 001 is deemed to be of Low heritage significance and is rated as Generally Protected C (GP.C). The building remains are situated in the location where three structures marked W (winkel) are depicted on the 1974 topographic map sheet. Therefore remains are likely to be 45 years old or younger. No mitigation measures or permits are therefore required before the site can be affected, moved or destroyed.

Figure 20: View of DUV002, burial ground, looking towards the Ash Dam drain servitude

Figure 21: DUV002, View looking north-west

Figure 22: Masilela headstone, dated 1989

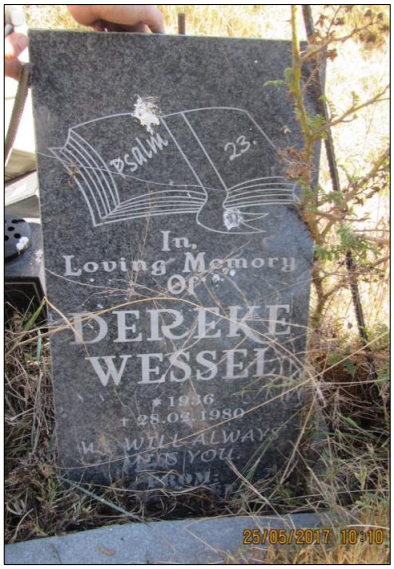

Figure 23: Wessel headstone, dated 1980

Figure 24: Skhosana headstone, dated 1974

Figure 25: George headstone, dated 1976

A small formal fenced burial ground is located here. It consists of approximately 11 visible graves, some of which have inscribed headstones. The area where the graves are located is heavily overgrown with thick long grass and it was difficult to determine exactly how many graves are present. The graves are oriented east to west. Several graves have headstones with inscriptions that contain names and dates for the 1970s-1980s. Names include Mandla Geelbooi Masilela (d.1989), Dereke Wessel (d. 1980), Konny Amos Skhosana (d. 1974), and George (d. 1976). The burial ground is located just outside the boundary of the Ash Dam drain servitude area, approximately 13m away.

The identified site DUV 002 is deemed to be of High heritage significance and is rated as Generally Protected A (GP.A). Mitigation measures and permits are therefore required before the site may be affected, moved or destroyed.

A preliminary investigation based on the SAHRIS Palaeosensitivity map identified the presence of geological deposits of both Low and Very High palaeontological sensitivity underlying the location of the four proposed drains (refer to **Figure 26**). Therefore, a detailed desktop assessment by a professional palaeontologist would be required before construction. This will confirm the initial sensitivity assessment and recommend specific mitigation measures to be undertaken before construction. A finds management protocol may need to be developed for the construction activities.

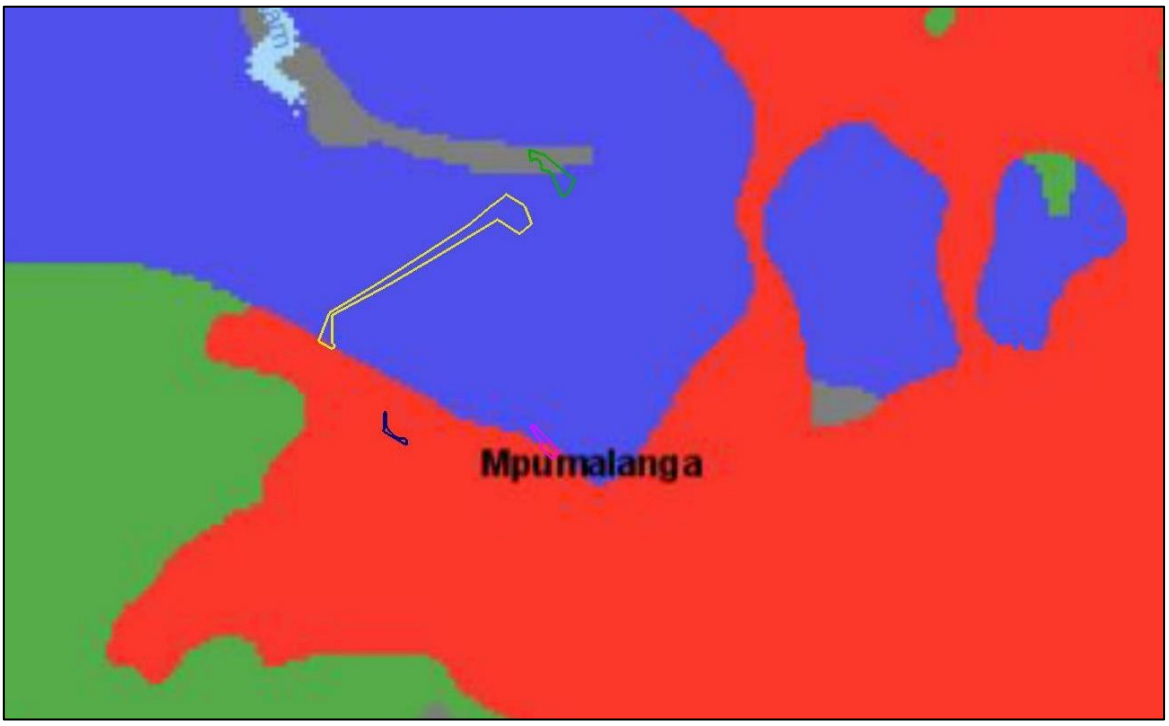

Figure 26: Overlay of the individual drainage footprints on the palaeosensitivity map from the SAHRIS database. Most of the area is coloured blue, which is rated as Low sensitivity, but the two southern dams (HLWRD and Raw Water Dam) are located over an area coloured red, which is rated as Very High sensitivity.

15.4.3 Conclusions and Recommendations

Mitigation will be required for DUV 002 (burial grounds)

- Demarcate the site as a “no go” area, with a 30-meter buffer and a fence.
- It is also recommended that the Environmental Control Officer (ECO) monitor construction at this location.
- If the graves will be disturbed in any way during construction or operation, and a buffer is not possible, a grave relocation process will need to take place.

Mitigation may be required for the geological formations rated as Very High Sensitivity for palaeontology which underlie a portion of the study area. This would be confirmed by the required desktop Palaeontological Impact Assessment study to be undertaken before construction commences. A detailed desktop assessment by a professional palaeontologist will recommend specific mitigation measures to be undertaken for palaeontological resources likely to be affected, before construction commences. A finds management protocol may need to be developed for the construction activities.

Provided that the recommended mitigation measures are followed, it is considered that the proposed development will have a LOW impact on heritage resources and therefore the development can proceed.

15.5 Desktop PIA

15.5.1 Details of the Specialist

Specialist	
Organisation:	Banzai Environmental (Pty) Ltd
Name:	Elize Butler
Qualifications:	MSc – Palaeontology
Affiliation (if applicable):	Member of the Palaeontological Society of South Africa

15.5.2 Main Findings

The proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province is primarily underlain by the metamorphic sediments of the Selons River Formation (Rooiberg Group) and a small area in the south is located in the Vryheid Formation of the Ecca Group (Karoo Supergroup). According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS), the Palaeontological Sensitivity of the metamorphic sediments of Selons River Formation is zero while the Vryheid Formation has a Very High Palaeontological Sensitivity (Almond and Pether 2008, SAHRIS website).

To date, no fossil vertebrates have been collected from the Vryheid formation. The occurrence of fossil insects are rare, while palynomorphs are diverse. Non-marine bivalves and fish scales have also been reported from this formation. Trace fossils are abundantly found but the diversity is low. The mesosaurid reptile, Mesosaurus has been found in the southern parts of the basin but may also be present in other areas of the Vryheid formation. Regardless of the rare and irregular occurrence of fossils in this biozone, a single fossil may be of scientific importance as many fossil taxa are known from a single fossil.

However, the southern portion of the development (2 camp sites, high level ash water return dam (HLAWRD), raw water dam as well as the most southern tip of the cut-off trench) falls in the Vryheid Formation which has a Very High Palaeontological Sensitivity. But, this area of the development footprint is very small and disturbed due to the agricultural and previous construction activities in the area. It is therefore considered that the construction and operation of the development may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

15.5.3 Conclusions and Recommendations

In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations, the Chance Find Protocol must be implemented by the Environmental Control Officer (ECO) in charge of these developments. This Chance Find Protocol must also be included in the Environmental Management Programme Reports (EMPr). These discoveries ought to be secured (preferably in situ) and the ECO ought to alert South African Heritage Resources Agency (SAHRA) so that appropriate mitigation (e.g.

documented and collection) can be undertaken by a palaeontologist. The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

16 IMPACT ASSESSMENT

16.1 Overview

This section focuses on the pertinent environmental impacts that could potentially be caused by the proposed Duvha seepage interception drains during the Pre-construction, Construction and Operational Phases of the project.

Please note that an “impact” refers to the change to the environment resulting from an environmental aspect (or activity), whether desirable or undesirable. An impact may be the direct or indirect consequence of an activity.

The impacts to the environmental features are linked to the project activities, which in broad terms relate to the proposed development and its associated services and infrastructure.

Impacts were identified as follows:

- Impacts associated with listed activities contained in GN No. R. 983, R.984 and R. 985, for which authorisation has been applied for;
- Issues highlighted by environmental authorities;
- Comments received during public participation;
- An appraisal of the project description and the receiving environment; and
- Findings from specialist studies.

16.2 Project Activities

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

Table 14: Activities associated with the Pre-construction Phase

PRE-CONSTRUCTION PHASE
Project Activities

1. Applicant to appoint ECO
2. Negotiations and agreements with affected stakeholders and parties
3. Detailed engineering design
4. Detailed geotechnical design
5. Site survey
6. Procurement of contractors
7. Mark construction servitude
8. Pre-construction photographic records
9. Development and approval of method statements
10. Development and approval of construction plans
11. Development of employment strategy
12. Construction site planning, access and layout
Environmental Activities
1. Demarcation of buffers around sensitive areas
2. Diligent compliance monitoring of the EA, EMPr and other relevant environmental legislation
3. Barricading and installing barriers around buffer areas identified in specialist studies
4. Ongoing consultation with affected parties

Table 15: Activities associated with the Construction Phase

CONSTRUCTION PHASE
Project Activities
1. Site establishment (including site camp and labour camp)
2. Fencing of the construction area
3. Registration of the servitude
4. Pegging of construction footprints
5. Site clearing
6. Delivery of construction material

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

Table 16: Activities associated with Operational Phase

OPERATIONAL PHASE
Project Activities
1. Access arrangements and requirements
2. Routine maintenance inspections of the interception drains
3. Repair and maintenance works of the interception drains
Environmental Activities
1. Ongoing consultation with affected parties
2. Erosion monitoring programme
3. Management of sensitive areas or buffered areas
4. Management of vegetation clearance
5. Stormwater management
6. Pollution control measures
7. Control of invasive plant species

16.3 Environmental Aspects

Environmental aspects are regarded as those components of an organisation's activities, products and services that are likely to interact with the environment and cause an impact. **Tables 17, 18** and **19** provide the environmental aspects that have been identified for the proposed project, are linked to the project activities (note that only high-level aspects are provided).

Table 17: Environmental aspects associated with the Pre-Construction Phase

ENVIRONMENTAL ASPECTS
Pre-construction Phase
1. Insufficient construction site planning and layout
2. Poor consultation with affected parties, stakeholders and authorities

ENVIRONMENTAL ASPECTS
Pre-construction Phase
3. Site-specific environmental issues not fully understood
4. Inadequate environmental and compliance monitoring
5. Absence of relevant permits
6. Lack of barricading of sensitive environmental features
7. Poor waste management
8. Absence of ablution facilities

Table 18: Environmental aspects associated with the Construction Phase

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

ENVIRONMENTAL ASPECTS
Construction Phase
13. Inadequate storage and handling of material
14. Inadequate storage and handling of hazardous material
15. Erosion
16. Poor maintenance of equipment and plant
17. Poor management of labour force
18. Pollution from ablution facilities
19. Inadequate management of construction camp
20. Poor waste management practices – hazardous and general solid and liquid
21. Poor management of pollution generation potential
22. Poor management of water
23. Damage to significant fauna and flora
24. Environmental damage of sensitive areas
25. Disruption of archaeological and culturally significant features (if encountered)
26. Dust and emissions
27. Noise nuisance due to construction activities
28. Poor reinstatement and rehabilitation

Table 19: Environmental aspects associated with the Operational Phase

Operational Phase
1. Poor consultation with affected parties, stakeholders and authorities
2. Inadequate environmental and compliance monitoring
3. Inadequate management of access, routine maintenance and maintenance works

4. Inadequate management of vegetation

16.4 Potential Significant Environmental Impacts

Environmental impacts are the change to the environment resulting from an environmental aspect, whether desirable or undesirable. Refer to **Tables 20** and **21** for the potential significant impacts associated with the preceding activities and environmental aspects for the pre-construction, construction and operational phase.

Table 20: Potential significant environmental impacts during Construction Phase

Feature	Impact
Geology and Soil	• Unsuitable geological conditions • Impacts associated with the sourcing of construction material and loss of topsoil • Soil erosion (land clearance and construction activities) • Soil pollution e.g. hydrocarbon and cement spillages • Compaction and erosion of removed and stockpiled soils • Soil contamination from incorrect storage/handling/disposal of hazardous waste • Soil contamination through spillages and leakages • Soil contamination due to mismanagement and/or incorrect storage of hazardous chemicals • Poor stormwater management during construction
Topography	• Visual impacts during construction • Crossing topographic features (watercourses) • Erosion of affected areas
Geohydrology	• Groundwater pollution due to spillages and poor construction practices
Surface Water	• Increased stormwater runoff • Water leakages and wastage
Flora	• Loss of sensitive vegetation and habitat • Damage and loss of vegetation of conservation significance • Proliferation of exotic vegetation in disturbed areas • Damage to vegetation in surrounding areas • Destruction of potential red list plants during site clearing and construction
Fauna	• Loss of habitat through site clearing and construction • Illegal killing or hunting of mammals • Killing of snakes during construction phase due to poor environmental education procedures • Potential illness and/or death of fauna due to pollution and/or littering • Damage / clearance of habitat of conservation importance • Loss of fauna species of conservation significance • Obstruction to animal movement corridors
Air Quality	• Increased dust generation • Greenhouse gas emissions

Feature	Impact
Transportation	• Construction-related traffic • Increase in traffic on the local road network • Damage to roads by heavy construction vehicles • Risks to road users
Noise	• Localised noise increase • Noise nuisance
Aesthetics	• Reduction in visual quality of area
Safety and Security	• Safety risk to employees and surrounding communities
Waste Management	• Waste generated from site preparations (e.g. plant material) • Domestic waste • Surplus and used building material • Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags) • Disposal of excess spoil material (soil and rock) generated as part of the bulk earthworks • Land, air and water pollution through poor waste management practices
Socio – Economic	• Nuisance from noise and dust • Safety and security
Heritage Resources and Palaeontological Sensitivity	• Potential damage to heritage resources • Potential impacts to palaeontological sensitivity
Riparian Habitat	• Loss of wetland vegetation within construction domain • Wetland habitat unit destruction • Soil erosion and sedimentation of vegetation through dewatering activities
Aquatic Ecology	• Disruptions to aquatic biota community due to water contamination, alteration of flow and disturbance to habitat during construction (particularly relevant to construction activities that take place instream or in close proximity to watercourses) • Alteration of habitat • Loss of aquatic-dependent biodiversity
Water Quality	• Inflow of contaminated stormwater • Release of contaminants from equipment and concreting activities • Water quality impacts due to spillages and poor construction practices • Water quality impacts due to siltation and pollution
Flow Regime	• Alteration of flow • Affect aquatic biodiversity

Table 21: Potential significant environmental impacts for Operational Phase

Feature	Impact
Topography	• Visual impacts from disturbed area and infrastructure • Crossing topographic features (watercourses) • Erosion of affected areas

Feature	Impact
Flora	• Encroachment by exotic species through inadequate eradication programme
Aesthetics	• Inadequate reinstatement and rehabilitation of construction footprint
Socio – Economic	• Safety and security issues through improper access control during inspections and maintenance activities • Use of local and internal road network for operation and maintenance purposes

16.5 Impact Assessment Methodology

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

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

Figure 27: Mitigation hierarchy

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

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

Information provided by specialists was used to calculate an overall impact score by multiplying the product of the nature, magnitude and the significance of the impact by the sum of the extent, duration and probability based on the following equation:

Overall Score = (NxMxS)x(E+D+P)

Where: N = Nature;
E = Extent
M = Magnitude
D = Duration
P = Probability
S = Significance

Table 22: Impact methodology table

Nature			
Negative	Neutral	Positive	
-1	0	+1	
Extent			
Local	Regional	National	International
1	2	3	4
Magnitude			
Low	Medium	High	
1	2	3	
Duration			
Short Term (0-5yrs)	Medium Term (5-11yrs)	Long Term	Permanent
1	2	3	4
Probability			
Rare/Remote	Unlikely	Moderate	Likely	Almost Certain
1	2	3	4	5
Significance			
No Impact/None	No Impact After Mitigation/Low	Residual Impact After Mitigation/Medium	Impact Cannot be Mitigated/High
0	1	2	3

The following definitions apply:

For the methodology of the impact assessment, the analysis is conducted on a quantitative basis with regard to the nature, extent, magnitude, duration, probability and significance of the impacts. The following definitions and scoring system apply:

Nature (/Status)

The project could have a positive, negative or neutral impact on the environment.

Extent

- Local – extend to the site and its immediate surroundings.

- Regional – impact on the region but within the province.
- National – impact on an interprovincial scale.
- International – impact outside of South Africa.

Magnitude

Degree to which impact may cause irreplaceable loss of resources.

- Low – natural and social functions and processes are not affected or minimally affected.
- Medium – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration

- Short term – 0-5 years.
- Medium term – 5-11 years.
- Long term – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability

- Almost certain – the event is expected to occur in most circumstances.
- Likely – the event will probably occur in most circumstances.
- Moderate – the event should occur at some time.
- Unlikely – the event could occur at some time.
- Rare/Remote – the event may occur only in exceptional circumstances.

Significance

Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-

0 – Impact will not affect the environment. No mitigation necessary.

1 – No impact after mitigation.

2 – Residual impact after mitigation.

3 – Impact cannot be mitigated.

For example, the worst possible impact score of -117 would be achieved based on the following ratings:

N = Nature = -1

M = Magnitude = 3

S = Significance = 3

E = Extent = 4

D = Duration = 4

P= Probability = 5

Worst impact score = (-1 x 3 x 3) x (4+4+5) = -117

On the other hand, if the nature of an impact is 0 (neutral or no change) or the significance is 0 (no impact), then the impact will be 0.

Impact Scores will therefore be ranked in the following way:

Table 23: Ranking of overall impact score

Impact Rating	Low/Acceptable impact	Medium	High	Very High
Score	0 to -30	-31 to -60	-61 to -90	-91 to -117

17 IMPACT MANAGEMENT

The impacts for each environmental feature identified are assessed for the pre-construction, construction, and operation phases for the proposed Duvha seepage interception drains.

17.1 Geology and Soil

17.1.1 Potential Impacts

During the construction phase, large areas will be cleared of vegetation, which may lead to soil erosion. The EMPr will include suitable erosion and stormwater management measures to prevent the occurrence of erosion.

Soil may be polluted by poor storage of construction material, spillages and inadequate housekeeping practices. Specific mitigation measures are contained in the EMPr, where the primary objective is the effective and safe management of materials on site, in order to minimise the impact of these materials on the biophysical environment. The same objective applies to the correct management and handling of hazardous substances (e.g. fuel).

17.1.2 Impact Assessment

Geology and Soil

Project Lifecycle:	Construction and Operational Phases						
Potential Impact:	Soil erosion						
Proposed Mitigation:	Erosion Control: • Suitable erosion protective measures to be implemented for access roads. • Stabilisation of cleared areas to prevent and control erosion. • Monitoring to be conducted to detect erosion. • Rehabilitate all areas disturbed during construction. • The Contractor shall take measures to the approval of the Engineer to ensure that there is no undue stormwater damage and soil erosion resulting from the construction activities outside the construction camp and works areas. • During construction, water diversion soil berms will be constructed to divert surface and stormwater from traversing the disturbed areas. • Cross and side stormwater drainage measures shall be constructed on access and haul roads to the site and roads within the site. • The Contractor shall ensure that run off from access and haul roads, and that diverted into cross and side drains, does not cause erosion. • Manage stormwater from construction site to avoid environmental contamination and erosion. Settling will be allowed for in a high-capacity attenuation pond downstream of the site. • At all stages of the project lifespan, stormwater control measures as specified by the Engineer and ECO shall be applied to keep soil on site by minimising: o erosion of temporary stockpiles of topsoil; o erosion from construction roads, excavations and other cleared areas; o silt-laden run off from all areas stripped of vegetation, including excavation surfaces and stockpiles of spoil and topsoil; o contaminated run off from storage areas.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Medium	Likely	3	-42
With Mitigation	-	Local	Low	Short	Unlikely	1	-4
Project Lifecycle:	Pre-Construction and Construction Phases						
Potential Impact:	Loss of topsoil						
Proposed Mitigation:	• During backfilling, all soils must be replaced in the same order as they were removed. • Remove, stockpile and preserve topsoil for re-use during rehabilitation as the final soil layer. • Topsoil should be stripped to a depth of at least 150 mm and temporarily stockpiled, separately from subsoil and rocky material, when areas are cleared. If mixed with sub-soil the usefulness of the topsoil for rehabilitation of the site will be lost. • Stockpiled topsoil should not be compacted. No vehicles are allowed access onto the stockpiles after they have been placed. • Stockpiled soil should be protected with erosion-control berms if exposed for a period of greater than 14 days during the wet season. The need for such measures will be indicated in consultation with the ECO. • Topsoil stockpiles must not exceed 1.5 m in height to minimise the wind erosion effects. • Topsoil stripped from different sites must be stockpiled separately and clearly identified as such and returned to the same sites during backfill operations. Topsoil obtained from sites with different soil types must not be mixed. • Topsoil stockpiles must not be contaminated with oil, diesel, petrol, waste or any other foreign matter, which may inhibit the later growth of vegetation and microorganisms in the soil. • Topsoil stockpiles must be kept free of weeds and alien invasive vegetation at all times. • Soil must not be stockpiled on drainage lines or near watercourses. • Soil should be exposed for the minimum time possible. The timing of clearing and grubbing should be coordinated well with construction activities to avoid prolonged disturbance and exposure of soils.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Medium	Likely	3	-42
With Mitigation	-	Local	Low	Short	Unlikely	1	-4
Project Lifecycle:	Construction Phase						
Potential Impact:	Contamination of soil						
Proposed Mitigation:	• Topsoil stockpiles must not be contaminated with oil, diesel, petrol, waste or any other foreign matter, which may inhibit the later growth of vegetation and microorganisms in the soil. • Limited vehicular access is allowed across rocky outcrops and ridges.						

	• All equipment must be inspected regularly for oil or fuel leaks before it is operated. Leakages must be repaired on mobile equipment or containment trays placed underneath immobile equipment until such leakage has been repaired. • Soil contaminated with oil must be appropriately treated and disposed of at a permitted landfill site or the soil can be regenerated using bio-remediation methods. • Vehicles must be maintained and serviced according to the manufacturers' standards. • Regularly checklists must be completed by drivers and operators before the vehicles and equipment are used. • Vehicles and equipment must be turned off when not in use. • Drip-trays must be placed under vehicles and equipment when not in use. • All vehicles and equipment will be kept in good working order and serviced regularly. Leaking equipment will be repaired immediately or removed from the site. • Suitable storage and disposal of hydraulic fluids and other vehicle oils. • Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. • No washing of plant may occur on the construction site. Plant to be washed in dedicated areas. • All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site.

	Nature +/-	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	Medium	Medium	Likely	3	-42
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

17.2 Geohydrology

17.2.1 Potential Impacts

Groundwater may be impacted on as follows during construction phase:

- Contamination of groundwater resulting from incorrect storage/handling and disposal of hazardous waste materials.
- Contamination of groundwater through spillages from equipment, machinery and vehicle storage or from the batching plant.

17.2.2 Impact Assessment

Geohydrology							
Project Lifecycle:	Construction and Operational Phases						
Potential Impact:	Contamination through spillage of fuel, hazardous chemicals, leaking vehicles, etc.						
Proposed Mitigation:	• All construction activities to comply with NWA. • Ensure that all hazardous storage containers and storage areas comply with the relevant SANS standards to prevent leakage. • Regularly inspect all vehicles for leaks. • Re-fuelling of vehicles must take place off-site; if this is not possible then re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • Littering must be prohibited by providing adequate number of rubbish bins during the construction and operational phases to ensure proper disposal of rubbish. • Staff must be trained to deal with fuel/chemical spills and spill kits must be easily available at all times. • Mixing of cement must be done on impermeable surface and all spills must be cleaned up immediately. • Ensure that all activities impacting on groundwater resources are managed according to the relevant DHSWS licensing requirements.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Medium	Likely	2	-28
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

17.3 Surface Water

17.3.1 Potential Impacts

The following impacts were identified by the Aquatic and Wetland Specialist and extracted from the Aquatic and Wetland Baseline and Impact Assessment (The Biodiversity Company, 2017):

- Loss of wetland areas
    - Project activities that can cause loss of wetland areas
        - Vegetation stripping
        - Soil excavations
        - Digging of foundations
    - Secondary impacts associated with the loss of wetlands
        - Loss of ecosystem services
- Altered hydrological regime
    - Project aspects that can causes changes to surface hydrology
        - Vegetation removal
        - Soil excavations
        - Intercepted surface and interflows by the drain
        - Increased interflow from seepage drains
    - Secondary impacts associated with altered regime
        - Loss of ecosystem services
        - Worsening of the ecological status of wetlands
- Impaired water quality
    - Project activities that can impact on the local water quality
        - Clearing of vegetation
        - Earth moving (removal and storage of topsoil and overburden)
        - Pollution of water resources due to spills and leaks
        - Chemical (organic/inorganic) spills
        - Erosion
        - Impaired water quality seepage
    - Secondary impacts associated with impaired water quality
        - Contaminated soil profile and loss of soil fertility
- Erosion and sedimentation of water resources
    - Project activities that can cause increased erosion and sedimentation
        - Vegetation removal
        - Soil excavations and stockpiles
        - Erosion
    - Secondary impacts associated with erosion and sedimentation
        - Loss of ecosystem services.

17.3.2 Impact Assessment

The methodology used by the aquatic and wetland specialist differs slightly from that described in Section 15.5. All impacts were analysed with regards to their nature, extent, magnitude, duration, probability and significance.

The assessments to follow were extracted from the Riparian Habitat and Wetland Delineation Impact Assessment (The Biodiversity Company, 2017) (**Tables 24** and **25**).

Table 24: Aspects assessed for the proposed project (The Biodiversity Company, 2017)

Activity	Impact	Aspect
Construction and operation of Seepage Interception Drains	Loss of wetland areas Loss of seepage / interflow Altered hydrological regime Impaired water quality inputs Decrease in water integrity Loss of ecological services	Removal of vegetation
		Stripping and stockpiling of top soil
		Excavation of drain
		Stockpiling of sub-soil
		Geotechnical sites
		Storm water management
		Contaminated seepage water input
		Drainage patterns change due to drain
		Clearing & shaping of drain
		Cleaning of drain area
		Mixing & pouring of fill
		Temporary access routes
		Temporary working areas
		Layering of drain fill material
		Compaction of fill material
		Additional Associated Infrastructure
		Operation of equipment and machinery
		Vehicle activity
		Domestic and industrial waste
		Storage of chemicals, mixes and fuel
		Spills and leaks

Table 25: DHSWS Risk Impact Matrix for the High level dam (The Biodiversity Company, 2017)

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase																
Removal of vegetation	**2**	**2**	**1**	**1**	1.5	**2**	**2**	5.5	2	2	**1**	2	7	38.5	**Low**	**Low**
Stripping and stockpiling of top soil	1	2	1	1	1.25	2	2	5.25	2	2	1	2	7	36.75	**Low**	**Low**
Excavation of drain	3	3	2	1	2.25	2	2	6.25	3	4	1	4	12	75	**Moderate***	**Low**
Stockpiling of sub-soil	**1**	**2**	**2**	**1**	1.5	**2**	**2**	5.5	2	2	1	2	7	38.5	**Low**	**Low**
Geotechnical sites	1	2	1	1	1.25	1	1	3.25	1	1	1	2	5	16.25	**Low**	**Low**
Storm water management	2	3	2	1	2	2	2	6	3	2	1	3	9	54	**Low**	**Low**
Contaminated seepage water input	1	3	2	2	2	3	3	8	3	2	1	4	10	80	**Moderate***	**Low**
Drainage patterns change due to drain	3	2	2	1	2	3	3	8	3	3	1	4	11	88	**Moderate**	**Low**
Clearing & shaping of drain	1	3	2	1	1.75	1	3	5.75	2	2	1	3	8	46	**Low**	**Low**
Cleaning of drain area	1	2	1	1	1.25	1	3	5.25	2	1	1	2	6	31.5	**Low**	**Low**
Mixing & pouring of fill	1	3	1	1	1.5	1	2	4.5	2	1	1	2	6	27	**Low**	**Low**
Temporary access routes	1	2	2	1	1.5	1	3	5.5	3	2	1	2	8	44	**Low**	**Low**
Temporary working areas	**1**	**2**	**2**	**1**	1.5	**1**	**3**	5.5	3	2	1	3	9	49.5	**Low**	**Low**
Layering of drain fill material	1	2	1	1	1.25	1	2	4.25	2	2	1	3	8	34	**Low**	**Low**
Compaction of fill material	2	2	1	1	1.5	1	2	4.5	2	1	1	3	7	31.5	**Low**	**Low**
Additional Associated Infrastructure	1	1	2	1	1.25	1	3	5.25	3	2	1	2	8	42	**Low**	**Low**
Operation of equipment and machinery	1	2	1	2	1.5	1	3	5.5	3	2	1	2	8	44	**Low**	**Low**

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Vehicle activity	1	2	1	2	1.5	2	3	6.5	3	2	1	2	8	52	**Low**	**Low**
Domestic and industrial waste	1	2	1	1	1.25	1	3	5.25	3	2	1	3	9	47.25	**Low**	**Low**
Storage of chemicals, mixes and fuel	1	3	1	1	1.5	1	3	5.5	3	2	1	3	9	49.5	**Low**	**Low**
Spills and leaks	1	3	1	1	1.5	2	3	6.5	3	2	1	3	9	58.5	**Moderate***	**Low**
Operational Phase																
Drainage patterns change due to drain	2	2	2	1	1.75	3	5	9.75	3	2	1	3	9	87.75	**Moderate***	**Low**
Loss of dam seepage	2	2	1	1	1.5	2	5	8.5	2	2	1	2	7	59.5	**Moderate***	**Low**
Contaminated seepage water input	1	3	1	2	1.75	3	5	9.75	4	2	1	3	10	97.5	**Moderate**	**Low**

(*) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.”

Table 26: DHSWS Risk Impact Matrix for the Ash dam (The Biodiversity Company, 2017)

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase																
Removal of vegetation	**2**	**3**	**2**	**2**	2.25	**2**	**2**	6.25	2	2	**1**	2	7	43.75	**Low**	**Low**
Stripping and stockpiling of top soil	2	2	2	2	2	2	2	6	2	2	1	2	7	42	**Low**	**Low**
Excavation of drain	3	3	2	2	2.5	2	2	6.5	3	4	1	4	12	78	**Moderate***	**Low**
Stockpiling of sub-soil	**2**	**2**	**2**	**1**	1.75	**2**	**2**	5.75	2	2	1	2	7	40.25	**Low**	**Low**
Geotechnical sites	2	2	2	1	1.75	1	1	3.75	1	1	1	2	5	18.75	**Low**	**Low**
Storm water management	3	3	2	1	2.25	2	2	6.25	3	2	1	3	9	56.25	**Moderate**	**Low**
Contaminated seepage water input	2	3	2	2	2.25	3	3	8.25	3	2	1	4	10	82.5	**Moderate**	**Low**
Drainage patterns change due to drain	3	2	2	2	2.25	3	3	8.25	3	3	1	4	11	90.75	**Moderate**	**Low**
Clearing & shaping of drain	3	3	2	1	2.25	1	3	6.25	2	2	1	3	8	50	**Low**	**Low**
Cleaning of drain area	2	2	1	1	1.5	1	3	5.5	2	1	1	2	6	33	**Low**	**Low**
Mixing & pouring of fill	2	3	2	1	2	1	2	5	2	1	1	2	6	30	**Low**	**Low**
Temporary access routes	1	2	2	1	1.5	1	3	5.5	3	2	1	2	8	44	**Low**	**Low**
Temporary working areas	**2**	**2**	**2**	**2**	2	**1**	**3**	6	3	2	1	3	9	54	**Low**	**Low**
Layering of drain fill material	2	2	1	1	1.5	1	2	4.5	2	2	1	3	8	36	**Low**	**Low**
Compaction of fill material	2	2	1	2	1.75	1	2	4.75	2	1	1	3	7	33.25	**Low**	**Low**
Additional Associated Infrastructure	2	2	2	2	2	1	3	6	3	2	1	2	8	48	**Low**	**Low**
Operation of equipment and machinery	1	3	2	2	2	1	3	6	3	2	1	2	8	48	**Low**	**Low**

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Vehicle activity	2	2	2	2	2	2	3	7	3	2	1	2	8	56	**Moderate***	**Low**
Domestic and industrial waste	1	2	1	2	1.5	1	3	5.5	3	2	1	3	9	49.5	**Low**	**Low**
Storage of chemicals, mixes and fuel	1	3	1	1	1.5	1	3	5.5	3	2	1	3	9	49.5	**Low**	**Low**
Spills and leaks	2	3	1	2	2	2	3	7	3	2	1	3	9	63	**Moderate***	**Low**
Operational Phase																
Drainage patterns change due to drain	3	2	2	2	2.25	3	5	10.25	3	2	1	3	9	92.25	**Moderate**	**Low**
Loss of dam seepage	2	2	1	1	1.5	2	5	8.5	2	2	1	2	7	59.5	**Moderate***	**Low**
Contaminated seepage water input	1	3	1	2	1.75	3	5	9.75	4	2	1	3	10	97.5	**Moderate**	**Low**

(*) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.”

Table 27: DHSWS Risk Impact Matrix for the Low level dam (The Biodiversity Company, 2017)

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase																
Removal of vegetation	**4**	**3**	**4**	**3**	3.5	**2**	**2**	7.5	2	2	**5**	2	11	82.5	**Moderate**	**Moderate**
Stripping and stockpiling of top soil	3	3	3	3	3	2	2	7	2	2	5	2	11	77	**Moderate**	**Moderate**
Excavation of drain	4	3	4	3	3.5	2	2	7.5	3	4	5	4	16	120	**Moderate**	**Moderate**
Stockpiling of sub-soil	**2**	**2**	**2**	**2**	2	**2**	**2**	6	2	2	1	2	7	42	**Low**	**Low**
Geotechnical sites	2	2	2	2	2	1	1	4	1	1	5	2	9	36	**Low**	**Low**
Storm water management	3	3	3	2	2.75	2	2	6.75	3	2	5	3	13	87.75	**Moderate**	**Moderate**
Contaminated seepage water input	2	3	2	2	2.25	3	3	8.25	3	2	1	4	10	82.5	**Moderate**	**Moderate**
Drainage patterns change due to drain	3	3	3	3	3	3	3	9	3	3	5	4	15	135	**Moderate**	**Moderate**
Clearing & shaping of drain	3	3	3	2	2.75	2	3	7.75	2	2	5	3	12	93	**Moderate**	**Moderate**
Cleaning of drain area	2	3	2	2	2.25	2	3	7.25	2	1	5	2	10	72.5	**Moderate***	**Low**
Mixing & pouring of fill	2	3	2	1	2	1	2	5	2	1	5	2	10	50	**Low**	**Low**
Temporary access routes	3	3	3	3	3	2	3	8	3	2	5	2	12	96	**Moderate**	**Moderate**
Temporary working areas	**3**	**3**	**3**	**3**	3	**2**	**3**	8	3	2	5	3	13	104	**Moderate**	**Moderate**
Layering of drain fill material	3	2	1	1	1.75	1	2	4.75	2	2	5	3	12	57	**Moderate***	**Low**
Compaction of fill material	2	2	1	1	1.5	1	2	4.5	2	1	5	3	11	49.5	**Low**	**Low**
Additional Associated Infrastructure	2	1	2	1	1.5	1	3	5.5	3	2	1	2	8	44	**Low**	**Low**
Operation of equipment and machinery	2	3	1	3	2.25	1	3	6.25	3	2	1	2	8	50	**Low**	**Low**

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Vehicle activity	1	3	1	3	2	2	3	7	3	2	1	2	8	56	**Moderate***	**Low**
Domestic and industrial waste	1	2	1	2	1.5	1	3	5.5	3	2	1	3	9	49.5	**Low**	**Low**
Storage of chemicals, mixes and fuel	1	3	1	2	1.75	1	3	5.75	3	2	1	3	9	51.75	**Low**	**Low**
Spills and leaks	2	3	1	2	2	2	3	7	3	2	1	3	9	63	**Moderate***	**Low**
Operational Phase																
Drainage patterns change due to drain	4	3	2	3	3	3	5	11	3	2	5	3	13	143	**Moderate**	**Moderate**
Loss of dam seepage	2	2	2	2	2	2	5	9	2	2	1	2	7	63	**Moderate***	**Low**
Contaminated seepage water input	1	3	1	2	1.75	3	5	9.75	4	2	1	3	10	97.5	**Moderate**	**Low**

(*) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.”

General mitigation measures to be implemented for the project (The Biodiversity Company, 2017):

- Prevent uncontrolled access of vehicles through the wetlands that can cause a significant adverse impact on the hydrology and functioning of the systems;
- Laydown yards, camps and storage areas must be beyond the water resource areas and associated buffers where applicable;
- As much material must be pre-fabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- No dumping of construction material on-site may take place;
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported; and
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching.

Following the completion of the wetland survey, the following conclusions and recommendations were offered:

- The wetlands that surround the power station facility are influenced by the management practices of the facility as well as those activities of the surrounding land users. They are therefore subject to a multitude of pressures and drivers of ecological change;
- Overall, the wetland units were found to have retained relatively good ecological functionality;
- The capacity that the surrounding wetlands have to purify contaminated water depends on the protection of the ecological integrity of the systems. This includes vegetation density and structure as well as geomorphological features (protection from erosion and factors that will enhance erosion features);
- At present, erosion features are being enhanced through defining the watercourses through excavations as well as activity of livestock within the wetland zones. These are two aspects that should be addressed, which will require coordination with surrounding land users/owners;

- It is recommended that any effluents that are discharged into the surrounding wetland units be tested for harmful contaminants to ensure that no significant impacts to the supported biodiversity will take place. Cross referencing the effluent quality to the present DHSWS target water quality guidelines should be undertaken;
- The use of the wetlands for water volume and quality management pertaining to the Duvha Power Station can be possible in a sustainable way and these wetlands can offer ecological services and functions that can reduce the costs of artificial water purification and volume management.

17.4 Terrestrial Ecology – Flora

17.4.1 Potential Impacts

Vegetation will be lost within areas that are to be cleared for the project infrastructure. The potential loss of significant flora species may occur.

Clearing of vegetation for construction purposes may result in the proliferation of exotic vegetation, which could spread beyond the construction domain. This potential impact will need to be managed.

17.4.2 Impact Assessment

The impact assessment below was extracted from the Terrestrial Ecological Impact Assessment (Phamphe, 2017):

FLORA PRE – CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Loss of plant species of conservation concern		• It is recommended that prior to construction, the *Hypoxis hemerocallidea,* a plant species recorded on site must be searched and rescued and then following construction activities, they can be re-established at the site. • Given that the species of conservation importance were observed, it is important that species of conservation importance and threatened species which may occur on the proposed development sites are addressed through a search and rescue plan.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Low	Short-term	Likely	1

FLORA PRE – CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Destruction of indigenous flora	• Indigenous plants naturally growing on the proposed development sites that would be otherwise destroyed during clearing for development purposes should be incorporated into landscaped areas. • Vegetation clearing should be kept to a minimum, and this should only occur where it is absolutely necessary. The use of a brush-cutter is highly preferable to the use of earth-moving equipment. • Rehabilitate all disturbed areas as soon as the construction is completed within the proposed development areas. • Ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm. This can be achieved through provision of appropriate awareness to all personnel.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Low	Short-term	Likely	1

FLORA AND FAUNA PRE – CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Loss of Habitat and Habitat Fragmentation	• The most significant way to mitigate the loss of habitat is to limit the footprint within the natural habitat areas remaining. • No structures should be built outside the area demarcated for the development. • Although it is unavoidable that sections of the proposed developments will need to traverse areas of potential sensitivity, the construction of the interceptions drains should be constructed in such cases so as to avoid further impact to these areas.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE	
Potential Impact	Mitigation
Loss of vegetation due to fuel and chemical spills	• Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills and then compliance monitored by an appropriate person. • Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks. • Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use. • Implement suitable erosion control measures.

FLORA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Introduction of alien species.	• During construction, the construction areas and immediate surroundings should be monitored regularly for emergent invasive vegetation. • Promote awareness of all personnel. • The establishment of pioneer species should be considered with the natural cycle of rehabilitation of disturbed areas, which assists with erosion control, dust and establishment of more permanent species. This can be controlled during construction phase and thereafter more stringent measures should be implemented during the rehabilitation and post rehabilitation. • Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent their spread into the Power Station. • Larger exotic species that are not included in the Category 1b list of invasive species could also be allowed to remain for aesthetic purposes.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Destruction of alien vegetation	• All alien seedlings and saplings must be removed as they become evident for the duration of construction phase. • Manual / mechanical removal is preferred to chemical control.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE	
Potential Impact	Mitigation
Increased soil erosion	• Topsoil should be stored in such a way that does not compromise its plant-support capacity.

FLORA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
	• Topsoil from the construction activities should be stored for post-construction rehabilitation work and should not be disturbed more than is absolutely necessary. • Protect topsoil in order to avoid erosion loss on steep slopes. • Protect topsoil from contamination by aggregate, cement, concrete, fuels, litter, oils, domestic and wastes. • An ecologically-sound stormwater management plan must be implemented during construction and appropriate water diversion systems put in place.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Loss of habitat of the Eastern Highveld Grassland, Rand Highveld, and CBA Optimal.	• Vehicles and construction workers should under no circumstances be allowed outside the site boundaries to prevent impact on the surrounding vegetation. • Where possible, natural vegetation must not be cleared and encouraged to grow. • All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation. • Disturbance of vegetation must be limited only to areas of construction. • Prevent contamination of natural grasslands by any pollution. • Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Damage to plant life outside of the proposed development sites	• Construction activities should be restricted to the development footprint area and then the compliance in terms of footprint can be monitored by Environmental Control Officer (ECO). • Areas which could be deemed as no go should be clearly marked.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA OPERATIONAL PHASE						
Potential Impact			Mitigation			
The proposed construction activities may affect biodiversity through the encroachment of exotic vegetation following soil disturbance, in addition the maintenance of the area would disturb naturalised species within the area.			Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed and there should be an on-going monitoring program to control and/or eradicate newly emerging invasives.			
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION/POST CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Loss of habitat due to construction activities	• All areas to be affected by the proposed project will be rehabilitated after construction and all waste generated by the construction activities will be stored in a temporary demarcated storage area, prior to disposal thereof at a licensed registered landfill site. • As much vegetation growth as possible should be promoted within the proposed development site in order to protect soils and to reduce the percentage of the surface area which is left as bare ground. In this regard special mention is made of the need to use indigenous vegetation species as the first choice during landscaping. In terms of the percentage of coverage required during rehabilitation and also the grass mix to be used for rehabilitation, the EMPr will be consulted for guidance. However, the plant material to be used for rehabilitation should be similar to what is found in the surrounding area.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Low	Short-term	Likely	1

17.5 Terrestrial Ecology – Fauna

17.5.1 Potential Impacts

Vulnerable species could occur within the study area and the construction of the proposed development will have a negative impact on the habitats of such species. Fauna could be adversely affected through construction-related activities (noise, illegal poaching, and habitat loss).

17.5.2 Impact Assessment

The impact assessment below was extracted from the Terrestrial Ecological Impact Assessment (Phamphe, 2017):

FAUNA PRE – CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Loss and displacement of animals on site.	• Prior to construction, animals of conservation concern must be rescued and relocated. An experienced person who knows the animals in the region well will identify any possible Red Data fauna on site and acquire the necessary permits to relocate fauna if avoidance is not possible. • Training of construction workers to recognise threatened animal species will reduce the probability of fauna being harmed unnecessarily. • The contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase. • Vehicles must adhere to a speed limit, 30-40 km/h is recommended for light vehicles and a lower speed for heavy vehicles. • All construction and maintenance vehicles must stick to properly demarcated and prepared roads. Off-road driving should be strictly prohibited. • No fires should be allowed at the sites. • No dogs or other domestic pets should be allowed at the sites.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Low	Short-term	Likely	1

FLORA AND FAUNA PRE – CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Loss of Habitat and Habitat Fragmentation	• The most significant way to mitigate the loss of habitat is to limit the footprint within the natural habitat areas remaining. • No structures should be built outside the area demarcated for the development. • Although it is unavoidable that sections of the proposed developments will need to traverse areas of potential sensitivity, the construction of the interceptions drains should be constructed in such cases so as to avoid further impact to these areas.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FAUNA CONSTRUCTION PHASE	
Potential Impact	Mitigation
Disturbance to animals	• Animals residing within the designated area shall not be unnecessarily disturbed. • During construction, refresher training can be conducted to construction workers with regards to littering and poaching. • The Contractor and his/her employees shall not bring any domestic animals onto site.

FAUNA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
	• Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding handling of snakes. • Illegal hunting is prohibited in the Power Station. • Any fauna (mammal, bird, reptile and amphibian) that becomes trapped in the trenches or in any construction or operational related activity may not be harmed and must be placed rescued and relocated by an experienced person.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FAUNA OPERATIONAL PHASE						
Potential Impact	Mitigation					
Disturbance of faunal species	• The disturbance of fauna should be minimized. • Animals residing within the designated area shall not be unnecessarily disturbed.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Low	Short-term	Likely	1

17.6 Heritage Resources

17.6.1 Potential Impacts

No heritage sites were identified inside the study area. However, two heritage sites were identified just outside the boundary of one of the study areas. These include the remains of a demolished farmstead, most likely of recent to modern date (DUV 001 of Low heritage significance), and a burial ground, consisting of 11 graves, (DUV 002 of High heritage significance).

There may be chance findings of heritage resources such as archaeological and cultural-historical sites or artefacts in or near the study area that could be destroyed during construction. Such heritage resources will need to be identified (if any) and protected (if required).

17.6.2 Impact Assessment

The impact assessment below was extracted from the HIA (PGS Heritage, 2017):

Table 28: Summary Impact Assessment Table (PGS Heritage, 2017)

POTENTIAL IMPACTS (in order of impact as described in Impact Matrix)	ASPECT (refer to Impact Matrix)	Nature	Type	Extent	Duration	Severity	Reversibility	Irreplaceable Loss	Probability	MITIGATION POTENTIAL	IMPACT SIGNIFICANCE		MITIGATION MEASURES
											Without Mitigation	With Mitigation	
CONSTRUCTION PHASE													
Impact on historical structures	Heritage Resources	**Negative**	Indirect	Site	Permanent	**Low**	Irreversible	Resource cannot be replaced	Unlikely	High	**Low**	**Low**	No mitigation required
Impact on burial grounds	Heritage Resource	**Negative**	Indirect	Local	Permanent	**High negative**	Irreversible	Resource cannot be replaced	Possible	Moderate or Partially Mitigatable	**High**	**Low**	Refer to Sections 9.1 and 9.3 of the HIA

POTENTIAL IMPACTS (in order of impact as described in Impact Matrix)	ASPECT (refer to Impact Matrix)	Nature	Type	Extent	Duration	Severity	Reversibility	Irreplaceable Loss	Probability	MITIGATION POTENTIAL	IMPACT SIGNIFICANCE		MITIGATION MEASURES
											Without Mitigation	With Mitigation	
Impact on palaeontology **(based on SAHRIS palaeosensitivity map at least a desktop PIA study is required to assess the impact)**											**Requires PIA**	**Requires PIA**	**NB: A desktop PIA by a professional palaeontologist is required prior to construction to confirm the SAHRIS palaeosensitivity ratings**

Note: these ratings are based on the SAHRIS palaeosensitivity map and will require confirmation by a professional palaeontologist undertaking at least a desktop PIA study.

17.7 Palaeontological Sensitivity

17.7.1 Potential Impacts

As a result of the excavations associated with the construction of the drains, the potential impacts during the construction phase include the loss of palaeontological sensitivity and potential impact to fossil heritage.

17.7.2 Impact Assessment

Relevant impacts to the proposed development are indicated in yellow (Banzai Environmental, 2019)

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity. The Nature of the Impact is the possible destruction of fossil heritage		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).

DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.

4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.

2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula:

(**Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.**

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive

Only the site of the Seepage Interception Drains at Duvha Power Station will be affected by the proposed development. The expected duration of the impact on fossil heritage is assessed as potentially permanent to long term. According to the SAHRIS PalaeoMap there is a possibility that the impact will most likely happen as the sensitivity is very high. But, this area of the development footprint is very small and disturbed due to the agricultural and previous construction activities in the area and thus the magnitude of the impact occurring is medium due to the very small area affected and disturbance of the land. Without mitigation there will be an irreversible and irreplaceable loss of fossil Heritage. The significance of the impact will be a negative medium impact.

In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations, the Chance Find Protocol must be implemented by the ECO in charge of these developments. This Chance Find Protocol must also be included in the EMPr. These discoveries ought to be secured (preferably in situ) and the ECO ought to alert SAHRA so that appropriate mitigation (e.g. documented and collection) can be undertaken by a palaeontologist. The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

17.8 Air Quality

17.8.1 Potential Impacts

Potential impacts during the construction phase include:

- Dust will be generated during the construction period from various sources, including blasting, earthworks, stockpiles, use of access roads, transportation of spoil material and general construction activities on site; and
- Exhaust emissions from vehicles and equipment.

Mitigation measures are included in the EMPr to ensure that the air quality impacts during the construction phase are suitably monitored (dust fallout and particulate matter) and managed and that regulated thresholds are not exceeded.

17.8.2 Impact Assessment

Air Quality	
Project Lifecycle:	Construction Phase
Potential Impact:	1. Increased dust levels as a result of construction activities and movement of construction vehicles. 2. Vehicles and construction machinery's emissions. 3. Smoke from uncontrolled fires.
Proposed Mitigation:	• Speed limits of 40 km/h must be implemented in all areas to limit the levels of dust pollution. • Dust must be suppressed on access roads and construction sites by the regular application of water or a biodegradable soil stabilisation agent. Water used for this purpose must be used in quantities that

	must not result in the generation of run-off. Water must be sourced from a legal connection. No water must be abstracted from streams or wetlands or other illegal sources. • Waste must be disposed of, as soon as possible at a municipal transfer station, skip or on a permitted landfill site. Waste must not be allowed to stand on site to decay, resulting in malodours. • The Contractor must inform all adjacent landowners of any after-hour construction activities and any other activity that could cause a nuisance e.g. the application of chemicals to the work surface. Normal working hours must be clearly indicated to adjacent landowners. No work will be permitted on Saturdays, Sundays, or public holidays without prior notification of the affected residents. • No fires are allowed. • Appropriate dust suppression measures or temporary stabilising mechanisms must be used when dust generation is unavoidable (e.g. dampening with water, chemical soil binders, straw, brush packs, chipping), particularly during prolonged periods of dry weather. Dust suppression to be undertaken for all bare areas, including construction area, access roads, borrow pits, etc. • Fine materials must be covered during transportation. • Vehicles and construction machinery must be well maintained to reduce excessive exhaust emissions. • The Contractor will take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, and pre-notification of affected parties) and will address any complaints received. • A complaints register to be maintained and any complaints from the public must be addressed immediately.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

17.9 Noise

17.9.1 Potential Impacts

During construction, localised increases in noise and vibration will be caused by the following:

- Operation of motorised vehicles for transportation of personnel, materials, and equipment to, from, and within the development site;
- Drilling operations;
- Operation of mobile and stationary motorised equipment within the site boundary (e.g. haul trucks, excavators, bulldozers, loaders, drill rigs, aggregate crushers, conveyor systems and generators);
- Operation of various auditory safety signals, alarms, or sirens (e.g. vehicle backup alarms and blast warning); and
- General construction activities on site.

Noise that emanates from construction and operational activities will be addressed through targeted best practices for noise monitoring and management in the EMPr. The associated regulated standards need to be adhered to.

Project personnel working on the site will experience the greatest potential exposure to the highest levels of noise and vibration. Workplace noise and vibration issues will be managed as part of the Occupational Health and Safety Management System to be employed on site, which will include specific measures aimed at preventing hearing loss and other deleterious health impacts.

17.9.2 Impact Assessment

Noise							
Project Lifecycle:	Construction Phase						
Potential Impact:	Excessive noise levels as a result of construction activities						
Proposed Mitigation:	• The provisions of SANS 10103:2008 will apply to all areas at the perimeter of the site, within audible distance of residents. • Working hours to be restricted to normal working hours, so as to minimise disturbance to landowners and community members. No work will be permitted on Saturdays, Sundays, or public holidays without prior notification of the affected residents. • No amplified music will be allowed on the site. The use of radios, tape recorders, compact disc players, television sets etc. will not be permitted unless at a level that does not serve as an intrusion to adjacent land-owners. • Construction activities generating output levels of 85 dB or more will be confined to the hours during normal working hours. • The Contractor must inform local communities and residents of any activity that could cause a nuisance to them. • Noise rules must be established for construction areas. • The Contractor will take preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to minimise complaints regarding noise and vibration nuisances from sources such as power tools. • All construction vehicles must be serviced on a frequent basis as a means of limiting excessive noise levels. • The contractor must ensure the silencers of all construction vehicles and machinery are working. • The Contractor will take preventative measures to minimise complaints regarding noise nuisances and will address any complaints received. • A complaints register to be maintained and any complaints from the public must be addressed immediately.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

17.10 Aesthetic Quality

17.10.1 Potential Impacts

Potential visual impacts during the construction phase will be caused by poor placement of the construction camp and equipment, as well as poor management of rubble, refuse and construction material on site. Additionally, destruction of the surrounding natural environment would decrease the aesthetic appeal of the area. Thus, the visual impacts should be minimised.

17.10.2 Impact Assessment

Aesthetics Quality	
Project Lifecycle:	Construction Phase
Potential Impact:	Reduction in visual quality due to construction activities
Proposed Mitigation:	• On-going housekeeping to maintain a tidy construction area. • Construction camp to be positioned so as to minimize its visual impacts. • Damage to the natural environment should be minimised. • Vegetation should be cut only if absolutely necessary. • The clearing of all sites should be kept to a minimum and surrounding vegetation should as far as possible be left intact as a natural shield.

	• The fragmentation of stands of indigenous vegetation and straight lines on trees should as far as possible be minimized. • No painting or marking of natural features shall be allowed. Marking for surveying and other purposes shall only be with pegs and beacons. • Trees and all woody shrubs should be protected from damage to provide a natural visual shield. Excavated material should not be placed on such plants nor should plant drive over them. • No construction rubble, construction material, refuse, litter or any other material not found naturally in the surroundings should be allowed at any time to be lying around on the construction site. • Particular aspects of concern to landowners and local residents should be addressed during construction. • Daily site cleanups to prevent the build-up of litter. • A complaints register to be maintained and any complaints from the public must be addressed immediately.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

17.11 Safety and Security

17.11.1 Potential Impacts

During construction, there may be the potential for employees to be injured, as well as the safety of landowners and surrounding communities may be compromised. All environmental hazards and safety risks must be included in the employees' safety file for inclusion into the contractor's mitigation measures.

17.11.2 Impact Assessment

Safety and Security							
Project Lifecycle:	Construction Phase						
Potential Impact:	1. Uncontrolled access to proposed boundary extension. 2. Construction employees getting injured. 3. Open trenches and construction vehicles may pose a safety risk.						
Proposed Mitigation:	• Compliance with Occupational Health and Safety Act (Act No. 85 of 1993). • Contractor to provide an Occupational Health and Safety Management Plan to the Construction Manager for approval prior to the commencement of works in terms of the Construction Regulations (2014). • Proper supervision of employees at all times. Employees to be clearly identifiable. • Employees must wear the necessary Personal Protective Equipment (PPE). • Employees to remain within the site boundary and no loitering to be allowed. • Access into and out of the servitude must only be via existing access roads from local public roads. • Contractor to prepare and submit, for approval, a rescue procedure for employees in the case of an injury. • Any employees of the Contractor or his sub-contractors found to be in breach of any of the Environmental Protection specifications may be ordered to leave the site forthwith. • Supervisory staff of the contractor, or sub-contractors shall not direct any person to undertake any activities, which would place such person/organization in contravention to any law, regulation or the EMPr itself. • Depending on the type of contravention or action it may also be necessary for the work to be called to a halt until such time as the contravention or action is corrected and investigated. • When working in the area of encroachment is prevalent, all open excavated trenches and foundations should be clearly marked and secured to keep people and fauna from falling in.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	High	Short	Unlikely	3	-36
With Mitigation	-	Local	High	Short	Rare	1	-9

17.12 Waste Management

17.12.1 Potential Impacts

Waste management aims to avoid waste pollution of land, air and water during and as a consequence of the construction of the interception drains.

The following describes the impacts during the construction phase:

- Waste generated from site preparations (e.g. plant material);
- Domestic waste;
- Surplus and used building material;
- Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags);
- Wastewater (sanitation facilities, washing of plant, operations at the batching plant, etc.); and
- Disposal of excess spoil material (soil and rock) generated as part of the bulk earthworks.

Poor waste management and practices during construction including lack of proper waste disposal, littering, and burning of refuse should not be tolerated.

17.12.2 Impact Assessment

Waste Management							
Project Lifecycle:	Construction Phase						
Potential Impact:	Land, air and water pollution through poor waste management practices						
Proposed Mitigation:	• Sufficient ablution facilities to be provided at the Construction Camp and along construction servitude. • Suitable litter receptacles to be positioned strategically across the site at all working areas. • Waste must be separated at source (e.g. containers for glass, paper, metals, plastics, organic waste and hazardous wastes). • The Contractor shall dispose of all refuse generated on site or from the activities of construction or its related activities. The contractor shall on a weekly basis dispose of all refuse at an approved refuse disposal site. Proof of disposal must be kept on record. • Littering by the workers is prohibited. Clearly marked litterbins must be provided on site. • Monitor the presence of litter on site. All staff shall be sensitised to this effect. • The entire site will be cleared of construction material, metal, tins, glass bottles, and food packaging or any other type of empty container or waste material or waste equipment used by the construction team on a daily basis. • Waste material that may harm man or animals should be removed immediately. • No hazardous materials, e.g. oil, diesel and fuel should be disposed of in the surrounding environment. Any diesel, oil or petrol spillages are to be collected and stored in specially marked containers and disposed of at a permitted waste disposal site and must be treated as hazardous waste. Proof of waste disposal to be kept on site. • No refuse or litter is allowed to be burnt on site. • The recycling of all waste is to be encouraged of both the contractor and staff. • All vehicle parking areas and vehicle servicing areas are to be inspected carefully for diesel, oil and other spillages weekly. • Excess spoil material should be disposed of at a location identified by the Contractor and approved by the Engineer and ECO.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	3	-36
With Mitigation	-	Local	Medium	Short	Unlikely	1	-8

17.13 Traffic

17.13.1 Potential Impacts

During the construction period, there will be an increase in traffic on the local road networks due to the delivery of plant and material, transportation of staff and normal construction-related traffic. Haul roads and access roads will also be created on site, within the construction domain.

As part of the construction phase, measures will be implemented for the selective upgrade of the roads (if necessary) and to render these roads safe for other users (amongst others). After the construction phase, the local roads will only need to be used for operation and maintenance purposes.

All the appropriate traffic safety measures and control must be implemented to minimise any potential impacts associated with the construction of the interception drains. Any disruptions to the transportation network must be mitigated and will be discussed in the EMPr.

17.13.2 Impact Assessment

Traffic							
Project Lifecycle:	Construction Phase						
Potential Impact:	Construction-related traffic						
Proposed Mitigation:	• Speed limit of 40km/h on roads within the project area to be adhered to. • Access roads to be maintained in a suitable condition. • Suitable erosion protective measures to be implemented for access roads during the construction phase. • Traffic safety measures (e.g. traffic warning signs, flagmen) to be implemented. • Clearly demarcate all access roads.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Moderate	1	-5

17.14 Socio-Economic Environment

17.14.1 Potential Impacts

A positive impact could be the creation of short-term work opportunities for local communities during construction.

There are also negative impacts associated with the construction of the interception drains and are as follows:

- Traffic disruptions;
- Dust, noise and visual impacts; and
- Proximity to construction work and associated inconvenience and dangers.

17.14.2 Impact Assessment

Traffic							
Project Lifecycle:	Construction Phase						
Potential Impact:	• Direct Employment						
Proposed Mitigation:	• Where feasible introduce a programme to transfer skills particularly during the construction phase of the project. • Employment opportunities to be created for women. • The selection process should be transparent and must include both men and women. • The project proponent should designate a person to ensure that employment is handled correctly, transparently and is not disruptive to the project. All evidence of the labour process must be stored by the project proponent.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	+	Local	Low	Short	Almost certain	2	+14
With Mitigation	+	Local	Medium	Short	Almost certain	3	+49
Project Lifecycle:	Construction and Operational Phases						
Potential Impact:	Poor communication with affected parties						
Proposed Mitigation:	• Establish lines of communications with affected parties. • Establish processes and procedures to effectively verify and address complaints and claims received. • Provide the relevant contact details to affected parties for queries / raising of issues or complaints.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	High	Medium	Almost Certain	2	-48
With Mitigation	+	Local	High	Medium	Almost Certain	2	+48
Project Lifecycle:	Construction						
Potential Impact:	Health and safety on site						
Proposed Mitigation:	• The Contractor must submit a Health and Safety Plan, prepared in accordance with the Health and Safety Specification, for approval prior to the commencement of work. These requirements are aligned with the Construction Regulations (2003). • Construction related material should kept in access-controlled area. • The requirements of the Occupational Health and Safety Act (Act 85 of 1993) and related regulations shall be adhered to. • Maintain access control to prevent access of the public to the construction areas.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Low	Short	Likely	2	-12
With Mitigation	-	Local	Medium	Short	Rare	1	-6
Project Lifecycle:	Construction						
Potential Impact:	Nuisance factors such as noise and dust						
Proposed Mitigation:	• Construction activities to remain within the designated construction areas. • The provisions of SANS 10103:2008 will apply to all areas at the perimeter of the site, within audible distance of residents. • Working hours to be agreed upon with Project Manager, so as to minimise disturbance to adjacent landowners and community members. • Where possible, noise disturbance should be at times after school hours. • Appropriate dust suppression measures or temporary stabilising mechanisms to be used when dust generation is unavoidable (e.g. dampening with water, chemical soil binders, straw, brush packs, chipping), particularly during prolonged periods of dry weather. Dust suppression to be undertaken for all bare areas, including construction area, access roads, site yard, etc.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Low	Short	Likely	2	-12
With Mitigation	-	Local	Medium	Short	Rare	1	-6

Project Lifecycle:	Construction						
Potential Impact:	Traffic disruptions						
Proposed Mitigation:	• Before any work can start, the Local Traffic Department must be consulted about measures to be taken regarding pedestrian and vehicular traffic control. • Undertake negotiations and confirm arrangements with the adjacent landowners regarding the use of traffic arrangements. • Ensure appropriate traffic safety measures are implemented. • Traffic safety measures (e.g. traffic warning signs, flagmen) to be implemented.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Low	Short	Likely	2	-12
With Mitigation	-	Local	Medium	Short	Rare	1	-6

17.15 Cumulative Impacts

According to GN No. R. 982 of the amended EIA Regulations (07 April 2017), a ***"cumulative impact"***, in relation to an activity, means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Cumulative impacts can be identified by combining the potential environmental implications of the proposed project with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the project area.

The following cumulative impacts are anticipated:

1. Loss of sensitive vegetation types
   The Terrestrial Ecological Impact Assessment (Phamphe, 2017) identified that the proposed development will impact on sensitive vegetation types such as Eastern Highveld Grassland and Rand Highveld Grassland threatened terrestrial ecosystems, as well as "*CBA Optimal"*. In addition, one plant species of conservation concern was noted, namely *Hypoxis hemerocallidea*. Clearing activities associated with construction will result in the loss of these vegetation types. Adhering to the mitigation measures recommended by the Terrestrial Ecologist and ensuring effective rehabilitation would assist in alleviating this impact.
2. Encroachment of alien vegetation
   The proposed development will take place within an existing power station with encroachment of alien invasive vegetation in the development area. Alien invasive plant species within the study area were observed to occur in clumps, scattered distributions or as single individuals on site. Construction activities related to the current proposed works are likely to exacerbate the encroachment of alien vegetation through the disturbance of soils and movement of soils along the servitude. Adhering to the mitigation measures of the EMPr and ensuring effective rehabilitation would assist in alleviating this impact.
3. Damage/loss of wetlands

The Riparian Habitat and Wetland Delineation Impact Assessment (The Biodiversity Company, 2017) identified that the project would impact Channelled Valley Bottom, Depression, Seepage, and Unchannelled Valley Bottom wetlands. The current impacts include the following:

- Commercial agriculture;
- Power station dams/impoundments;
- Excavated drains in wetlands;
- Developments (access routes, working areas, pipelines);
- Alien and/or Invasive Plants (AIP);
- Impaired water quality;
- Stormwater management; and
- Erosion.

Construction impacts would worsen the delineated wetland units if the mitigation measures recommended by the Riparian Habitat and Wetland Delineation Impact Assessment (The Biodiversity Company, 2017) isn't instituted. However, dams can typically benefit from the construction of a seepage drain in the foundation (Stephens, 2010), which will reduce seepage and improve stability. However, for this project the focus will be to reduce seepage of the dams.

Cumulative Impacts							
Potential Impact:	Loss of sensitive vegetation types						
Proposed Mitigation:	• Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills and then compliance monitored by an appropriate person. • Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks. • Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use. • Implement suitable erosion control measures. • All conditions of the EMPr must be adhered to.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Long Term	Likely	2	-32
With Mitigation	-	Local	Low	Long Term	Unlikely	1	-6
Potential Impact:	Encroachment of alien vegetation						
Proposed Mitigation:	• Rehabilitation measures must be implemented once construction activities are complete to ensure that alien vegetation will be controlled during the construction and operational phases. • All conditions of the EMPr must be adhered to.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Moderate	2	-20
With Mitigation	-	Local	Low	Short	Unlikely	1	-4
Potential Impact:	Damage/loss to wetland						
Proposed Mitigation:	• Keep all demarcated sensitive zones outside of the construction area off limits during the construction and rehabilitation phases of the development. • Monitor all systems for erosion and incision. • Revegetate all disturbed areas with indigenous riparian species. • All conditions of the EMPr must be adhered to.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without	-	Local	Medium	Short	Likely	2	-24

Mitigation							
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

18 ANALYSIS OF ALTERNATIVES

Alternatives are the different ways in which the project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the project. By conducting the comparative analysis, the BPEOs can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term".

18.1 No-go Alternative

The no-go alternative implies that the project will not proceed and thus the seepage interception drains will not be constructed. This would result in the Duvha Power Station Ash Dam, LLAWRD and HLAWRD continuing to experience seepages toward the Witbank Dam, leading to more groundwater contamination and future contamination of Witbank Dam. In addition, Duvha Power Station will not be compliant with NWA.

18.2 Best Practicable Environmental Option (BPEO)

Based on technical considerations and environmental impacts, the closed cut-off trench was selected as the best option to proceed with.

The closed cut-off trench was selected as the BPEO due to the following reasons:

- The seepage water will drain by gravity to the LLAWRD and be re-used by the power station; and
- The subsoil drain will not pose a safety risk.

19 CONCLUSIONS AND RECOMMENDATIONS

19.1 Sensitive Environmental Features

Within the context of the project area, cognisance must be taken of the following sensitive environmental features, attributes and aspect, for which mitigation measures are included in the BAR and EMPr (**Figure 28**):

- The existing structures and infrastructure in the area.
- Channelled Valley Bottom, Depression, Seepage, and Unchannelled Valley Bottom wetlands are affected by the proposed developments.
- The proposed drains fall within the grassland biome, within the Eastern Highveld Grassland and Rand Highveld Grassland vegetation units, of which both are listed as endangered.
- Eastern Highveld Grassland and Rand Highveld Grassland threatened terrestrial ecosystems were recorded on the proposed sites and these ecosystem types have a vulnerable status.
- According to the Mpumalanga Biodiversity Conservation Plan, the proposed development sites fall within the "*CBA Optimal"*, "*Heavily modified"* and *"Moderately modified- Old lands".*
- One plant species of conservation concern was noted, namely *Hypoxis hemerocallidea* (Star flower/African potato) and this species is listed as *Declining.*
- Two heritage sites were identified just outside the boundary of one of the study areas. These include the remains of a demolished farmstead, most likely of recent to modern date (DUV 001 of Low heritage significance), and a burial ground, consisting of 11 graves, (DUV 002 of High heritage significance).

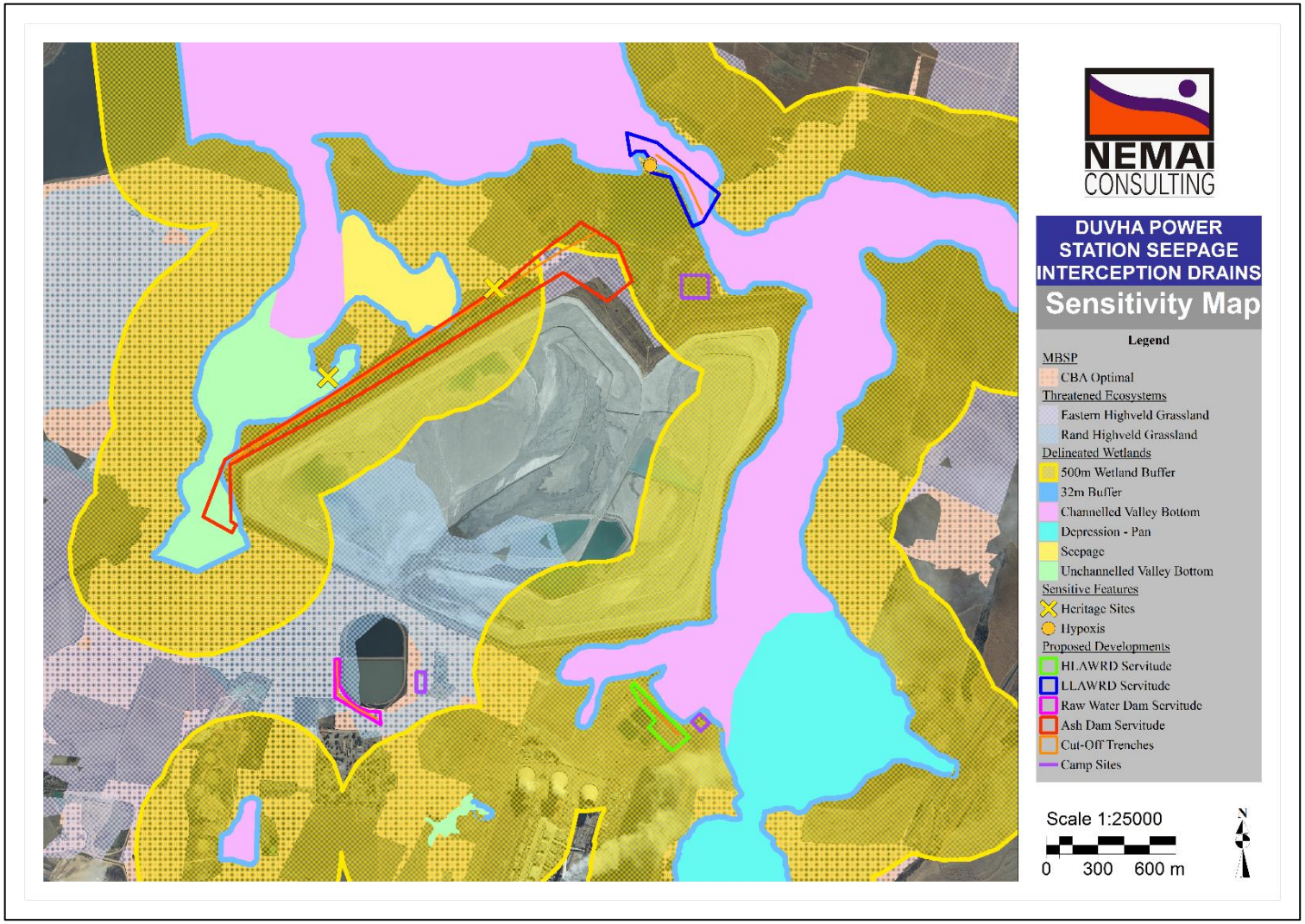

Figure 28: Sensitivity Map

19.2 Environmental Impact Statement

With the selection of the BPEO, the adoption of the mitigation measures included in the BAR and the dedicated implementation of the EMPr, it is believed that the significant environmental aspects and impacts associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

19.3 Recommendations

Based on the information contained in this report and taking into account the outcome of the impact assessment, opinions and recommendations included in the specialist studies as well as all supporting documentation, it is the recommendation of the practitioner that EA be granted by the DEFF for the proposed Duvha Power Station seepage interception drains.

The following key recommendations, which may also influence the conditions of the EA (where relevant), accompany the BAR for the proposed Duvha Power Station seepage interception drains:

1. Appointment of an ECO to monitor compliance with the EA and the approved EMPr.
2. As discussed in the EMPr, various forms of monitoring are required to ensure that the receiving environment is suitably safeguarded against the identified potential impacts, and to ensure that the environmental management requirements are adequately implemented and adhered to during the execution of the project. The types of monitoring to be undertaken include:
    a. Baseline Monitoring needs to be undertaken to determine to the pre-construction state of the receiving environment, and serves as a reference to measure the residual impacts of the project by evaluating the deviation from the baseline conditions and the associated significance of the adverse effects;
    b. Environmental Monitoring entails checking, at pre-determined frequencies, whether thresholds and baseline values for certain environmental parameters are being exceeded; and
    c. Compliance Monitoring and Auditing for the independent ECO to monitor and audit compliance against the EMPr and EA, if granted.
3. All mitigation measures provided in the Specialist Studies in **Appendix D** of the BAR are to be adhered to, specifically the following:
    - It is recommended that prior to construction, the *Hypoxis hemerocallidea,* a plant species recorded on site must be searched and rescued and then following construction activities, they can be re-established at the site.

- Given that the species of conservation importance were observed, it is important that species of conservation importance and threatened species which may occur on the proposed development sites are addressed through a search and rescue plan.
- Prevent uncontrolled access of vehicles through the wetlands that can cause a significant adverse impact on the hydrology and functioning of the systems
- Laydown yards, camps and storage areas must be beyond the water resource areas and associated buffers where applicable.
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching.
- Vegetation clearing should be kept to a minimum, and this should only occur where it is absolutely necessary. The use of a brush-cutter is highly preferable to the use of earth-moving equipment.
- Rehabilitate all disturbed areas as soon as the construction is completed within the proposed development areas.
- Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent their spread into the Power Station.
- Construction activities should be restricted to the development footprint area and then the compliance in terms of footprint can be monitored by ECO;
- Demarcate the burial grounds as a “no go” area, with a 30-meter buffer and a fence.
- If the graves will be disturbed in any way during construction or operation, and a buffer is not possible, a grave relocation process will need to take place; and
- In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations, the Chance Find Protocol must be implemented by the ECO in charge of these developments. This Chance Find Protocol must also be included in the EMPr. These discoveries ought to be secured (preferably in situ) and the ECO ought to alert SAHRA so that appropriate mitigation (e.g. documented and collection) can be undertaken by a palaeontologist. The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

20 OATH OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

I (name and surname) _____

Of (address) _____

ID No. _____ *Contact No.* _____

I hereby make an oath and state that:

In accordance with Appendix 1 of Government Notice No. R. 982 of the amended 2014 EIA Regulations (07 April 2017), this serves as an affirmation by the Environmental Assessment Practitioner (EAP) in relation to:

Section 1(j) -

1. *The correctness of the information provided in this report(s);*
2. *The inclusion of comments and inputs from stakeholders and interested and affected parties;*
3. *The inclusion of inputs and recommendations from the specialist reports where relevant; and*
4. *Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.*

Section 1(k) -

The level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment.

1. I know and understand the contents of this declaration.

2. I do not have any objection in taking prescribed oath.

3. I consider the prescribed oath to be binding on my conscience.

Signature _____ *Date:* _____

I certify that the deponent has acknowledged that he/she knows and understands the contents of the statement and the deponent signature was placed there on in my presence.

COMMISSIONER OF OATH | FULL NAME | DESIGNATION