PROPOSED DEVELOPMENT OF FOXWOOD DAM & ASSOCIATED INFRASTRUCTURE

Terrestrial Fauna and Flora Assessment Report

Authority Reference No: DEA Ref. No.: 14/12/16/3/3/1/2/817

OCTOBER 2015

Draft

Prepared for: Department of Water & Sanitation

NEMAI CONSULTING

Environmental, Social and OHS Consultants

P.O. Box 1673
Sunninghill
2157

147 Bram Fisher Drive
Ferndale
2194

Tel: 011 781 1730
Fax: 011 781 1731
Email: info@nemai.co.za

Title and Approval Page

Project Name:	Proposed Development of Foxwood Dam & Associated Infrastructure
Report Title:	Terrestrial Fauna and Flora Assessment Report
Authority Reference:	14/12/16/3/3/1/2/817
Report Status	Draft

Applicant	Department of Water & Sanitation

Prepared By:	Nemai Consulting			
NEMAI CONSULTING	☎	+27 11 781 1730		147 Bram Fischer Drive, FERNDALE, 2194
	🖷	+27 11 781 1730		
	✉	ronaldp@nemai.co.za		PO Box 1673, SUNNINGHILL, 2157
	🌍	www.nemai.co.za		
Report Reference:	10563			R-PRO-REP|20151015

Authorisation	Name	Signature	Date
Author:	Ronald Phamphe		15/10/15
Reviewed By:	Donavan Henning		09/11/15

Author's affiliations	**Professional Natural Scientist**: South African Council for Natural Scientific Professions	Ecological Science (400349/2)
	Professional Member of South African Institute of Ecologists and Environmental Scientists	
	Professional Member: South African Association of Botanists.	

.

Executive Summary

The Department of Water and Sanitation (DWS) is investigating the feasibility of developing a multi-purpose dam on the Koonap River outside of Adelaide in the Eastern Cape (EC). The proposed site is known as the Foxwood Dam site. Foxwood Dam could provide additional assurance of water supply to improve resilience of domestic water supply within the region. In addition, the project is being considered for implementation as a strategic initiative to mobilize the water resources in the area as a stimulus for socio-economic development in this rural, economically depressed region. This initiative would support the objectives of the National Development Plan and is consistent with the National Water Resource Strategy 2. The proposed project consists of the following:

- Major storage dam (Foxwood Dam);
- Bulk water supply pipeline and pump station;
- Gauging weir;
- Access roads (construction and operational phases);
- Quarry and borrow areas;
- Eskom supply to the dam and gauging weir;
- Relocate existing infrastructure (including water supply canal, R344, MR00639, Telkom telephone line and Eskom power line);
- Construction camp; and
- Permanent offices and accommodation for dam operator.

Nemai Consulting was appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment (EIA) for the proposed development of Foxwood Dam & Associated Infrastructure. A Terrestrial Fauna and Flora Assessment was undertaken as part of the EIA process in order to assess the impacts that the proposed development will have on the flora and fauna on site. The current ecological status and conservation priority of vegetation on the site were assessed. Potential faunal habitats were investigated in the study area and all mammals, birds, reptiles and amphibians known to occur on site or seen on site were recorded. Red data species (both fauna and flora) that are known to occur on site were investigated

The study area is situated within the Albany Centre of Endemism. According to Rutherford and Westfall (1994), the project footprint primarily falls within the Albany Thicket Biome with

the western access roads also lying within the Grassland Biome. Albany Thicket is highly transformed and shows high levels of degradation which is attributed to cultivation in the moister regions, herbivory by livestock in the driers regions and urban settlements along the coast. Within the Albany Centre of Endemism, 126 plant species are threatened with extinction. Game ranching, which is a popular land use in the region, is contributing towards the preservation of the biome.

The Grassland biome has a high biodiversity, ranked only below the Fynbos biome in terms of biodiversity in South Africa. The Grassland Biome is found mainly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. Grasslands are dominated by a single layer of grasses. Trees are absent, except in a few localised habitats and geophytes are often abundant.

The project footprint in relation to Terrestrial CBAs is as follows:

- Western part of the impoundment, gauging weir option 1, the majority of the routes for the MR00639 deviation and power line alignment A, sections of the deviation of the R344, power line alignment B, telephone line deviation, as well as Borrow Pits C3, C2, C6, C7, D1 and D2 fall within CBA 3;
- Northern and eastern sections of the impoundment, canal deviation, pipeline, dam permanent access road, gauging weir option 2, Borrow Pits C3, C2, C6, C7, D1 and D2, quarry, construction laydown areas, as well as the majority of routes for the deviation of the R344, power line alignment B and telephone line fall within CBA 2.

The impacts to vegetation in the study area mostly include cultivation (historical and current) and livestock. The land cover is predominantly natural, with pockets of cultivated land along the Koonap River and Mankazana River. The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices, except for the land in the south-eastern part of the project footprint which is owned by the municipality. Grazing by cattle is prevalent all over the basin. The riparian habitat of the Koonap River is relatively intact and the same applies to the Mankazana River. The vegetation encountered in the riparian zone is typical of the Great Fish Thicket. During the field surveys, only one threatened plant species was observed on site, namely *Haemanthus deformis* and only three (3) species of conservation importance were noted, namely *Crinum macowanii*, *Drimia altissima* and *Crassula rupestris*. *Haemanthus deformis* is listed as "*Near Threatened*", and whereas *Crassula rupestris* is listed as "*Rare*". *Crinum macowanii* and *Drimia altissima* are

listed as "*Declining"* . It is thus recommended that a botanist be appointed to perform a final walkthrough of the proposed Foxwood dam and its associated infrastructure in order to identify more sensitive plant species, and assist in identifying areas that require protection.

Alien invasive plant species within the study area were observed to occur in clumps, scattered distributions or as single individuals on site. Species such as *Cereus jamacaru*, *Xanthium strumarium, Cirsium vulgare* and *Opuntia ficus-indica*, (all Category 1b) were common in the study area. It is important that the Environmental Management Programme (EMPr) takes into account suitable methods to ensure that alien invasive plant species are controlled in areas affected by the construction.

Although isolated portions of northern and eastern sections of the impoundment, canal deviation, pipeline, dam permanent access road, gauging weir option 2, Borrow Pits C3, C2, C6, C7, D1 and D2, quarry, construction laydown areas, as well as the majority of routes for the deviation of the R344, power line alignment B and telephone line fall within CBA 2, which are associated with high biodiversity, the majority of the study areas are areas which have now been transformed through agricultural activities, grazing, roads, alien plant species, weeds and exotic plants. The distribution ranges of those species found during the Terrestrial Fauna and Flora are also not endemic to the project area.

The proposed development areas consisted of suitable habitats for mammalian species such as rivers, bushveld and patches of grasslands. During the field assessments, some small rodent species were observed on the study area but the identity of these species could not be verified. 16 mammal species were recorded on sites but many were confirmed to occur by locals. The traps set did not yield any positive results as no mammals were captured. The reasons for the low mammalian species diversity may be due to degradation of habitat in the study area due to anthropogenic impacts such as grazing and the fact that some species have been persecuted historically.

The following microhabitats were recorded in the study area, namely riparian habitat, patches of open grasslands, rivers and savanna woodlands/bushveld. Rivers represent important habitat for many species, including Black Stork, Yellow-billed Stork, Saddle-billed Stork, Ducks, Geese and a variety of other water birds. The wooded riparian habitat alongside a river may provide habitat for various species such as the Hamerkop, African Darter, various cormorants, kingfishers, bee-eaters, robinchats and numerous smaller species. Rivers also represent feeding areas for fish eating raptors such as the African Fish Eagle. Grasslands on the other hand represent a significant foraging and/or hunting area for

many bird species. The patches of grasslands are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as being hunting habitat for raptors such as Martial Eagle, African Marsh Harrier, Lesser Kestrel and Black-shouldered kite. Most parts of the dam basin are characterised by the savanna woodlands and these are primarily associated with the Rivers, and areas of overgrazing. Species such as Martial Eagle, African Crowned Eagle, and Lanner Falcon may occur in this micro-habitat type. Nineteen (19) bird species were recorded during the field survey. Species recorded were common and widespread and were of no conservation importance. No Red Data bird species associated with the proposed development areas were recorded within the study area.

The reptile assessments indicate that the remaining patches of grasslands, bushveld, rocky areas and riparian vegetation are of high importance to reptiles. Some sections of the study areas have resulted in increased habitat modification and transformation, especially due to agricultural activities and grazing, which result in increased human presence and associated disturbances (illegal reptile collecting, indiscriminate killing of all snake species, frequent fires). The increased habitat destruction and disturbances are all causal factors in the alteration and disappearance of reptile diversity in the area (Jacobsen, 2005). Termite mounds were present on the study area. Some large mounds had been damaged by previous foraging by Antbears. This resulted in the exposing of tunnels into the interior of the termite mound. Old termite mounds offer important refuges especially during veld fires as well as cold winter months for numerous frog, lizard, snake and smaller mammal species. Large number of species of mammal, birds, reptiles and amphibians feed on the emerging alates (winged termites). No termite mounds were destroyed during the brief field survey. All overturned rock material was carefully replaced in its original position. **Table 16** indicates reptile species recorded on proposed development areas are of no conservation importance and were recorded all over the project areas.

The Koonap River, as well as the Adelaide Dam hold water on a permanent basis and are probably important breeding habitat for most of the frog species which occur at the study area. No frog species were recorded on site during the field assessment even though commonly occurring frog species such as Common Platannas, Guttural Toads, Common Cacos and Bubbling Kassinas could not be discounted. The river system is considered to be the most sensitive from an amphibian conservation perspective. However, the proposed developments are unlikely to have a negative impact on amphibians in the study area.

Large areas will be cleared during the construction phase of the project and all disturbed areas will need to be appropriately rehabilitated to ensure that a cumulative impact is not caused in this regard. Through the Search, Rescue and Relocation Plans, a concerted effort will be made to prevent the loss of red data, protected and endangered fauna and flora species that will be affected by the project. With the relocation of these species to suitable habitat, the cumulative impact to biodiversity could be adequately managed. In terms of the alternatives provided for this project, Tables 20, 21, 22, 23 and 24 compare the Major Storage Dam, Gauging Weir, Power Line Deviation, Western Access Road and Laydown Area of the proposed development of Foxwood Dam & Associated Infrastructures on factors associated with the terrestrial flora and fauna.

Contents

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION AND BACKGROUND

The Department of Water and Sanitation (DWS) is investigating the feasibility of developing a multi-purpose dam on the Koonap River outside of Adelaide in the Eastern Cape (EC). The proposed site is known as the Foxwood Dam site. Foxwood Dam could provide additional assurance of water supply to improve aresilience of domestic water supply within the region. In addition, the project is being considered for implementation as a strategic initiative to mobilize the water resources in the area as a stimulus for socio-economic development in this rural, economically depressed region. This initiative would support the objectives of the National Development Plan and is consistent with the National Water Resource Strategy 2. The proposed project consists of the following:

- Major storage dam (Foxwood Dam);
- Bulk water supply pipeline and pump station;
- Gauging weir;
- Access roads (construction and operational phases);
- Quarry and borrow areas;
- Eskom supply to the dam and gauging weir;
- Relocate existing infrastructure (including water supply canal, R344, MR00639, Telkom telephone line and Eskom power line);
- Construction camp; and
- Permanent offices and accommodation for dam operator.

Nemai Consulting was appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment (EIA) for the proposed development of Foxwood Dam & Associated Infrastructure. A Terrestrial Fauna and Flora Assessment was undertaken as part of the EIA process in order to assess the impacts that the proposed development will have on the flora and fauna on site. The current ecological status and conservation priority of vegetation on the site were assessed. Potential faunal habitats were investigated in the study area and all mammals, birds, reptiles and amphibians known to occur on site or seen on site were recorded. Red data species (both fauna and flora) that are known to occur on site were investigated

1.1 **Objectives of the survey**

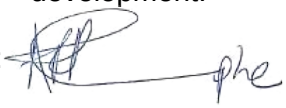
In order to achieve the aim stated above, the following objectives are to be achieved:

- To apply relevant literature to determine the diversity and eco-status of the plants, mammals, reptiles and amphibians on the proposed development areas;
- To carry out a field surveys to gain an understanding of the diversity and eco-status of taxa which inhabit the proposed study area, as well as the presence of unique habitats that might require further investigation or protection;
- To assess the current habitat and conservation status of plant and animal species on the study sites;
- To comment on ecological sensitive species/areas;
- To assess the possible impact of the proposed project on these taxa and/or habitats;
- To list the species on sites and to recommend necessary actions in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance;
- To provide management recommendations to mitigate negative and enhance positive impacts of the proposed development areas; and
- To recommended the preferred alternative from a terrestrial ecological perspective.

2 DECLARATION OF INDEPENDENCE

The specialist investigator declares that I:

- Act as independent specialist for this project.
- Consider myself bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- Do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
- Will not be affected by the outcome of the environmental process, of which this report forms part of.
- Do not have any influence over the decisions made by the governing authorities.
- Do not object to or endorse the proposed developments, but aim to present facts and my best scientific and professional opinion with regards to the impacts of the development.

Signature: 

3 RELEVANT LEGISLATION AND GUIDELINES

The following pieces of legislation are relevant to this project.

- The Constitution, 1996 (Act 108 of 1996)–Section 24;
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- The white paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997);
- National Environmental Management Act, 1998 (Act No. 107 of 1998);
- National Water Act, 1998 (Act No. 36 of 1998);
- National Forests Act, 1998 (Act No 84 of 1998)
- National Environmental Management Protected Areas Act, 2003 (Act No 57 of 2003);
- National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004);
- Eastern Cape Biodiversity Conservation Plan Technical Report, 2007 and
- Department of Environmental Affairs (DEA)'s Draft Discussion Document on Environmental Offsets (2015).

4 STUDY AREA

The project area is situated in central part of the Eastern Cape, in the Amatole District Municipality and Nxuba Local Municipality. From a southern direction the proposed dam wall site (coordinates 32˚40'30"S, 26˚16'0"E) is accessed via the R344 (off the R63) (**Figures 1 & 2**).

The town of Adelaide and the Bezuidenhoutville Township are located to the south-east of the dam. Adelaide lies 37 km west of Fort Beaufort, on the R63 between Bedford and Fort Beaufort, and is situated in the foothills of the Winterberg Mountain range. Adelaide serves as an administrative and decision-making centre in the region. It is predominantly a farming town, in a beef, mutton, wool and citrus farming district.

The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices, except for the land in the south-eastern part of the project footprint which is owned by the municipality.

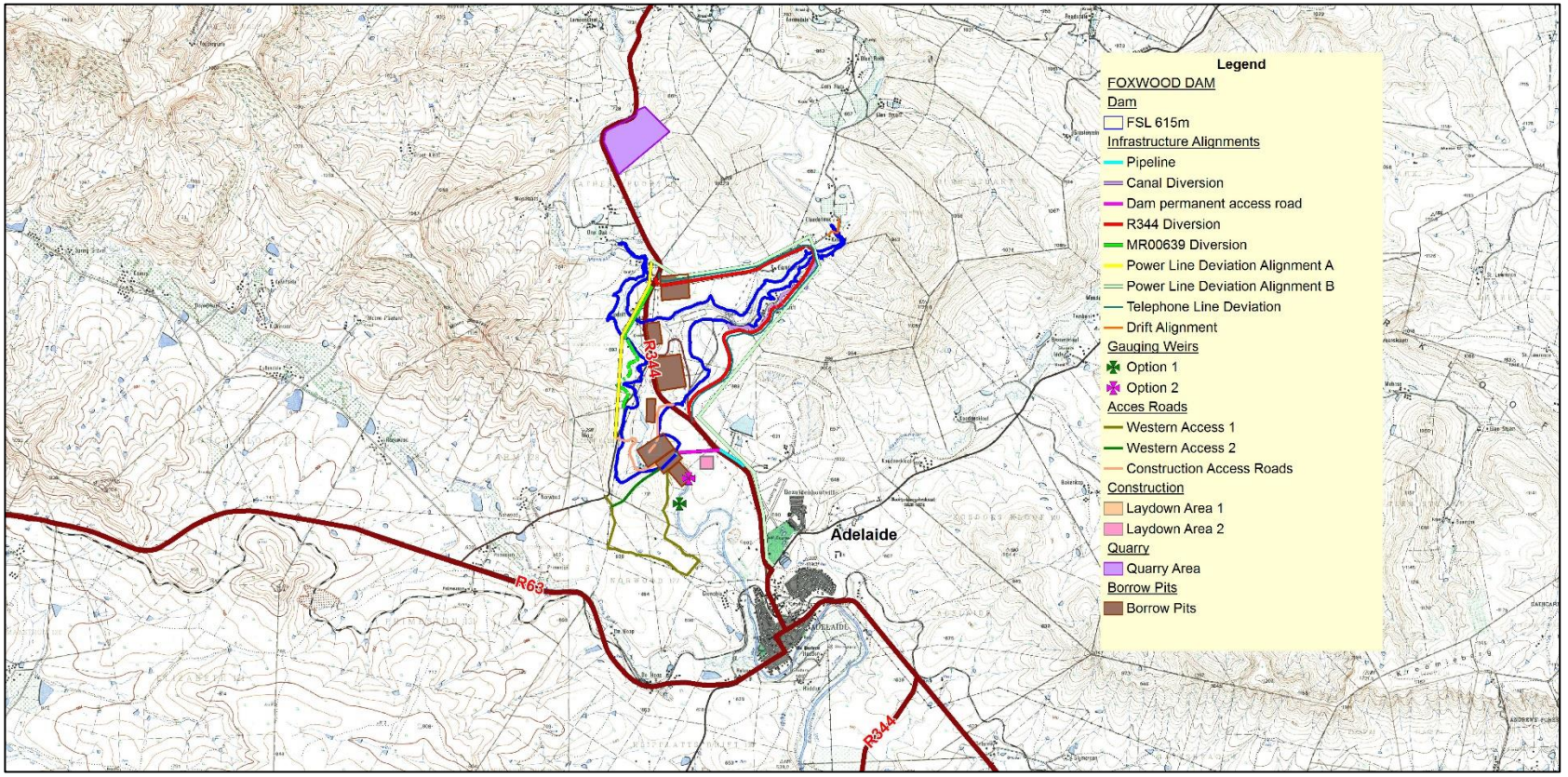


Figure 1: Locality Map

Figure 2: A collage of images illustrating the proposed development areas

4.1 Project Description

The project consists of the components listed in the Table 1 below.

Table 1. List of Project Components

Project Components	Associated Infrastructure
Major storage dam (Foxwood Dam)	1. Dam wall 2. Embankment 3. Dam outlet works (including dam intake tower, tunnel and outlet valve house) 4. Access roads (construction and operation) 5. Quarry and earthfill borrow areas 6. Electrical supply 7. Construction camp (temporary) 8. Operator's offices and accommodation (permanent)
Bulk water supply pipeline	1. Pump station 2. Pipeline and associated structures (chambers, Cathodic Protection measures, AC mitigation measures, pipeline markers)
Gauging Weir	1. Weir and associated instrumentation 2. Access roads (construction and operation) 3. Electrical supply 4. Satellite construction camp
Relocation of Infrastructure	1. Relocate water supply canal 2. Relocate R344 3. Relocate MR00639 4. Relocate Telkom telephone line 5. Relocate Eskom power line

4.2 Alternative to Project Components

The alternatives to the project components, as listed in **Table 2**, are discussed in the subsections to follow. An option selection process was carried out on a number of dam construction types and sizes during the feasibility process with evaluation being undertaken based on selected major bulk material quantities.

Table 2. Alternatives to the project components

Component	Alternatives
Major Storage Dam	Dam type
Gauging Weir	Option 1
	Option 2
Power Line Deviation	Alignment A
	Alignment B
Laydown Area	Option 1
	Option 2

4.2.1 Dam Type and Capacity

In order to select the preferred dam type of four types of dam were considered during the Technical Feasibility Study, based on topographical and geotechnical conditions, namely:

- Earthfill (**Figure 3**);
- Rockfill (**Figure 4**)
- Concrete Gravity (**Figure 5**), and
- Composite Gravity Spillway and Earthfill (**Figures 6 & 7**).

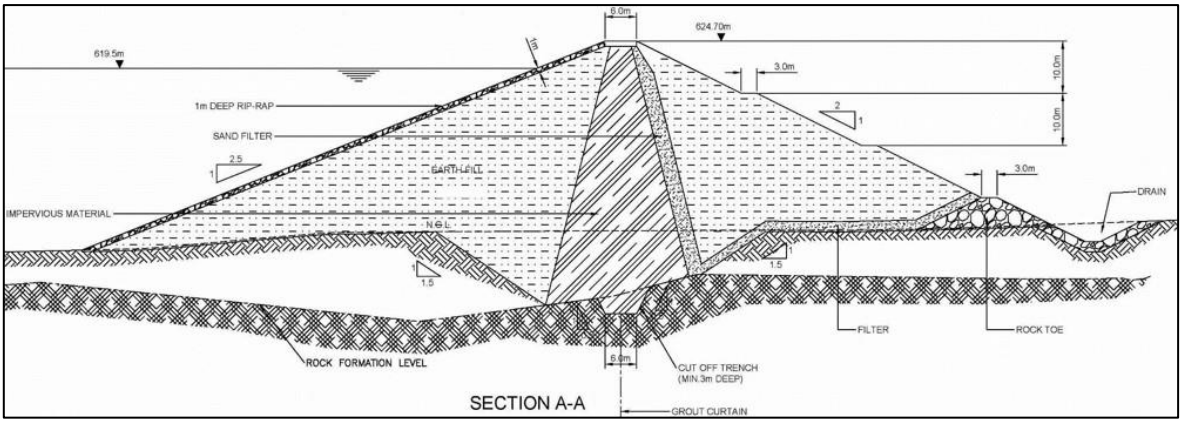


Figure 3: Cross section of Earthfill dam type

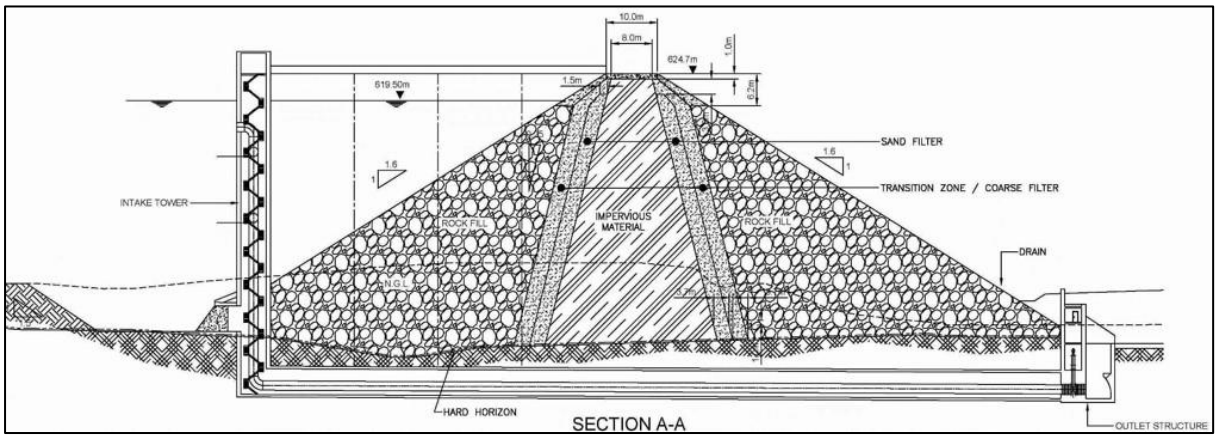


Figure 4: Cross section of Rockfill dam type

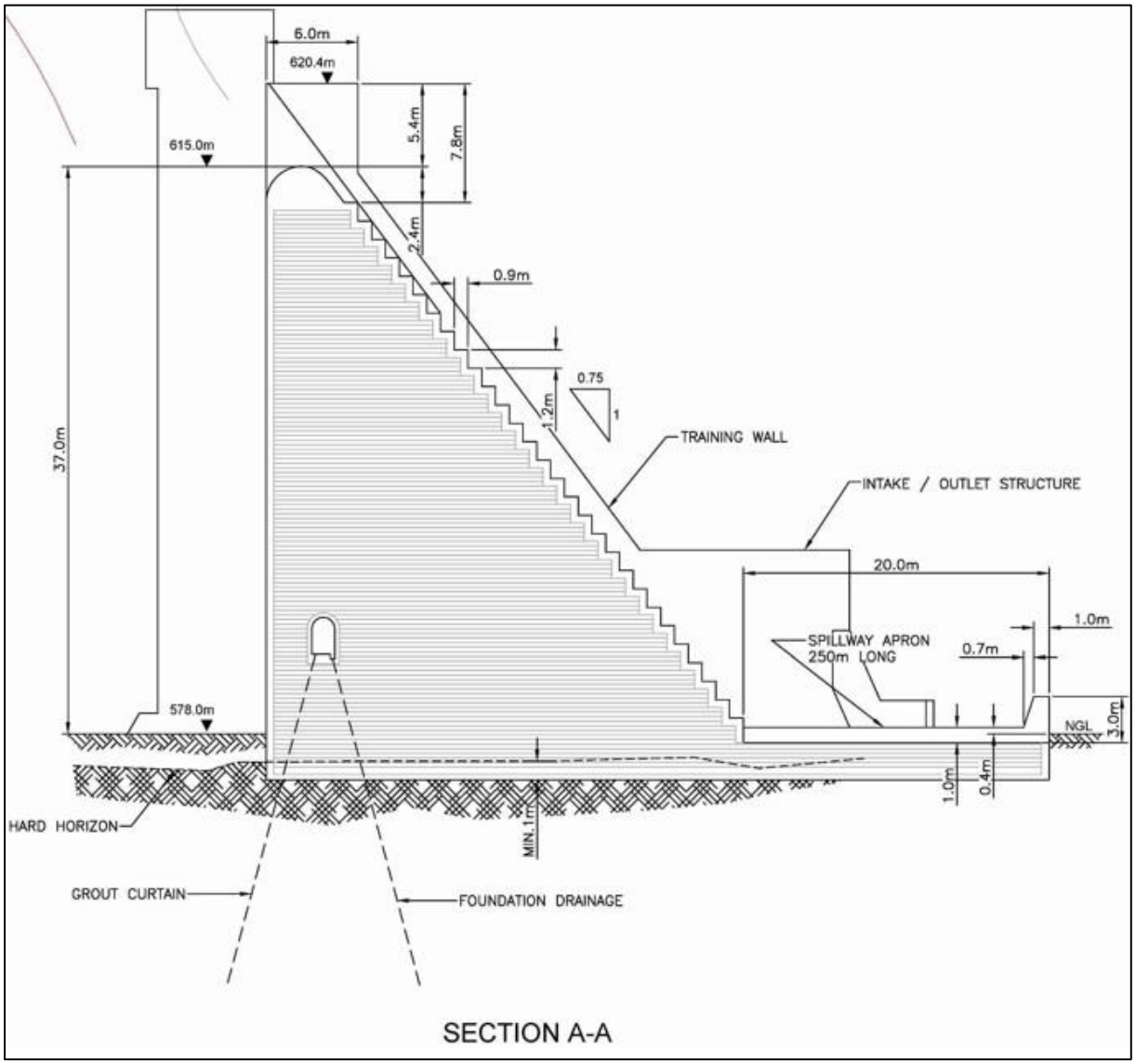


Figure 5: Cross section of Concrete dam type

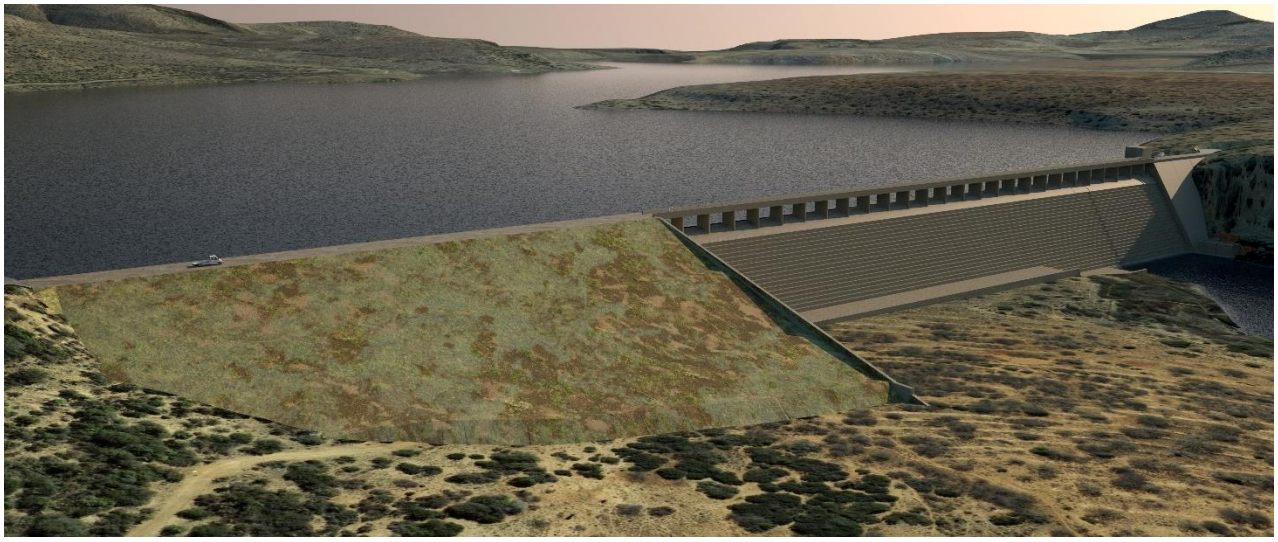


Figure 6: 3 dimensional view of Composite Gravity Dam with Earthfill Embankment on the right flank

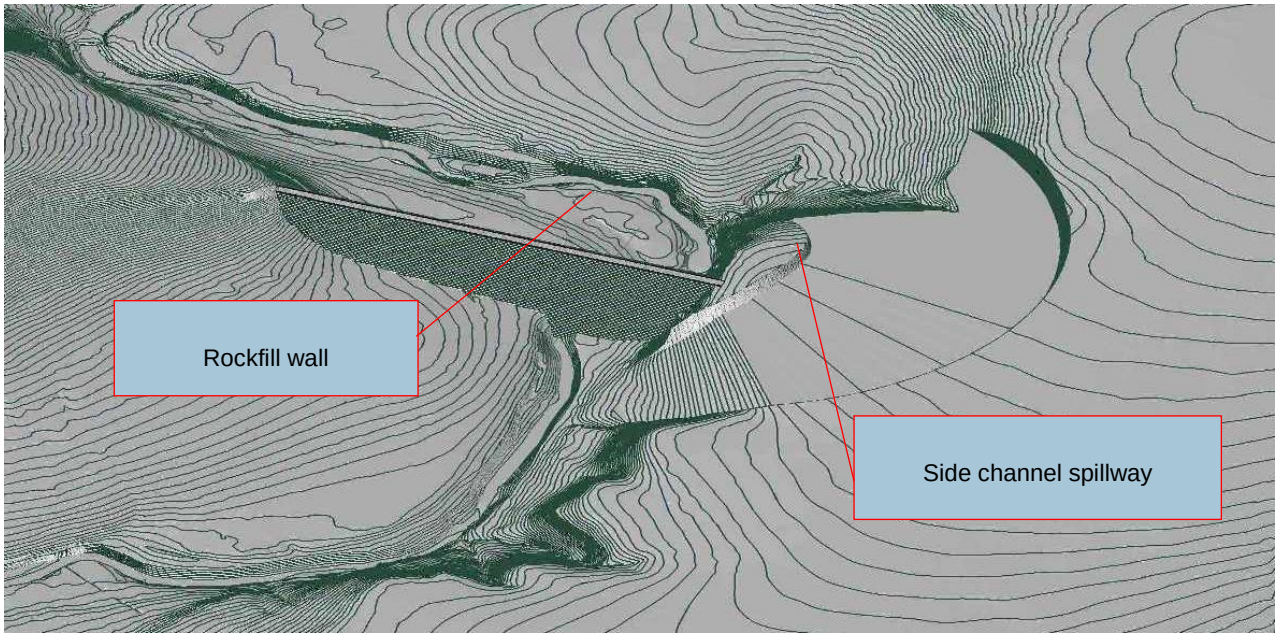


Figure 7: 3 dimensional view of Rockfill wall with side-channel spillway

4.2.2 Relocation of Power Line and Telephone Line

An existing 11 kV over-head power line is routed along the western side of the dam basin through the area of inundation (see photograph in **Figure 8**). It will be necessary to relocate this power line around the extent of the basin. Two possible routes are illustrated in **Figure 9**. An existing overhead telephone line is routed along the existing R344, which will be

affected by the proposed dam basin and will need to be relocated. Refer to proposed new route shown in **Figure 9**.

Figure 8: Photograph of existing power line along MR00639

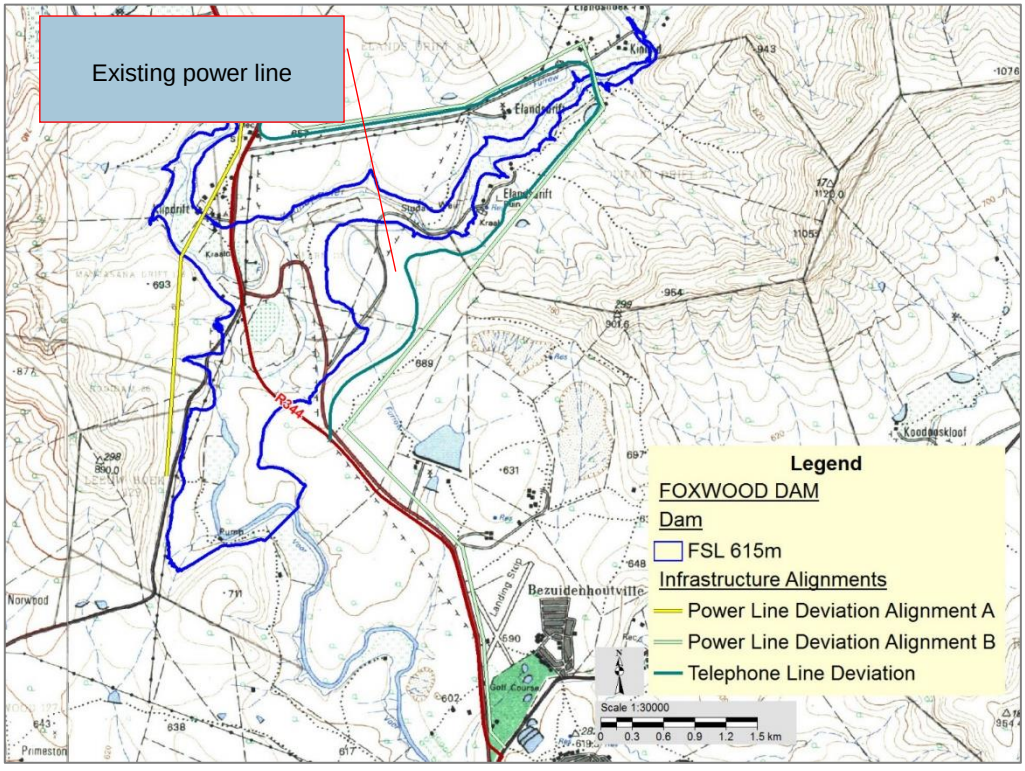


Figure 9: Proposed relocation of power line and telephone line

4.2.3 Gauging Weir Location

The following key factors are generally considered when selecting a site for a gauging weir:

- Adequate foundation conditions;
- Steep slope downstream from the site and a gradual to flat slope upstream;
- A bend in the river, upstream and downstream, must be avoided to facilitate straight flowlines over the weir;
- The river banks must be stable; and
- Easy access to the site.

A gauging station is a site on a river which has been selected, equipped and operated to provide the basic data from which systematic records of water level (stage) and discharge may be derived. Essentially it consists of a natural or artificial river cross-section where a continuous record of stage can be obtained and where a relation between stage and discharge can be determined (Lambie, 1978).

The project requires that a gauging weir be constructed below Foxwood Dam to determine the discharges (i.e. spills and releases) for application in the dam balance. The alternative sites for the weir structure are shown in **Figure 21**.

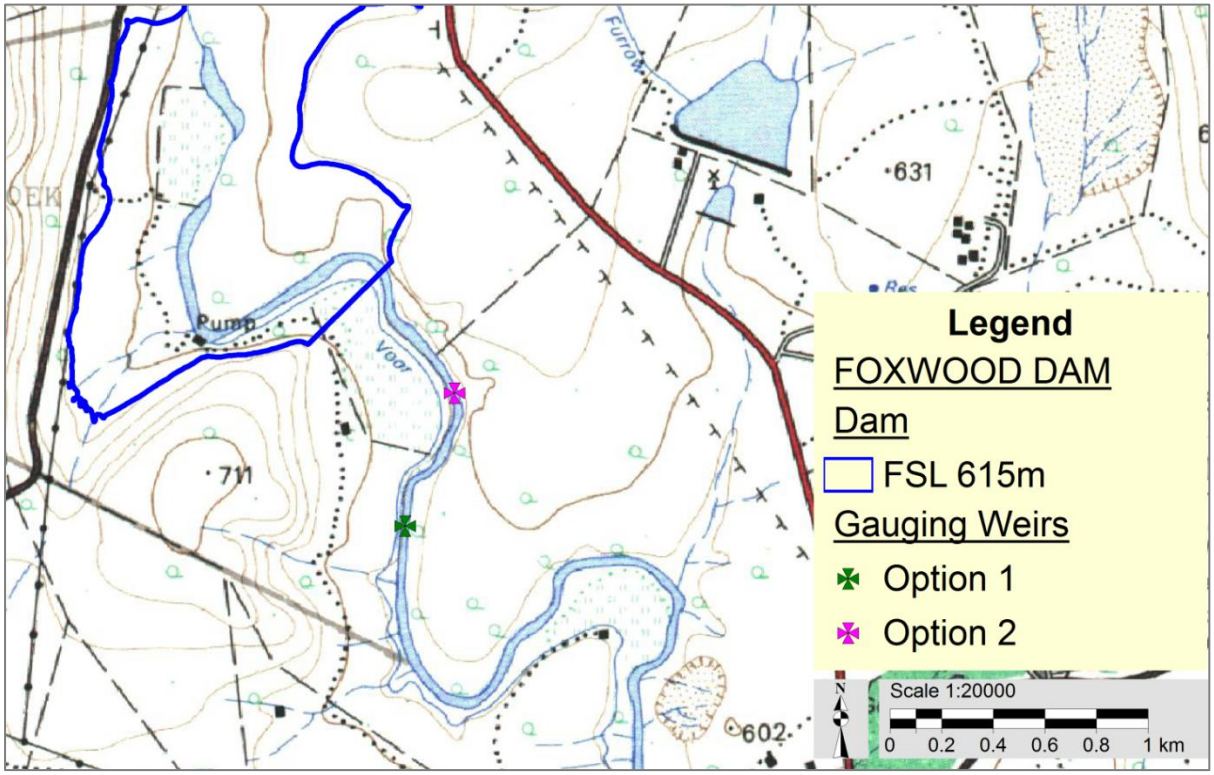


Figure 10: Proposed gauging weir site options

4.2.4 Borrow Pits and Quarry

The borrow pits and quarry identified as part of the geotechnical investigations during the Technical Feasibility Study to source construction material are shown in **Figure 11**. A photograph of the quarry site is provided in **Figure 12**.

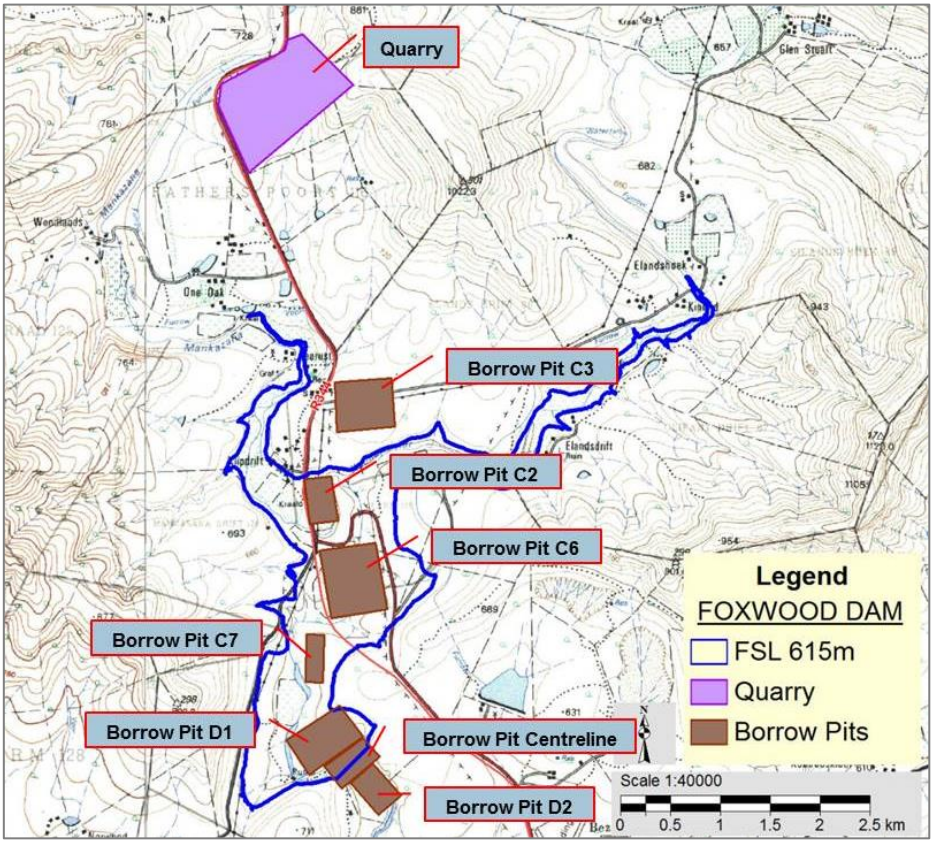


Figure 11: Borrow pits and quarry site

Figure 12: Photograph of proposed quarry site

4.2.5 Access Roads

The proposed access roads for the project include the following (refer to **Figure 13**):

- Permanent access roads –
  - Access road to dam wall (from R344);
  - Access road to right bank crest (from MR00639);
  - Access road to right bank earth embankment (from MR00639).
- Temporary access roads –
  - Access roads to construction laydown areas (from R344);
  - Access road to right bank (from MR00639);

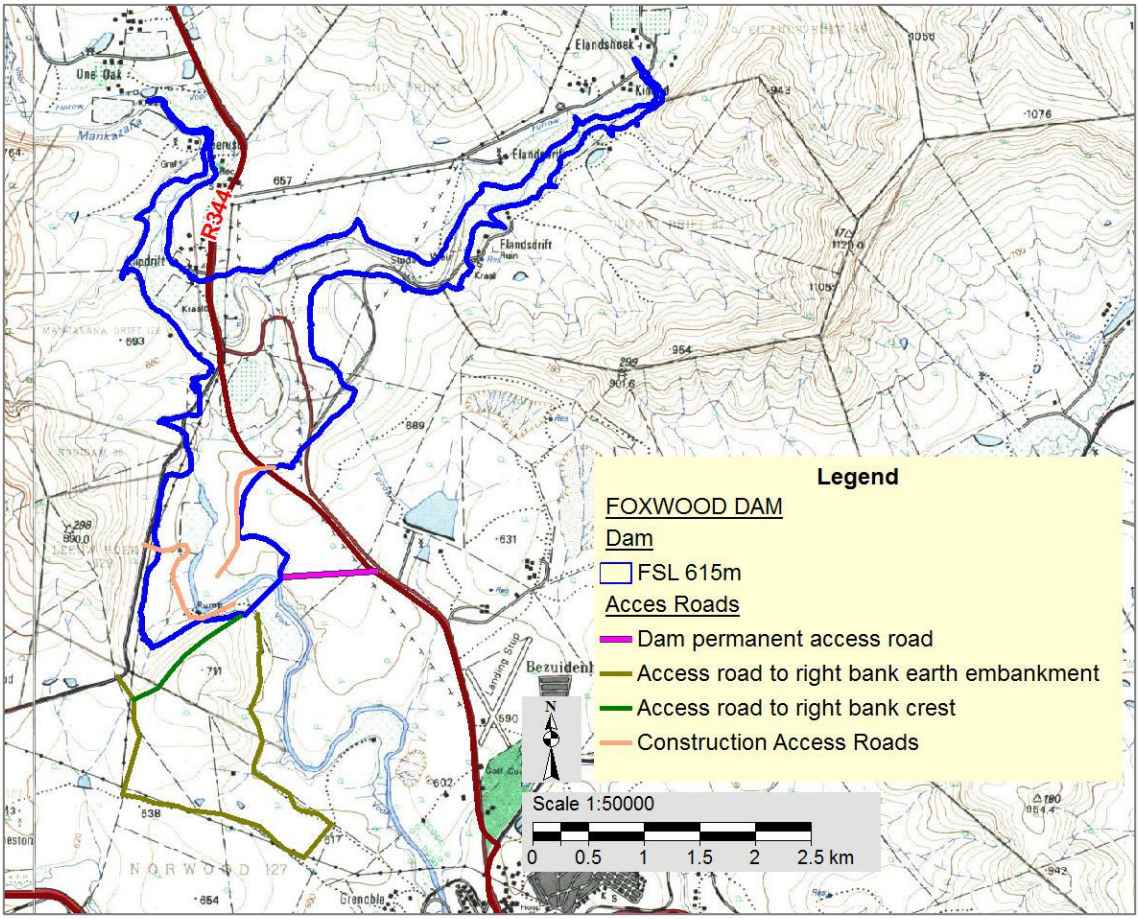


Figure 13: Proposed access roads

4.2.6 Construction Laydown Area

A laydown area is an area that has been cleared for the temporary storage of equipment and supplies to be used during the construction period. Laydown areas are usually covered with

rock and/or gravel to ensure accessibility and safe manoeuvrability for transport and off-loading of vehicles.

The proposed options for the laydown area are shown in **Figure 14**. The approximate size of the laydown area is 250 m by 250 m (62 500 m^2).

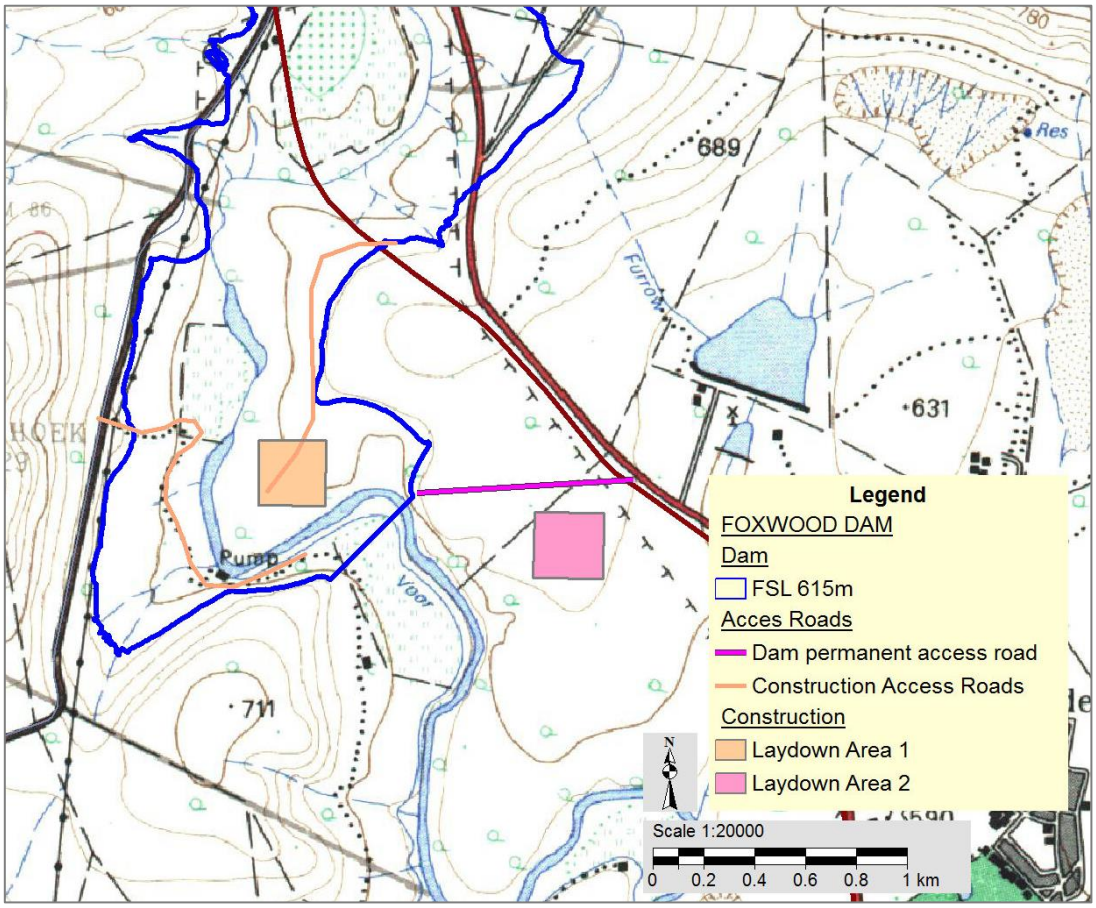


Figure 14: Proposed Construction Laydown Areas

5 METHODOLOGY

The White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997) and the National Environmental Management Act 1998 (Act No 107 of 1998) specify that due care must be taken to conserve and avoid negative impacts on biodiversity, as well as the sustainable, equitable and efficient use of biological resources.

5.1 **Flora**

The flora assessment consisted of two complementary approaches:

- A desktop analysis, which included literature review, topographical maps, and Google Earth imagery; and
- Site visits were conducted in March 2015.

Satellite imagery of the area was obtained from Google Earth and was studied in order to acquire a three dimensional impression of the topography and land use and also to identify potential “hot-spots” or specialized habitats such as rivers, wetlands and grasslands on the proposed development sites.

The Pretoria Computerised Information System (PRECIS) list of Red Data plants recorded in the 3226CB quarter degree grid square was obtained from SANBI (http://posa.sanbi.org/searchspp.php). The list was consulted to verify the record of occurrence of the plant species seen in the vicinity of the proposed development sites. The sites sampled are only a very small portion of the whole grid and so habitats suitable for certain species in the PRECIS list may not be present at the areas sampled. The vegetation map published in Mucina and Rutherford (2006) was consulted to identify vegetation units that are found in the study area. The desktop component of the study of the habitats of the red-data-listed plants was conducted before the site visits.

The habitats on the proposed development sites were inspected in a random zigzag fashion, paying particular attention to areas that at first sight appeared to be sensitive. All general observations were noted such as grasses, herbs (forbs), shrubs and trees. The habitats suitable for Red Data listed species known to occur in the quarter degree grid squares were examined intensively for the presence of such species. Attention was also paid to the occurrence of medicinal, alien and declared weed species. Field guides such as van Wyk *et al.,* (1997), Pooley (1998), van Oudshoorn (1999), Scott-Shaw, (1999) and Manning (2009) were utilised during the field work and in instances where confirmation was required; pictures of plant species were emailed to Prof van Wyk from University of Pretoria for identification.

Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983). CARA defines weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, can also be of alien origin but may serve useful

purposes as ornamental plants, as sources of timber, or other benefits such as medicinal uses (Henderson, 2001). These plants need to be managed and prevented from spreading.

Invasive species are controlled by the National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004) - Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014. The AIS Regulations list four (4) different categories of invasive species that must be managed, controlled or eradicated from areas where they may cause harm to the environment, or that are prohibited to be brought into South Africa. Invasive plant species are divided into four categories:

- Category 1a: Invasive species which must be combatted and eradicated. Any form of trade or planting is strictly prohibited.
- Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form or trade or planting is strictly prohibited.
- Category 2: Invasive species, or species deemed to be potentially invasive, in which a permit is required to carry out a restricted activity. Category 2 species include commercially important species such as pine, wattle and gum trees.
- Category 3: Invasive species which may remain in prescribed areas or provinces. Further planting, propagation or trade, is however prohibited.

According to van Oudtshoorn (1999), a grass species reacts to grazing in one of two ways: it can either become more or less abundant. **Table 3** describes the classification of grasses.

Table 3. Classification of grasses (van Oudtshoorn, 1999).

Class	Description	Examples
Decreasers	Grasses that are abundant in good veld, but that decrease in number when the veld is overgrazed or undergrazed.	*Themeda trianda, Digitaria eriantha*
Increaser 1	Grasses that are abundant in underutilised veld. These grasses are usually unpalatable, robust climax species that grow without any defoliation	*Hyperthelia dissoluta, Trachypogon spicatus*
Increaser 2	Grasses that are abundant in overgrazed veld. These grasses increase due to the disturbing effect of overgrazing and include mostly pioneer and subclimax species	*Aristida adscensionis, Eragrostis rigidor*
Increaser 3	Grasses that are commonly found in overgrazed veld. These are usually unpalatable, dense climax grasses	*Sporobolus africanus, Elionurus muticus*
Invaders	All plants that are not indigenous to an area. These plants are mostly pioneer plants and are difficult to eradicate	*Arundo donax*

5.2 Mammals

Mammal site visits were conducted in March 2015 and during these visits, the observed and presence of mammals associated with the recognized habitat types of the study sites were recorded during the day. No night surveys were undertaken. Adjoining properties were also scanned for important faunal habitats. During the site visits, mammals were identified by spoor, burrow and visual sightings through random transect walks. Terrestrial and arboreal rats, mice (non-volant small mammals) were sampled using LFAHD-P Sherman large folding aluminium heavy duty perforated traps (23x7.5x9cm/250grams) (**Figure 15**) that were set approximately 20 m apart and baited with oats and butter and left overnight. Placement of traps were either on the ground near to burrow systems and areas of potential foraging activity such as logs and base of trees, or low branches situated above the ground. Locals were interviewed to confirm occurrences or absences of species.

Figure 15. Sherman traps used for small mammals such as rats and mice

5.3 **Avifauna**

Site visits were conducted in March 2015 in order to record the presence of bird species associated with the habitat systems on the studied site and to identify possible sensitive areas. The study site was surveyed on foot and any bird species seen or heard were recorded. Adjoining properties were also scanned for important bird species and/or habitats. Birds were identified visually using 10X42 Bushnell Waterproof binoculars where necessary, by call and from feathers. Where necessary, identifications were verified using Sasol Birds of Southern Africa (Sinclair *et al.,* 2002) and the Chamberlain Guide to Birding Gauteng (Marais and Peacock, 2008).

5.4 **Reptiles**

The reptile assessment was conducted in March 2015 and this was during the day. During the field visits, the observed and derived presence of reptiles associated with the recognised habitat types of the study site was recorded. This was done with due regard to the known distributions of Southern African reptiles. Reptiles were identified by sightings during random transect walks. Possible burrows or other reptile retreats were inspected for any inhabitants

5.5 **Amphibians**

According to Carruthers (2001), amphibians are extremely sensitive to habitat transformation and degradation. The identification technique which was used for this study was frog's call. According to Carruthers (2001), a frog's call is a reliable means of identifying species. Frog calls were compared with pre-recorded calls from du Preez and Carruthers (2009)'s cd and identified from this comparison. Samplings were conducted on the moist to semi-aquatic areas. During these surveys; fieldworks were augmented with species lists compiled from personal records; data from the South African frog atlas project (SAFAP) (1999-2003) and published data.

6 EASTERN CAPE BIODIVERSITY CONSERVATION PLAN

A regional conservation plan was published by the Department of Water Affairs and Forestry (DAFF). This plan indicated several areas requiring some level of conservation within the strategic premise to either systematically include these areas into conservation areas or to

protect these areas from irresponsible development. These areas known as Critical Biodiversity Areas (CBA) have been categorised in different levels of conservation need (**Table 4**) (Berliner & Desmet, 2007). **Figure 16** indicates the CBA in relation to the proposed development of Foxwood dam & associated infrastructure.

Table 4. Categories and criteria used to map Critical Biodiversity Areas in the Eastern Cape (Berliner & Desmet, 2007)

CBA Categories& CBA Field Codes	Features used to define category	Map Layer Name	CBA Sub-Category Name	CBA Field
Terrestrial Environment Terrestrial Critical Biodiversity Area (CBA) Level 1				
T1	National critically endangered vegetation types (ecosystems): The Amount of remaining intact SA vegetation type is less than representation target.	SA vegetation	Critically endangered ecosystems	CBA_saveg
T1	STEP critically endangered vegetation types	STEP vegetation	Critically endangered ecosystems	CBA_step
T1	Maloti-Drakensberg critically endangered vegetation types	MDTP vegetation	Critically endangered ecosystems	CBA_mdtpvg
T1	National Forest Assessment critically endangered forest patches	Forests patches	Critically endangered ecosystems	CBA_forest
T1	80-100% irreplaceable planning units: Areas definitely required to meet representation targets for biodiversity features (SA vegetation types, expert mapped areas)	Planning units	Irreplaceable sites	CBA_marx
T1	KZN C-Plan minset R1 & R2 minset display categories	KZN CPlan	Irreplaceable sites	CBA_kzn
T1	Important forest clusters: Clusters identified in the forestry planning process as critical (All forest clusters with IRR>=10 (50%))	Forest clusters	Irreplaceable forest clusters	
T1	MDTP priority habitats selected (Selection sequence values = 1, 2, 4 & 6)	MDTP priority habitat	Irreplaceable sites	CBA_mdtpmx
Terrestrial CBA Level 2				
T2	50-90% irreplaceable sites. This criterion is not included here. By definition this implies all remaining areas of critical and endangered vegetation types, and most areas of vulnerable vegetation types not included in T1. This criterion is covered by T2-level ecosystem status	No Layer	Near irreplaceable sites	
T2	Endangered SA vegetation types. The area of intact vegetation remaining of a vegetation type is within 15% of the set representation target	SA vegetation	Endangered ecosystems	CBA_saveg
T2	Endangered STEP vegetation types	STEP vegetation	Endangered ecosystems	CBA_step

CBA Categories& CBA Field Codes	Features used to define category	Map Layer Name	CBA Sub-Category Name	CBA Field
T2	Endangered MDTP vegetation types	MDTP vegetation	Endangered ecosystems	CBA_mdtpvg
T2	Endangered forest patches	Forest patches	Endangered ecosystems	CBA_forest
T2	All expert mapped areas less than 25 000ha in size. Includes expert data from this project, STEP birds, SKEP, Wild Coast, Pondoland and marine studies.	Expert areas	Known important sites for biodiversity	CBA_expert
T2	All other Forest Clusters (with 500m buffers)	Forest clusters	Forest clusters	CBA_forpat
T2	1km coastal buffer (forests are not added to this as these are captured elsewhere)	Coastal buffer	Coastal buffer	CBA_coast
T2	MDTP priority habitats selected (Selection sequence values = 3, 5 & 7)	MDTP negotiable habitat	Ecological corridors	CBA_mdtpmx
Corridor1	Ecological corridors and/or named macro-ecological corridors from existing studies (i.e. from STEP, Wild Coast/Pondoland, SEA, etc.) and expert mapped	Corridor1	Ecological corridors	CBA_corr1
Corridor2	Ecological corridors identified in this project using an Integrated corridor design for the whole province that considers all (not only thicket) terrestrial priorities as well as aquatic priorities whilst minimizing conflict with existing production landscapes. Design units are sub-QCs.	Corridor2	Ecological corridors	CBA_corr2
Terrestrial CBA Level 3				
T3	Vulnerable SA vegetation types	SA vegetation	Vulnerable ecosystems	CBA_saveg
T3	Vulnerable STEP vegetation types	STEP vegetation	Vulnerable ecosystems	CBA_step
T3	Vulnerable MDTP vegetation types	MDTP vegetation	Vulnerable ecosystems	CBA_mdtpvg

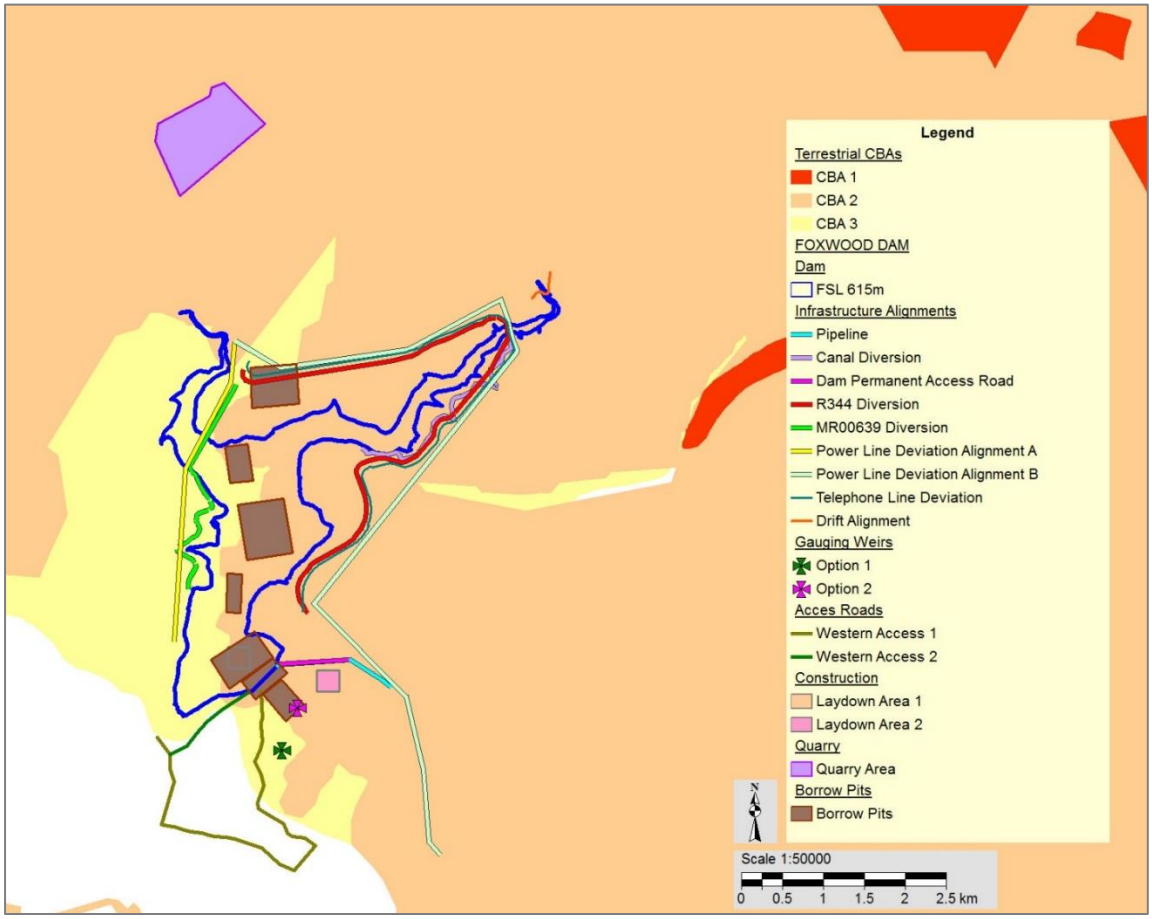


Figure 16. Map indicating CBA in relation to the proposed development of Foxwood dam & associated infrastructure.

The project footprint in relation to Terrestrial CBAs is as follows:

- Western part of the impoundment, gauging weir option 1, the majority of the routes for the MR00639 deviation and power line alignment A, sections of the deviation of the R344, power line alignment B, telephone line deviation, as well as Borrow Pits C3, C2, C6, C7, D1 and D2 fall within CBA 3;
- Northern and eastern sections of the impoundment, canal deviation, pipeline, dam permanent access road, gauging weir option 2, Borrow Pits C3, C2, C6, C7, D1 and D2, quarry, construction laydown areas, as well as the majority of routes for the deviation of the R344, power line alignment B and telephone line fall within CBA 2.

7 LIMITATIONS AND GAPS

The constraints or limitations to the survey included:

- The majority of threatened plant species are seasonal and only flower during specific periods of the year and so desktop surveys were used to provide additional information based on the current state of the receiving environment.
- Species of conservation concern are hard to find and to identify, consequently the species described in this report do not comprise an exhaustive list.
- Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage and Nemai Consulting can thus not accept responsibility for conclusions and mitigation measures made in good faith based information gathered or databases consulted at the time of the investigation.

8 REGIONAL VEGETATION

The study area is situated within the Albany Centre of Endemism (**Figure 17**). According to Rutherford and Westfall (1994), the project footprint primarily falls within the Albany Thicket Biome with the western access roads also lying within the Grassland Biome (**Figure 18**).

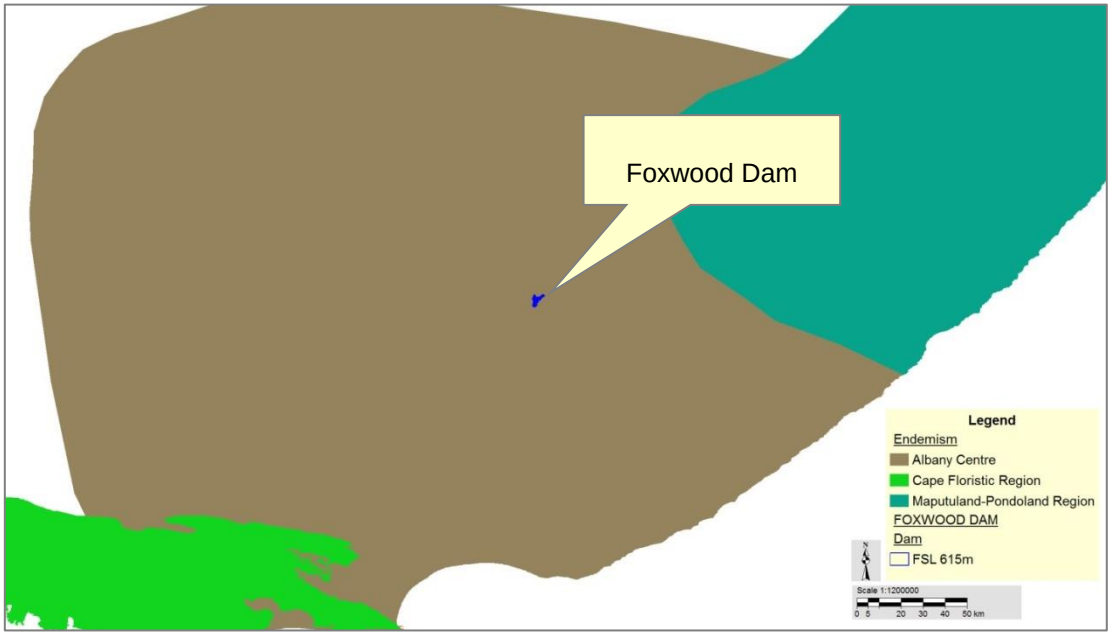


Figure 17: Endemism in project area

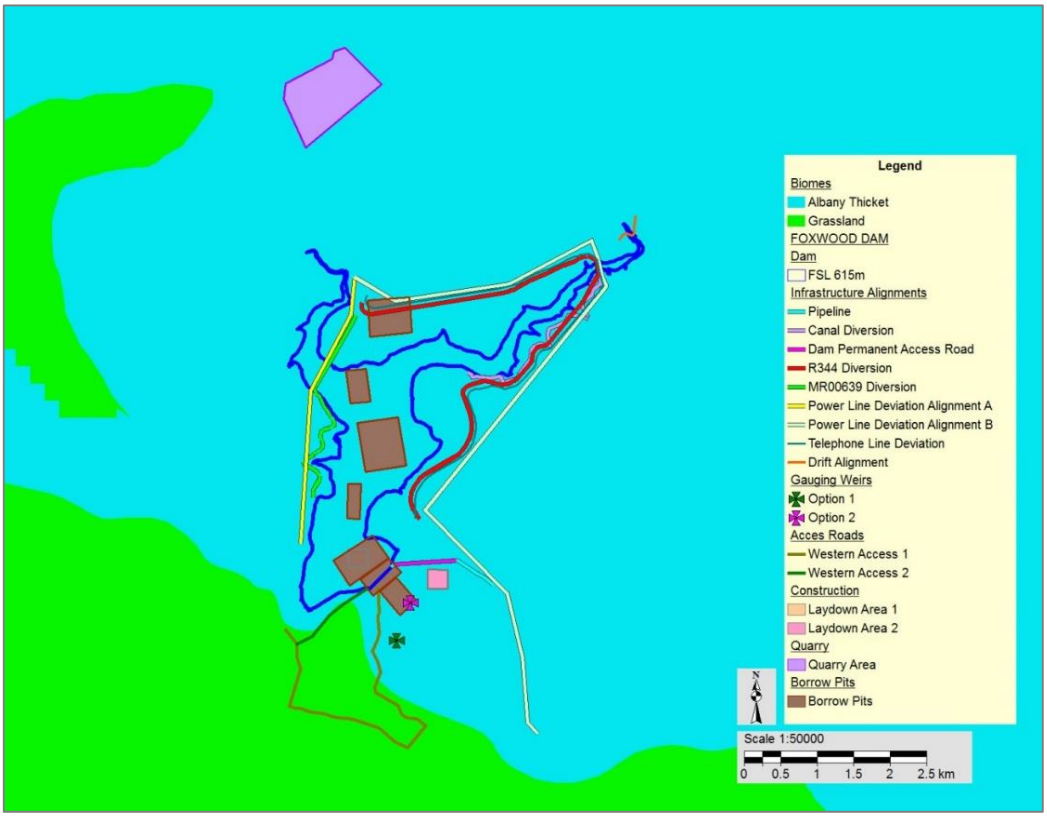


Figure 18: Biomes in project area

Albany Thicket occurs in the semi-arid areas of the Eastern and Western Cape. The vegetation of the Albany Thicket Biome is described as a dense, woody, semi-succulent and thorny vegetation type, of an average height of 2-3 m, and relatively impenetrable in an unaltered condition. It comprises a broad spectrum of physiognomic types reflecting gradients in climate, geology, soil and herbivory. There is a wide range of growth forms and a high diversity of plant species, including leaf and stem succulents, deciduous and semi-deciduous woody shrubs and dwarf shrubs, geophytes, annuals and grasses (Rutherford & Westfall (1994).

Albany Thicket is highly transformed and shows high levels of degradation which is attributed to cultivation in the moister regions, herbivory by livestock in the driers regions and urban settlements along the coast. Within the Albany Centre of Endemism, 126 plant species are threatened with extinction. Game ranching, which is a popular land use in the region, is contributing towards the preservation of the biome.

The Grassland biome has a high biodiversity, ranked only below the Fynbos biome in terms of biodiversity in South Africa (Driver *et. al*., 2004). The Grassland Biome is found mainly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. Grasslands are dominated by a single layer of grasses. Trees are absent, except in a few localised habitats and geophytes are often abundant (Low and Rebelo, 1996).

The vegetation types in the study area are shown in **Figure 19**. All the project components lie within the Great Fish Thicket, except for the quarry which is located within EC Escarpment Thicket and sections of the western access roads that cross through the Bedford Dry Grassland.

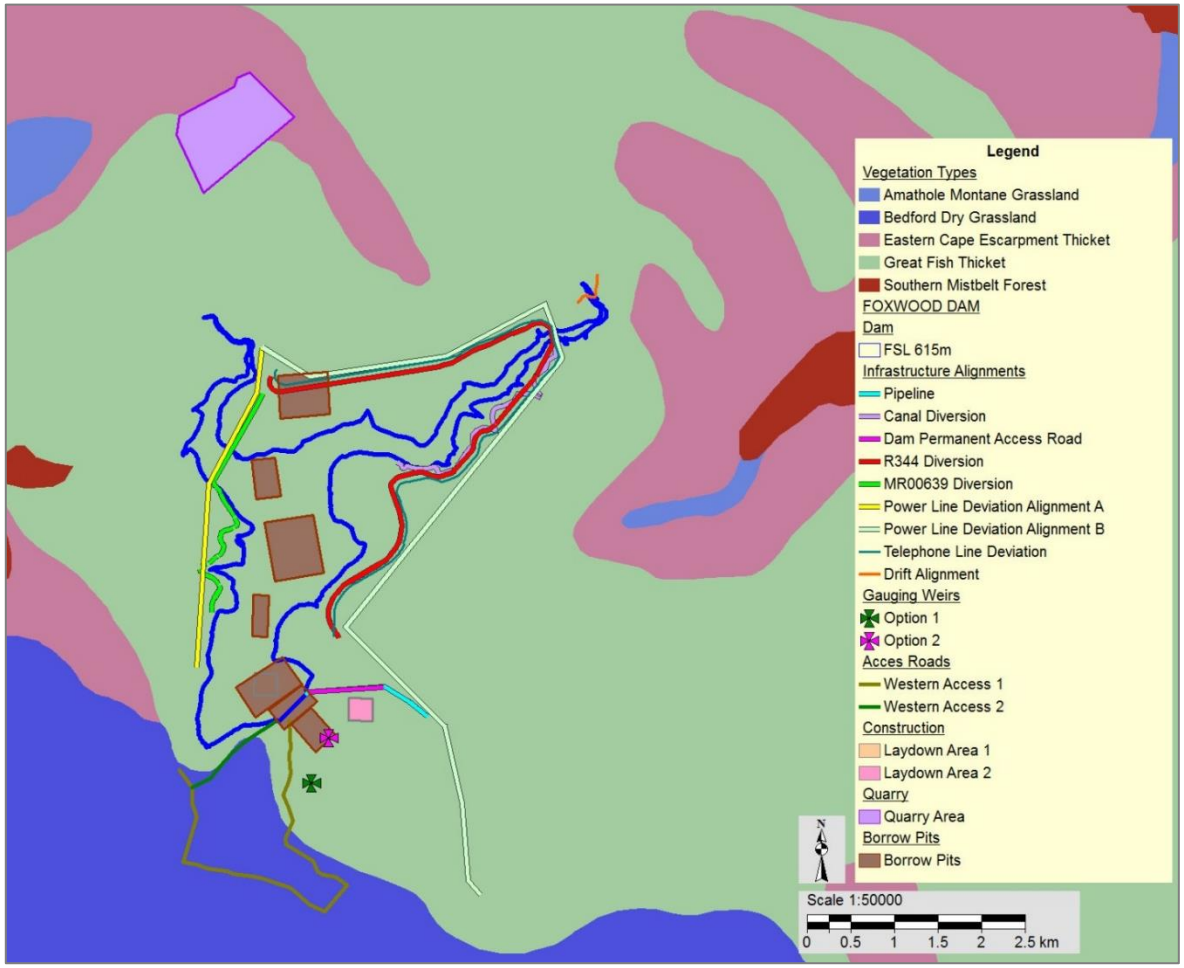


Figure 19: Vegetation types in project area

The description of each vegetation type follows.

- Great Fish Thicket vegetation type:

It is distributed in Eastern Cape Province. It is mainly in the lower Great Fish River and Keiskamma River Valleys (including the smaller intervening river valleys nearer the coast) extending up the Great Fish River Valley northwards to Cookhouse and into the southernmost part of the Cradock District. Extending up the Keiskamma River Valley as far as its confluence with the Tyume River. It also includes the lower reaches of the Koonap River and part of its upper reaches immediately north of Adelaide, as well as parts of the Kat River and Little Fish River Valleys (Mucina and Rutherford, 2006).

It is found in steep slopes of deeply dissected rivers supporting short, medium and tall thicket types, where both the woody trees and shrubs and the succulent component are well developed, with many spinescent shrubs. *Portulacaria abra* is locally dominant, decreasing in relative abundance and is replaced by *Euphorbia bothae* with increasing aridity. With

increasing moisture status on southern aspects and in the riparian zone, *P afra* is replaced by woody elements and tall emergent *Euphorbia tetragona* and *E. triangularis*. There is distinct clumping of the vegetation, which is linked to zoogenic mounds, formed principally by termites (*Microhodotermes viator*), earthworms (Microchaetus), mole rats (*Cryptomus hottentotus*) and aardvarks (*Orycteropus afer*)—these islands of concentrated nutrients and moisture have richer, deep soils and are often occupied by long-lived woody shrubs and trees such as *Pappea capensis* and *Boscia oleoides* and provide deep soils for endemic geophytes. The closed canopy of the *Portulacaria afra*-dominated thicket is another distinctive feature of parts of the Great Fish Thicket. There is high heterogeneity within this vegetation unit, which has been divided into nine distinct subtypes ((Mucina and Rutherford, 2006).

This vegetation type is listed as **Least threatened** with a national conservation target of 19%. A total of 6% of this vegetation unit is protected in seven statutory reserves, especially in the Great Fish River Complex Nature Reserve and 4.5% in addition in at least nine private conservation areas. Great Fish Thicket has not been radically altered, only 3% by cultivation and 1 % by urbanisation (Mucina and Rutherford, 2006).

- Bedford Dry Grassland vegetation type

It is distributed in Eastern Cape Province. It is found south of the Winterberg Mountains from Bruintjieshoogte and Somerset East in the west to Bedford and Adelaide, and to Fort Beaufort in the east. The eastern section lies north of the Great Fish River Valley (Mucina and Rutherford, 2006).

It occurs in gently undulating plains supporting open, dry grassland interspersed with *Acacia karroo* woodland vegetation (especially along the drainage lines). The grassland is relatively short (10—100 cm) and is dominated by *Digitaria argyrograpta, Tragus koelerioides, Eragrostis curvula* and *Cymbopogon caesius*. It contains a dwarf shrubby component of karroid origin in the southern and southwestern parts of its range (Mucina and Rutherford, 2006).

This vegetation type is listed as **Least threatened** with a national conservation target of 23%. None is conserved in statutory conservation areas and only 1 % is conserved in private reserves (Kingsdale Game Farm, Woodlands Game Reserve, Glen Avon Falls Kloof and Kruizemuntfontein Natural Heritage Sites). Some 3% transformed due to cultivation (Mucina and Rutherford, 2006).

A photograph showing the dominant vegetation in the central part of the dam basin is provided in **Figure 20**. Impacts to vegetation in the study area mostly include cultivation (historical and current) and livestock.

Figure 20: View of vegetation in dam basin

9 RESULTS AND DISCUSSION

9.1 **Flora**

9.1.1 **Desktop study results**

The proposed development site is located within the 3226CB quarter degree square in terms of the 1:50 000 grid of South Africa. SANBI uses this grid system as a point of reference to determine any Red Data plant species or any species of conservation importance occurring in South Africa. This can be used to determine the list of species which may potentially occur within an area. **Table 5** provides details on the Red Data plant species

which could potentially occur in the study area as they were recorded in 3226CB grid cell, which the proposed development falls into. The definitions of the Red data status are provided in **Table 6**. Due to the fact that threatened species have been historically noted in the area, it is imperative that detailed searches for these rare/threatened and protected species are made during the appropriate time of year when plants are likely to be more visible.

Table 5. The following threatened plant species have been recorded in grid cells 3226CB, and could potentially be found on the proposed development site

Family	Species	Threat status	SA Endemic	Growth forms
Cornaceae	*Curtisia dentata* (Burm.f.) C.A.Sm.	NT	No	Shrub
Iridaceae	*Watsonia amatolae* Goldblatt	Rare	No	Geophyte

***Note**: NT=Near Threatened*

Table 6. Definitions of Red Data status (Raimondo *et. al*., 1999)

Symbol	Status	Description
NT	Near Threatened	A taxon is Near Threatened when available evidence indicates that it is close to meeting any of the five International Union for Conservation of Nature (IUCN) criteria for Vulnerable and it is therefore likely to qualify for a threatened category in the near future.
	Rare	A taxon is rare when it does not meet any of the four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to the five IUCN criteria.

9.1.2 Plant communities and species recorded along the proposed development areas

The land cover is predominantly natural, with pockets of cultivated land along the Koonap River and Mankazana River. The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices, except for the land in the south-eastern part of the project footprint which is owned by the municipality. Grazing by cattle is prevalent all over the basin (**Figure 21**).

Figure 21: Cattle grazing in dam basin

The Foxwood Dam catchment is rural in nature with agriculture representing a major land use (**Figure 22**). Water related infrastructure is dominated by run of river abstractions or diversions for domestic use and for the irrigation of crops.

Figure 22: Example of agricultural land use downstream of proposed dam site

As shown in **Figure 23**, the riparian habitat of the Koonap River is relatively intact and the same applies to the Mankazana River. The vegetation encountered in the riparian zone is typical of the Great Fish Thicket.

Figure 23: Riparian habitat of the Koonap River

All of the species recorded in the proposed development areas are listed in **Table 7** below. Species of conservation importance recorded on sites are indicated in **BOLD**. All alien invasive and weeds are indicated with an Asterix (*).

Table 7. Plant species recorded on the proposed Foxwood dam & associated infrastructure

Scientific Name	Ecological status	Infrastructure Alignments									Gauging Weir		Access Roads		Quarry	Burrow Pits							Laydown Areas	
		Pipeline	Canal Diversion	Dam permanent access road	R344 Diversion	MR00639 Diversion	Power Line Deviation Alignment A	Power Line Deviation Alignment B	Telephone Line Deviation	Drift alignment	Option 1	Option 2	Western Access 1	Western Access 2		BP D1	BD C7	BP D2	BP Centreline	BD C6	BP C2	BP C3	1	2
Acacia ataxacantha			✓										✓	✓										
Acacia karroo	Medicinal	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Acacia caffra					✓			✓	✓							✓	✓			✓			✓	✓
**Acacia mearnsii*	Invader 2															✓		✓	✓	✓	✓			
**Agave sisalana*	Invader 2				✓	✓	✓	✓	✓															
Aloe ciliaris var. *ciliaris*																✓	✓	✓		✓	✓		✓	✓
Acacia xanthophloea	Medicinal															✓							✓	✓
Aloe ferox			✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓						✓	✓
Aloe marlothii		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓					✓	✓
Aloe arborescens																✓							✓	✓
**Alternanthera pungens*	Weed					✓	✓			✓						✓	✓			✓				
**Arundo donax*	1b				✓			✓	✓		✓					✓				✓	✓			
Ammocharis coranica																✓				✓			✓	✓
Asparagus virgatus	Medicial	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓							✓	✓
**Atriplex nummularia*	Invader 2																✓			✓				
Berkheya setifera				✓		✓			✓	✓							✓							
Bulbine abyssinica					✓			✓	✓							✓							✓	
Bulbine narcissifolia					✓			✓	✓							✓							✓	
Brunsvigia sp.																✓							✓	
**Caesalpinia decapetala*	1b				✓			✓	✓	✓						✓								
**Canna indica*	1b				✓			✓	✓	✓						✓				✓				
Carissa haematocarpa																✓							✓	✓
Celtis africana				✓	✓			✓	✓				✓	✓		✓				✓				
**Cereus jamacaru*	1b	✓		✓	✓	✓	✓	✓	✓							✓							✓	
**Cirsium vulgare*	1b		✓		✓	✓		✓	✓	✓							✓							
Combretum erythrophyllum	Medicinal				✓	✓	✓	✓	✓		✓	✓				✓		✓	✓					
**Conyza bonariensis*	Weed	✓	✓			✓	✓		✓	✓							✓				✓			

Scientific Name	Ecological status	Infrastructure Alignments									Gauging Weir		Access Roads		Quarry	Burrow Pits							Laydown Areas	
		Pipeline	Canal Diversion	Dam permanent access road	R344 Diversion	MR00639 Diversion	Power Line Deviation Alignment A	Power Line Deviation Alignment B	Telephone Line Deviation	Drift alignment	Option 1	Option 2	Western Access 1	Western Access 2		BP D1	BD C7	BP D2	BP Centreline	BD C6	BP C2	BP C3	1	2
Coddia rudis			✓		✓			✓	✓				✓	✓		✓				✓	✓			
Cotyledon papillaris	Ranknenta																			✓				
Crassula rupestrus	**Rare**	✓		✓												✓							✓	✓
Crinum macowanii	**Declining**	✓		✓												✓							✓	✓
Cynodon dactylon	Increaser 2	✓	✓	✓		✓	✓	✓	✓	✓						✓	✓			✓	✓		✓	✓
Cussonia spicata		✓		✓	✓			✓	✓						✓	✓		✓	✓			✓	✓	✓
Cyperus esculentus	Medicinal															✓								
**Datura stramonium*	1b				✓			✓	✓		✓													
Deloperma sp																				✓				
Dichrostachys cinerea			✓			✓	✓										✓							
Digitaria eriantha	Decreaser	✓		✓	✓	✓	✓	✓	✓								✓			✓				
Diospyros lycioides																✓								
Drimia altissima	**Declining**					✓	✓									✓				✓			✓	
**Eucalyptus camaldulensis*	Invader 2	✓		✓	✓	✓	✓	✓	✓															
Euphorbia ingens		✓		✓	✓			✓	✓						✓	✓						✓		
Euphorbia tirucalli	Medicinal	✓		✓	✓			✓	✓						✓	✓							✓	✓
Ehretia rigida		✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Gerbera pilloselloides	Medicinal	✓		✓																				
Haemanthus deformis	**Near Threatened**															✓							✓	
Hyparrhenia hirta	Increaser 1					✓	✓																	
**Hypochaeris radicata*	Weed	✓			✓	✓	✓	✓	✓	✓						✓				✓	✓			
**Jacaranda mimosifolia*	Invader 3					✓	✓																	
Kalanchoe rotundifolia	Medicinal	✓		✓												✓		✓	✓				✓	✓
Lampranthus sp.		✓		✓																				
Ledebouria ovatifolia	Medicinal															✓							✓	✓
Lippia javanica	Medicinal															✓							✓	✓
Leonotis leonurus	Medicinal															✓								
Lycium acutifolium			✓																					

Scientific Name	Ecological status	Infrastructure Alignments									Gauging Weir		Access Roads		Quarry	Burrow Pits							Laydown Areas	
		Pipeline	Canal Diversion	Dam permanent access road	R344 Diversion	MR00639 Diversion	Power Line Deviation Alignment A	Power Line Deviation Alignment B	Telephone Line Deviation	Drift alignment	Option 1	Option 2	Western Access 1	Western Access 2		BP D1	BD C7	BP D2	BP Centreline	BD C6	BP C2	BP C3	1	2
**Melia azedarach*	1b		✓																					
Melinis repens	Increaser 2	✓	✓	✓		✓	✓	✓	✓	✓						✓					✓			
Malephora sp																✓	✓							
Olea europaea subsp. *africana*											✓													
**Opuntia ficus-indica*	1b	✓	✓	✓	✓			✓	✓							✓	✓	✓		✓			✓	✓
Oxalis obliquifolia	Medicinal	✓		✓												✓							✓	
**Plantago major*	Weed	✓									✓					✓	✓			✓			✓	
Peltophorum africanum		✓		✓				✓	✓		✓	✓	✓			✓				✓				
Pentanisia angustifolia							✓	✓	✓	✓														
**Persicaria lapathifolia*					✓	✓	✓	✓	✓	✓	✓	✓				✓								
**Populus deltoides*	Invader 3				✓			✓	✓															
Portulacaria afra		✓		✓																				
Phragmites australis	Thatching				✓	✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓			
**Prunus persica*					✓			✓	✓															
**Psidium guajava*					✓			✓	✓															
Pteridium aquilinum					✓			✓	✓	✓	✓	✓												
Pseudognaphalium luteo-album	Medicinal				✓			✓	✓															
Ptaeroxylon oblique					✓			✓	✓	✓														
**Ricinus communis*	1b				✓			✓	✓		✓	✓				✓								
Richardia brasiliensis	Weed				✓			✓	✓															
**Rubus fruticosus*	Invader 2				✓	✓	✓	✓	✓		✓	✓				✓								
**Salix babylonica*	Invader 2															✓		✓		✓	✓			
**Schinus molle*	Invader 3																			✓				
Schoenoplectus corymbosus					✓	✓	✓	✓	✓	✓	✓	✓												
Schotia afra		✓		✓									✓		✓	✓		✓		✓	✓		✓	✓
Searsia dentata																		✓		✓		✓		
Searsia lancea		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓		✓	✓	✓
Searsia lucida																✓							✓	✓

Scientific Name	Ecological status	Infrastructure Alignments									Gauging Weir		Access Roads		Quarry	Burrow Pits							Laydown Areas	
		Pipeline	Canal Diversion	Dam permanent access road	R344 Diversion	MR00639 Diversion	Power Line Deviation Alignment A	Power Line Deviation Alignment B	Telephone Line Deviation	Drift alignment	Option 1	Option 2	Western Access 1	Western Access 2		BP D1	BD C7	BP D2	BP Centreline	BD C6	BP C2	BP C3	1	2
**Senna septemtrionalis*	Invader 3																✓							
**Sesbania punicea*	1b				✓			✓	✓	✓	✓	✓												
Setaria sphacelata var. sphacelata	Decreaser				✓			✓	✓	✓														
Sporobolus africanus			✓		✓	✓	✓	✓	✓	✓	✓													
**Tagetes minuta*	Weed										✓													
**Tecoma capensis*	Weed										✓													
Themeda triandra	Decreaser	✓		✓												✓				✓			✓	✓
Tylecodon sp.																				✓				
Typha capensis					✓	✓	✓	✓	✓	✓	✓	✓				✓		✓		✓	✓			
Vangueria infausta					✓	✓	✓	✓	✓															
**Verbena bonariensis*	1b				✓	✓	✓	✓	✓	✓	✓													
**Xanthium spinosum*	1b																✓							
**Xanthium strumarium*	1b				✓			✓	✓	✓														
**Zinnia peruviana*											✓	✓												
Ziziphus mucronata	Medicinal	✓		✓		✓	✓				✓	✓	✓			✓		✓				✓	✓	✓
Zornia capensis					✓	✓	✓	✓	✓	✓						✓		✓			✓			

9.1.3 Alien invasive species recorded in the proposed Foxwood dam & associated infrastructure

Alien invader plants are species that are of exotic, non-native or of foreign origin that typically invade undeveloped or disturbed areas. Invaders are a threat to our ecosystem because by nature they grow fast, reproduce quickly and have high dispersal ability (Henderson, 2001). This means that invader plants and seeds spread rapidly and compete for the growing space of our own indigenous plants. If these invader plants out-compete indigenous plants there is a shift in the species composition of the area and the changing our plant communities causes a decline in species richness and biodiversity (Henderson, 2001). Many factors allow alien invasive plants to succeed, particularly the absence of their natural enemies. This makes it difficult to control invasive plants without bringing in natural enemies and eliminating the high competition they have over the indigenous vegetation (Bromilow, 2010). Alien invasive plant species within the study area were observed to occur in clumps, scattered distributions or as single individuals on site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of invader species (Especially Category 1) must be removed and eradicated (Henderson, 2001). Species such as *Cereus jamacaru* (**Figure 24**), *Xanthium strumarium* (**Figure 25)** *Cirsium vulgare* (**Figure 26**) and *Opuntia ficus-indica* (**Figure 27)**, (all Category 1b) were common in the study area.

Figure 24: Alien plant *Cereus jamacaru* recorded along the MR00639 Diversion

Figure 25. Alien plant *Xanthium strumarium* recorded along the R344 Diversion route

Figure 26. Alien plant *Cirsium vulgare* recorded along the Canal Diversion

Figure 27. Alien plant *Opuntia ficus-indica* recorded along the Pipeline and Dam Permanent Access Road

There are methods to eradicate alien invasive species, such as:

- Mechanical methods - felling, removing or burning invading alien plants;
- Chemical methods - using environmentally safe herbicides;
- Biological control - using species-specific insects and diseases from the alien plant's country of origin and
- Integrated control - combinations of the above three approaches. Often an integrated approach is required in order to prevent serious impacts (http://www.dwaf.gov.za/wfw/default.aspx).

It is important that the Environmental Management Programme (EMPr) takes into account suitable methods to ensure that alien invasive plant species are controlled in areas affected by the construction.

9.1.4 Threatened Species and Species of Conservation Concern and medicinal plants recorded on the proposed Foxwood dam & associated infrastructure

According to the National Environmental Management Biodiversity Act 2004 (Act 10 of 2004 as amended), there is a dire need to conserve biodiversity in each province and as such, all natural and/or indigenous resources must be utilised sustainably. At the proposed sites, there are a number of plants that are used to provide medicinal products (**Table 7**). In some cases there is merit in protecting or translocating them before the proposed development commences. While many of these plants are indigenous or exotic weeds that have medicinal value (and for which no action is necessary with respect to conservation), their economic value means that they are considered to be in need of protection.

According to the South African Red data list categories done by SANBI (**Figure 28**), **threatened species** are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered, Endangered or Vulnerable is a threatened species whereas **Species of conservation concern** are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD).

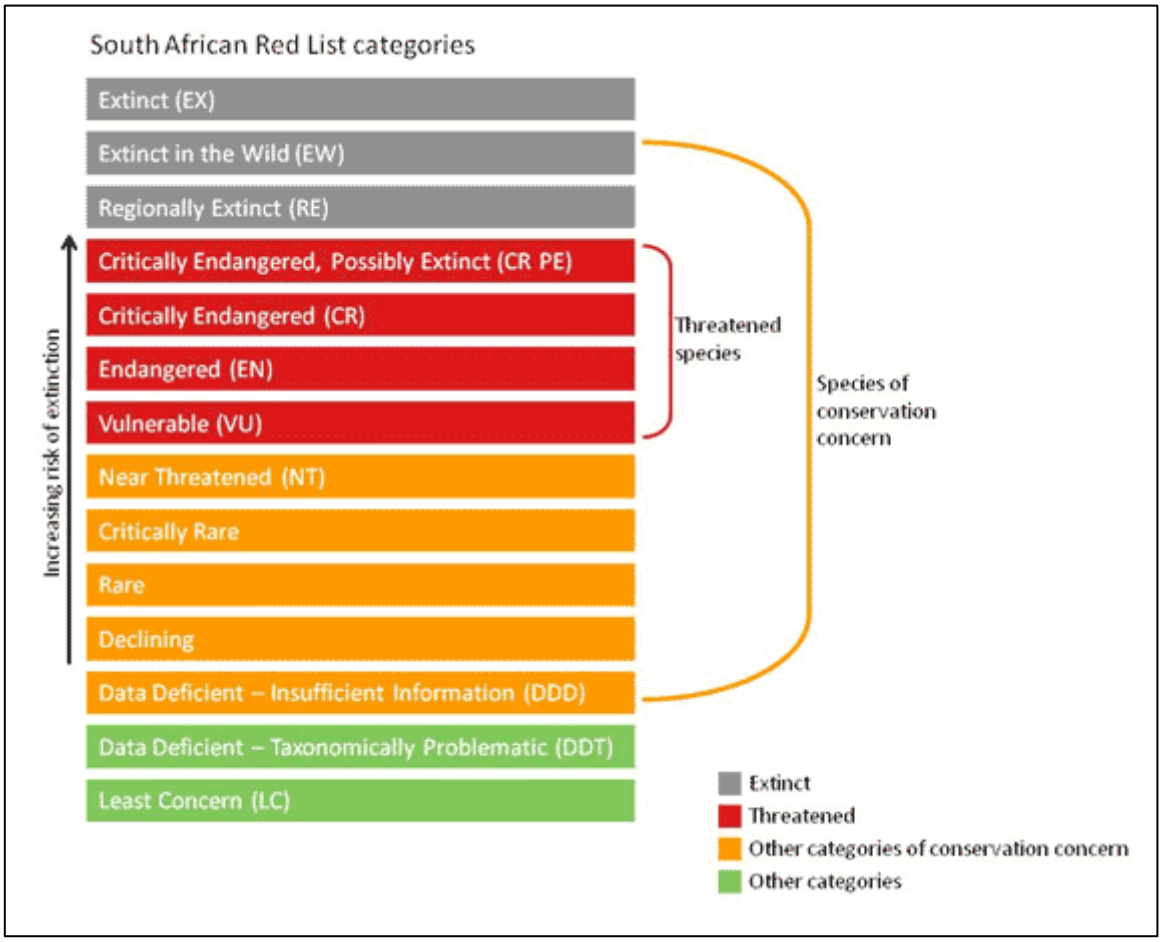


Figure 28. South African Red data list categories (SANBI website)

During the field surveys, only one threatened plant species was observed on site, namely *Haemanthus deformis* and only three (3) species of conservation importance were noted, namely *Crinum macowanii*, *Drimia altissima* and *Crassula rupestris*. *Haemanthus deformis* is listed as "*Near Threatened*", and whereas *Crassula rupestris* is listed as "*Rare*". *Crinum macowanii* and *Drimia altissima* are listed as "*Declining"* (Raimondo *et. al.,* 2009). It is thus recommended that a botanist be appointed to perform a final walkthrough of the proposed Foxwood dam and its associated infrastructure in order to identify more sensitive plant species, and assist in identifying areas that require protection.

The Near Threatened *Haemanthus deformis* (**Figure 29**) has a limited distribution in the north-eastern parts of the Eastern Cape (in the former Transkei) and in the coastal and Midland areas of KwaZulu-Natal. It grows in moist, shaded conditions amongst bushy undergrowth or between rocks on shady slopes. As it is an evergreen plant, it likes moisture throughout the year, especially in summer, but less during the winter months. It is sensitive to frost (Williams & Crouch, 2011).

Figure 29. *Haemanthus deformis* recorded on BP D1 and Laydown Area 1

Crinum macowanii (**Figure 30)** is not endemic to South Africa and is found in Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West provinces (Pooley, 1998). It occurs in mountain grassland and stony slopes in hard dry shale, gravely soil or sandy flats (Archer and Condy, 1999; Cunningham, 1988).

Figure 30. Crinum macowanii recorded on Pipeline, BP D1 and Laydown Areas 1 & 2

Drimia altissima (**Figure 31**) is found in Albany Thicket, Fynbos, Grassland, Savanna biomes and is located in hot, dry bushveld and thicket (Williams *et al.,* 2008). .It has a national conservation status of 'Declining' (Raimondo *et al.* 2009) and as such a permit for either removing or transplanting these plants will be required from Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) before any construction commences.

Figure 31. *Drimia altissima* recorded on BP D1, BP C6, Laydown Area 1 and MR00639 Diversion

Crassula rupestris (**Figure 32**) occurs in southern Namibia, the Richtersveld, Namaqualand Ceres Tanqua Karoo, Worcester Robertson Karoo and Little Karoo. It favours hot, dry, rocky habitats. They survive in predominately winter rainfall areas that receive little more than 120 mm annually. They are relatively frost tolerant, being able to survive temperatures of - 4°C (Pooley, 1998). Raimondo *et al.* (2009) has listed this plant species as “Rare”.

Figure 32. *Crassula rupestrus* recorded on Pipeline, BP D1 and Laydown Areas 1 & 2

9.1.5 Habitat available for species of conservation importance

The list of threatened plant species previously recorded in the region (3226CB quarter degree square) in which the proposed development is situated was obtained from the SANBI. These species and their probability of occurrence are indicated in **Table 8** below. The probability of occurrence is based on the suitable habitat where the species is likely to occur. Actual species list will most likely contain far fewer species due to high levels of habitat transformation and disturbances. On the basis of habitat preferences, the species could be allocated to habitats within the study area where they are most likely to be found.

Table 8. Red Listed plant species which are known to occur in the general vicinity of the project area (Raimondo *et. al*., 1999; Scott-Shaw (1999), which could potentially be found on the proposed development areas.

Species	Threat status	Suitable habitat	Probability of Occurrence
Curtisia dentata (Burm.f.) C.A.Sm.	NT	In the forest it is usually found in climax forest and grows into a tall tree with a clean, unbuttressed bole. It also grows on grassy mountain slopes and in coastal scrub forest where it is a small bushy tree	Low
Watsonia amatolae Goldblatt	Rare	Occurs in wet, sometimes rocky sites and in montane grassland	Low

Given the site review methodology expounded above:

- The probability of the presence of Red data species on site is considered to be “low” on account that the proposed development areas do not offer any suitable habitat for the species mentioned above.

9.2 Fauna

The evaluation of faunal presence is based on the presence / absence of mammals, avifauna, reptiles and amphibians at the proposed development areas. The survey determined the current status of threatened animal species occurring, or likely to occur within the proposed areas, describing the available and sensitive habitats. Faunal data was obtained during a field survey of the proposed development, which was carried out on foot. The data was supplemented by previous surveys conducted in similar habitats, literature investigations, and historic data. Different habitats were explored to identify any sensitive or endangered species. Mammal nomenclature is referred to using Stuart & Stuart, (1998), Skinner & Chimimba (2005), Friedman & Daly (2004); bird names by Hockey *et al.* (2006); reptile names by Branch (1988), Branch (2001) and Amphibian names by Minter *et al.* 2004.

9.2.1 Mammals

9.2.1.1 Desktop survey results

The potential mammal species that could be found on the proposed development sites/routes are those which have been recorded in the grid cell 3226CB (ADU, 2015) and are listed in **Table 9** below. According to this list, one species of conservation importance, namely Blue Duiker could potentially occur in the proposed study area.

Table 9. Mammals recorded in 3226CB grid cell

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Bathyergidae	*Cryptomys*	*hottentotus*	Southern African Mole-rat	Least Concern	Yes
Bovidae	*Alcelaphus*	*buselaphus*	Hartebeest	Not listed	Yes
Bovidae	*Connochaetes*	*gnou*	Black Wildebeest	Least Concern	Yes
Bovidae	*Philantomba*	*monticola*	Blue Duiker	Vulnerable	Yes
Bovidae	*Tragelaphus*	*scriptus*	Bushbuck	Least Concern	Yes
Cercopithecidae	*Chlorocebus*	*pygerythrus*	Vervet Monkey	Not listed	Yes
Equidae	*Equus*	*quagga*	Plains Zebra	Not listed	Yes
Muridae	*Mus*	*minutoides*	Southern African Pygmy Mouse	Least Concern	Yes
Procaviidae	*Dendrohyrax*	*arboreus*	Southern Tree Hyrax	Not listed	Yes

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Viverridae	*Genetta*	*tigrina*	Cape Genet	Least Concern	Yes

9.2.1.2 Mammals recorded on site

The proposed development areas consisted of suitable habitats for mammalian species such as rivers, bushveld and patches of grasslands. During the field assessments, some small rodent species were observed on the study area but the identity of these species could not be verified. **Table 10** indicates the species recorded on sites while the species that were confirmed to occur by locals are indicated by an asterix (*****). The traps set did not yield any positive results as no mammals were captured. The reasons for the low mammalian species diversity may be due to degradation of habitat in the study area due to anthropogenic impacts such as grazing and the fact that some species have been persecuted historically.

Table 10. Mammals recorded on the proposed development areas

Order:	Scientific name	English name	Status
Lagomorpha	*Lepus saxatilis*	Scrub Hare	Least concern
Muridae	*Rattus rattus*	House Rat	Least concern
Artiodactyla	*Sylvicapra grimmia*	Grey /Common Duiker	Least concern
Cercopithecidae	*Cercopithecus aethiops pygerythrus*	Vervet Monkey	Least concern
Procaviidae	*Procavia capensis*	Rock Hyrax	Least Concern
Bovidae*	*Aepyceros melampus*	Impala	Least Concern
Canidae*	*Canis mesomelas*	Black-backed Jackal	Least Concern
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern
Bovidae*	*Tragelaphus scriptus*	Bushbuck	Least Concern
Rodentia	*Hystrix africaeaustralis*	Cape porcupine (**Figure 33**)	Least Concern
Suidae*	*Phacochoerus africanus*	Common warthog	Least Concern
Bovidae*	*Tragelaphus strepsiceros*	Kudu or Greater Kudu	Least Concern
Bovidae*	*Kobus ellipsiprymnus*	Waterbuck	Least Concern
Bovidae*	*Tragelaphus angasii*	Nyala	Least Concern
Bovidae*	*Damaliscus pygargus phillipsi*	Blesbok	Least Concern
Suidae*	*Potamochoerus larvatus*	Bushpig	Least Concern

Figure 33. Cape porcupine quills recorded on the proposed Dam basin

Scats of the Cape Clawless Otter (*Aonyx capensis*) were observed within the banks of the Koonap River (**Figure 34**). According to Somers & Nel (2004), Cape Clawless Otter can be found anywhere from open coastal plains, to semiarid regions, to densely forested areas. The otters live in areas surrounding permanent bodies of water, usually surrounded by some form of foliage. This species is listed as “Protected” according to the National Environmental Management: Biodiversity Act (2004) but Friedman & Daly (2004) listed this mammal species as a Least Concern.

Figure 34. Scat of Cape Clawless Otter observed along the Koonap River

The bushveld habitat, which is interspersed by rocky outcrops is found in the proposed dam basin, and has the highest faunal species as compared to the other habitat types. It is characterised by a woody structure stretching from the water's edge up to the base of the cliffs located at higher altitudes. *Acacia* species predominate this habitat unit and are regularly harvested by the local community members for firewood. Local herds of cattle were frequently observed, which would adversely impact the natural faunal species. On the other hand, the riparian habitat is located along the river edges. This habitat unit provides refugia and breeding sites for aquatic mammals that inhabit the river system. This habitat unit will be completely inundated with the rising waters of the proposed dam, and as such important faunal habitat for mammal species will be permanently lost.

9.2.1.3 Habitat available for species of conservation importance

Data sourced from SANBI (ADU, 2015) indicates that there are mammal species which are known to occur in the general vicinity of the site. **Table 11** below indicates the suitable habitat together with the probability of occurrence. The probability of occurrence is based on the presence of suitable habit where the species is likely to occur.

Table 11. A Red Data Listed mammal species which could potentially occur in the proposed development site with suitable habitat and the probability of occurrence (Friedmann & Daly (2004), Skinner & Chimimba (2005)).

Common name	Red list category	Suitable habitat	Probability of occurrence
Blue Duiker	Vulnerable	Inhabits a wide range of forest and wooded habitats, including lowland rainforest, gallery forest, coastal scrub farmland, dense thicket and montane forest up to elevations of 3,000 metres. It is found in both primary and secondary forest and can also survive in small patches of modified or degraded forest and thicket, including close to human settlements	Low

In order to effectively mitigate the negative impacts relating to mammal species that are considered to conservation importance, attention needs to be given to reducing the general impacts on the habitat units (*i.e*. minimising the construction footprints, *etc*.). Even though disturbance factors will play a role in displacing certain more sensitive species, the proposed development activities are not thought to pose significant long-term impacts on the conservation of these species.

9.2.2 Avifauna

9.2.2.1 Desktop survey results

The Important Bird & Biodiversity Area (IBA) Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that are globally threatened, have a restricted range and are restricted to specific biomes/vegetation types (Barnes, 1998). Several Conservation and planning tools were consulted for relevancy for the project.

IBAs are classified on the basis of the following criteria:

- The site regularly holds significant numbers of a globally threatened species;
- The site is thought to hold, a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area; and
- The site is known or thought to hold a significant component of a group of species whose distributions are largely or wholly confined to one biome.

The following IBA (Barnes, 1998), which is partially protected, is situated to the east of the project area (see **Figure 35**):

- SA092 - Amatola-Katberg Mountain (approximately 19 km to the east of the dam).

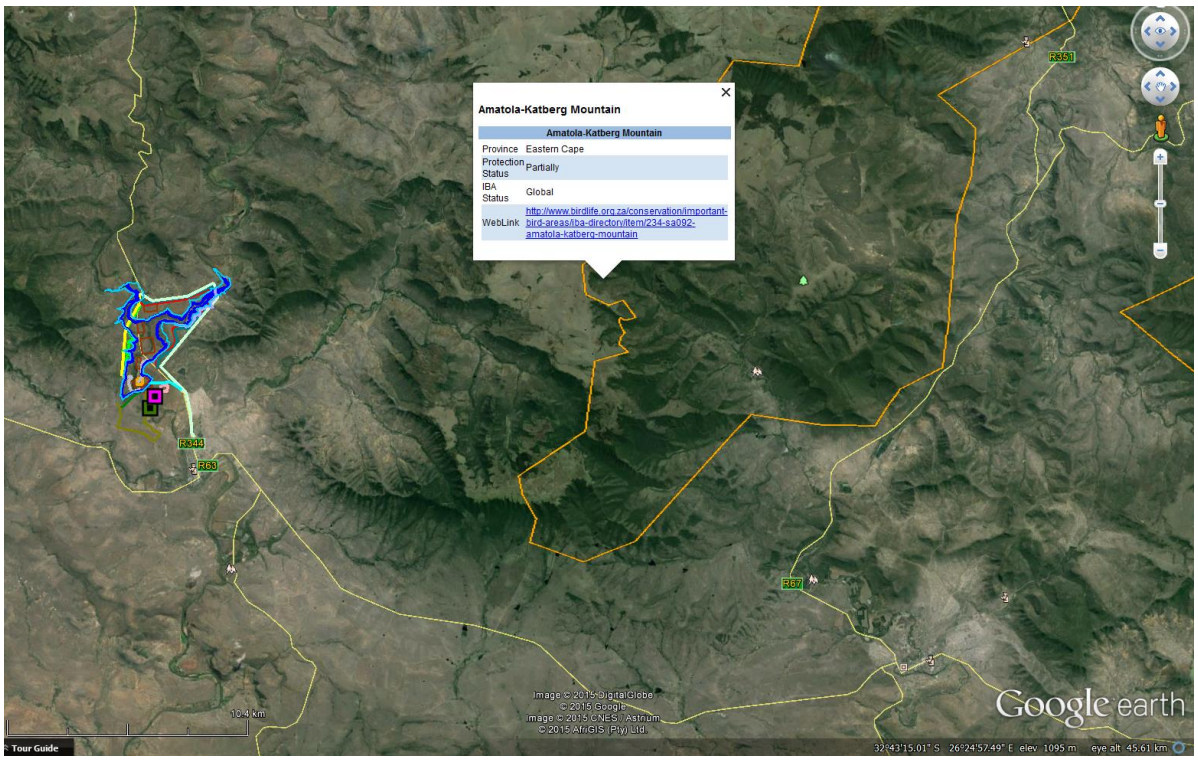


Figure 35. Amatola-Katberg Mountain IBA is situated to the east of the project area

Table 12 indicates the Red data bird species (SABAP1) recorded in grid cell 3226CB.

Table 12. Red data bird species recorded in 3226CB grid cell

Species Code	Common Name	Conservation Status
84	Black Stork	NT
118	Secretarybird	NT
122	Cape Vulture (Griffon)	VU
140	Martial Eagle	VU
141	African Crowned (Crowned) Eagle	NT
168	Black Harrier	NT
172	Lanner Falcon	NT
208	Blue Crane	VU
231	Denham's (Stanley's) Bustard	VU
463	Southern Ground-Hornbill	VU
484	Knysna Woodpecker	NT

***Note**: NT=Near Threatened; VU = Vulnerable*

9.2.2.2 Field work results

More intensive surveys conducted over longer periods over several seasons are required in order to ascertain the current status of the threatened bird species on and surrounding the site. Many avifaunal species are adaptable as they are habitat generalists and can therefore accommodate a certain degree of habitat degradation and transformation (Harrison *et al*., 1997). Other species are extremely habitat specific and have to rely on certain habitat units for breeding, hunting or foraging and roosting. Habitat-specific species are sensitive to environmental change, with destruction of habitat being the leading cause of species decline worldwide (Barnes, 2000).

The following microhabitats were recorded in the study area, namely riparian habitat, patches of open grasslands, rivers and savanna woodlands/bushveld. Rivers represent important habitat for many species, including Black Stork, Yellow-billed Stork, Saddle-billed Stork, Ducks, Geese and a variety of other water birds. The wooded riparian habitat alongside a river may provide habitat for various species such as the Hamerkop, African Darter, various cormorants, kingfishers, bee-eaters, robinchats and numerous smaller species. Rivers also represent feeding areas for fish eating raptors such as the African Fish Eagle. Grasslands on the other hand represent a significant foraging and/or hunting area for many bird species. The patches of grasslands are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as being hunting habitat for raptors such as Martial Eagle, African Marsh Harrier, Lesser Kestrel and Black-shouldered kite. Most parts of the dam basin are characterised by the savanna woodlands and these are primarily associated with the Rivers, and areas of overgrazing. Species such as Martial Eagle, African Crowned Eagle, and Lanner Falcon may occur in this micro-habitat type.

Nineteen (19) bird species (**Table 13)** were recorded during the field survey. Species recorded were common and widespread and were of no conservation importance. No Red Data bird species associated with the proposed development areas were recorded within the study area.

Table 13. Bird species recorded on the proposed development areas

Species number	Common name	Scientific name
62	Grey Heron	*Ardea cinerea*
71	Cattle egret (**Figure 36**)	*Bubulcus ibis*
	Yellow-billed kite	*Milvus aegyptius*
181	Rock Kestrel **(Figure 37)**	*Falco rupicolus*
203	Helmeted Guineafowl	*Numida meleagris*

Species number	Common name	Scientific name
255	Crowned lapwing (Plover),	*Vanellus coronatus*
258	Blacksmith Lapwing (Plover)	*Vanellus armatus*
349	Rock Pigeon	*Columba guinea*
352	Red-eyed Dove	*Streptopelia semitorquata*
355	Laughing Dove	*Streptopelia senegalensis*
373	Grey go-away-bird (Lourie)	*Corythaixoides concolor*
451	African Hoopoe	*Upupa africana*
548	Pied crow	*Corvus albus*
568	Red-eyed Bulbul	*Pycnonotus nigricans*
698	Fiscal flycatcher **(Figure 38)**	*Sigelus silens*
732	Common Fiscal (Fiscal Shrike)	*Lanius collaris*
758	Common (Indian) Myna	*Acridotheres zeylonus*
764	Cape Glossy Starling (**Figure 39**)	*Lamprotornis nitens*
801	House Sparrow	*Passer domesticus*

Figure 36. Cattle egret on site

Figure 37. Rock Kestrel on site

Figure 38. Fiscal flycatcher on site

Figure 39. Cape Glossy Starling on site

9.2.2.3 Habitat requirements for Red Data bird species

Data sourced from SABAP **1,** Harrison *et al*., (1997), Barnes (2000), SABAP2 and Tarboton *et. al.,* (1987) indicated bird species on the Red Data List that are known to occur on grid cell 3226CB; as well as their probability of occurrence (indicated in **Table 14**). The probability of occurrence is based on the presence of suitable habit where the species is likely to occur. In this case few of the potential species are likely to occur at the site due to a lack of suitable microhabitats.

Table 14. Red Data Bird species recorded in grid cell 2528CD which could potentially occur in the study area (SABAP 1) (Harrison *et. al*. (1997), Barnes (2000), SABAP2 and Tarboton *et. al*., (1987).

Common Name	Status	Preferred Habitat	Probability of Occurrence
Denham's Bustard	Vulnerable	Inhabit grassland up to altitudes of 3,000 metres, including dense shrubland, light woodland, farmland, dried marsh and arid plains	Medium-high
Blue Crane	Vulnerable	Present in pockets of remaining grassland and wetlands	Medium
Cape Vulture	Vulnerable	Mostly occur in mountainous country, or open county with inselbergs and escarpments; less commonly as visitors to savannah or desert. Forage over open grassland, woodland and agricultural areas; usually roosts on cliffs, but will also roost on trees and pylons.	Low
Martial Eagle	Vulnerable	It tolerates a wide range of vegetation types, being found in open grassland, scrub, Karoo, agricultural lands and woodland. It relies on large trees (or electricity pylons) to provide nest sites as well as windmills and even cliffs in treeless areas.	Medium-high
Secretarybird	Near Threatened	Prefers open grassland with scattered trees, shrubland, open *Acacia* and *Combretum* savanna. Avoids densely wooded areas, rocky hills and mountainous areas.	Low
Lanner Falcon	Near Threatened	Open grassland, woodland	Medium-high
Black Stork	Near Threatened	Associated with rivers, dams and cliffs.	High
African Crowned Eagle	Near Threatened	Inhabits forest and dense woodland, including rainforest, riverine forest and montane forest. It may also be found in plantations and in remnant forest patches, and may sometimes move into surrounding secondary forest or dry savannah to forage	Low
Black Harrier	Near Threatened	Grassland, wetland	Low
Southern Ground-Hornbill	Vulnerable	Prefers woodland and savanna habitat and as a group, they forage on the grassland and roost in the woods, commonly in broad-leaved trees	Medium-high
Knysna Woodpecker	Near Threatened	Its natural habitats are subtropical or tropical moist lowland forests, moist savanna, and subtropical or tropical moist shrubland.	Low

9.2.3 Reptiles

9.2.3.1 Desktop survey results

According to the Animal Demography Unit (2015), the reptiles that have been recorded in the 3226CB grid cell are listed in **Table 15**. According to this list, no reptile species of conservation importance is known to occur in the region.

Table 15. Reptile species recorded in grid cell 3226CB which could occur in the study area (ADU, 2015)

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Least Concern (SARCA 2014)	
Colubridae	*Crotaphopeltis*	*hotamboeia*		Red-lipped Snake	Least Concern (SARCA 2014)	
Colubridae	*Duberria*	*lutrix*	*lutrix*	South African Slug-eater	Least Concern (SARCA 2014)	Yes
Colubridae	*Lycodonomorphus*	*laevissimus*		Dusky-bellied Water Snake	Least Concern (SARCA 2014)	Yes
Cordylidae	*Chamaesaura*	*anguina*	*anguina*	Cape Grass Lizard	Least Concern (SARCA 2014)	Yes
Cordylidae	*Pseudocordylus*	*melanotus*	*subviridis*	Drakensberg Crag Lizard	Least Concern (SARCA 2014)	Yes
Elapidae	*Hemachatus*	*haemachatus*		Rinkhals	Least Concern (SARCA 2014)	
Lacertidae	*Tropidosaura*	*montana*	*rangeri*	Ranger's Mountain Lizard	Not listed	
Scincidae	*Acontias*	*gracilicauda*		Thin-tailed Legless Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Acontias*	*meleagris*		Cape Legless Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Least Concern (SARCA 2014)	
Scincidae	*Trachylepis*	*homalocephala*		Red-sided Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Trachylepis*	*varia*		Variable Skink	Least Concern (SARCA 2014)	
Typhlopidae	*Rhinotyphlops*	*lalandei*		Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)	
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern (SARCA 2014)	
Viperidae	*Causus*	*rhombeatus*		Rhombic Night Adder	Least Concern (SARCA 2014)	

9.2.3.2 Reptiles recorded on site

The reptile assessments indicate that the remaining patches of grasslands, bushveld, rocky areas and riparian vegetation are of high importance to reptiles. Some sections of the study areas have resulted in increased habitat modification and transformation, especially due to agricultural activities and grazing, which result in increased human presence and associated disturbances (illegal reptile collecting, indiscriminate killing of all snake species, frequent fires). The increased habitat destruction and disturbances are all causal factors in the alteration and disappearance of reptile diversity in the area (Jacobsen, 2005). Termite mounds were present on the study area (**Figure 40**). Some large mounds had been damaged by previous foraging by Antbears. This resulted in the exposing of tunnels into the interior of the termite mound. Old termite mounds offer important refuges especially during veld fires as well as cold winter months for numerous frog, lizard, snake and smaller mammal species (Jacobsen, 2005). Large number of species of mammal, birds, reptiles and amphibians feed on the emerging alates (winged termites). No termite mounds were destroyed during the brief field survey. All overturned rock material was carefully replaced in its original position. **Table 16** indicates reptile species recorded on proposed development areas while the species that were confirmed to occur by locals are indicated by an asterix (*****). The species recorded are of no conservation importance and were recorded all over the project areas.

Figure 40. Termite mound recorded along the Pipeline and Dam Permanent Access Road

Table 16. Reptiles recorded in the proposed development areas

Genus	Species	Subspecies	Common name
Agama	*aculeata*		Ground Agama
Lygodactylus	*capensis*	*capensis*	Common Dwarf Gecko
Trachylepis	*punctatissima*		Montane Speckled Skink
Boaedon	*capensis*		Brown House Snake
Duberria	*lutrix*		Common Slug eater (**Figure 41**)
Varanus	*niloticus*		Water monitor (**Figure 42**)
**Bitis*	*arietans*		Puff adder
**Naja*	*mossambica*		Mozambique spitting cobra
**Hemachatus*	*haemachatus*		Rinkhals
**Causus*	*rhombeatus*		Common night adder
**Dispholidus*	*typus*		Boomslang
**Crotaphopeltis*	*hotamboeia*		Red Lipped Snake or Herald Snake
**Naja*	*nivea*		Cape cobra
Opistophthalmus	*glabrifrons*		Shiny burrowing scorpions

Figure 41. Common Slug eater recorded on site

Figure 42. Water monitor recorded along the Koonap River

The rocky ledges and open outcrops also provide a variety of niche habitats for many reptile, spider and scorpion species, as indicated in the figures below. **Figure 43** indicates the Ground Agama, commonly occurring in the area. The rocky outcrop, savanna bushveld and riparian habitats are considered to be the most sensitive from a reptile conservation perspective.

Figure 43. Ground agama recorded on site

9.2.4 Invertebrates

Scorpion's are classified as arachnids, they share this category with spiders and mites. They have eight legs and are considered nocturnal (most waking activity is at night) arthropods. Scorpion's are also considered venomous invertebrates (they lack a backbone). According to the ADU (2015), no scorpions were recorded in grid cell 3226CB. During the field survey, a Shiny burrowing scorpion (*Opistophthalmus* spp) (**Figure 44**) was recorded on site. This scorpion is known from dry areas with different temperature regimes and its distrubution appears to be determined by soil hardness rather than soil type. Sandy soil seem to be avoided because it makes this scorpion difficult to burrow (Gaban, 1997).

Figure 44. A Shiny burrowing scorpions Scorpion recorded on site

9.2.5 Amphibians

9.2.5.1 Desktop survey results

According to the Animal Demography Unit (2015), the amphibians that have been recorded in 3226CB grid cell are listed in **Table 17**. According to this list, no amphibian species of conservation importance is known to occur in the region

.

Table 17: Amphibian species recorded in the grid cell 3226CB (ADU, 2015), which could potentially occur on the proposed development sites.

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Bufonidae	*Amietophrynus*	*rangeri*	Raucous Toad	Least Concern	
Bufonidae	*Vandijkophrynus*	*gariepensis*	Karoo Toad	Least Concern	
Hyperoliidae	*Hyperolius*	*marmoratus*	Painted Reed Frog	Least Concern	
Hyperoliidae	*Kassina*	*senegalensis*	Bubbling Kassina	Least Concern	
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern	
Pyxicephalidae	*Amietia*	*quecketti*	Drakensberg River Frog	Least Concern	Yes
Pyxicephalidae	*Cacosternum*	*boettgeri*	Common Caco	Least Concern	
Pyxicephalidae	*Cacosternum*	*nanum*	Bronze Caco	Least Concern	
Pyxicephalidae	*Strongylopus*	*grayii*	Clicking Stream Frog	Least Concern	
Pyxicephalidae	*Tomopterna*	*tandyi*	Tandy's Sand Frog	Least Concern	

9.2.5.2 Field work results

The Koonap River, as well as the Adelaide Dam hold water on a permanent basis and are probably important breeding habitat for most of the frog species which occur at the study area. No frog species were recorded on site during the field assessment even though commonly occurring frog species such as Common Platannas, Guttural Toads, Common Cacos and Bubbling Kassinas could not be discounted. The river system is considered to be the most sensitive from an amphibian conservation perspective. However, the proposed developments are unlikely to have a negative impact on amphibians in the study area.

10 ECOLOGICAL SENSITIVITY ANALYSIS OF THE STUDY AREA

The ecological function describes the intactness of the structure and function of the vegetation communities which in turn support faunal communities. It also refers to the degree of ecological connectivity between the identified vegetation communities and other systems within the landscape. Therefore, systems with a high degree of landscape connectivity among each other are perceived to be more sensitive.

High – Sensitive vegetation communities with either low inherent resistance or resilience towards disturbance factors or vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems.

Medium – Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree of connectivity with other ecological systems.

Low – Degraded and highly disturbed vegetation with little ecological function.

The sensitivity was based on the following criteria (**Figure 45**):

- Terrestrial Critical Biodiversity Areas 2 (High);
- Threatened species (*Haemanthus deformis*) (High);
- Species of conservation importance (*Crinum macowanii, Drimia altissima* and *Crassula rupestris*) (Medium); and
- Perennial River and its associated buffer zone (Medium).

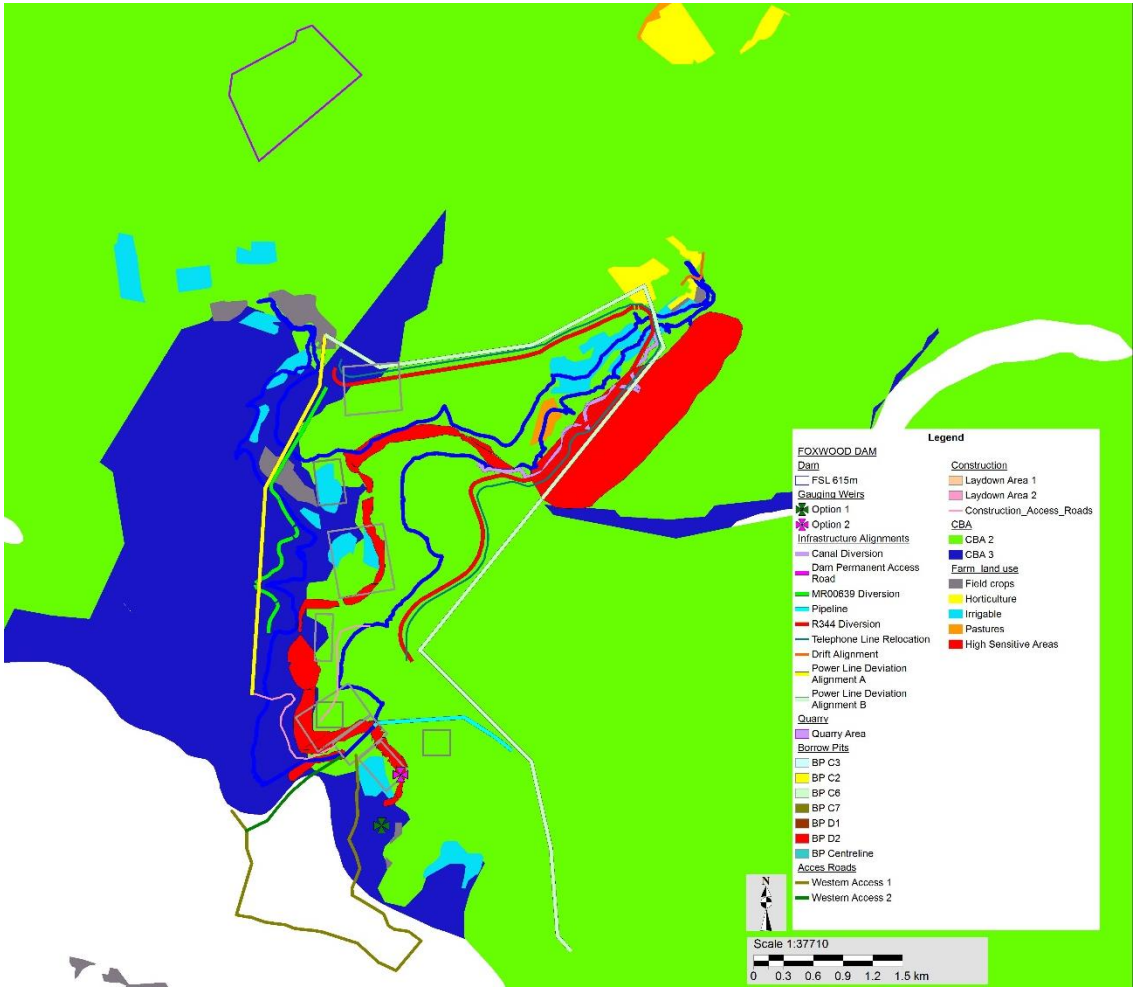


Figure 45. Ecological Sensitivity Map of the project area

Although isolated portions of northern and eastern sections of the impoundment, canal deviation, pipeline, dam permanent access road, gauging weir option 2, Borrow Pits C3, C2, C6, C7, D1 and D2, quarry, construction laydown areas, as well as the majority of routes for the deviation of the R344, power line alignment B and telephone line fall within CBA 2, which are associated with high biodiversity, the majority of the study area are areas which have now been transformed through agricultural activities, grazing, roads, alien plant species, weeds and exotic plants.

It is thus recommended that a botanist be appointed to perform a final walkthrough of the proposed Foxwood dam and its associated infrastructure in order to identify more sensitive plant species, and assist in identifying areas that require protection.

As mentioned, a Search, Rescue and Relocation Plan needs to be developed that takes into consideration red data, protected and endangered fauna species (amongst others). In this regard, attention will be given to the threatened species and all plant species of conservation importance. All relocations will need to comply with the requirements of the Eastern Cape Parks and Tourism Agency (ECPTA), in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

11 BIODIVERSITY OFFSETS

According to the Department of Environmental Affairs (DEA)'s Draft Discussion Document on Environmental Offsets (2015), *"An environmental offset is an intervention, or interventions, specifically implemented to counterbalance an adverse environmental impact of land-use change, resource use, discharge, emission or other activity at one location that is implemented at another location to deliver a net environmental benefit."*

The Western Cape's Draft Biodiversity Guidelines include the following description of Biodiversity Offsets: *Biodiversity offsets provide a mechanism to compensate for residual negative impacts on biodiversity after a developer has proven that a) all feasible and reasonable alternatives have been considered in arriving at the proposed development, and b) reasonable and responsible actions have been taken in the location, siting, scale, layout, technology and design of the proposed development to avoid, minimize and repair/restore associated impacts. That is, offsets are seen as a last resort option in the mitigation hierarchy.*

Offsets could include formal commitment to managing substitute areas of comparable or greater biodiversity value for conservation, entering into a secure and permanent conservation agreement with the conservation authority, setting aside protected natural areas, establishing a trust fund for biodiversity conservation, thereby enabling land acquisition or management, *etc.* Biodiversity offsets should be considered to compensate for residual negative impacts on biodiversity and ecosystem services of **'medium' to 'high'** significance. The draft provincial guidelines provide detailed guidance in terms of evaluating the significance and extent of anticipated and actual residual impacts. In particular the biodiversity status of the land as defined in existing spatial plans needs to be considered, with development in the following areas likely to trigger residual impacts of very high or high significance:

- Core Biodiversity Areas as defined in Bioregional Plans
- Priority Areas identified in Biodiversity Plans or declared in terms of the Protected Areas Act
- Threatened ecosystems, ecological corridors and habitat containing threatened species
- Areas identified as containing irreplaceable biodiversity by a national or provincial management authority for protected areas.

Offsets are calculated by multiplying this measure by a basic offset ratio for terrestrial ecosystems. The basic offset ratio is linked to the conservation significance and status of the area(s) to be affected by development.

- Where residual negative impacts are of high or medium significance, the basic offset ratio is determined by the conservation status of each of the 67 terrestrial ecosystems (vegetation types) in the province, namely:
    - Ratios of 3:1 to 25:1 for **endangered** ecosystems, depending on the particular vegetation type;
    - Ratios of 3:1 to 5:1 for **vulnerable** ecosystems, depending on the particular vegetation type; and
    - Ratios of 3:1 for **near threatened** ecosystems, depending on the particular vegetation type.

This document should serve as a plan of action in order to establish offset areas to compensate for the loss of biodiversity and habitat, and for their management during the operational phase of the dam. The National Environmental Management Act (NEMA) provides the overarching legislative framework for the environmental sector and establishes a number of important principles as requirements for sustainable development that provide potential support for environment offsets. In particular, NEMA states:

… "*that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied*".

The proposed Foxwood dam and its associated infrastructures does not fall in any of the threatened ecosystems, protected areas, Critical Biodiversity Areas 1, ecological corridors and habitat containing threatened species, or areas identified as containing irreplaceable biodiversity by a national or provincial management authority for protected areas. Biodiversity offsets should only be considered after all feasible and reasonable measures to avoid, minimize and rehabilitate or restore negative impacts have been exhausted. Offsets account for the residual loss that remains after all alternatives have been considered and on-site mitigation measures implemented. It has to be noted that no unique features and special habitats were noted on site. The distribution ranges of those species found during the Terrestrial Fauna and Flora are also not considred to be endemic to the project area and therefore the Biodiversity Offsets is not required.

12 ENVIRONMENTAL IMPACT ASSESSMENT

12.1 **Methodology**

The quantitative impact assessment will focus on the direct and indirect impacts associated with the project. All impacts will be analysed with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions apply:

Nature	The project could have a positive, negative or neutral impact on the environment.
Extent	**Local** – extend to the site and its immediate surroundings. **Regional** – impact on the region but within the province. **National** – impact on an interprovincial scale. **International** – impact outside of South Africa.
Magnitude	Degree to which impact may cause irreplaceable loss of resources: **Low** – natural and social functions and processes are not affected or minimally affected. **Medium** – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.

	High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration	**Short term** – 0-5 years. **Medium term** – 5-11 years. **Long term** – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. **Permanent** – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability	**Almost certain** – the event is expected to occur in most circumstances. **Likely** – the event will probably occur in most circumstances. **Moderate** – the event should occur at some time. **Unlikely** – the event could occur at some time. **Rare/Remote** – the event may occur only in exceptional circumstances.
Significance	Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows- **0** – Impact will not affect the environment. No mitigation necessary. **1** – No impact after mitigation. **2** – Residual impact after mitigation. **3** – Impact cannot be mitigated.

12.2 Assessment of Environmental Impacts and Suggested Mitigation Measures

Only the environmental issues identified during the appraisal of the receiving environment and potential impacts are assessed below. Mitigation measures are provided to prevent (first priority), reduce or remediate adverse environmental impacts.

12.2.1 Flora

Clearing of vegetation for construction purposes will result in the proliferation of exotic vegetation, which could spread beyond the construction domain. These potential impacts will be managed through suitable rehabilitation and eradication methods contained in the EMPr.

As part of the future management plans (**Table 18**) to be developed for the project, a Search, Rescue and Relocation Plan is recommended that takes into consideration red data, protected and endangered flora and fauna species, and medicinal plants. In this regard, attention will be given to the following threatened species (*Haemanthus deformis*) and plant species of conservation importance (*Crinum macowanii, Drimia altissima and Crassula rupestris*). For flora species, the following factors need to be considered (amongst others) as part of this plan:

- Detailed plan of action (including timeframes, methodology and costs);
- Site investigations;
- Consultation with authorities and stakeholders;
- Marking of species to be relocated;
- Seeking of permits;
- Identification of suitable areas for relocation;
- Aftercare; and
- Monitoring (including targets and indicators to measure success).

The following permits may need to be acquired:

- Permit from the Department of Agriculture, Forestry and Fisheries under the National Forests Act (No. 84 of 1998) if protected trees are to be cut, disturbed, damaged, destroyed or removed; and
- Permit from ECPTA for the relocation of species protected under the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

Table 18. Flora Impact Assessment

Environmental Feature	**Flora**
Relevant Alternatives & Activities	**Proposed Foxwood Dam & Associated Infrastructure**
Project life-cycle	**Pre-construction, Construction & operational phases**
Potential Impact	**Proposed Management Objectives / Mitigation Measures**

• Loss of vegetation of conservation significance through construction activities.	• A botanist should be appointed to perform a final walkthrough of the proposed Foxwood dam and its associated infrastructure in order to identify more sensitive plant species, and assist in identifying areas that require protection. • A search and rescue of indigenous vegetation must be undertaken by a qualified specialist in order to identify floral species that require to be relocated and or transplanted to similar habitat types outside of the construction footprint. • All relevant approvals to be obtained prior to relocation of red data, protected and endangered flora species and medicinal plants. • Any protected plants or trees in proximity to construction areas that will remain, should be clearly marked and must not be disturbed. • Adequate re-instatement and rehabilitation of areas disturbed by the construction activities.
• Proliferation of exotic vegetation in disturbed areas	• Control of alien invasive species and noxious weeds for areas disturbed by the construction activities, in accordance with the requirements of the Conservation of Agricultural Resources Act (No. 43 of 1983). Eradication method to be approved by the Project Manager. • To prevent unnecessary alien plant infestations, an alien plant monitoring and eradication program needs to be in place, at least until the disturbed areas have recovered and properly stabilised.
• Loss of medicinal	• Search, rescue and relocation plan to include medicinal plants.
• Damage to plant life outside of the proposed development areas.	• Construction activities should be restricted to the development footprint area. All workers must be trained before construction commences.
• Rehabilitation of site after construction	• Bare surfaces should be grassed as soon as possible after construction to minimise time of exposure. Locally occurring, indigenous runner grasses should be used, for example *Stenotaphrum secundatum, Dactyloctenium australe* and *Cynodon dactylon*. • All re-seeding activities will be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for germination and rapid vegetation establishment. • The rehabilitated and seeded areas must be harrowed after spreading the topsoil and fertilizer uniformly. • Inspect rehabilitated area at three monthly intervals during the first and second growing season to determine the efficacy of rehabilitation measures. • Take appropriate remedial action where vegetation establishment has not been successful or erosion is evident. • Only locally indigenous vegetation is to be used for rehabilitation.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**

Before Mitigation	-	local	high	long-term	almost certain	3
After Mitigation	-	local	low	long-term	moderate	1

12.2.2 Fauna

Natural habitats will also be lost where clearing is done within the construction areas, especially along the riparian vegetation, savanna bushveld and grasslands. Fauna could also be adversely affected through construction-related activities (noise, illegal poaching, and pollution of the biophysical environment). It is expected that sensitive fauna will move away from the area during the construction area phase.

As mentioned, a Search, Rescue and Relocation Plan needs to be developed that takes into consideration red data, protected and endangered fauna species (amongst others. All relocations will need to comply with the requirements of the ECPTA, in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

The EMPrs include measures to manage the potential adverse impacts to fauna associated with the construction activities (**Table 19**).

Table 19. Fauna Impact Assessment

Environmental Feature	**Fauna**
Relevant Alternatives & Activities	**Proposed Foxwood Dam & Associated Infrastructure**
Project life-cycle	**Pre-construction, Construction & operational phases**
Potential Impact	**Proposed Management Objectives / Mitigation Measures**

• Loss of habitat and animals of conservation significance through construction activities.	• Search, rescue and relocation Plan to be developed for sensitive fauna species within the construction areas. The Plan is to be implemented in accordance with the project programme to ensure that these sensitive environmental features are rescued prior to potential impact occurrence. ECPTA is to be consulted to ensure that the plan incorporates all the authority's requirements. • There should be a stringent and dedicated control of poaching. No fishing is allowed. No wilful harm to any animals, unless a direct threat is posed to a worker's health or safety. • Captured animals to be safely released to a similar representative habitat. Proper access control to be maintained to prevent livestock from accessing construction areas.
• Disturbance of animals found on site during construction	• Faunal species encountered during construction activities and which are at risk of being harmed or self-injury should be removed by the ECO from the immediate site and relocated to an adjacent, suitable area. In order to prevent cases where fauna may fall into excavations, it is strongly recommended that suitably designed barriers or covers are used when excavated pits remain open.
• Habitat lost during clearing for the construction works.	• During site preparation, special care must be taken during the clearing of the works area to minimise damage or disturbance of roosting and nesting sites.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	high	long-term	likely	3
After Mitigation	-	local	low	long-term	unlikely	1

12.2.3 Cumulative impacts

Exotic vegetation is encountered in the project area and is mostly associated with grazing, and disturbances linked to subsistence livelihoods. Large areas will be cleared during the construction phase of the project and all disturbed areas will need to be appropriately rehabilitated to ensure that a cumulative impact is not caused in this regard.

Through the Search, Rescue and Relocation Plan a concerted effort will be made to prevent the loss of red data, protected and endangered fauna and flora species that will be affected by the project. With the relocation of these species to suitable habitat, the cumulative impact to biodiversity could be adequately managed.

13 COMPARISON OF ALTERNATIVES

The tables to follow compares the Major Storage Dam (**Table 20**), Gauging Weir (**Table 21**), Power Line Deviation (**Table 22**), and Laydown Area (**Table 23**) of the proposed development of Foxwood Dam & Associated Infrastructures on factors associated with the terrestrial flora and fauna.

Table 20. Comparison of Options – Major Storage Dam

Components	Alternatives	Order of preference 1 (most preferred) to 4 (least preferred]	Motivation	Fatal Flaws / Significant residual impacts after mitigation
Major Storage Dam - Dam type	1. Earthfill	2	This will require an additional site of a sizable side channel spillway, which again will leave a scar and possible erosion after construction and would require extensive rehabilitation. Also the addional land will be required.	No fatal flaws should this option be the preferred one as the activities after construction can be mitigated. An additional land can be purchased. Indigenous plant species which naturally occurs in the region should be used during the rehabilitation of the site. Gabions can be used to prevent further soil erosion
	2. Rockfill			
	3. Concrete Gravity			
	4. Composite Gravity Spillway and Earthfill	1	The spillway is already incorporated into the dam wall.	

Table 21. Comparison of Options – Gauging Weir

Components	Alternatives	Order of preference 1 (most preferred) to 2 (least preferred)	Motivation	Fatal Flaws / Significant residual impacts after mitigation

Gauging Weir	Option 1	No Preference	The two options have similar habitats and species composition.	
	Option 2			

Table 22. Comparison of Options – Power Line Deviation

Components	Alternatives	Order of preference 1 (most preferred) to 2 (least preferred)	Motivation	Fatal Flaws / Significant residual impacts after mitigation
Power Line Deviation	Alignment A	1	This is a shorter route and the natural vegetation and habitats to be cleared for the power line will be smaller.	
	Alignment B	2	This is a much longer route and the natural vegetation and habitats to be cleared for the power line will be much greater.	No fatal flaws should this option be the preferred one as the activities after construction can be mitigated.

Table 23. Comparison of Options – Laydown Area

Components	Alternatives	Order of preference 1 (most preferred) to 2 (least preferred)	Motivation	Fatal Flaws / Significant residual impacts after mitigation
Laydown Area	Option 1	1	Even though this option has more plant species of conservation importance as compared to Option 2, the fact that it will be inundated means that no rehabilitation will be required.	

	Option 2	2	This option has less fewer species of conservation importance as compared to Option 1 but after construction it would require intensive rehabilitation.	No fatal flaws should this option be the preferred one as the activities after construction can be mitigated. Indigenous plant species which naturally occurs in the region should be used during the rehabilitation of the site.

14 CONCLUSION AND RECOMMENDATIONS

The land cover is predominantly natural, with pockets of cultivated land along the Koonap River and Mankazana River. The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices, except for the land in the south-eastern part of the project footprint which is owned by the municipality. Grazing by cattle is prevalent all over the basin. The riparian habitat of the Koonap River is relatively intact and the same applies to the Mankazana River. The vegetation encountered in the riparian zone is typical of the Great Fish Thicket. During the field surveys, only one threatened plant species was observed on site, namely *Haemanthus deformis* and only three (3) species of conservation importance were noted, namely *Crinum macowanii*, *Drimia altissima* and *Crassula rupestris*. *Haemanthus deformis* is listed as "*Near Threatened*", and whereas *Crassula rupestris* is listed as "*Rare*". *Crinum macowanii* and *Drimia altissima* are listed as "*Declining"* . It is thus recommended that a botanist be appointed to perform a final walkthrough of the proposed Foxwood dam and its associated infrastructure in order to identify more sensitive plant species, and assist in identifying areas that require protection.

Although isolated portions of northern and eastern sections of the impoundment, canal deviation, pipeline, dam permanent access road, gauging weir option 2, Borrow Pits C3, C2, C6, C7, D1 and D2, quarry, construction laydown areas, as well as the majority of routes for the deviation of the R344, power line alignment B and telephone line fall within CBA 2, which are associated with high biodiversity, the majority of the study areas are areas which have now been transformed through agricultural activities, grazing, roads, alien plant species, weeds and exotic plants. The distribution ranges of those species found during the Terrestrial Fauna and Flora are also not endemic to the project area.

No fauna of conservation importance were recorded on sites. Subsistence hunting and habitat transformation within the areas would limit the occurrence of sensitive species and have a detrimental impacts on fauna species (especially mammals and snakes) in the area. Natural habitats will also be lost where clearing is done within the construction areas, especially along the riparian vegetation, savanna bushveld and grasslands. Fauna could also be adversely affected through construction-related activities (noise, illegal poaching, and pollution of the biophysical environment). It is expected that sensitive fauna will move away from the area during the construction area phase. Faunal species encountered during construction activities and which are at risk of being harmed or self-injury should be removed by the ECO from the immediate site and relocated to an adjacent, suitable area. In order to prevent cases where fauna may fall into excavations, it is strongly recommended that suitably designed barriers or covers are used when excavated pits remain open. In order to effectively mitigate the negative impacts relating to animal species that are considered to conservation importance, attention needs to be given to reducing the general impacts on the habitat units (*i.e*. minimising the construction footprints, *etc*.). Even though disturbance factors will play a role in displacing certain more sensitive species, the proposed development activities are not thought to pose significant long-term impacts on the conservation of these species

Large areas will be cleared during the construction phase of the project and all disturbed areas will need to be appropriately rehabilitated to ensure that a cumulative impact is not caused in this regard. Through the Search, Rescue and Relocation Plans, a concerted effort will be made to prevent the loss of red data, protected and endangered fauna and flora species that will be affected by the project. With the relocation of these species to suitable habitat, the cumulative impact to biodiversity could be adequately managed. In terms of the alternatives provided for this project, Tables 20, 21, 22, 23 and 24 compare the Major Storage Dam, Gauging Weir, Power Line Deviation, Western Access Road and Laydown Area of the proposed development of Foxwood Dam & Associated Infrastructures on factors associated with the terrestrial flora and fauna.

15 REFERENCES

ANIMAL DEMOGRAPHY UNIT (2015). **FrogMAP Virtual Museum.** Accessed at http://vmus.adu.org.za/?vm=FrogMAP on 2015-10-01

ANIMAL DEMOGRAPHY UNIT (2015). **MammalMAP Virtual Museum**. Accessed at http://vmus.adu.org.za/?vm=MammalMAP on 2015-10-01.

ANIMAL DEMOGRAPHY UNIT (2015). **ReptileMAP Virtual Museum**. Accessed at http://vmus.adu.org.za/?vm=ReptileMAP on 2015-10-01.

ARCHER, R.H. AND CONDY, G. (1999). *Crinum macowanii*. Flowering Plants of Africa 56:30-35.

BARNES, K.N. (ed.) (1998). **The Important Bird Areas of Southern Africa**. BirdLife South Africa: Johannesburg.

BARNES, K.N. (ed.) (2000). **The Eskom Red Data Book of Birds of South Africa, Lesotho & Swaziland**. Birdlife South Africa, Johannesburg.

BERLINER, D. AND DESMET, P. (2007). **Eastern Cape Biodiversity Conservation Plan Technical Report**. Department of Water Affairs and Forestry Project No 2005-012, Pretoria.

BRANCH, W.R. (1988). **South African Red Data Book - Reptiles and Amphibians**. South African National Scientific Programmes Report No. 151. CSIR, Pretoria.

BRANCH, B. (2001). **Field guide to the snakes and other reptiles of southern Africa**, 3rd ed. Struik Publishers, Cape Town.

BROMILOW, C. (2010). **Problem plants of South Africa**. Briza, Pretoria. , Pretoria.

CUNNINGHAM, A.B. (1988). An investigation of the herbal medicine trade in Natal/KwaZulu. Investigational Report No. 29. Institute of Natural Resources, Pietermaritzburg.

CARRUTHERS, V. (2001). **Frogs and frogging in southern Africa**. Struik Publishers, Cape Town.

DU PREEZ, L.H. & CARRUTHERS, V.C. (2009). **Complete Guide to the Frogs of Southern Africa**. Random House Struik. 488pp.

DRIVER, A., MAZE, K., LOMBARD A.T., NEL, J., ROUGET, M., TURPIE, J.K., COWLING, R.M., DESMET, P., GOODMAN, P., HARRIS, J., JONAS, Z., REYERS, B., SINK, K. & STRAUSS, T. (2004). **South African National Spatial Biodiversity Assessment 2004**: Summary Report. South African National Biodiversity Institute, Pretoria.

FRIEDMANN, Y. AND DALY, B, (EDITORS) (2004). **Red Data Book of the mammals of South Africa: a conservation assessment: CBSG southern Africa, Conservation Breeding Specialist Group (SSC/IUCN)**. Endangered Wildlife Trust, South Africa.

GABAN, D. (1997). On: *Opistophthalmus glabrifrons* (Peters). Forum American Tarantula Society 6(6), p. 196.

HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V. & BROWN, C.J. (EDS) (1997). **The atlas of Southern African birds**. Vols. 1&2. BirdLife South Africa, Johannesburg.

HENDERSON, L. 2001. **Alien weeds and invasive plants**. ARC, Pretoria.

HOCKEY, P.A.R., DEAN, W.R.J. & RYAN, P.G. (eds.) (2005). **Roberts – Birds of Southern Africa**. VIIth ed. John Voelcker Bird Book Fund. Cape Town.

JACOBSEN, N. (2005). **Remarkable Reptiles of South Africa**. Briza Publications. Pretoria. South Africa.

LAMBIE, J. C, (1978). **Measurement of Flow-Velocity Area Methods**. In: RW Herschy (ed.) Hydrometry. John Wiley & Sons, Chichester.

LOW, A.B & REBELO, A.G. (1996). **Vegetation of South Africa, Lesotho and Swaziland**. Department of Environmental Affairs and Tourism, Pretoria

MANNING, J. (2009). **Field guide to the wild flowers of South Africa**. Struik, Cape Town.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J. AND KNOEPFER, D. (2004). Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series No. 9, Washington, D.C.

MUCINA, L. & RUTHERFORD, M.C. (eds). (2006). **The vegetation of South Africa, Lesotho and Swaziland**. *Strelitzia* 19. South African Biodiversity Institute, Pretoria.

POOLEY, E.S. (1998). **A Field Guide to Wildflowers Kwazulu-Natal and the eastern region**. Natal Flora Publishers Trust: Durban, South Africa.

RAIMONDO, D., VON STADEN, L., FODEN, W., VICTOR, J.E., HELME, N.A., TURNER, R.C., KAMUNDI, D.A. & MANYAMA, P.A. (eds) **In press. Red List of South African plants**. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.

RUTHERFORD, M.C. & WESTFALL, R.H. (1994). **Biomes of southern Africa: an objective characterisation**. *Mem. Bot. Surv. S. Afr. No*. 63.

SINCLAIR, I., HOCKEY, P. & TARBOTON, W. (2002). **Sasol Birds of Southern Africa**. Struik Publishers, Cape Town.

SMITHERS, R.H.N. (1986). **South African Red Data Book - Mammals**. South African National Scientific Programmes Report No. 125.

SKINNER, J.D. & CHIMIMBA, C. T. (2005). **The Mammals of the Southern African Subregion**. Cambridge University Press, Cambridge.

STUART, C. & STUART, T. (1988). **Field Guide to the Mammals of Southern Africa**. Struik Publishers, Cape Town.

SOMERS, M. J. AND NEL, J. A. J. (2004). **Habitat selection by the Cape clawless otter *(Aonyx capensis*) in rivers in the Western Cape Province, South Africa**. *African Journal of Ecology* 42: pg 298-305.

TARBOTON, W.R., KEMP.M.I. & KEMP. A. C., (1987): **Birds of the Transvaal**. Transvaal Museum: Pretoria.

VAN WYK, B., VAN OUDTSHOORN, B. AND GERICKE, N. (1997). **Medicinal plants of South Africa**. Briza Publications, Pretoria.

VAN OUDSHOORN, F. (1999). **Guide to grasses of southern Africa**. Briza Publications, Pretoria.

WILLIAMS, V.L., RAIMONDO, D., CROUCH, N.R., BRUETON, V.J., CUNNINGHAM, A.B., SCOTT-SHAW, C.R., LÖTTER, M. & NGWENYA, A.M. 2008. ***Drimia altissima*** (L.f.) Ker Gawl. National Assessment: Red List of South African Plants version 2015.1. Accessed on 2015/09/22.

WILLIAMS, V.L. & CROUCH, N.R. (2011). ***Haemanthus deformis*** Hook.f. National Assessment: Red List of South African Plants version 2015.1. Accessed on 2015/09/28.

Websites:

http://posa.sanbi.org/searchspp.php

http://www.dwaf.gov.za/wfw/default.aspx

(http://www.dwaf.gov.za/wfw/default.aspx).