PROPOSED DEVELOPMENT OF THE MAPUNGUBWE VISITOR INTEPRETATION CENTRES AND OVERNIGHT FACILITIES, LIMPOPO PROVINCE

ECOLOGICAL IMPACT ASSESSMENT

November 2017

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EXECUTIVE SUMMARY

Introduction

SANPARKS (The Applicant) appointed Enviroworks (Pty) Ltd., an Independent Environmental Practitioner (EAP), to undertake the required Basic Assessment Process for the upgrade of existing facilities and the building of new accommodation and tourist facilities at Mapungupwe National Park in Limpopo Province. The Ecological Impact Assessment was done to identify potential significant impacts on the surrounding environment.

Study area

The proposed development entails three separate sites, containing the following:

- The development of Mapungubwe Overnight Facilities. This includes the upgrading of existing facilities and the addition of accommodation for school groups, teachers and overnight visitors with a cafeteria and garden area;
    - The Present Ecological State (PES) would thus be classified as B, being **Largely natural** with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
    - The vegetation type is of least concern and Ecological Importance and Sensitivity (EIS) will be classified as D, not ecologically important and sensitive at any scale. Biodiversity is ubiquitous and not sensitive to flow and habitat modifications. The development is capitalizing on existing structures (roads, parking and buildings) which will help minimize disturbance to the environment. No species of conservation concern will be affected by the proposed development.
- The development of Visitor Interpretation Centres at Mapungubwe Hill that includes:
    - Orientation Centre Alternative 1
        - Alternative 1 of the orientation centre is situated on an open sandy area (Fig 30-31) next to an existing dirt road. The PES is classified as A, being **unmodified** and natural.
        - The EIS is classified as C. The site is of moderate importance and sensitivity. It is ecologically important and sensitive on a provincial/local scale. Biodiversity is not usually sensitive to flow and habitat modifications. The site has a low species diversity. It is dominated by *Vachellia tortilis subsp. heteracantha (*Umbrella

thorn), *Gardenia volkensii* and grasses. The reason for classifying it as moderate ecological importance and sensitivity is the location in the floodplain with visible drainage network. Even though flooding of the floodplain is unlikely and infrequent, the structure will be at risk of flood damage.

- Orientation Centre Preferred Alternative
  - The Preferred Alternative for the orientation centre is on slightly elevated ground on the foot of a hill. It also has a low species diversity. The area has an open structure of low trees and shrubs (*Grewia, Boscia foetida subsp. rehmanniana* and *Terminalia prunioides)* some grasses and herbs characteristic of the Subtropical Alluvial Vegetation (*Ocimum americanum L. var. americanum)* and others of bushveld (*Hermbstaedtia odorataI).* The PES is classified as A, being **unmodified** and natural.
  - The EIS is classified as D and is marginal. The area is not ecologically important and sensitive at any scale. Biodiversity is ubiquitous and not sensitive to flow and habitat modifications. No species of conservation concern occur in the footprint and due to its location on a higher elevation, the risk to infrequent flooding is significantly lower.
- Boma
  - The boma is located in the riparian thicket type of Subtropical Alluvium Vegetation. The proposed site is below the shade of a big Nyala tree (*Xanthocercis zambesiaca*) but the understorey is open and sandy. The PES is classified as A, being **unmodified** and natural.
  - The EIS is classified as C. The site is of moderate importance and sensitivity. It is ecologically important and sensitive on a provincial/local scale. Biodiversity is not usually sensitive to flow and habitat modifications. The reason for classifying it as moderate ecological importance and sensitivity is the location in floodplain with a visible drainage network. Even though flooding of the floodplain is unlikely and infrequent, the structure will be at risk of flood damage. The boma has a very small footprint and the light building materials pose a low risk to the environment is case of flooding.

- Dig Site Building
    - The dig site building will be constructed over the existing archaeological dig site. The site is denuded of vegetation, it is bare and sandy with an Umbrella thorn tree with phown nests next to the proposed development site. The PES is D. Due to the existing structure and disturbance the area is **largely modified**. The site is surrounded by intact natural ecosystems. A large loss of natural habitat, biota and basic ecosystem functions has occurred.
    - There are no sensitive natural features and the EIS is classified as D and is marginal. The area is not ecologically important and sensitive at any scale. Biodiversity is ubiquitous and not sensitive to flow and habitat modifications.

- The development of Schroda Dam Orientation Centre for visitors.
    - The vegetation has a typical bushveld vegetation structure, and species characteristic of the Limpopo Ridge Bushveld. It is dominated by *Vachellia tortilis subsp. heteracantha, Boscia albitrunca, Terminalia prunioides* interspersed but a sparse ground cover of grasses such as *Enneapogon cenchroides.* The grass can indicate other disturbances in the area such as grazing by cattle (cattle observed on site). The PES is classified as A, being **unmodified** and natural.
    - The EIS is classified as D and is marginal. The area is not ecologically important and sensitive at any scale. Biodiversity is ubiquitous and not sensitive to flow and habitat modifications. No species of conservation concern occur in the footprint.

Methodology

A site visit took place on the 11th & 12th of September 2017. A walkthrough was done, assessing environmental conditions and pictures were taken of the environment and plant species. The site visits took place in spring. Due to dry conditions in the bushveld before the summer rain, very few identifiable annual herbs and grass species were observed. The weather conditions were accommodating, where full sun allowed for clear visibility and no weather factors hindered the integrity of the inspection.

A part of the assessment depends on a desktop study to determine what species of conservation concern are known to occur in the area and which are most likely to occur in the proposed site. This is thought to be an acceptable method. Even though the site is in a Protected Area.

Potential Impacts

Construction phase

Impacts on Critical Biodiversity Areas and Listed Vegetation Types

- The project construction footprint must be kept as small as practicably possible.
- Movement of vehicles and construction personnel should be restricted to the road and within the development footprint as much as possible to limit trampling of indigenous species and further disturbance to the surrounding vegetation.

Impacts on Listed or Protected Plant Species

- It is recommended that an additional ecological walkthrough be conducted prior to commencement of the project during the flowering period of herbs and grasses. This will ensure that no provincially protected or significant species have potentially been omitted.

Direct and Indirect Faunal Impacts

- Holes and trenches should not be left open for extended periods of time and should only be dug when immediately needed. Trenches left open for some days, should have escape ramps present at regular intervals to allow any fauna that fall in to escape.
- Any fauna threatened by construction activities should be removed to safety by the ECO or another suitably qualified person.
- Posters of species of conservation concern should be kept on site where they will be visible to construction workers.

Alien Invasive Species Establishment

- Implement suitable alien invasive species establishment prevention measures during the construction phase such as proper storage, transport and disposal of plant material and minimizing disturbance to the area surrounding the development footprint.
- Areas around the proposed project footprint must be adequately rehabilitated to prevent significant alien invasive species establishment.
- The project footprint and surroundings should be monitored for alien invasive species yearly for three years and managed according to the Park's Alien Invasive Species Management Plan.
- Care should be taken to remove any biological material from equipment and personnel clothing and gear before entering and when leaving the work site to prevent the spread and establishment of alien invasive species.

Surface Material Erosion

- Implement suitable erosion prevention measures during the construction phase.
- Areas around the proposed project footprint must be adequately rehabilitated to prevent significant erosion.
- Adequate storm water management measures must be implemented on site in order to sufficiently manage storm water runoff and clean/dirty separation during the construction phases. This must be done to ensure that no significant contamination of the surrounding areas occurs.
- Soil disturbance must be kept to a minimum within and around the development footprint.

Dust Generation and Emissions

- Implement suitable dust management and prevention measures during the construction phase.
- Areas around the proposed project footprint must be adequately rehabilitated to prevent significant dust emissions.

Surface- and Groundwater Contamination

- Construction site should be kept clean and tidy
- Any waste should be disposed in a registered landfall and not be allowed to be dumped in the surrounding landscape
- All surfaces used for waste storage and loading areas should have an impermeable surface.
- Storm water and run-off should be managed and diverted to not be in contact with waste.

Operational phase

Continued Alien Invasive Species Establishment

- It must be ensured that no alien invasive weeds are introduced to the property during the operational phase.
- If any alien invasive plant species are observed it must immediately be removed in the correct environmentally friendly manner.
- Indigenous species should be used during any landscaping, no plant material should preferably be introduced from outside the park.
- The monitoring, control and eradication of invasive alien species should be conducted as part of SANPARK's invasive alien species monitoring and eradication plan, according to the NEMBA regulation.

Faunal Impacts

- Keep the facility neat, tidy and clean.
- It is expected that any small mammals that occurred on the property before construction commenced would have moved from the area. Should any animals return to the property once the facilities are in operation, care should be taken not to disturb any animals.
- It must be ensured that no alien invasive animals or birds are introduced into the area. Should any accidental introductions occur, the species must be controlled in the correct environmentally friendly manner.
- Keep the facility neat, tidy and clean in order not to attract scavenging animals such as rats and mice.

Waste Management

- An integrated waste management programme must be developed for the facility.
- Sufficient waste receptacles should be placed around the facility in order to encourage visitors to use them.
- The principle of reduce, re-use and recycle should be followed.
- Visitors should be made aware of best-practice environmental practices while visiting the park.

Decommission Phase Impacts

Impacts on Vegetation and Listed or Protected Plant Species

- It is recommended that an ecological walkthrough be conducted prior to commencement of the decommissioning during the flowering period to ensure that no provincially- or nationally protected or significant species could be impacted upon.
- The decommissioning activities should be confined within the development footprint and avoid disturbing vegetated area beyond the borders of the development footprint.
- Posters of species of conservation concern should be kept on site where they will be visible to construction workers.

Impacts on Critical Biodiversity Areas and Listed Vegetation Types

- The decommissioning footprint must be kept as small as practicably possible.
- Movement of vehicles and construction personnel should be restricted to the road area and within the development footprint as much as possible to limit trampling of indigenous species and further disturbance to the area.
- The intact vegetation surrounding development should not be disturbed.

- Posters of species of conservation concern should be kept on site where they will be visible to construction workers.

Direct and Indirect Faunal Impacts

- Excavations should not be left open for extended periods of time and should only be dug when immediately needed. Trenches left open for some days, should have escape ramps present at regular intervals to allow any fauna that fall in to escape.
- Any fauna threatened by decommissioning activities should be removed to safety by the ECO or another suitably qualified person.
- Posters of species of conservation concern should be kept on site where they will be visible to construction workers.

Surface material erosion

- Implement suitable erosion prevention measures during the decommissioning.
- Areas around the proposed project must be adequately rehabilitated to prevent significant erosion.
- Adequate storm water management measures must be implemented on site in order to sufficiently manage storm water runoff from the site during the decommissioning phases. This must be done to ensure that no significant erosion occurs.
- Soil disturbance must be kept to a minimum within and around the footprint.

Dust Generation and Emissions

- Implement suitable dust management and prevention measures during the decommissioning.
- Areas around the proposed project footprint must be adequately rehabilitated to prevent significant dust emissions.

Positive Impact of Rehabilitating Development Footprint

- On completion of a section of works, the area must be rehabilitated by suitable landscaping, leveling, topsoil dressing, land preparation, alien plant eradication and where ascribed for by the ECO, vegetation establishment;
- Clear and completely remove from site all construction structures and temporary infrastructure;
- All permanent infrastructure must be returned to a useable state;
- Remove all inert waste and rubble, such as excess rock, any structural foundations and remaining aggregates. Only once this material has been removed, the site shall be re-instated and rehabilitated;

- The reinstatement of disturbed areas must follow immediately after the removal of structures and temporary infrastructure'
- Topsoil backfilling must be undertaken when the soil is dry, and not following any recent rainfall events
- The replacement of topsoil should be sought in situ with construction where possible, or as soon as construction in an area has be completed;
- All stockpiled topsoil together with herbaceous vegetation should be replaced and redistributed over a disturbed area such as temporary access roads;
- Topsoil must be returned to the same site from where it was stripped;
- When insufficient topsoil remains, soil of a similar quality can be obtained from a nearby area within the construction area which was disturbed;
- Once topsoil has been returned to the ground, stripped vegetation should be randomly spread by hand over the area;
- All re-growth of invasive vegetative material will be monitored by the Developer for one year;
- All areas under rehabilitation are to be treated as no-go areas using danger tape and steel droppers/fencing and cordoned off, to prevent vehicular, pedestrian and livestock access;
- Re-vegetation should be done by sourcing indigenous plants from local suppliers or the surrounding vegetation, whether it be whole plants, seedlings, cuttings or seeds;
- Control invasive plant species and weeds using approved methods of manual or chemical intervention; and
- The re-establishment of vegetation should be allowed several rainy seasons.

Cumulative Impacts

The area surrounding the proposed developments is adjacent to natural vegetation. Due to the small surface footprint size of the proposed project area in relation to the park's extent, the negative impact that the project will cumulatively add to habitat preservation or ecological functionality persistence of the broader area will be low. The developments will add to the Park's infrastructure and tourist attraction value. It will be in line with the park's management plan. If mitigation measures are implemented and best-practice environmentally friendly construction-, maintenance- and deconstruction methods are followed, the development will provide significant benefits in terms of preserving cultural heritage and also gaining socio-economic benefits from eco-tourism.

Conclusion

In terms of the Alternative sites, Alternative 1 is the preferred and recommended site. Even though both sites have a similar ecological state, Alternative 2 is closest to the drainage line and would increase the risk of pollution and contamination during construction and decommissioning phase. It is devised that developments should be restricted as much as possible in close proximity to water sources. The drainage line is not permanent. The development poses a low risk to the environment and water sources.

Overall, the likely impacts associated with the development are likely to be low and there are no anticipated impacts of high significance. Consequently, it is recommended that the proposed development should be allowed to continue.

The proposed project is recommended to continue only if all recommended mitigation measures as per this ecological report are adequately implemented and managed during the construction phase, operational- and decommission phases of the proposed project. All necessary authorisations and permits must also be obtained prior to any commencement.

CONTENT CROSS-REFERENCE CHECKLIST

Table 1 As stated per Government Notice (GN) Regulation 326 of 7 April 2017, Appendix 6, a Specialist Report should contain the information listed in the table, with corresponding section names.

Requirement	**Section**
(a) details of— (i) the specialist who prepared the report; and (ii) (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	Details of the Specialist
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority	Declaration of Independence
(c) an indication of the scope of, and the purpose for which, the report was prepared	Objective of the Assessment
(cA) an indication of the quality and age of base data used for the specialist report	Date and Season of Site Visit
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) & Risk Ratings of Potential Impacts
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Date and Season of Site Visit,
(e) a description of the methodology adopted in preparing the report or carrying out the	Methodology

specialised process inclusive of equipment and modelling used	
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Sensitivity map (Study Area)
(g) an identification of any areas to be avoided, including buffers	Description of Potential Ecological Impacts and their Recommended Mitigation Measures
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Sensitivity map (Study Area)
(i) a description of any assumptions made and any uncertainties or gaps in knowledge	Assumptions, Uncertainties and Gaps in Knowledge,
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Description of Potential Ecological Impacts and their Recommended Mitigation Measures
(k) any mitigation measures for inclusion in the EMPr	Description of Potential Ecological Impacts and their Recommended Mitigation Measures
(l) any conditions for inclusion in the environmental authorisation	Conditions
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation	Conditions
(n) a reasoned opinion— (i) whether the proposed activity, activities or portions thereof should be authorised	Recommendation

(iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report	Methodology
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q) any other information requested by the competent authority	None up to date

1. DETAILS OF THE SPECIALIST

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Surname:	Mostert
Highest qualification:	MSc Botany (SU)
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Relevant qualifications

MSc Botany (SU)

BSc Hons Plant Sciences- Ecology (UP)

BSc Environmental Sciences (UP)

Work experience

- March 2016- May 2017: Field assistant, Plant Ecologist at Department of Environmental Affairs (Oceans & Coasts)
- June 2017- current: Environmental Consultant at Enviroworks

Key project experience

2017

Basic assessment experience

- The proposed construction of a cellular telecommunications base station and associated infrastructure on Portion 76 of Farm No. 106, Robertson, Western Cape Province, Coast to Coast Towers (Pty) Ltd.
- The proposed construction of a cellular telecommunications base station and associated infrastructure on Portion 1 of Farm No. 178, Fisantekraal, City of Cape Town, Western Cape Province, Coast to Coast Towers (Pty) Ltd.

Ecological Impact Assessment Specialist Report Experience

2. Periodic maintenance of National Route 2 Section 4 between Riviersonderend (km 0.0) and Swellendam (km 56.9), Western Cape Province, SANRAL.
3. Proposed Construction of Six Lay Houses and Two New Production (Hen) Houses at Frans Dam Farm, No 803 Portion 3 in Brandfort, Free State, Moreson Pluimvee Boerdery (Pty) Ltd.
4. Proposed Construction of a Composting Facility on Farm No 1136 Terugval Portion 1 in Brandfort, Free State, Moreson Pluimvee Boerdery (Pty) Ltd.
5. Plant Species Translocation Guidelines: Periodic maintenance of National Route 2 Section 4 between Riviersonderend (km 0.0) and Swellendam (km 56.9), Western Cape Province, SANRAL.
6. Plant Species Identification Study: Re-Surfacing of the Donkergat Access Road Located within The Langebaan 4 Special Forces Regiment Base, Langebaan, Western Cape, Department of Public Works.

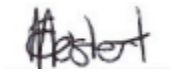
7. Proposed upgrading and building of related infrastructure for the R27 Gate and Geelbek Restaurant in the West Coast National Park, Western Cape, SANPARKS.
8. Proposed upgrading and building of related infrastructure for the Langebaan Gate in the West Coast National Park, Western Cape, SANPARKS.
9. The proposed construction of a cellular telecommunications base station and associated infrastructure in Roodepoort, Gauteng, Coast to Coast Towers (Pty) Ltd.
10. Appointed For: JV 03/2017/18 Provision Of Professional Services: Appointment Of An Environmental Consultant For The Preparation Of A Plan To Control And Eradicate Invasive Species As Contemplated In Section 76 Of The Act, National Environmental Management: Biodiversity Act, 2004 (Act No.10 Of 2004) (Nemba) **(in Progress)**

2. DECLARATION OF INDEPENDENCE

I, Elana Mostert, ID 910523 0099 085, declare that I:

- am an Environmental Consultant at Enviroworks
- act as an independent specialist consultant in the field of Botany, Ecology and Vegetation Science;
- am assigned as specialist consultant by Enviroworks Consultants (Pty) Ltd for this proposed project;
- I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference;
- remuneration for services by the proponent in relation to this proposal is not linked to approval by decision-making authorities responsible for permitting this proposal and
- the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project.
- have no and will not engage in conflicting interests in the undertaking of the activity;
- undertake to disclose to the client and the competent authority any material, information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations 2017; and,
- will provide the client and competent authority with access to all information at my disposal, regarding this project, whether favourable or not.

Elana Mostert



Signature

3. BACKGROUND

Mapungupwe National Park is under the management and control of SANPARKS. It is situated in Limpopo Province and shares a boundary with Botswana and Zimbabwe (Figure 1). It is declared a World Heritage Site. According to the Park Management Plan (2013-2018): "*There is more than 400 archaeological sites in the Park, dating back to the Iron Age. The challenge for SANParks is to retain the authenticity and integrity of the archaeological remains and the biodiversity in the landscape that shaped, and was shaped by, the people who have lived there. They strive to do this by consolidating the park and integrating management of the cultural and natural values. Mapungubwe National Park and World Heritage Site offers unique potential for visits to heritage sites that increase public understanding of the important interconnections between people, their heritage and biodiversity in the landscape.*"

3.1 Climate

The closest town to the Park is Musina and the town receives and average of 246mm of rain annually ("Musina climate", 2014). It falls in a summer rainfall area with the majority of rainfall occurring in January ("Musina climate", 2014). Daily average temperatures range between 23.9°C in winter to 32.1°C in summer ("Musina climate", 2014).

3.2 Project Description

SANPARKS (The Applicant) appointed Enviroworks, an Independent Environmental Practitioner (EAP), to undertake the required Basic Assessment Process for the upgrade of existing facilities and the building of new accommodation and tourist facilities at Mapungupwe National Park in Limpopo Province.

The proposed development entails three separate sites (Fig 2), containing the following:

- The development of Mapungubwe Overnight Facilities. This includes the upgrading of existing facilities and the addition of accommodation for school groups, teachers and overnight visitors with a cafeteria and garden area;
- The development of Visitor Interpretation Centres at Mapungubwe Hill that includes:
    - an Orientation Centre with a deck;
    - Boma for discussions and resting; and
    - Dig Site Building with deck where archeological diggings will be viewed and discussed.
- The development of Schroda Dam Orientation Centre for visitors.

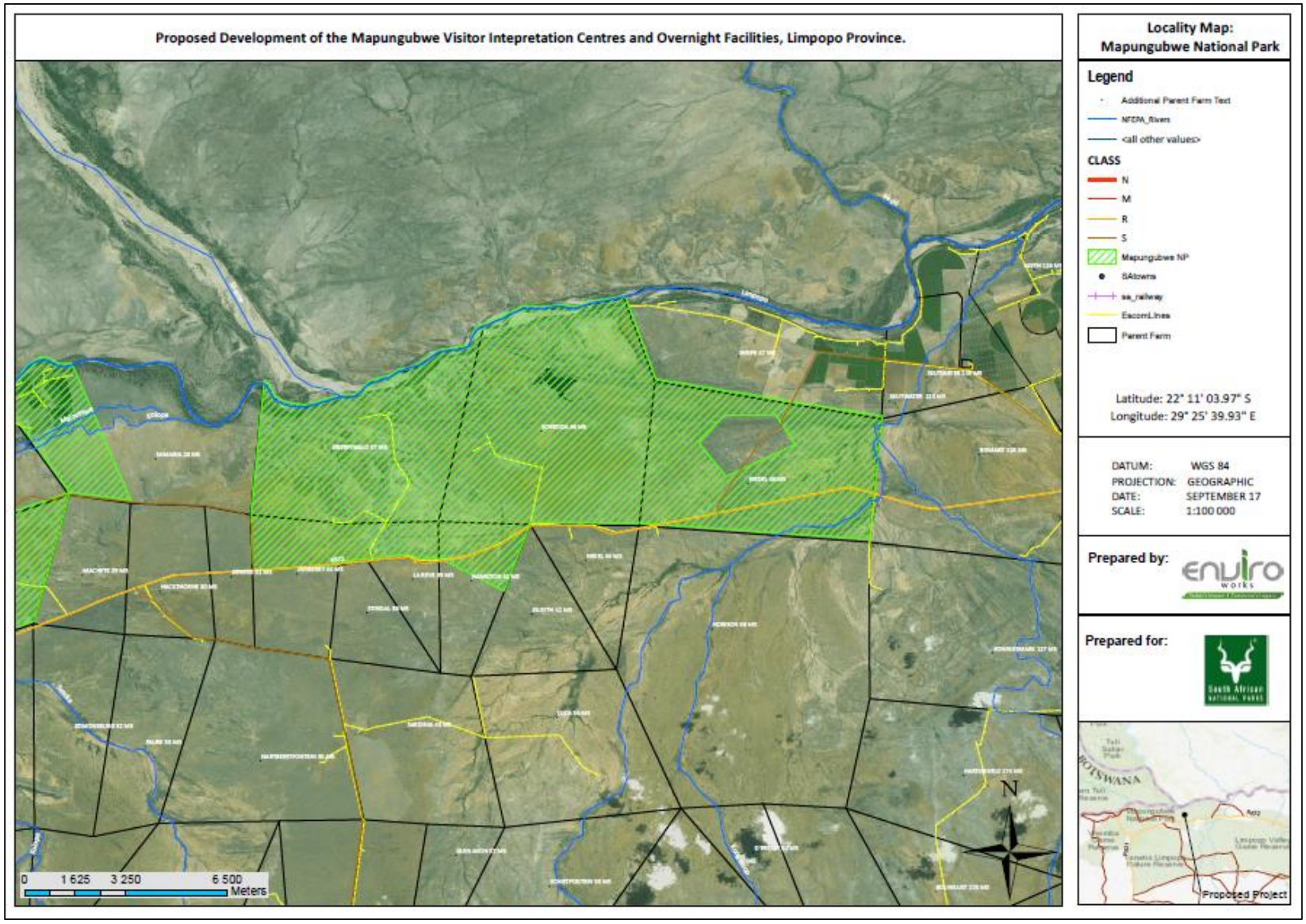


Figure 1 Location of Mapungubwe National Park

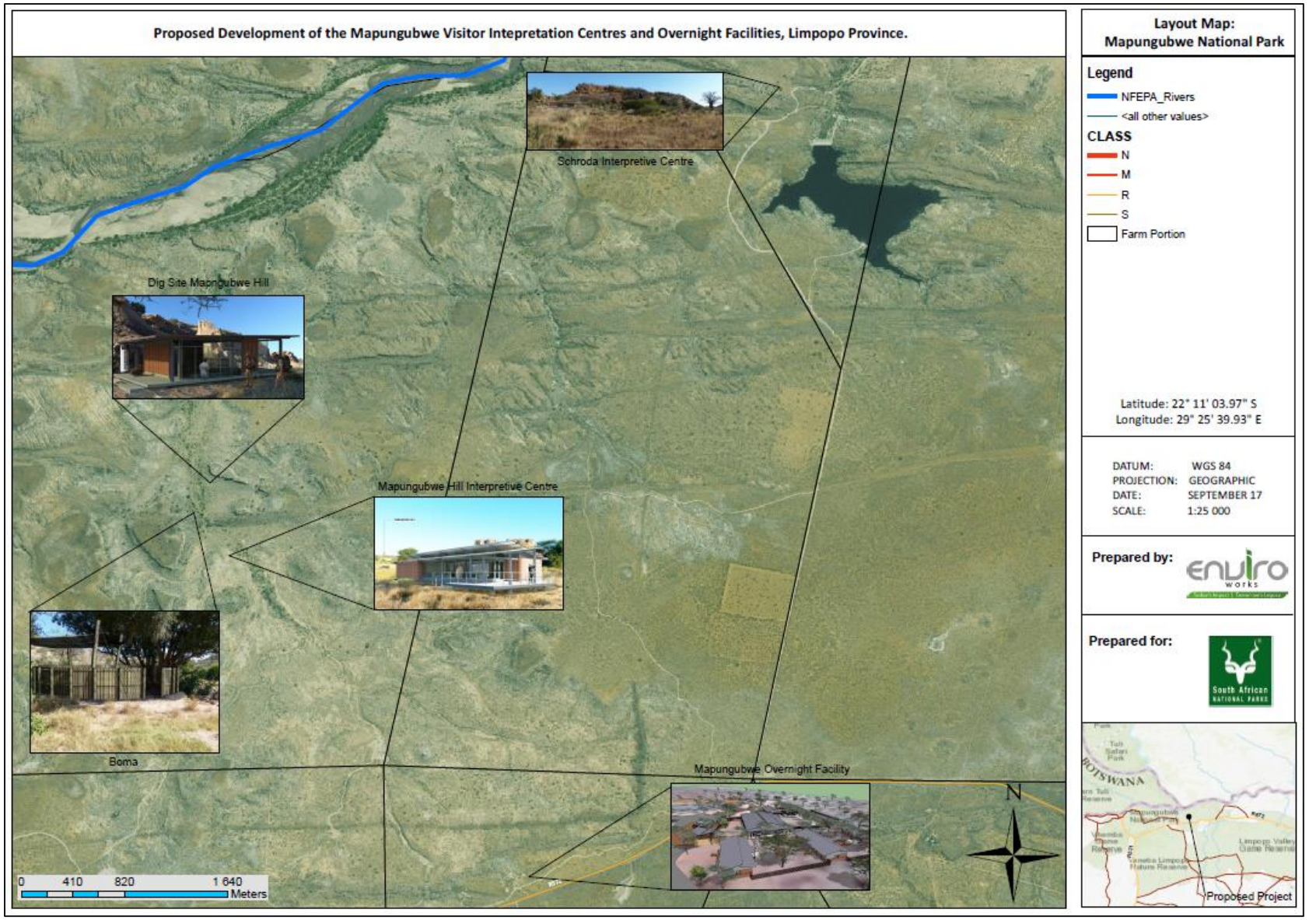


Figure 2 Map of Mapungubwe National Park, indicating the position and structure of the proposed developments

4. OBJECTIVE OF THE ASSESSMENT

Various environmental legislation in South Africa makes provision for the protection of our natural resources and the functionality of ecological systems in order to ensure sustainability. Such acts include the National Environmental Management: Biodiversity Act (Act 10 of 2004), National Forests Act (Act 84 of 1998), Conservation of Agricultural Resources Act (Act 43 of 1983), National Water Act (Act 36 of 1998) and framework legislation such as the National Environmental Management Act (Act 10 of 2004).

The various components of ecological systems are all interrelated and it is therefore important that specialist studies of all such components be conducted prior to the commencement of any proposed project development. Only once the potential impacts and outcomes of proposed developments on the ecological systems of an area are understood, can informed decisions be made regarding the viability of projects to address and achieve the environmental and socio-economic needs of an area.

The development of the accommodation and visitor facilities could have potential impacts on the vegetation and surrounding environment. Vegetation will be displaced since the new development footprint will transform much of the surface area. In order to evaluate the level of acceptability of the impact on the natural environment an Ecological study was conducted. This was required in order to determine the potential presence of ecologically significant species, habitats or wetland areas within the proposed project footprint. Proposed mitigation and management measures must also be recommended in order to attempt to reduce/alleviate the identified potential impacts. This report constitutes the Ecological Impact Assessment.

The Ecological Impact Assessment included a vegetation and habitat survey in order to do the following:

- Identify and list significant species encountered on the proposed project area and list any protected and/or Red Data Listed species;
- Determine and discuss the condition and extent of degradation and/or transformation of the vegetation on the proposed project area;
- Determine and discuss the ecological sensitivity and significance of the proposed project area;
- Identify all wetland areas potentially present on the proposed project area;
- Identify, evaluate and rate the potential impacts of the proposed project on the natural environment; and
- Provide recommendations on mitigation and management measures in order to attempt to reduce/alleviate these identified potential impacts.

5. METHODOLOGY

5.1 Data Sourcing and Review

Data sources from literature was consulted and used where necessary in the study and includes the following:

5.1.1 Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford, 2006).
- Plants were identified from photographs taken on site.
- A list of endemic taxon species know to occur in the area was compiled from the vegetation type (Mucina and Rutherford, 2006).
- Species and the listing, occurring in the Quarter Degree Square (QDS; 2229AB) were obtained from the following data bases: MushroomMAP, OrchidMAP and TreeMAP & Botanical Database of South Africa (SANBI, 2016). The conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants version 2017.1.

5.1.2 Fauna:

- Lists of mammals, reptiles, avifauna and amphibians which are likely to occur at the site were based on distribution records from literature and spatial databases available from The Virtual Museum and SABAP2 (ADU, 2017).
- The faunal species lists provided are based on species which are known to occur in the broad geographical area (QDS), as well as an assessment of the availability and quality of suitable habitat at the site.
- The conservation status of each species is listed, based on the IUCN Red List Categories and Criteria version 2014.2 and those listed form the ADU (VirtualMAP, 2017). These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone.

5.2 Date and Season of Site Visit

A site visit took place on the 11th & 12th of September 2017. A walkthrough was done, assessing environmental conditions and pictures were taken of the environment and plant species. The site visits

took place in spring. Due to dry conditions in the bushveld before the summer rain, very few identifiable annual herbs and grass species were observed. The weather conditions were accommodating, where full sun allowed for clear visibility and no weather factors hindered the integrity of the inspection.

5.3 Impacts and ratings methodology

Potential impacts of the proposed project on the surrounding natural environment were identified, evaluated and rated as per the methodology described below:

The **Present Ecological State (PES)** of the proposed project area was assessed and rated as per Table 2 below.

- The Present Ecological State (PES) refers to the current state or condition of an area in terms of all its characteristics and reflects the change to the area from its reference condition. The value gives an indication of the alterations that have occurred in the ecosystem.

Table 2 Criteria for PES calculations

Ecological Category	Score	Description
A	> 90-100%	**Unmodified**, natural.
B	> 80-90%	**Largely natural** with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	> 60-80%	**Moderately modified**. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	> 40-60%	**Largely modified**. A large loss of natural habitat, biota and basic ecosystem functions has occurred.
E	> 20-40%	**Seriously modified**. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	0-20%	**Critically/Extremely modified**. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

The **Ecological Importance and Sensitivity (EIS)** of the proposed project area was assessed and rated as per Table 3 below.

- The Ecological Importance and Sensitivity (EIS) of an area is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales, and both abiotic and

biotic components of the system are taken into consideration. Sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred.

Table 3 Criteria for EIS calculations

EIS Categories	Score	Description
Low/Marginal	**D**	Not ecologically important and sensitive at any scale. Biodiversity ubiquitous and not sensitive to flow and habitat modifications.
Moderate	**C**	Ecologically important and sensitive on provincial/local scale. Biodiversity not usually sensitive to flow and habitat modifications.
High	**B**	Ecologically important and sensitive. Biodiversity may be sensitive to flow and habitat modifications.
Very High	**A**	Ecologically important and sensitive. On national even international level. Biodiversity usually very sensitive to flow and habitat modifications.

The tables below indicate and explain the methodology and criteria used for the evaluation of the **Environmental Risk Ratings** as well as the calculation of the final **Environmental Significance Ratings** of the identified potential ecological impacts.

Each potential environmental impact is scored for each of the **Evaluation Components** as per the Table 4 below.

Table 4 Scale utilised for the evaluation of the Environmental Risk Ratings

Evaluation Component	Rating Scale and Description/criteria
MAGNITUDE of NEGATIVE IMPACT (at the indicated spatial scale)	**10 - Very high**: Bio-physical and/or social functions and/or processes might be *severely* altered. **8 - High**: Bio-physical and/or social functions and/or processes might be *considerably* altered. **6 - Medium**: Bio-physical and/or social functions and/or processes might be *notably* altered. **4 - Low** : Bio-physical and/or social functions and/or processes might be *slightly* altered. **2 - Very Low**: Bio-physical and/or social functions and/or processes might be *negligibly* altered. **0 - Zero**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	**10 - Very high (positive)**: Bio-physical and/or social functions and/or processes might be *substantially* enhanced. **8 - High (positive)**: Bio-physical and/or social functions and/or processes might be *considerably* enhanced. **6 - Medium (positive)**: Bio-physical and/or social functions and/or processes might be *notably* enhanced. **4 - Low (positive)**: Bio-physical and/or social functions and/or processes might be *slightly* enhanced.

	2 - Very Low (positive): Bio-physical and/or social functions and/or processes might be *negligibly* enhanced. **0 - Zero (positive)**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
DURATION	**5 - Permanent** **4 - Long term**: Impact ceases after operational phase/life of the activity > 60 years. **3 - Medium term**: Impact might occur during the operational phase/life of the activity – 60 years. **2 - Short term**: Impact might occur during the construction phase - < 3 years. **1 - Immediate**
EXTENT (or spatial scale/influence of impact)	**5 - International**: Beyond National boundaries. **4 - National**: Beyond Provincial boundaries and within National boundaries. **3 - Regional**: Beyond 5 km of the proposed development and within Provincial boundaries. **2 - Local**: Within 5 km of the proposed development. **1 - Site-specific**: On site or within 100 m of the site boundary. **0 -** None
IRREPLACEABLE loss of resources	**5 – Definite** loss of irreplaceable resources. **4 – High** potential for loss of irreplaceable resources. **3 – Moderate** potential for loss of irreplaceable resources. **2 – Low** potential for loss of irreplaceable resources. **1 – Very low** potential for loss of irreplaceable resources. **0 - None**
REVERSIBILITY of impact	**5 –** Impact **cannot** be reversed. **4 – Low** potential that impact might be reversed. **3 – Moderate** potential that impact might be reversed. **2 – High** potential that impact might be reversed. **1 –** Impact **will be** reversible. **0 –** No impact.
PROBABILITY (of occurrence)	**5 - Definite**: >95% chance of the potential impact occurring. **4 - High probability**: 75% - 95% chance of the potential impact occurring. **3 - Medium probability**: 25% - 75% chance of the potential impact occurring **2 - Low probability**: 5% - 25% chance of the potential impact occurring. **1 - Improbable**: <5% chance of the potential impact occurring.
CUMULATIVE impacts	**High**: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern. **Medium**: The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern. **Low**: The activity is localised and might have a negligible cumulative impact. **None**: No cumulative impact on the environment.

Once the **Environmental Risk Ratings** have been evaluated for each potential ecological impact, the **Significance Score** of each potential ecological impact is calculated by using the following formula:

- **SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.**

The maximum **Significance Score** value is 150.

The **Significance Score** is then used to rate the **Environmental Significance** of each potential ecological impact as per Table 5 below. The **Environmental Significance** rating process is completed for all identified potential ecological impacts both before and after implementation of the recommended mitigation measures.

Table 5 Scale used for the evaluation of the Environmental Significance Ratings

Significance Score	Environmental Significance	Description/criteria
125 – 150	**Very high (VH)**	An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options.
100 – 124	**High (H)**	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.
75 – 99	**Medium-high (MH)**	If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be relooked.
40 – 74	**Medium (M)**	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
<40	**Low (L)**	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.
+	**Positive impact (+)**	A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project.

Wetlands were identified and delineated on the proposed project area as per the methodology described below:

For the purposes of this investigation a wetland was defined according to the definition in the National Water Act (Act 36 of 1998) as: “land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

In 2005 DWAF published a wetland delineation procedure in a guideline document titled “A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas”. Guidelines for the undertaking of biodiversity assessments exist. These guidelines contain a number of stipulations relating to the protection of wetlands and the undertaking of wetland assessments. These guidelines state that a wetland delineation procedure must identify the outer edge of the temporary zone of the wetland, which marks the boundary between the wetland and adjacent terrestrial areas and is that part of the wetland that remains flooded or saturated close to the soil surface for only a few weeks in the year, but long enough to develop anaerobic conditions and determine the nature of the plants growing in the soil.

The guidelines also state that locating the outer edge of the temporary zone must make use of four specific indicators namely:

- the terrain unit indicator,
- the soil form indicator,
- the soil wetness indicator and
- the vegetative indicator.

In addition the wetland and a protective buffer zone, beginning from the outer edge of the wetland temporary zone, must be designated as sensitive in a sensitivity map. The guidelines stipulate buffers to be delineated around the boundary of a wetland. A protective 32 m buffer zone, beginning from the outer edge of the wetland temporary zone, must be implemented and designated as sensitive within which no development must be allowed to occur.

6. ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

The processes of investigation which have led to the production of this report, harbours several **assumptions**, which include the following:

- All information provided by the applicant and engineering design team to the environmental specialist was correct and valid at the time that it was provided;
- The proposed project footprint as provided by the engineering design team is correct and will not be significantly deviated from.
- Strategic level investigations undertaken by the applicant prior to the commencement of the EIA process, determined that the development site represents a potentially suitable and technically acceptable location;
- The public will receive a fair and reoccurring opportunity to participate and comment during the EIA process, through the provision of adequate public participation timeframes stipulated in the Regulations;
- The need and desirability of the project is based on strategic national, provincial and local plans and policies which reflect the interests of both statutory and public viewpoints;
- The EIA process is a project-level framework and the specialists are limited to assessing the anticipated environmental impacts associated with the construction and operational phases of the proposed project
- Strategic level decision making is conducted through cooperative governance principles with the consideration of sustainable and responsible development principles underpinning all decision making.
- Given that an EIA involves prediction, **uncertainty** forms an integral part of the process. Two types of uncertainty are associated with the BA process, namely process-related and prediction-related.
- Uncertainty of prediction is critical at the data collection phase as final certainty will only be obtained upon implementation of the proposed development. Adequate research, experience and expertise may minimise this uncertainty;
- Uncertainty of values depicts the approach assumed during the BA process, while final certainty will be determined at the time of decision making. Enhanced communication and widespread/comprehensive coordination can lower uncertainty;
- Uncertainty of related decision relates to the interpretation and decision making aspect of the EIA process, which shall be appeased once monitoring of the project phases is undertaken.

The significance/importance of widespread/comprehensive consultation towards minimising the risk/possibility of omitting significant impacts is further stressed. The use of quantitative impact significance rating formulas (as utilised in this document) can further standardise the interpretation of results and limit the occurrence and scale of uncertainty.

Gaps in knowledge can be attributed to:

The ecological study process is being undertaken prior to the availing of certain information which would be derived from the final project design and layout.

The principle of human nature provides for uncertainties with regards to the identified socio-economic impacts of the proposed development.

Enviroworks is an independent environmental consulting firm and as such, all processes and attributes of the specialist investigations and EIA are addressed in a fair and unbiased/objective manner. It is believed that through the running of a transparent and participatory process, risks associated with assumptions, uncertainties and gaps in knowledge can be and have been acceptably reduced.

7. RESULTS AND DISCUSSION

Each area will now be discussed in detail in terms of the vegetation type, fauna and flora in the development footprint, Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS).

7.1 Hostel accommodation

7.1.1 Vegetation type

The hostel accommodation facilities development footprint falls in Musina Mopane Bushveld (SVmp1; Mucina & Rutherord 2006). The feature consists of undulating to very irregular plains with hills (Mucina & Rutherord 2006). The vegetation type is Least Concern with 2% formally conserved in Mapungubwe National Park. Vegetation can be described as open woodland to moderately closed shrubveld dominated by *Colophospermum mopane* on clayey bottomlands and *Combretum apiculatum* on hills. In the eastern section on basalt, moderately closed to open shrubveld is dominated by *C. mopane* and *Terminalia prunioides*. On areas with deep sandy soils, moderately open savanna dominated by *C. mopane*, *T. sericea*, *Grewia flava* and *C. apiculatum*. The vegetation is generally open during the dry season and the herbaceous layer is poorly developed in areas with dense cover of *C. mopane* shrubs.

Most of the area is underlain by the Archaean Beit Bridge Complex, except where it is covered by younger Karoo sandstones and basalts (Mucina & Rutherord 2006). The Beit Bridge Complex consists of gneisses and metasediments and is structurally complex. Variable soils from deep red/brown clays, moderately deep, dark, heavy clays to deep, freely drained sandy soils to shallower types including skeletal Glenrosa and Mispah soil forms. Soil erosion is high to moderate.

The proposed visitor accommodation is aimed at housing school groups and teachers and also visitors (Fig 3). This will entail sleeping facilities, bathrooms, kitchen, cafeteria and gardens with parking lots. The proposed development is close to the main entrance gate (about 300 m) with an existing access road and structures with paving and parking.

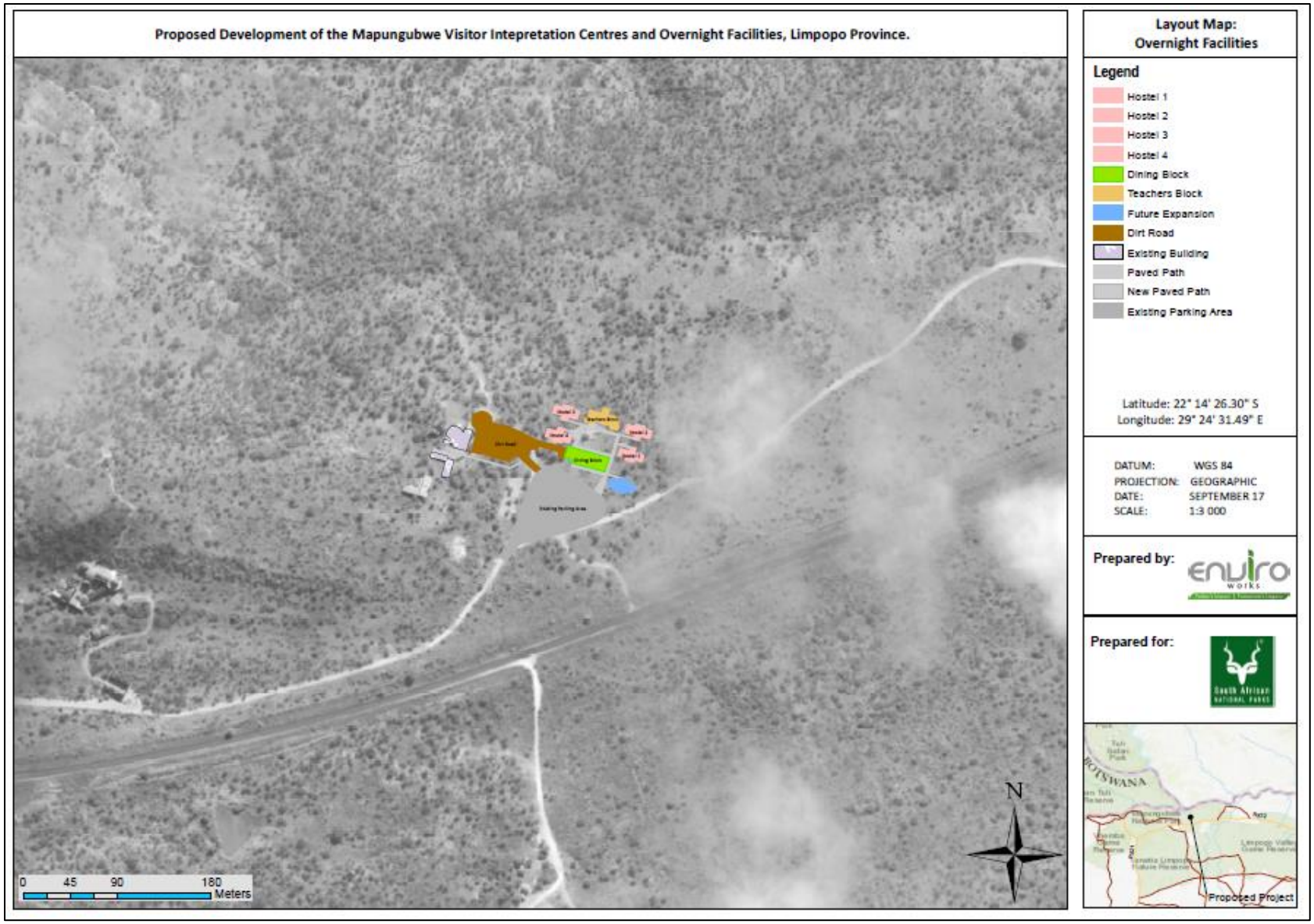


Figure 3 Layout of the proposed overnight facilities, Hostel Accommodation

Table 6 Plant species in the Hostel development footprint

Family	Species	Redlist Status	Criteria	LIMPOPO ENVIRONMENTAL MANAGEMENT ACT (Act No 7 of 2003)
MALVACEAE	*Abutilon* (Fig 4)	Least Concern	NA	NA
FABACEAE	*Vachellia tortilis subsp. heteracantha* (Fig 5)	Least Concern	NA	NA
LAMIACEAE	*Acrotome inflate* (Fig 6)	Least Concern	NA	NA
BRASSICACEAE	*Boscia foetida subsp. rehmanniana* (Fig 7)	Least Concern	NA	NA
COMBRETACEAE	*Combretum apiculatum subsp. apiculatum* (Fig 17)	Least Concern	NA	NA
POACEAEA	*Enneapogon cenchroides* (Fig 8)	Least Concern	NA	NA
POACEAEA	*Eragrostis lehmanniana var. lehmanniana* (Fig 9)	Least Concern	NA	NA
BIGNONIACEAE	*Rhigozum zambesiacum* (Fig 10)	Least Concern	NA	NA
POACEAEA	*Themeda triandra* (Fig 11)	Least Concern	NA	NA
FABACEAE	*Colophospermum mopane* (Fig 12)	Least Concern	NA	NA
ASTERACEAE	*Dicoma tomentosa* (Fig 13)	Least Concern	NA	NA
RUBIACEAE	*Gardenia volkensii* (Fig 14)	Least Concern	NA	NA
COMBRETACEAE	*Terminalia prunioides* (Fig 15)	Least Concern	NA	NA
OLACACEAE	*Ximenia americana var. microphylla* (Fig 16)	Least Concern	NA	NA

Figure 4 *Abutilon*

Figure 5 *Vachellia tortilis subsp. heteracantha*

Figure 6 *Acrotome inflata*

Figure 7 *Boscia foetida subsp. rehmanniana*

Figure 8 *Enneapogon cenchroides*

Figure 9 *Eragrostis lehmanniana var. lehmanniana*

Figure 10 *Rhigozum zambesiacum*

Figure 11 *Themeda triandra*

Figure 12 *Colophospermum mopane*

Figure 13 *Dicoma tomentosa*

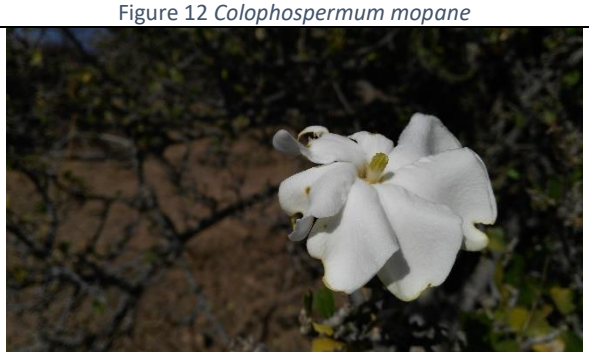


Figure 14 *Gardenia volkensii*

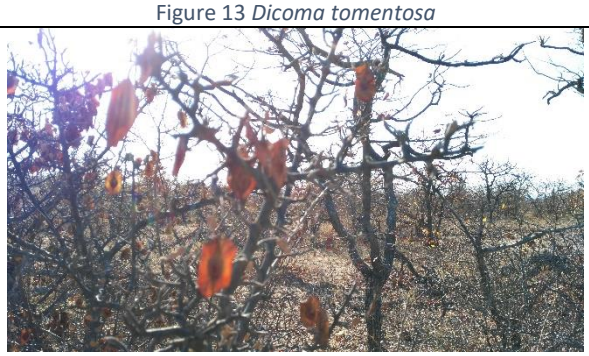


Figure 15 *Terminalia prunioides*

Figure 16 *Ximenia americana*

Figure 17 *Combretum apiculatum subsp. leutwenii*

7.1.2 Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS)

The development footprint comprised of species typical of the sandy bushveld (Fig 18), dominated by a mopane (*Colophospermum mopane*) overstory, interspersed by medium-tall trees such as *Terminalia prunioides, Vachellia tortilis subsp. heteracantha* and *Boscia foetida subsp. rehmanniana* and a poorly developed undercover of grasses and herbs. The development footprint is disturbed on the areas bordering the existing structures (Fig 19-20), as indicated by the presence of *Enneapogon cenchroides* and *Eragrostis lehmanniana var. lehmanniana*. No invasive species were observed and the majority of the development footprint is a similar condition as the surrounding intact bushveld.

The PES would thus be classified as B, being **Largely natural** with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.

The vegetation type is of least concern and EIS will be classified as D, not ecologically important and sensitive at any scale. Biodiversity is ubiquitous and not sensitive to flow and habitat modifications. The development is capitalizing on existing structures (roads, parking and buildings) which will help minimize

disturbance to the environment. No species of conservation concern will be affected by the proposed development. A list of plant species occurring in the development footprint can be found in Table 6.

Figure 18 Vegetation is dominated by mopane trees and has a dry, grass and herbs understorey

Figure 19 Existing structures and paved surfaces in the Hostel development footprint

Figure 20 Hostel development footprint containing parsley vegetated areas caused by previous disturbance

7.2 Mapungubwe Hill

7.2.1 Vegetation type

Planned developments at Mpungubwe Hill consist of three Visitor Interpretation Centers (Figure 21) that are situated within the Subtropical Alluvial Vegetation (Aza 7; Mucina & Rutherford, 2006). This vegetation type consists of broad river alluvia and around some river-fed pans in the subtropical regions of eastern South Africa, in particular in the Lowveld, Central Bushveld and in northern KwaZulu-Natal. The area is characterized by flat alluvial riverine terraces supporting an intricate complex of macrophytic vegetation

(channel of flowing rivers and river-fed pans), marginal reed belts (in sheltered oxbows and along very slow-flowing water courses) as well as extensive flooded grasslands, ephemeral herblands and riverine thickets. Vegetation occurring in the Hill footprint is listed in Table 7.

The soil is comprised of recent alluvial deposits with deep fine-structured sandy to loamy soils (Dundee, Estcourt, Valsrivier, Sterkspruit, Oakleaf forms), waterlogged as it is often exposed to floods, especially during the rainy summer season (Mucina & Rutherford, 2006). Salt often accumulates in the alluvial soils due to strong evaporation.

The visitor interpretation centers are situated in the foodplain. The development footprint is relatively small and includes an orientation centre with a deck, a boma for discussions and resting and constructing a deck over the existing dig site where archeological diggings will be viewed and discussed.

During the site visit a position alternative was suggested for the interpretation centre (Figure 21). Alternative one is ideally situated close to the existing road, enabling convenient access for tourist groups. It is however situated in a natural depression and drainage line. During heavy rains or floods, the structure could be at risk of damage. Another alternative, the Preferred Alternative was located on higher ground at the foot of a small rocky hill. This position will be of considerable lower risk of flood damage.

7.2.2 Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS)

7.2.2.1 Orientation Centre Alternative 1

Alternative 1 of the orientation centre is situated on an open sandy area (Fig 30-31) next to an existing dirt road. The PES is classified as A, being **unmodified** and natural.

The EIS is classified as C. The site is of moderate importance and sensitivity. It is ecologically important and sensitive on a provincial/local scale. Biodiversity is not usually sensitive to flow and habitat modifications. The site has a low species diversity. It is dominated by *Vachellia tortilis subsp. heteracantha (*Umbrella thorn), *Gardenia volkensii* and grasses. The reason for classifying it as moderate ecological importance and sensitivity is the location in the floodplain with visible drainage network. Even though flooding of the floodplain is unlikely and infrequent, the structure will be at risk of flood damage.

7.2.2.2 Orientation Centre Preferred Alternative

The Preferred Alternative for the orientation centre is on slightly elevated ground on the foot of a hill (Fig 32-33). It also has a low species diversity. The area has an open structure of low trees and shrubs (*Grewia, Boscia foetida subsp. rehmanniana* and *Terminalia prunioides)* some grasses and herbs characteristic of

the Subtropical Alluvial Vegetation (*Ocimum americanum L. var. americanum)* and others of bushveld (*Hermbstaedtia odoratal).* The PES is classified as A, being **unmodified** and natural.

The EIS is classified as D and is marginal. The area is not ecologically important and sensitive at any scale. Biodiversity is ubiquitous and not sensitive to flow and habitat modifications. No species of conservation concern occur in the footprint and due to its location on a higher elevation, the risk to infrequent flooding is significantly lower.

7.2.2.3 Boma

The boma is located in the riparian thicket type of Subtropical Alluvium Vegetation. The proposed site is below the shade of a big Nyala tree (*Xanthocercis zambesiaca*) but the understorey is open and sandy (Fig 34-35). The PES is classified as A, being **unmodified** and natural.

The EIS is classified as C. The site is of moderate importance and sensitivity. It is ecologically important and sensitive on a provincial/local scale. Biodiversity is not usually sensitive to flow and habitat modifications. The reason for classifying it as moderate ecological importance and sensitivity is the location in floodplain with a visible drainage network. Even though flooding of the floodplain is unlikely and infrequent, the structure will be at risk of flood damage. The boma has a very small footprint and the light building materials pose a low risk to the environment is case of flooding.

7.2.2.4 Dig Site Building

The dig site building will be constructed over the existing archaeological dig site. The site is denuded of vegetation, it is bare and sandy with an Umbrella thorn tree with phown nests next to the proposed development site (Fig 36-37). The PES is D. Due to the existing structure and disturbance the area is **largely modified**. The site is surrounded by intact natural ecosystems. A large loss of natural habitat, biota and basic ecosystem functions has occurred.

There are no sensitive natural features and the EIS is classified as D and is marginal. The area is not ecologically important and sensitive at any scale. Biodiversity is ubiquitous and not sensitive to flow and habitat modifications.

Figure 21 Layout of the proposed Visitor Interpretation Centers, Mapungubwe Hill

Table 7 Plant species in the Mapungubwe Hill visitor interpretation centers' development footprint

Family	Species	Redlist Status	Criteria	LIMPOPO ENVIRONMENTAL MANAGEMENT ACT (Act No 7 of 2003)
MALVACEAE	*Abutilon*	Least Concern	NA	NA
FABACEAE	*Vachellia tortilis subsp. heteracantha*	Least Concern	NA	NA
BRASSICACEAE	*Boscia foetida subsp. rehmanniana*	Least Concern	NA	NA
POACEAEA	*Enneapogon cenchroides*	Least Concern	NA	NA
ASTERACEAE	*Dicoma tomentosa*	Least Concern	NA	NA
MALVACEAEA	*Grewia* (Fig 22)	Least Concern	NA	NA
MALVACEAEA	*Grewia flavescens*	Least Concern	NA	NA
RUBIACEAE	*Gardenia volkensii* (Fig 25)	Least Concern	NA	NA
AMARANTHACEAE	*Hermbstaedtia odorata* (Fig 24)	Least Concern	NA	NA
LAMIACEAE	*Ocimum americanum L. var. americanum* (Fig 23)	Least Concern	NA	NA
POACEAEA	*Panicum maximum* (Fig 26)	Least Concern	NA	NA
COMBRETACEAE	*Terminalia prunioides*	Least Concern	NA	NA
POACEAEA	*Urochloa mosambicensis* (Fig 27)	Least Concern	NA	NA
FABACEAE	*Xanthocercis zambesiaca* (Fig 28-29)	Least Concern	NA	NA

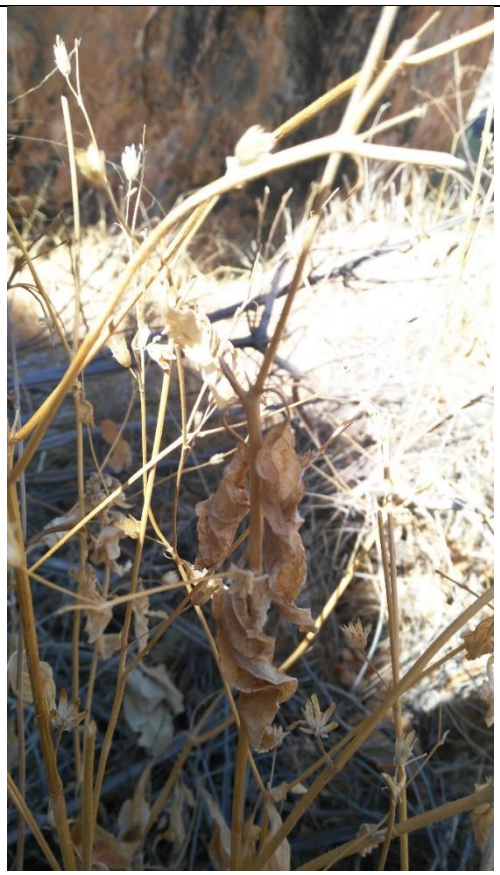


Figure 22 *Grewia*

Figure 23 *Ocimum americanum L. var. americanum*

Figure 24 *Hermbstaedtia odorata*

Figure 25 *Grewia flavescens*

Figure 26 *Panicum maximum*

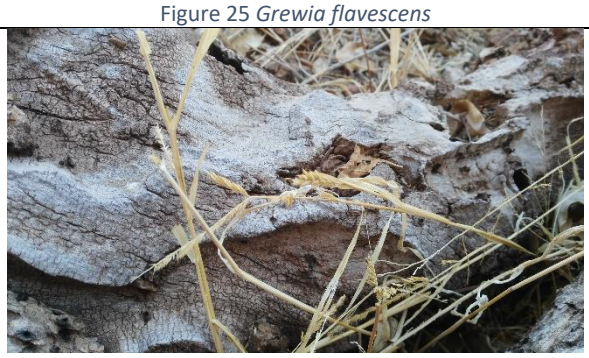


Figure 27 *Urochloa mosambicensis*

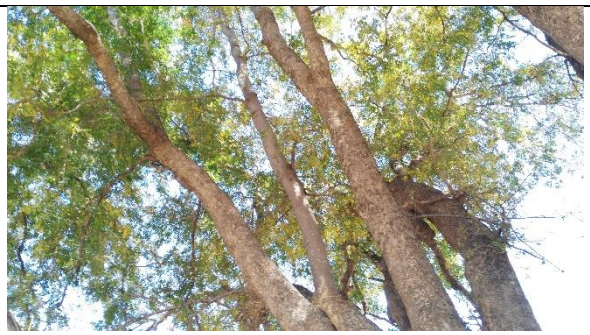


Figure 28 *Xanthocercis zambesiaca*

Figure 29 *Xanthocercis zambesiaca*

Figure 30 View of the development footprint, orientation centre Alternative 1

Figure 31 Development footprint, orientation centre Alternative 1

Figure 32 Development footprint, orientation centre Preferred Alternative

Figure 33 Development footprint, orientation centre Preferred Alternative

Figure 34 View of the development footprint of the boma

Figure 35 View of the development footprint of the boma

Figure 36 Current dig site where building and deck is proposed

Figure 37 Umbrella thorn tree with phown nests next to the proposed dig site building

7.3 Schroda Dam

7.3.1 Vegetation type

The Schroda Dam interpretation centre fall in Limpopo Ridge Bushveld (SVmp 2; Mucina & Rutherford, 2006). This vegetation type is characterized by extremely irregular plains with ridges and hills. The vegetation has a similar structure to Musina Mopane Bushveld: moderately open savanna with poorly developed ground layer. Vegetation is usually dominated by tall trees *Kirkia acuminate* and *Adansonia digitata* (Baobab) on shallow calcareous gravel; shrub *Catophractes alexandri* is dominant on calc-silicate soils.

The landscape often have prominent rock formations of the Clarens Formation (Mucina & Rutherford, 2006). The geology is mostly of the Beit Bridge Complex (Swazian Erathem) as well as sediments (including sandstones of the Clarens Formation) and basalt (particularly in the east) of the Karoo Supergroup. Shallow gravel and sand (Glenrosa and Mispah soil forms) to calcareous clayey soil.

The vegetation type is of Least Concern with the target of 19% being already conserved in nature reserves. The visitor interpretation center is planned to be a closed structure with viewing deck. It will be used to

display information of the archeological and historical importance of the Schroda dam area to tourist groups and act as a vantage point of the landscape (Fig 38).

7.3.2 Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS)

The vegetation has a typical bushveld vegetation structure, and species characteristic of the Limpopo Ridge Bushveld. It is dominated by *Vachellia tortilis subsp. heteracantha, Boscia albitrunca, Terminalia prunioides* interspersed but a sparse ground cover of grasses such as *Enneapogon cenchroides* (Fig 39-40). The grass can indicate other disturbances in the area such as grazing by cattle (cattle observed on site). The PES is classified as A, being **unmodified** and natural.

The EIS is classified as D and is marginal. The area is not ecologically important and sensitive at any scale. Biodiversity is ubiquitous and not sensitive to flow and habitat modifications. No species of conservation concern occur in the footprint. A list of species in the development footprint can be seen in Table 8.

Table 8 Plant species in the Schroda Dam visitor interpretation centers' development footprint

Family	**Species**	**Redlist Status**	**Criteria**	LIMPOPO ENVIRONMENTAL MANAGEMENT ACT (Act No 7 of 2003)
MALVACEAE	*Abutilon*	Least Concern	NA	NA
FABACEAE	*Vachellia tortilis subsp. heteracantha*	Least Concern	NA	NA
BRASSICACEAE	*Boscia albitrunca* (Fig 41)	Least Concern	NA	NA
POACEAEA	*Enneapogon cenchroides*	Least Concern	NA	NA
APIACEAE	*Heteromorpha* Fig 42)	Least Concern	NA	NA
MALVACEAEA	*Grewia flavescens*	Least Concern	NA	NA
BRASSICACEAE	*Maerua parvifolia* (Fig 43)	Least Concern	NA	NA
FABACEAE	*Senegalia senegal var. leiorhachis* (Fig 44)	Least Concern	NA	NA
COMBRETACEAE	*Terminalia prunioides*	Least Concern	NA	NA

Figure 38 Layout of the proposed Visitor Interpretation Centers, Schroda Dam

Figure 39 View of the development footprint of Schroda Dam

Figure 40 View of the development footprint of Schroda Dam

Figure 41 *Boscia albitrunca*

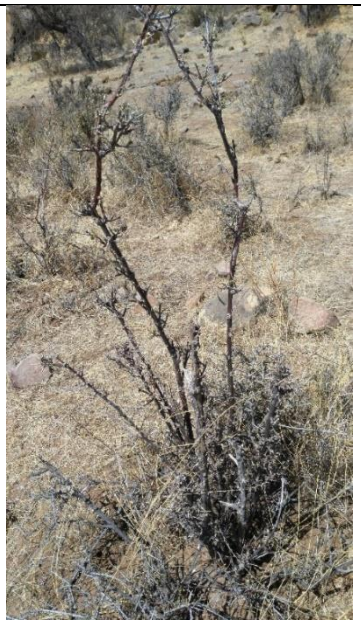


Figure 42 *Heteromorpha*

Figure 43 *Maerua parvifolia*

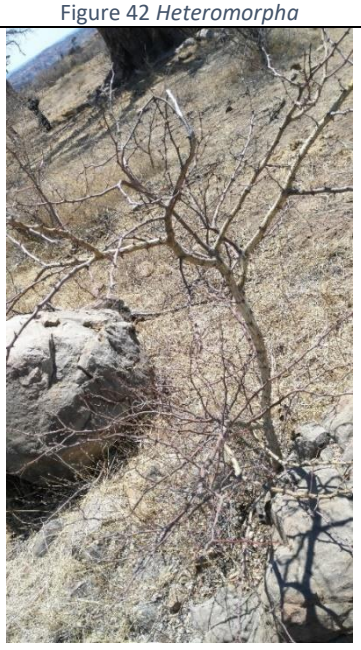


Figure 44 *Senegalia senegal var. leiorhachis*

8. RED LISTED SPECIES

No listed species of vultures, trees, spiders, butterflies, Odonata, lacewings, dung beetles, frogs, fish or scorpions are known from the QDS (2229AB; ADU, 2017).

8.1 Vegetation

Two Rare species (SANBI Redlist, 2017) are known from the QDS. *Dicliptera gillilandiorum* and *D. cliffordii* (SANBI, 2016). The former has a restricted range size but is locally common (Victor & Von Staden, 2007a). It occurs in Limpopo River Valley, in Zimbabwe and Limpopo Province between Beit Bridge and the confluence of the Limpopo and Shashe rivers (Victor & Von Staden, 2007a). It prefers various habitats within mopane bushveld, including rocky hillsides and clay flats (Victor & Von Staden, 2007a). The latter is known from only three subpopulations, two of which are protected within the Vhembe-Dongola National Park (Victor & Von Staden, 2007b). It prefers the sandy soils of Kalahari sand in mopane bushveld (Victor & Von Staden, 2007b). Neither of the two were spotted in the development footprints.

8.2 Reptiles

One Vulnerable species (also protected under Limpopo Environmental Management Act, Act No. 7 of 2003) of reptile is known from the QDS (RetileMAP, 2017). The Nile Crocodile (*Crocodylus niloticus*) is unlikely to be affected by the development as the proposed developments are not in or next to permanent water bodies.

8.3 Birds

One species of phown nests were observed outside the development site at Mapungupwe Hill, likely to be Southern Masked Weavers (*Ploceus velatus*). It is a species of Least Concern. No other birds or nests were observed in the development footprint.

Listed species known to be breeding in the area are discussed below (BIRP, 2017). White-backed vultures - *Gyps africanus*- nests are typically concentrated in tall trees along watercourses (Allan, 2015). Nests are built of sticks and usually lined with grass. The egg-laying period spans April-September, mainly April-July. The key conservation measures required focus primarily on the major threats stemming from poisoning, energy-related infrastructure, the traditional health industry, potential food shortages, drowning and negative perceptions and ignorance. No tall riparian trees will be removed during construction and the development will pose a low threat to the White-backed vultures.

Pel's Fishing Owl (*Scotopelia peli*) is known from the QDS. The most significant threat to the species is loss of suitable habitat due to a decline in the quality and quantity of water in rivers and other waterbodies

(Barnes and Parker 2000). This may be a result of water extraction and pollution, due to such activities as water provision to urban settlements, agricultural, industrial and mining activities, and the construction of impoundments within catchments. The species is particularly sensitive to clearing and disturbance of tall riparian fringes (Mendelsohn 1997). The species is listed under Schedule 2: Specially Protected Wild Animal under the Limpopo Environmental Management Act No 7 of 2003. The Birds of Prey Programme endeavours to create greater awareness of the impact of human activities on the habitat and population of this species and actively engages with stakeholders within the catchments of river systems that could have an impact on water quality and quantity, and riparian habitats (Botha et al., 2015). Pel's Fishing Owl is found along river systems, pans and quiet backwaters that are fringed by suitable riparian vegetation, which provides hunting perches, cover and natural cavities in trees that the birds breed in (Mendelson, 1997). Breeding in neighboring Botswana occurs January-June with egg-laying peaking February-April (Skinner 1996), and March-April in northern South Africa (Tarboton et al. 1987). The proposed development activities pose a very small threat to the owl as very little to no clearing of riparian vegetation will be done.

Kori bastard (*Ardeotis kori*) is a polygynous, solitary nester (Allan 1997), with the breeding season lasting from July to April. The species inhabits fairly dry, open savannahs, within the 100-600 mm rainfall zone, as well as Nama Karoo dwarf shrublands and occasionally western grasslands where clumps of trees on tree-lined watercourses provide shade and shelter (Allan 1997). The species is faced by multiple threats although habitat destruction would seem to be the highest concern (Anderson 2000). Changes in land-use and habitat quality, e.g. through establishment of agricultural fields, overgrazing or bush encroachment, may lead to diminished food supplies, causing local extinction events (Allan 1997, Anderson 2000, Young et al. 2003). The proposed development activities pose a very small threat to the species.

Greater Painted-snipe (*Rostratula benghalensis)* is found in the QDS and the main threat faced by this species is transformation, degradation and loss of its wetland habitat due to increasing human pressures (Navarro 1997). Threats to wetlands include drainage and clearing for development and agriculture, and invasion of bulrushes *Typha capensis* due to regulation of stream flow reducing the extent of flooding and drying cycles (Hockey and Tree 2005). Direct water abstraction and damming may also lead to reed overgrowth and salinisation. Greater Painted-snipe are limited to freshwater wetlands, where they prefer secluded muddy areas adjacent to concealing vegetation (Urban et al. 1986). The species occurs sparsely along the shorelines of dams, lakes and pans, on the banks of slow-flowing rivers, on marshy floodplains, in temporarily flooded grassland, at rainwater pools on clay soils with plentiful adjacent cover, and in

other similar locations. Birds often congregate where the water is receding, but vacate such habitats when the water level falls beyond the fringes of vegetation (Hockey and Tree 2005). Reported occurrence in savannah and other terrestrial vegetation types is conditional on the presence of suitable, usually ephemeral, wetlands (Navarro 1997). Due to its nomadic and partly migratory lifestyle, wanderers are occasionally encountered at small, isolated waterbodies in arid regions. The proposed sites is unlikely to pose a suitable habitat.

The Tawny Eagle (*Aquila rapax*) is one of the most threatened eagles in South Africa (Barnes 2000), with a high sensitivity to land transformation making it largely dependent on conservation areas to survive (Herremans & Herremans-Tonnoeyr, 2000). Tawny Eagles are found in lightly wooded savannah and thornveld, as well as semi-desert (Simmons 1997), but avoid dense forest and highlands. Breeding occurs in winter (Hustler and Howells 1989). (Taylor, 2015). No trees should be removed if they contain bird nest or have bird activity. A suitably qualified avifaunal specialist should be consulted in these cases.

The primary threat to the Lanner Falcon (*Falco biamicus*) is the loss or transformation of habitat within the Grassland Biome, through urbanisation, agriculture and afforestation, with corresponding reductions in preferred prey and foraging opportunities (Barnes and Jenkins 2000). Lanner Falcons favour open grassland, cleared woodlands and agricultural areas. Breeding pairs tend to favour cliffs as nesting and roosting sites; however, they will use alternative structures such as trees, pylons and buildings. The dominant prey group is birds, followed by small mammals, reptiles and insects (Jenkins and Avery 1999). The proposed development will not impact breeding sites and due to the small size of the development footprint will unlikely have a significant impact on foraging grounds.

8.4 Mammals

There were droppings and animal tracts in the development footprints but the impact on mammals are unlikely to be significant in terms of breeding and feeding ground. The development footprints are most likely used for passing through and feeding for herbivores. The development footprint is small relative to the size of the park and suitable habitat is available to mammals outside of the development footprints. One of the Redlisted bats, Rusty Pipistrelle (*Pipistrellus rusticusI)* is the only species that could possible occur in the development footprint (MammalMap, 2017). The small bats has been recorded from savanna woodland, and both dry and moist savanna habitats. Animals have been reported roosting in tree crevices, under bark and in old buildings (Skinner and Chimimba 2005). The species is only locally threatened according to Friedman and Dalys (2004) and is not listed in terms of the IUCN Red listed species and are unlikely to be impacted by the proposed developments (Monadjem *et al.*, 2017; Friedman & Daly, 2004)

Pictures of the Rusty Pipistrelle should be available on site. It is strongly recommended that any trees that are removed should be inspected prior to removal (by an ECO or SANPARKS ranger) for presence of the bats. No bats should be harmed during construction. If any bats are seen in the development footprint the ECO/Environmental Officer or SANPRKS ranger should be contacted.

9. OVERALL ECOLOGICAL IMPACT ASSESSMENT

The following section identifies the potential ecological impacts (both positive and negative) which the proposed project will have on the environment.

Once the potential ecological impacts are identified, they are assessed by rating their Environmental Risk after which the final Environmental Significance is calculated and rated for each identified ecological impact.

The same Environmental Risk rating process is then followed for each ecological impact to determine the Environmental Significance if the recommended mitigation measures were to be implemented.

The objective of this section is therefore firstly to identify all the potential ecological impacts of the proposed project and secondly to determine the significance of the impacts and how effective the recommended mitigation measures will be able to reduce their significance. The potential ecological impacts which are still rated as highly significant, even after implementation of mitigations, can then be identified in order to specifically focus on implement of effective management strategies for them.

9.1 Description of Potential Ecological Impacts and their Recommended Mitigation Measures

The following section provides descriptions of the potential ecological impacts which the proposed project will have as well as the recommended mitigation measures to be implemented for each impact as identified.

9.1.1 Construction phase

Impacts on Critical Biodiversity Areas and Listed Vegetation Types

Even though the developments are in a Protected Area, the vegetation type of each site is classified as Least Threatened. Vegetation will be lost during the construction of the developments. The impacts on existing indigenous grasses, trees and shrubs will likely be low. A walkthrough will have to be done pre-construction to check for any listed species that was not notable at the time of the site visit. The relatively small nature of the development footprint resulted in the area not being of as high conservation

significance for habitat preservation or ecological functionality persistence in support of the surrounding ecosystem or broader vegetation type. The proposed project area does have high PES scores (except in the case of the Dig Site Building) and low EIS scores.

Mitigation measures to reduce potential impacts:

- The project construction footprint must be kept as small as practicably possible.
- Movement of vehicles and construction personnel should be restricted to the road and within the development footprint as much as possible to limit trampling of indigenous species and further disturbance to the surrounding vegetation.

Impacts on Listed or Protected Plant Species

The vegetation that is impacted contains no protected species of conservation significance. No provincially protected species were found in the development footprint. Even though some indigenous species occur within the development footprint, they are of Least Concern. The significance of this potential impact on any relevant species individuals is therefore zero. It is however recommended that an additional ecological walkthrough be conducted prior to commencement of the project during the rainy season/flowering period of herbs and grasses. This will ensure that no Red Data Listed species have potentially been omitted.

Mitigation measures to reduce potential impacts:

- It is recommended that an additional ecological walkthrough be conducted prior to commencement of the project during the flowering period of herbs and grasses. This will ensure that no provincially protected or significant species have potentially been omitted.

Direct and Indirect Faunal Impacts

The construction of the facility will result in some foraging and/or roaming area loss for some resident fauna. In addition, increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to resident fauna. Fauna is expected to avoid the area during the construction phase as a result of the noise and human activities.

Mitigation measures to reduce potential impacts:

- Holes and trenches should not be left open for extended periods of time and should only be dug when immediately needed. Trenches left open for some days, should have escape ramps present at regular intervals to allow any fauna that fall in to escape.

- Any fauna threatened by construction activities should be removed to safety by the ECO or another suitably qualified person.
- Posters of species of conservation concern should be kept on site where they will be visible to construction workers.

Alien Invasive Species Establishment

Areas within and around the proposed project footprint could potentially be prone to significant alien invasive species establishment due to disturbances caused by construction activities. Due to the locality of the proposed development in pristine vegetation, spreading of alien invasive species into surrounding areas would have a negative impact.

Mitigation measures to reduce potential impacts:

- Implement suitable alien invasive species establishment prevention measures during the construction phase such as proper storage, transport and disposal of plant material and minimizing disturbance to the area surrounding the development footprint.
- Areas around the proposed project footprint must be adequately rehabilitated to prevent significant alien invasive species establishment.
- The project footprint and surroundings should be monitored for alien invasive species yearly for three years and managed according to the Park's Alien Invasive Species Management Plan.
- Care should be taken to remove any biological material from equipment and personnel clothing and gear before entering and when leaving the work site to prevent the spread and establishment of alien invasive species.

Surface Material Erosion

Areas within and around the proposed project footprint could potentially be prone to significant surface soil erosion due to the loosening of materials and potential removal of vegetation during construction which usually binds surface material. Due to the small surface footprint size the risk of erosion is however relatively small. The Hostel accommodation soil is prone to erosion and care should be taken during construction to monitor erosion and implement erosion control measures.

Mitigation measures to reduce potential impacts:

- Implement suitable erosion prevention measures during the construction phase.
- Areas around the proposed project footprint must be adequately rehabilitated to prevent significant erosion.

- Adequate storm water management measures must be implemented on site in order to sufficiently manage storm water runoff and clean/dirty separation during the construction phases. This must be done to ensure that no significant contamination of the surrounding areas occurs.
- Soil disturbance must be kept to a minimum within and around the development footprint.

Dust Generation and Emissions

The construction activities of the proposed project construction phase could potentially result in significant fugitive dust emissions due to vegetation removal which could spread into the surrounding areas. The significance of this potential impact will however be low and only temporarily.

Mitigation measures to reduce potential impacts:

- Implement suitable dust management and prevention measures during the construction phase.
- Areas around the proposed project footprint must be adequately rehabilitated to prevent significant dust emissions.

Surface- and Groundwater Contamination

If any waste from construction activities or contaminated run-off water enters the local streams, surface- or ground water it can lead to negative impacts on the water quality and the aquatic ecosystem.

Mitigation measures to reduce potential impacts:

- Construction site should be kept clean and tidy
- Any waste should be disposed in a registered landfall and not be allowed to be dumped in the surrounding landscape
- All surfaces used for waste storage and loading areas should have an impermeable surface.
- Storm water and run-off should be managed and diverted to not be in contact with waste.

9.1.2 Operational phase

Continued Alien Invasive Species Establishment

Areas within and around the proposed project footprint, especially on the spaces between the soil surface and visitor interpretation centers (elevated on stilts) could potentially continue to be prone to significant alien invasive species establishment due to the activities associated with the construction phase of the proposed project and continued traffic from visitors. Due to the location of proposed developments in pristine vegetation spreading of alien invasive species into adjacent natural vegetation is likely.

Mitigation measures to reduce potential impacts:

- It must be ensured that no alien invasive weeds are introduced to the property during the operational phase.
- If any alien invasive plant species are observed it must immediately be removed in the correct environmentally friendly manner.
- Indigenous species should be used during any landscaping, no plant material should preferably be introduced from outside the park.
- The monitoring, control and eradication of invasive alien species should be conducted as part of SANPARK's invasive alien species monitoring and eradication plan, according to the NEMBA regulation.

Faunal Impacts

During the operational phase, interactions between the infrastructure considered here and fauna are likely to be very low. Fauna will most likely avoid the area by moving around the proposed infrastructure.

Mitigation measures to reduce potential impacts:

- Keep the facility neat, tidy and clean.
- It is expected that any small mammals that occurred on the property before construction commenced would have moved from the area. Should any animals return to the property once the facilities are in operation, care should be taken not to disturb any animals.
- It must be ensured that no alien invasive animals or birds are introduced into the area. Should any accidental introductions occur, the species must be controlled in the correct environmentally friendly manner.
- Keep the facility neat, tidy and clean in order not to attract scavenging animals such as rats and mice.

Waste Management

The operation of the facilities pose a pollution risk to the environment, should any general waste generated be improperly disposed of, such as littering. The operation of the Boma and Orientation Centre Alternative 1 is in a floodplain and pollution due to improper waste management pose a larger risk to the surrounding environment, especially during large rain- or flooding events.

Mitigation measures to reduce potential impacts:

- An integrated waste management programme must be developed for the facility.
- Sufficient waste receptacles should be placed around the facility in order to encourage visitors to use them.

- The principle of reduce, re-use and recycle should be followed.
- Visitors should be made aware of best-practice environmental practices while visiting the park.

9.1.3 Decommission Phase Impacts

Impacts on Vegetation and Listed or Protected Plant Species

Vegetation will be disturbed during the decommissioning of facilities.

Mitigation measures to reduce potential impacts:

- It is recommended that an ecological walkthrough be conducted prior to commencement of the decommissioning during the flowering period to ensure that no provincially- or nationally protected or significant species could be impacted upon.
- The decommissioning activities should be confined within the development footprint and avoid disturbing vegetated area beyond the borders of the development footprint.
- Posters of species of conservation concern should be kept on site where they will be visible to construction workers.

Impacts on Critical Biodiversity Areas and Listed Vegetation Types

The vegetation type of each site is classified as Least Threatened. Vegetation will be lost during the construction of the base station. The impacts on existing indigenous grasses, trees and shrubs will likely be low.

Mitigation measures to reduce potential impacts:

- The decommissioning footprint must be kept as small as practicably possible.
- Movement of vehicles and construction personnel should be restricted to the road area and within the development footprint as much as possible to limit trampling of indigenous species and further disturbance to the area.
- The intact vegetation surrounding development should not be disturbed.
- Posters of species of conservation concern should be kept on site where they will be visible to construction workers.

Direct and Indirect Faunal Impacts

Increased levels of noise, pollution, disturbance and human presence during decommissioning will be detrimental to resident fauna in the area. Fauna is expected to avoid the area during the decommissioning phase as a result of the noise and human activities.

Mitigation measures to reduce potential impacts:

- Excavations should not be left open for extended periods of time and should only be dug when immediately needed. Trenches left open for some days, should have escape ramps present at regular intervals to allow any fauna that fall in to escape.
- Any fauna threatened by decommissioning activities should be removed to safety by the ECO or another suitably qualified person.
- Posters of species of conservation concern should be kept on site where they will be visible to construction workers.

Surface material erosion

Areas within and around the proposed project footprint could potentially be prone to surface soil erosion. Decommissioning will likely loosen soil substrate and remove vegetation which usually binds surface material. Due to the small footprint area and the flat terrain, the risk of erosion is however relatively small, except the Hostel accommodation that is prone to erosion. The significance of this potential impact will be low.

Mitigation measures to reduce potential impacts:

- Implement suitable erosion prevention measures during the decommissioning.
- Areas around the proposed project must be adequately rehabilitated to prevent significant erosion.
- Adequate storm water management measures must be implemented on site in order to sufficiently manage storm water runoff from the site during the decommissioning phases. This must be done to ensure that no significant erosion occurs.
- Soil disturbance must be kept to a minimum within and around the footprint.

Dust Generation and Emissions

The decommissioning activities of the proposed project could potentially result in fugitive dust emissions due to soil disturbance which could spread into the surrounding areas. The significance of this potential impact will likely however be low and only temporarily.

Mitigation measures to reduce potential impacts:

- Implement suitable dust management and prevention measures during the decommissioning.
- Areas around the proposed project footprint must be adequately rehabilitated to prevent significant dust emissions.

Positive Impact of Rehabilitating Development Footprint

Once the operation is decommissioned a positive impact on the environment is possible if the site is suitably rehabilitated and restored to host a structure, composition and ecological functioning similar to the surrounding vegetation.

Rehabilitation measures include:

- On completion of a section of works, the area must be rehabilitated by suitable landscaping, leveling, topsoil dressing, land preparation, alien plant eradication and where ascribed for by the ECO, vegetation establishment;
- Clear and completely remove from site all construction structures and temporary infrastructure;
- All permanent infrastructure must be returned to a useable state;
- Remove all inert waste and rubble, such as excess rock, any structural foundations and remaining aggregates. Only once this material has been removed, the site shall be re-instated and rehabilitated;
- The reinstatement of disturbed areas must follow immediately after the removal of structures and temporary infrastructure'
- Topsoil backfilling must be undertaken when the soil is dry, and not following any recent rainfall events
- The replacement of topsoil should be sought in situ with construction where possible, or as soon as construction in an area has be completed;
- All stockpiled topsoil together with herbaceous vegetation should be replaced and redistributed over a disturbed area such as temporary access roads;
- Topsoil must be returned to the same site from where it was stripped;
- When insufficient topsoil remains, soil of a similar quality can be obtained from a nearby area within the construction area which was disturbed;
- Once topsoil has been returned to the ground, stripped vegetation should be randomly spread by hand over the area;
- All re-growth of invasive vegetative material will be monitored by the Developer for one year;
- All areas under rehabilitation are to be treated as no-go areas using danger tape and steel droppers/fencing and cordoned off, to prevent vehicular, pedestrian and livestock access;
- Re-vegetation should be done by sourcing indigenous plants from local suppliers or the surrounding vegetation, whether it be whole plants, seedlings, cuttings or seeds;

- Control invasive plant species and weeds using approved methods of manual or chemical intervention; and
- The re-establishment of vegetation should be allowed several rainy seasons.

9.1.4 Cumulative Impacts

The area surrounding the proposed developments is adjacent to natural vegetation. Due to the small surface footprint size of the proposed project area in relation to the park's extent, the negative impact that the project will cumulatively add to habitat preservation or ecological functionality persistence of the broader area will be low. The developments will add to the Park's infrastructure and tourist attraction value. It will be in line with the park's management plan. If mitigation measures are implemented and best-practice environmentally friendly construction-, maintenance- and deconstruction methods are followed, the development will provide significant benefits in terms of preserving cultural heritage and also gaining socio-economic benefits from eco-tourism.

9.2 Risk Ratings of Potential Impacts

The following section provides the Environmental Risk as well as the Environmental Significance Ratings for the potential ecological impacts for the proposed project both before and after implementation of the recommended mitigation measures.

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																	
		Before mitigation									After mitigation								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Construction phase																	
Impacts on CBA's and Listed Vegetation Types	Hostel accommodation	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	4	**36**	Low	Low
	Orientation Centre Alternative 1	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	4	**36**	Low	Low
	Orientation Centre Preferred Alternative	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	4	**36**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																		
		Before mitigation									After mitigation									
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Construction phase																		
	Boma	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	4	**36**	Low	Low
	Dig Site Building	2	4	1	2	2	5	**55**	Medium	Low	0	4	1	1	1	4	**28**	Low	Low
	Schroda Dam Centre	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	4	**36**	Low	Low
Impacts on Listed or Protected Plant Species	Hostel accommodation	2	4	1	1	2	2	**20**	Low	Low	2	4	1	1	2	1	**10**	Low	Low
	Orientation Centre Alternative 1	2	4	1	1	2	2	**20**	Low	Low	2	4	1	1	2	1	**10**	Low	Low
	Orientation Centre Preferred Alternative	2	4	1	1	2	2	**20**	Low	Low	2	4	1	1	2	1	**10**	Low	Low
	Boma	2	4	1	1	2	2	**20**	Low	Low	2	4	1	1	2	1	**10**	Low	Low
	Dig Site Building	2	4	1	1	2	2	**20**	Low	Low	0	4	1	1	2	1	**8**	Low	Low
	Schroda Dam Centre	2	4	1	2	2	2	**20**	Low	Low	2	4	1	2	2	1	**10**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																		
		Before mitigation									After mitigation									
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Construction phase																		
Direct and Indirect Faunal Impacts	Hostel accommodation	4	4	2	1	2	4	**52**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Orientation Centre Alternative 1	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Orientation Centre Preferred Alternative	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Boma	2	4	1	1	2	3	**30**	Low	Low	2	4	1	0	1	3	**24**	Low	Low
	Dig Site Building	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Schroda Dam Centre	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
Alien Invasive Species Establishment	Hostel accommodation	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Orientation Centre Alternative 1	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Orientation Centre Preferred Alternative	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																		
		Before mitigation									After mitigation									
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Construction phase																		
	Boma	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Dig Site Building	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Schroda Dam Centre	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
Surface Material Erosion	Hostel accommodation	6	3	1	4	3	4	**68**	Medium	Low	2	2	1	1	1	2	**14**	Low	Low
	Orientation Centre Alternative 1	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low
	Orientation Centre Preferred Alternative	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low
	Boma	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low
	Dig Site Building	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low
	Schroda Dam Centre	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																	
		Before mitigation									After mitigation								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Construction phase																	
Dust Generation and Emissions	Hostel accommodation	2	2	2	1	5	5	**60**	Medium	Low	1	2	1	1	5	4	**40**	Medium	Low
	Orientation Centre Alternative 1	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low
	Orientation Centre Preferred Alternative	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low
	Boma	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low
	Dig Site Building	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low
	Schroda Dam Centre	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low
Surface- and Groundwater Emissions	Hostel accommodation	2	2	1	2	3	2	**20**	Low	Low	0	1	0	0	0	1	**1**	Low	Low
	Orientation Centre Alternative 1	6	2	2	3	4	3	**51**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Orientation Centre Preferred Alternative	2	2	1	2	3	2	**20**	Low	Low	0	1	0	0	0	1	**1**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																		
		Before mitigation									After mitigation									
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Construction phase																		
	Boma	6	2	2	3	4	3	**51**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Dig Site Building	2	2	1	2	3	2	**20**	Low	Low	0	1	0	0	0	1	**1**	Low	Low
	Schroda Dam Centre	2	2	1	2	3	2	**20**	Low	Low	0	1	0	0	0	1	**1**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																		
		Before mitigation									After mitigation									
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Operational phase																		
Continued Alien Invasive Species Establishment	Hostel accommodation	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Orientation Centre Alternative 1	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Orientation Centre Preferred Alternative	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																	
		Before mitigation									After mitigation								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Operational phase																	
	Boma	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Dig Site Building	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
	Schroda Dam Centre	4	4	2	1	2	4	**52**	Medium	Low	0	1	0	0	0	1	**1**	Low	Low
Faunal Impacts	Hostel accommodation	4	4	2	1	2	4	**52**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Orientation Centre Alternative 1	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Orientation Centre Preferred Alternative	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Boma	2	4	1	1	2	3	**30**	Low	Low	2	4	1	0	1	3	**24**	Low	Low
	Dig Site Building	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Schroda Dam Centre	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																	
		Before mitigation									After mitigation								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Operational phase																	
Waste Management	Hostel accommodation	4	4	2	1	2	3	**39**	Low	Low	0	1	1	0	0	1	**2**	Low	Low
	Orientation Centre Alternative 1	6	4	2	2	3	3	**51**	Medium	Low	0	1	1	0	0	1	**2**	Low	Low
	Orientation Centre Preferred Alternative	4	4	2	1	2	3	**39**	Low	Low	0	1	1	0	0	1	**2**	Low	Low
	Boma	6	4	2	2	3	3	**51**	Medium	Low	0	1	1	0	0	1	**2**	Low	Low
	Dig Site Building	4	4	2	1	2	3	**39**	Low	Low	0	1	1	0	0	1	**2**	Low	Low
	Schroda Dam Centre	4	4	2	1	2	3	**39**	Low	Low	0	1	1	0	0	1	**2**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																	
		Before mitigation									After mitigation								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Decommission phase																	
Impacts on Vegetation and Listed or Protected Plant Species	Hostel accommodation	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	5	**45**	Low	Low
	Orientation Centre Alternative 1	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	5	**45**	Low	Low
	Orientation Centre Preferred Alternative	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	5	**45**	Low	Low
	Boma	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	5	**45**	Low	Low
	Dig Site Building	2	4	1	2	2	5	**55**	Medium	Low	0	4	1	1	1	5	**35**	Low	Low
	Schroda Dam Centre	2	4	1	2	2	5	**55**	Medium	Low	2	4	1	1	1	5	**45**	Low	Low
Impacts on Critical Biodiversity Areas and Listed Vegetation Types	Hostel accommodation	2	4	1	1	2	2	**20**	Low	Low	2	4	1	1	2	1	**10**	Low	Low
	Orientation Centre Alternative 1	2	4	1	1	2	2	**20**	Low	Low	2	4	1	1	2	1	**10**	Low	Low
	Orientation Centre Preferred Alternative	2	4	1	1	2	2	**20**	Low	Low	2	4	1	1	2	1	**10**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																		
		Before mitigation									After mitigation									
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Decommission phase																		
	Boma	2	4	1	1	2	2	**20**	Low	Low	2	4	1	1	2	1	**10**	Low	Low
	Dig Site Building	2	4	1	1	2	2	**20**	Low	Low	0	4	1	1	2	1	**8**	Low	Low
	Schroda Dam Centre	2	4	1	2	2	2	**20**	Low	Low	2	4	1	2	2	1	**10**	Low	Low
Direct and Indirect Faunal Impacts	Hostel accommodation	4	4	2	1	2	4	**52**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Orientation Centre Alternative 1	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Orientation Centre Preferred Alternative	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Boma	2	4	1	1	2	3	**30**	Low	Low	2	4	1	0	1	3	**24**	Low	Low
	Dig Site Building	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low
	Schroda Dam Centre	2	4	2	1	2	4	**44**	Medium	Low	2	4	1	0	1	3	**24**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																		
		Before mitigation									After mitigation									
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Decommission phase																		
Surface Material Erosion	Hostel accommodation	6	3	1	4	3	4	**68**	Medium	Low	2	2	1	1	1	2	**14**	Low	Low
	Orientation Centre Alternative 1	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low
	Orientation Centre Preferred Alternative	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low
	Boma	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low
	Dig Site Building	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low
	Schroda Dam Centre	4	2	1	2	3	3	**36**	Low	Low	0	1	1	1	0	1	**3**	Low	Low
Dust Generation and Emissions	Hostel accommodation	2	2	2	1	5	5	**60**	Medium	Low	1	2	1	1	5	4	**40**	Medium	Low
	Orientation Centre Alternative 1	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low
	Orientation Centre Preferred Alternative	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low

Potential environ-mental impact/ Nature of impact	Project alternative	Environmental significance																		
		Before mitigation									After mitigation									
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significances	Cumulative	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	Total (SP)	Significance	Cumulative
Impact	Location	Decommission phase																		
	Boma	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low
	Dig Site Building	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low
	Schroda Dam Centre	2	2	2	1	5	4	**48**	Medium	Low	1	2	1	1	5	3	**30**	Low	Low
Positive Impact of Rehabilitating Development Footprint	Hostel accommodation	2	5	1	0	1	3	**27(+)**	Low	Low	4	5	2	0	1	5	**60 (+)**	Medium	Low
	Orientation Centre Alternative 1	2	5	1	0	1	3	**27(+)**	Low	Low	4	5	2	0	1	5	**60 (+)**	Medium	Low
	Orientation Centre Preferred Alternative	2	5	1	0	1	3	**27(+)**	Low	Low	4	5	2	0	1	5	**60 (+)**	Medium	Low
	Boma	2	5	1	0	1	3	**27(+)**	Low	Low	4	5	2	0	1	5	**60 (+)**	Medium	Low
	Dig Site Building	4	5	1	0	1	3	**33 (+)**	Low	Low	6	5	2	0	1	5	**70 (+)**	Medium	Low
	Schroda Dam Centre	2	5	1	0	1	3	**27(+)**	Low	Low	4	5	2	0	1	5	**60 (+)**	Medium	Low

10 RECOMMENDATION

Although the proposed development will completely transform the existing surface vegetation on the project footprint area, the low species diversity and lack of species of conservation concern has resulted in overall low EIS scores. The proposed development areas are therefore not of high conservational significance for habitat preservation or ecological functionality persistence in support of the surrounding ecosystem or broader vegetation type. No provincially protected species were found to be present on site.

Even though large-mammal tracks were observed in the development footprint, no important faunal species are expected to utilize the area for breeding or persistence habitat.

It is in the opinion of the specialist that the identified significant potential ecological impacts associated with destruction/damage to vegetation and habitat can be suitably reduced and mitigated to within acceptable levels.

Any risk of pollution due to inappropriate disposal of waste and litter can be mitigated to an acceptable level through the appropriate waste management and ensuring that no runoff or effluent from the construction site and operation enters the environment.

The proposed project is recommended to continue only if all recommended mitigation measures as per this ecological report are adequately implemented and managed during the construction phase, operational- and decommission phases of the proposed project. All necessary authorisations and permits must also be obtained prior to any commencement.

10.1 Conditions

- All mitigation measures should be strictly adhered to.
- No fauna or flora should be harmed moved, damaged or killed outside of the development footprint.
- Monitoring of the continued spread of alien invasive plants should be conducted as part of SANPARK's invasive alien species monitoring and eradication program.

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