

## NCWABENI: OFF-CHANNEL STORAGE DAM



## TERRESTRIAL ECOLOGY ASSESSMENT



JULY 2012

DRAFT



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## EXECUTIVE SUMMARY

Flora and Fauna surveys were carried out in March 2012 to determine the impact of the proposed construction of Ncwabeni Off-Channel Storage (OCS) Dam. Two alternative schemes for the proposed OCS dam are being considered, these are the Ncwabeni Scheme and the Gugamela Scheme.

The study area falls within two biomes, namely the Savanna and Indian Ocean Coastal Belt. The vegetation types at the dam localities (D2 and D3A) include Kwazulu-Natal Coastal Belt (Endangered) and Eastern Valley Bushveld (Least threatened). KwaZulu-Natal Coastal Belt is listed as a threatened terrestrial ecosystem. The study area also lies within the Maputaland-Pondoland terrestrial priority conservation area, which lies along the east coast of southern Africa, below the Great Escarpment.

According to the Terrestrial Systematic Conservation Plan: Minimum Selection Surface (MINSET), the proposed Ncwabeni OCS dam site falls within the Areas of Not Conservation Significance (0Co) (Available) and Critical Biodiversity Area (CBA) or Biodiversity Priority Area (BPA) 3, which are **Optimal** areas. CBA 3 areas reflect the negotiable sites with an Irreplaceability score of less than 0.8 but this does not mean they are of a lower biodiversity value however, only that there are more alternate options available within which the features located within can be met. On the contrary, the data provided by South African National Biodiversity Institute (SANBI) on terrestrial CBAs around the southern parts of KwaZulu Natal indicates that the two proposed dam sites fall within CBA 2. CBA 2 are **Mandatory** areas which represent areas of significantly high biodiversity value, and this means that there are alternate sites within which the targets can be met for the biodiversity features contained within, but there aren't many.

One Red Data plant species was found on the study site (D2) namely *Hypoxis hemerocallidea* (Star-flower or African potato). This species is listed as Declining and will have to be relocated to another area of the same habitat during construction. The exotic plant species *Melia azedarach* (Syringa trees), *Chromolaena odorata* (Triffid weed), *Lantana camara* (Common lantana) and *Solanum mauritianum* (Bugweed) were common at the proposed D3A site while *Chromolaena odorata* (Triffid weed) and *Lantana camara* were the dominant exotic vegetation on proposed D2 dam site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of the

invader species be removed and eradicated. According to EKZNW Threatened or Protected Species programme, *Celtis africana* (White stinkwood), which is currently listed as Vulnerable (VU) on the National Threatened or Protected Species was recorded on both two proposed sites.

Several protected trees have distributions that include the two sites according to National Forests Act 1998 (Act No 84 of 1998). These tree species are *Prunus africana*, *Rhizophora mucronata*, *Sideroxylon inerme* subsp *inerme*, *Mimusops caffra*, *Ocotea bullata*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *P. henkelii*, *P. latifolius*, *Colubrina nicholsonii*, *Curtis dentate*, *Barringtonia racemosa*, and *Bruguiera gymnorrhiza*.

The nearest protected areas to the proposed dam sites include two provincial nature reserves: the Oribi Gorge Nature Reserve (approximately 7km to the south of D3A) and the Mehlomyama Nature Reserve (approximately 7km to the east of D2).

National Protected Area Expansion Strategy is mandated to expand its formal protected area network. Using nationally developed guidelines, an acquisition target of 9% has been set for KwaZulu Natal's for purchase by 2028. The nearest proposed Stewardship site, Umgano Community Project, lies approximately 80Km north east of the two proposed dam sites.

The presence of dogs in the study area, especially on D3A site, poses a threat to the presence of mammals on sites. Some small rodent species were observed on the study area but these species could not be verified due to the lack of close-up observation. The only species of conservation importance which was recorded on D3A was the Cape Clawless Otter (*Aonyx capensis*). Other species recorded on site include Cape Porcupine, Common Duiker, Warthog, Black-backed jackal, Bushbuck, and Chacma Baboon.

An avifaunal study indicated that while the riparian and bushland thickets should provide natural habitats for bird species, no Red data bird species were observed on the two proposed sites. The riparian habitats on the proposed sites provide suitable habitat for water-dependent bird species. Species recorded during field survey are common and widespread. The proposed dam will only have a negative impact during the construction phase where after the birds will return to the area.

Four reptile species were recorded on the two proposed sites, namely Green Mamba, Black mamba, Southern African Python, and Rock monitor. According to the local people, two pythons were killed last year (2011) for their skins which are utilised by the locals.

Two red listed frog species are known from the 3030CA and 3030CB Quarter Degree Grid Cell (QDGC) including Natal Kloof Frog (*Natalobatrachus bonebergi*) and Natal Leaf-folding Frog (*Afrixalus natalensis*). The Natal Kloof Frog is classified as **Endangered** and is restricted to the coastal forests of southern Kwazulu-Natal and southern Eastern Cape provinces. Suitable habitat in the form of perennial forest streams and pools with rocky beds especially, but not exclusively in ravines remains within certain perennial streams for Natal Kloof Frog.

The Natal Leaf-Folding Frog (*Afrixalus spinifrons*) which is classified as **Vulnerable** has been recorded within the 3030CA and 3030CB Quarter Degree Grid Cell (QDGC). *Afrixalus spinifrons* breeds in low-lying areas adjacent to the coast and breeds in standing water, in dense sedge beds and inundated grassy wetlands with abundant surface vegetation. Suitable habitat remains for Natal-Leaf-Folding Frog in the sedge and grass dominated valley bottom wetlands with large clumps of White Arums (*Zantedeschia aethiopica*). More intensive surveys conducted over extended periods are required in order to ascertain the current conservation status of Kloof Frogs and Natal Leaf-Folding Frogs in the area.

The dam basin of the proposed D2 on the Ncwabeni River is in a more natural state than that of the proposed D3A site on the Gugamela River, due to some human settlement in the Gugamela dam basin. The human settlement in the area increases the invasion of alien plants as it was evident during the site visits. Due to the inundation of large area during the operation of the dam will lead to total loss of species and their habitats on either site of the proposed dam. The areas that are closer to the CBA 1 need to be protected by a suitable buffer zone. If the D3A proposed scheme were to go ahead, then a new (not 'existing') quarry will need to be created at the D2 site as the possibility exists that rock material is not available within the D3A basin. This will enlarge the footprint of D3A and create a large area outside on the Full Supply Level (FSL) that will require rehabilitation. The inundation of ecosystems inevitably leads to the loss of habitat and terrestrial wildlife.

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|-----------------------------|
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|-----------------------------|

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Date: 06-08-2012

Signature:





## 1. INTRODUCTION

Nemai Consulting was appointed by Department of Water Affairs as the independent Environmental Assessment Practitioner (EAP) to undertake Environmental Impact Assessment for the proposed Ncwabeni Off-Channel Storage (OCS) Dam. Two alternative schemes for the proposed OCS dam are being considered - the Ncwabeni scheme and the Gugamela scheme. The objective of the terrestrial ecology assessment was to identify sensitive species and their habitats in the two proposed sites. The current ecological status and conservation priority of the vegetation on the site were assessed. Potential faunal habitats were assessed in the study area and all mammals, birds, reptiles and terrestrial invertebrates occurring on site were recorded. Red data species that are known to occur on site were investigated.

Environmentally sensitive areas at the site include features such as forest, rivers, threatened species and their habitats, areas of high species diversity and sites of scenic value. Even though no wetlands were recorded on the two proposed sites, wetlands are particularly vulnerable in the Ugu region (Umzumbe Spatial Development Framework, 2009). They are under severe pressure because of the inappropriate development pressure, which has characterized the history of Wetland depletion along the South Coast. The two rivers on site, i.e. nCwabeni and Gugamela Rivers were dominated by alien invasive plant species and throughout the Ugu District, indigenous vegetation is gradually being replaced by alien invasive species. This call for an aggressive invasive alien species eradication strategy and programme from and by all affected parties.

As far as conservation is concerned, the protected areas (according to NEM: Protected Areas Act) within Ugu District Municipality consist of Vernon Crookes, Mpenjati, Oribi Gorge, Umthamvuna and Mbumbazi Nature Reserves. These are privately owned game and nature reserves which are under the management of Ezemvelo KwaZulu-Natal Wildlife (EKZNW). No protected areas were recorded on the two proposed dam sites. The nearest protected areas to the proposed dam sites include the Oribi Gorge Nature Reserve (approximately 7km to the south of D3A) and the Mehlomyama Nature Reserve (approximately 7km to the east of D2).

## 1.1 Objectives of the survey

- To apply relevant literature to determine the diversity and eco-status of the plants, mammals, birds, reptiles and terrestrial invertebrates at the two proposed dam sites;
- To carry out a field survey to gain an indication of the diversity and eco-status of the above-mentioned taxa which inhabit the proposed study area, as well as the presence of unique habitats that might need further investigation or protection;
- To assess the possible impact of the proposed project on these taxa and/or habitats;
- To assess the current habitat and conservation status of plant and animal species in the study sites;
- To comment on ecological sensitive species/areas;
- To list the species on site and to recommend necessary mitigation measures in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance;
- To recommend any suitable buffer zones; and
- To provide management recommendations to mitigate negative and enhance positive impacts of the proposed two dam sites.

## 2. RELEVANT LEGISLATION AND GUIDELINES

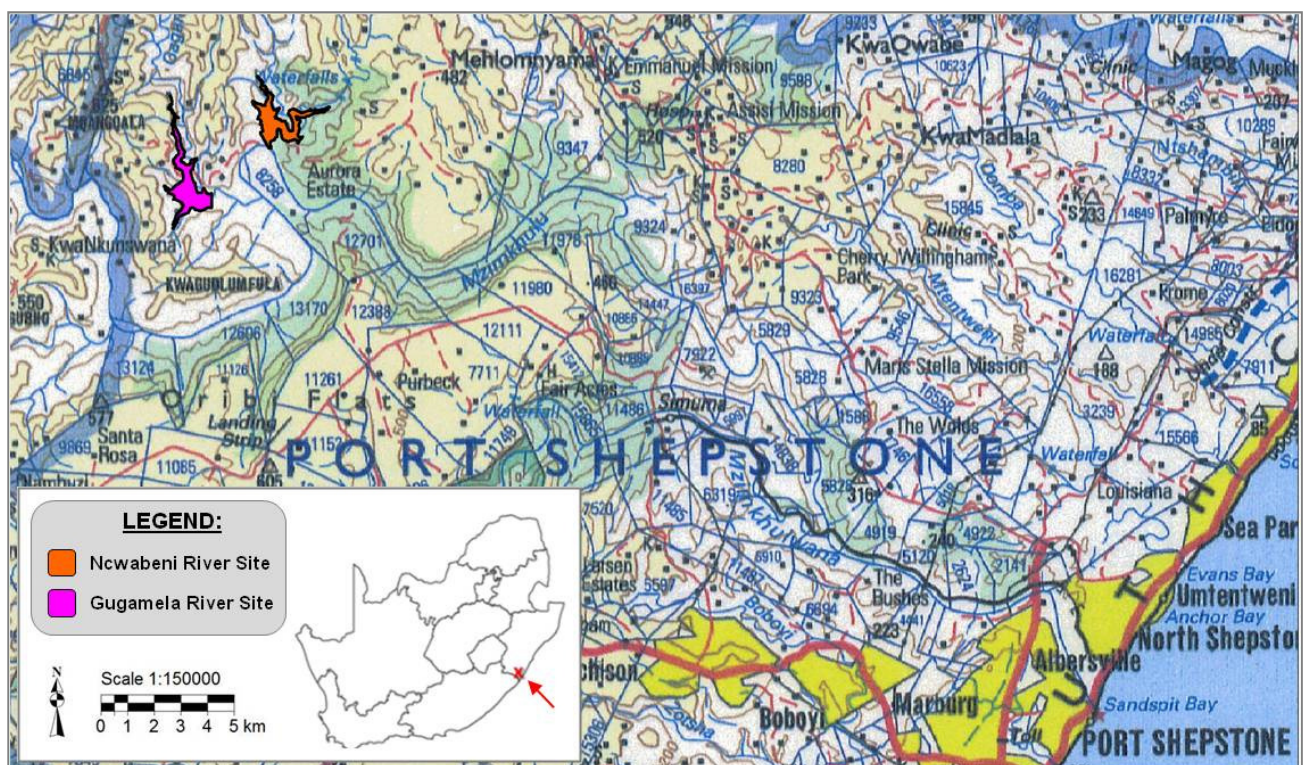
The following pieces of legislation are relevant to this project.

- Nature Conservation Ordinance, Ordinance 19 of 1974;
- Conservation of Agricultural Resources Act (Act 43 of 1983);
- Environment and Conservation Act (Act 73 of 1989);
- The Constitution, 1996 (Act 108 of 1996) – Section 24;
- The white paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997);
- National Water Act (Act 36 of 1998);
- National Environmental Management Act (Act 107 of 1998);
- National Forests Act (Act No 84 of 1998);
- National Veld and Forest Fire Act (Act 101 of 1998);
- National Environmental Management: Protected Areas Act (Act No 57 of 2003);
- Umzumbe Spatial Development Framework 2009;
- Ezemvelo KZNWildlife Strategic Environment Assessment;

- EKZNW Terrestrial Systematic Conservation Plan: Minimum Selection Surface (MINSET) 2010; and
- National Environmental Management Biodiversity Act (Act 10 2004).

### 3. STUDY AREA

The project area is situated in the central part of Kwa-Zulu Natal (KZN), approximately 20km north-west of Port Shepstone (Figure 1). The two OCS Dam sites are located close to the southern boundary of Ward 1 of the Umzumbe Local Municipality (KZ213), which falls within the Ugu District Municipality (DC21)



**Figure 1. Locality Map**

The Umzumbe Local Municipality covers a vast, largely rural area of some 1260 km<sup>2</sup> with approximately 1% being built up / semi-urban area. The municipality incorporates 17 traditional authority areas comprising 19 municipal wards. The study site is situated within the 3030CA and 3030CB quarter degree grid cells (q.d.g.c) within the KwaZulu Natal Province. The project area falls under the Nyamande Traditional Authority Ward on land which is registered under the Ngonyama Trust. The land on the opposite bank of the

Mzimkhulu River (Gibraltar 8258) is privately owned and commercially farmed. Refer to the layout of the two dam options contained in **Annexure A**.

### 3.1 OCS Dam Alternatives

A number of phases of identifying, comparing and selection of alternative options to meet the growing water demands of the Lower South Coast Water Supply System have been conducted. The construction of an OCS dam as part of a larger scheme of upgrading the current infrastructure and linking it to other existing systems was found to be the preferred alternative.

#### 3.1.1 Dam Sites

The two dam sites that are to be investigated further, which are located in two tributaries of the Mzimkhulu River, include:

The Ncwabeni scheme option consists of the following:

1. A 45 meter high dam from river bed level on the Ncwabeni River, with associated reservoir storage of approximately 15 million m<sup>3</sup>. The dam will have a multiple level off-take tower to ensure good quality water is release to the downstream environment. Two main dam types are being considered:
  - a) A rockfill dam with either a concrete face, asphalt core or a bentonite/sand core. This dam type will have a spillway, weir and chute that is routed directly to the Mzimkhulu River from the left flank of the dam; or
  - b) A roller compacted concrete dam with a central spillway.
2. An abstraction weir on the main Mzimkhulu River approximately 2m high from river bed level. Of the various weir positions considered, the lower weir position has been selected as the preferred option. The abstraction weir will also be fitted with a gauging facility in order to monitor flow rates in the Mzimkhulu River.
3. An abstraction works to remove silt and sand from the water diverted by the weir. This reduces the quantity of silt pumped into the dam and extends the dam's lifespan. The abstraction works consists of a gravel trap and a stilling basin. The delivery of water through the abstraction and de-silting works will be between 1 and 2 m<sup>3</sup>/s.

4. A pump station located on the left-hand bank (northern bank) of the abstraction weir. Water will be pumped from the abstraction works to the dam via a rising main pipeline. The pump station will deliver up to 1 m<sup>3</sup>/s of water.
  5. The pipeline will be routed alongside the slipway chute of the dam (should the rockfill dam be constructed) to reduce impacts on the surrounding landscape. The pipeline will be approximately 600m long and 900mm in diameter. The pipeline will spill the water into the dam approximately 200m upstream of the dam wall to avoid interfering with the dam wall.
  6. A re-alignment of the existing district gravel road. 1000m of new road to divert the existing district road around the downstream side of the dam embankment. A further additional 800m of road to provide access to the abstraction works and pumpstation.
  7. Three borrow areas:
    - a) A borrow area inside the proposed dam basin (quarry) to provide 800 000m<sup>3</sup> of rock material for a rockfill embankment as well as aggregate and sand for concrete;
    - b) A borrow area outside of the dam basin to provide sandy material; and
    - c) A possible borrow area in the Gugamela basin, however, initial indications are that the required material is not available in sufficient quantity for the particular dam type. This site is still under consideration until the geotechnical and materials investigation has been concluded.
  8. A new high voltage power line to bring electrical power to the site. The closest existing power line is the Qwabeni 11 kV line approximately 8km away, north east of the dam site.
- Site D2 situated on the Ncwabeni River – see **Figure 2**.



**Figure 2: Elevated view of Site D2**

The alternative scheme, namely the Gugamela scheme option consists of:

1. A 46 meter high dam from river bed level on the Gugamela River, with associated reservoir storage of approximately 17 million m<sup>3</sup>. The dam will have a multiple level off-take tower to ensure good quality water is released to the downstream environment. The same dam type options are being considered for the Gugamela dam as for the Ncwabeni Dam. The spillway of an embankment dam would be a side channel spillway delivering water back into the Gugamela River and not directly into the Mzimkhulu River.
2. An abstraction weir on the main Mzimkhulu River approximately 2m high from river bed level.
3. An abstraction works to remove silt and sand from the water diverted by the weir. This reduces the quantity of silt pumped into the dam and extends the dam's lifespan. The abstraction works consists of a gavel trap and a stilling basin. The delivery of water through the abstraction and de-silting works will be between 1 and 2 m<sup>3</sup>/s.
4. A pump station located on the left-hand bank (northern bank) of the abstraction weir. Water will be pumped from the abstraction works to the dam via a rising main pipeline. The pump station will deliver up to 1 m<sup>3</sup>/s of water.

5. The pipeline will be approximately 1600m long and 900m in diameter. The pipeline will spill the water into the dam approximately 1500m upstream of the dam wall to avoid interfering with the dam wall.
  6. A re-alignment of the existing district gravel road. 5000m of new road to divert the existing district road around the downstream side of the dam embankment. A further additional 400m of road to provide access to the abstraction works and pumpstation.
  7. Three borrow areas: one inside the proposed dam basin to provide semi-permeable and impermeable material and two outside of the basin to provide 800 000m<sup>3</sup> of rock material for a rock-fill embankment as well as aggregate and sand for concrete, and a second outside of the dam basin to provide sandy material.
  8. A new high voltage power line to bring electrical power to the site. The closest existing power line is the Qwabeni 11 kV line approximately 11km away, north east of the dam site.
- Site D3A situated on the Gugamela River – see **Figure 3**;



**Figure 3: Elevated view of Site D3A**

An aerial perspective of the sites, which are located on tribal land, is shown in **Figure 4**.

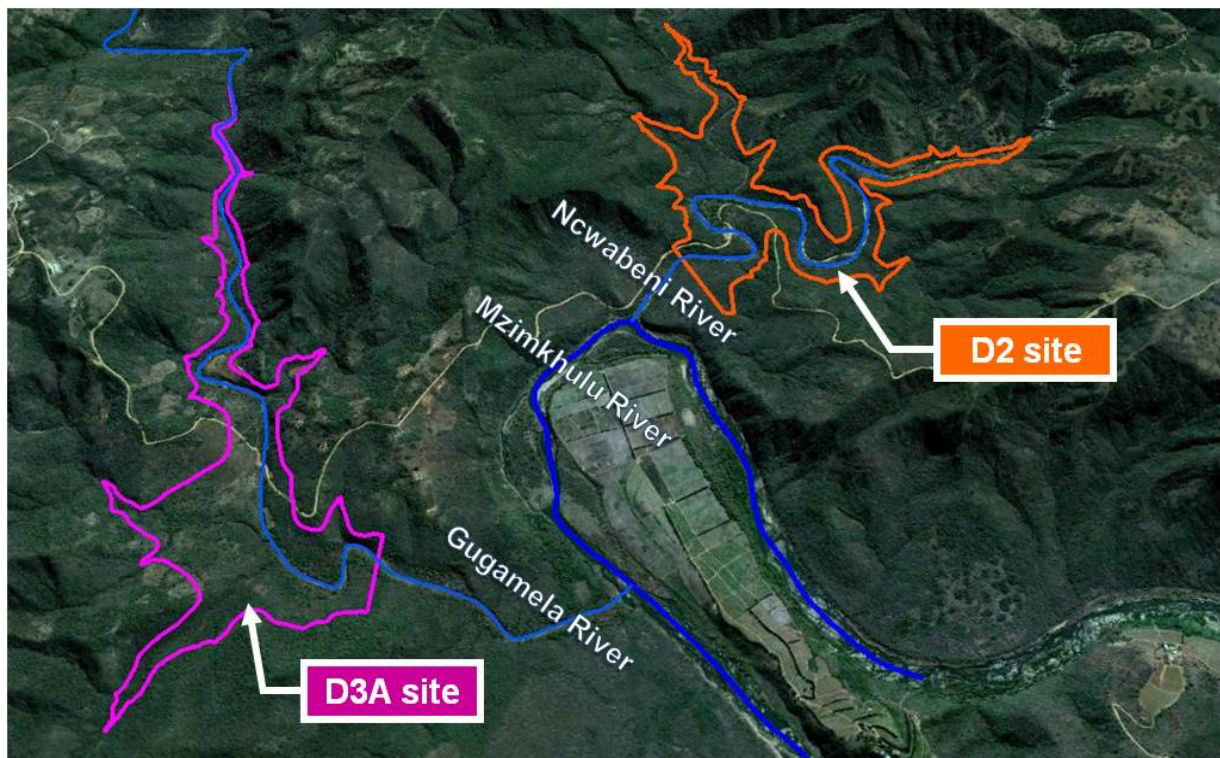


Figure 4: Aerial view of OCS Dam Sites

#### 4. LIMITATIONS AND GAPS

The constraints or limitations to the survey included:

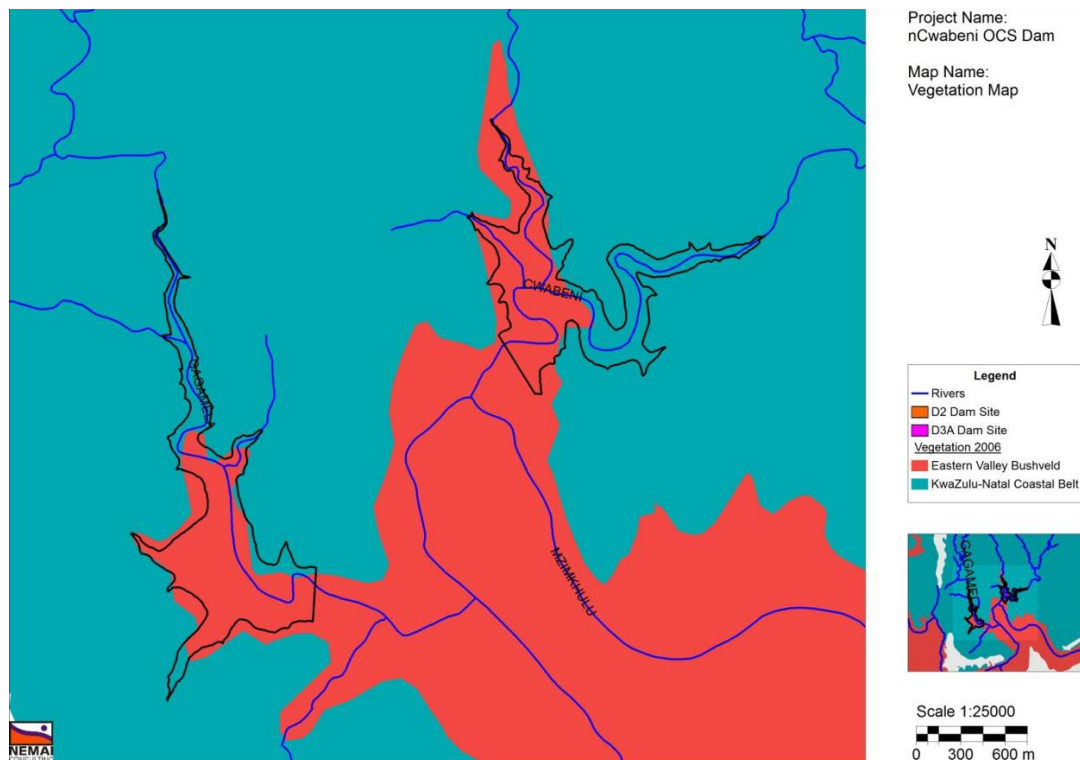
- The survey was based on a single site visit conducted for three days (30 hours) during the late summer months in March 2012.
- No comprehensive vegetation or faunal surveys were conducted due to time and financial constraints and as such several red data plants and animals could still occur in degraded habitats as well as in remnant wooded pockets.
- Areas such as valley bushveld thickets are situated on steep slopes and are extremely inaccessible.
- The majority of threatened plant species are seasonal and only flower during specific periods of the year, time constraints did not allow for repeated sampling over different seasons and so existing data were used to provide additional information.
- The majority of threatened faunal species are secretive and difficult to observe even during intensive field surveys conducted over several seasons. For this reason supplementary data from EKZNW records had been included in this report.
- A separate Invertebrate Assessment Report was conducted by Vincent van der Merwe from Endangered Wildlife Trust.



- Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage and Nema 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.

## 5. VELD TYPE DESCRIPTION

The vegetation types at the dam localities (D2 and D3A) include Kwazulu-Natal Coastal Belt and Eastern Valley Bushveld (**Figure 5**) (Mucina & Rutherford, 2006). The area also lies within the Maputaland-Pondoland terrestrial priority conservation area, which lies along the east coast of southern Africa, below the Great Escarpment.



**Figure 5: Vegetation Types in project area**

The study area falls within the savanna and Indian Ocean Coastal Belt biomes (Rutherford & Westfall, 1994; Low & Rebelo 1996).

The conservation status of the vegetation unit occurring within the study area is indicated in **Table 1**.

**Table 1.** Conservation status of the vegetation units recorded for the two proposed dam sites, D2 and D3A.

| Vegetation unit            | Ecosystem Status | Transformed | Target |
|----------------------------|------------------|-------------|--------|
| Eastern Valley Bushveld    | Least threatened | 15%         | 25%    |
| KwaZulu-Natal Coastal Belt | Endangered       | 50%         | 25     |

The description of the vegetation type follows.

### 5.1 KwaZulu-Natal Coastal Belt

The KwaZulu-Natal Coastal Belt occurs in long, broad, coastal strip along the KwaZulu-Natal coast from near Mtunzini in the north, past Durban to Margate and just short of Port Edward in the south. It is characterised by highly dissected undulating coastal plains which presumably used to be covered to a great extent with various types of subtropical coastal forest. Some primary grassland dominated by *Themeda triandra* still occurs in hilly, high-rainfall areas where pressure from natural fire and grazing regimes prevails. At present the KwaZulu-Natal Coastal Belt is affected by an intricate mosaic of very extensive sugarcane fields, timber plantations and coastal holiday resorts, with interspersed secondary *Aristida* grasslands, thickets and patches of coastal thornveld. At least three endemic plant species occur in the ecosystem (Mucina and Rutherford, 2006).

#### Conservation Status

KwaZulu-Natal Coastal Belt is formally classified as an Endangered and the remaining natural area of ecosystem is 45% and only 1% is protected in Ngoye, Mbumbazi and Vernon Crookes Nature Reserves. Alien invasive species that are threat to this vegetation type include *Chromolaena odorata*, *Lantana camara*, *Melia azedarach* and *Solanum mauritianum* (Mucina and Rutherford, 2006).

### 5.2 Eastern Valley Bushveld

Eastern Valley Bushveld is described by Mucina & Rutherford (2006) as being semideciduous savanna woodlands with pockets of thickets in a mosaic pattern. This may be succulent and dominated by *Euphorbia* and *Aloes*. Acocks (1988) called this vegetation type Valley Bushveld whereas Low & Rebelo (1996) called it Valley Thicket. It occurs in

KwaZulu-Natal and Eastern Cape Provinces, in deeply incised valleys of rivers including the lower reaches of the Thukela, Mvoti, Mgeni, Mlazi, Mkhomazi, Mzimkulu, Mzimkulwana, Mtamvuna, Mtentu, Msikaba, Mzimvubu (and its several tributaries), Mthatha, Mbhashe, Shixini, Qhorha and Great Kei. The Endemic taxa include the tall shrub *Bauhinia natalensis* and the succulent herb *Huernia pendula* (Mucina and Rutherford, 2006).

### **Conservation Status**

The Eastern Valley Bush currently has the conservation status of being Least Threatened. Of the National Conservation Target of 25% only 0.8 % is statutorily protected. Approximately 15% has been transformed through cultivation. *Chromolaena odorata*, *Lantana camara* and *Caesalpinia decapetala* are the most problematic alien invader plants threatening this vegetation type (Mucina and Rutherford, 2006).

## **6. TERRESTRIAL SYSTEMATIC CONSERVATION PLAN**

Below are the Conservation Plan Legend Definitions and their applicable interpretation derived from Terrestrial Systematic Conservation Plan: Minimum Selection Surface (MINSET) (EKZMW, 2010):

### **Critical Biodiversity Area 1 Mandatory (Previously: Biodiversity Priority Area 1)**

The Critical Biodiversity Area (CBA) 1 Mandatory areas are identified based on the C-Plan Irreplaceability analyses. These planning units have an Irreplaceability value of 1 as they represent the only localities for which the conservation targets for one or more of the biodiversity features contained within can be achieved i.e. there are no alternative sites available.

The distribution of biodiversity features is not always uniform across the entire extent of the Planning Unit (PU) however, but is more often than not confined to a specific niche habitat e.g. a forest or wetland reflected as a portion of the PU in question. In such cases, development could be considered within the PU if special mitigation measures are put in place to safeguard this feature(s) and if the nature of the development is commiserate with the conservation objectives. Obviously this is dependent on a site by site, case by case analysis. This distribution dynamics outlined above are the same for all three CBA's indicated in the C-Plan MINSET analysis.

### **Critical Biodiversity Area 2 Mandatory (Previously: Biodiversity Priority Area 2)**

CBA 2 Mandatory areas represent areas of significantly high biodiversity value. In C-Plan analyses, these areas are identifiable as having an Irreplaceability scores of  $\geq 0.8$  and  $< 1.0$  whilst the MARXAN equivalent is reflected in Planning Unit's (PU) displaying a selection frequency value of between 80 – 100%. In practical terms, this means that there are limited alternate sites within which the targets can be met for the biodiversity features contained within. This site was chosen because it represents the most optimal area for choice in the systematic planning process, meeting both the conservation target goals for the features concerned as well as a number of other guiding criteria as defined by the Decision Support Layers. Whilst the targets could be met elsewhere, the revised reserve design (derived through either the C-Plan MINSET or MARXAN analysis) would more often than not require more area in order to meet its conservation objectives. The scarcity of the Biodiversity features contained within is, however, still the primary driver for this PU's selection in the conservation analyses.

### **Critical Biodiversity Area 3 Optimal (Previously: Biodiversity Priority Area 3)**

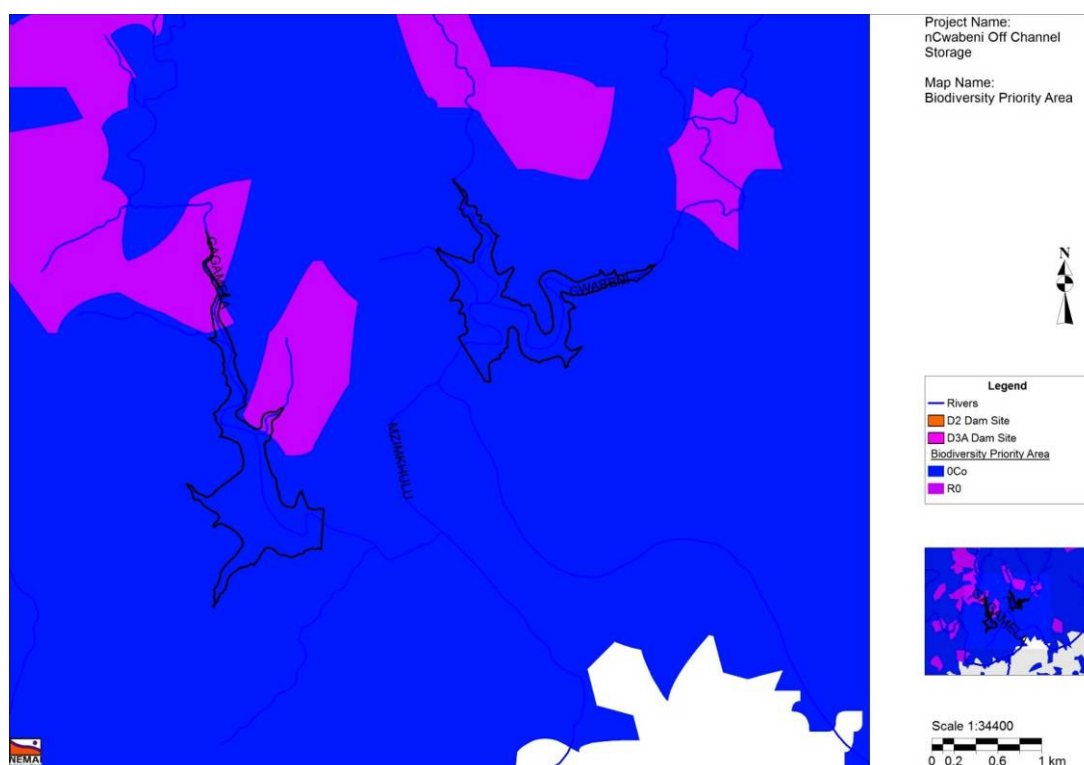
CBA 3 Optimal areas are areas identified through systematic conservation planning software which represent the best localities out of a potentially larger selection of available PU's that are optimally located to meet both the conservation target but also the criteria defined within the Decision Support Layers. Using C-Plan, these areas are identified through the MINSET analysis process and reflect the negotiable sites with an Irreplaceability score of less than 0.8. Within the C-Plan MINSET analysis this does not mean they are of a lower biodiversity value however, only that there are more alternate options available within which the features located within can be met. The determination of the spatial locality of these PU's is driven primarily by the Decision Support Layers.

The MARXAN equivalent is reflected within the "Best" solution output less the CBA 2 Mandatory areas. (The "Best" solution output is essentially the most efficient solution and thus the most optimal solution to meet all biodiversity conservation targets while avoiding high cost areas as much as possible). Even though these areas may display a lower Irreplaceability value or selection frequency score than the previous categories, it must be noted that these areas, together with the above two categories, collectively reflect the minimal reserve design required to meet the Systematic Conservation Plans targets and as such, they are also regarded as CBA areas. A brief summary of the above mentioned categories is in **Table 2**.

**Table 2.** A brief summary of the Terrestrial Systematic Conservation Plan: Minimum Selection Surface (MINSET).

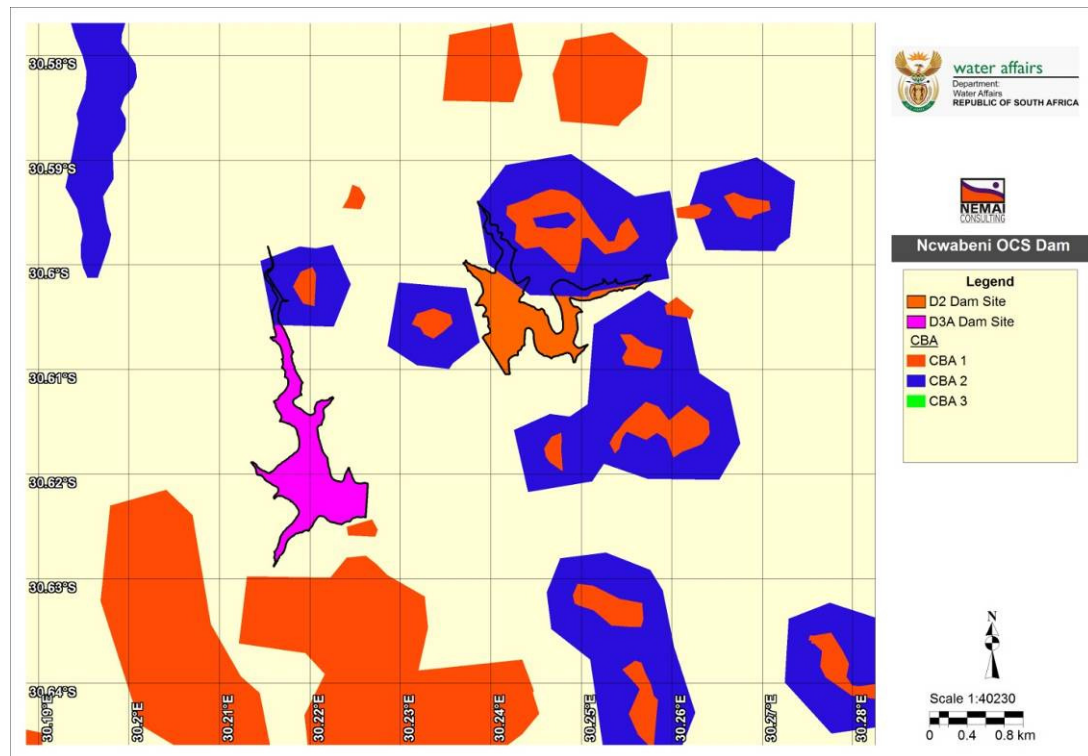
| Category                | C-plan  | Marxan   | Biodiversity sector and regional plans |
|-------------------------|---|--|--|
| CBA 1 Mandatory (BPA 1) | Irreplaceability = 1                          | No equivalent  | CBA Mandatory                          |
| CBA 2 Mandatory (BPA 2) | Irreplaceability Score $\geq 0.8$ and $< 1.0$ | Selection frequency value = 80% – 100%                           | CBA Mandatory                          |
| CBA 3 Optimal (BPA 3)   | Irreplaceability Score $\geq 0$ and $< 0.8$   | “Best” solution from MARXAN runs less the identified CBA 2 areas | CBA Optimal                            |

Based on the information data received from Ezemvelo KZN Wildlife, Ncwabeni OCS falls within Areas of Not Conservation Significance (0Co) while Gugamela falls within a Biodiversity Priority Area (BPA) 3, also known as CBA 3 Optimal and 0Co (see **Figure 6**).



**Figure 6. Occurrence of two proposed sites in the Biodiversity Priority Areas**

The data provided by South African National Biodiversity Institute (SANBI) on terrestrial CBAs around the southern parts of KwaZulu Natal indicates that the two proposed dam sites fall within CBA 2 as indicated in **Figure 7**.



**Figure 7. Occurrence of the OCS dam sites in a CBA**

## 7. MAPUTALAND-PONDOLAND-ALBANY BIODIVERSITY HOTSPOT

The proposed sites also fall within the Maputaland-Pondoland-Albany Hotspot which is the second richest Floristic Region in southern Africa and Africa (after the Cape Floristic Region) for its size. The hotspot spans an area of nearly 275 000 km<sup>2</sup> and includes portions of South Africa, Swaziland and Mozambique. At a habitat level, one type of forest, three types of thicket, six types of bushveld and five types of grasslands are unique to the hotspot. The coastal waters of this hotspot are also significant at a global level for their diverse marine species (<http://www.wildlands.co.za/our-work/where-we-do-it/maputaland-pondoland-albany-biodiversity-hotspot/>).

The Maputaland-Pondoland-Albany Hotspot is the amalgamation of three centers of endemism (Maputaland, Pondoland and Albany), and is the meeting point of six of South Africa's eight biomes. The region has unusually high levels of endemism at all levels, as well as an endemic vegetation type called "subtropical thicket." Subtropical thicket is a condensed forest of thorny trees, shrubs and vines and is an unusual ecosystem driven by elephants, black rhino and Cape buffalo that crash open paths and disperse seeds through

their digestive tracts (Conservation International Southern African Hotspots Programme, 2010).

The Maputaland-Pondoland-Albany centre of endemism is a globally recognised hotspot (i.e. an area of high biodiversity which is under serious threat (Driver et al. 2004). There are only three such globally recognised hotspots in South Africa. The conservation value of Maputaland is internationally recognised, as it forms part of the Maputaland-Pondoland-Albany biodiversity hotspot (**Figure 8**) (Smith & Leader-Williams, 2006).

Some of the endemic and near-endemic plant species restricted to the Maputaland-Pondoland-Albany Hotspot is *Erythrina caffra*, *Hibiscus pendunculatus*, *Aloe thraskii*, *Dracaena aletriformis*, *Albizia suluensis*, *Allophylus natalensis*, *Aloe thraskii*, *Atalaya alata*, *Atalaya natalensis*, *Baphia racemosa*, *Brachylaena discolor*, *Deinbollia oblongifolia*, *Encephalartos natalensis*, *Encephalartos woodii*, *Ficus bizanae*, *Isoglossa woodii*, *Jubaeopsis caffra*, *Millettia grandis*, *Raphia australis*, *Stangeria eriopus*, *Tephrosia pondoensis* and *Isoglossa woodii* (Conservation International Southern African Hotspots Programme, 2010).



**Maputaland-Pondoland-Albany  
Biodiversity Hotspot:  
Grants Awarded**

0 75 150 300 Kilometers



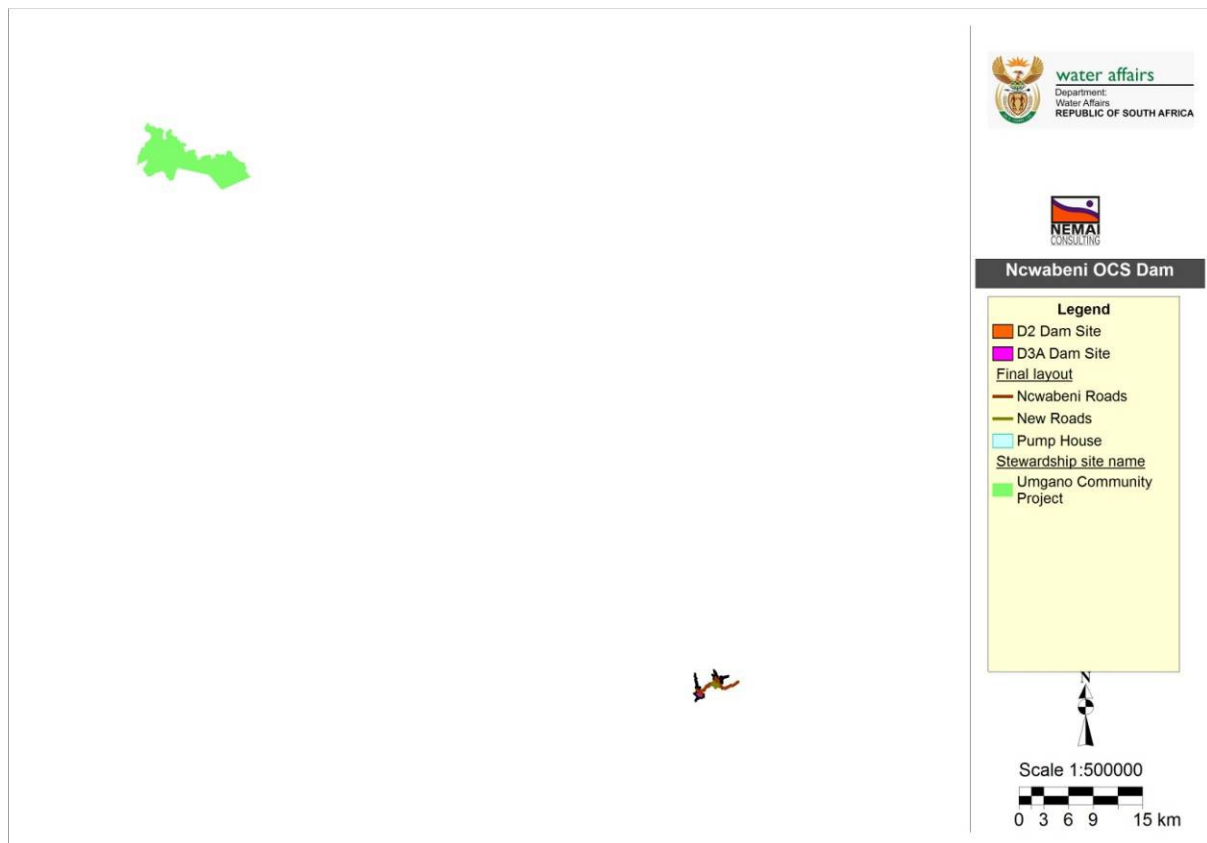
**Figure 8. Map of Maputaland-Pondoland-Albany biodiversity hotspot (Conservation International Southern African Hotspots Programme, 2010).**

## **8. NATIONAL PROTECTED AREA EXPANSION STRATEGY**

It had been established through KZN systematic conservation planning process that more than half of the province's high priority and conservation-worthy biodiversity is located on



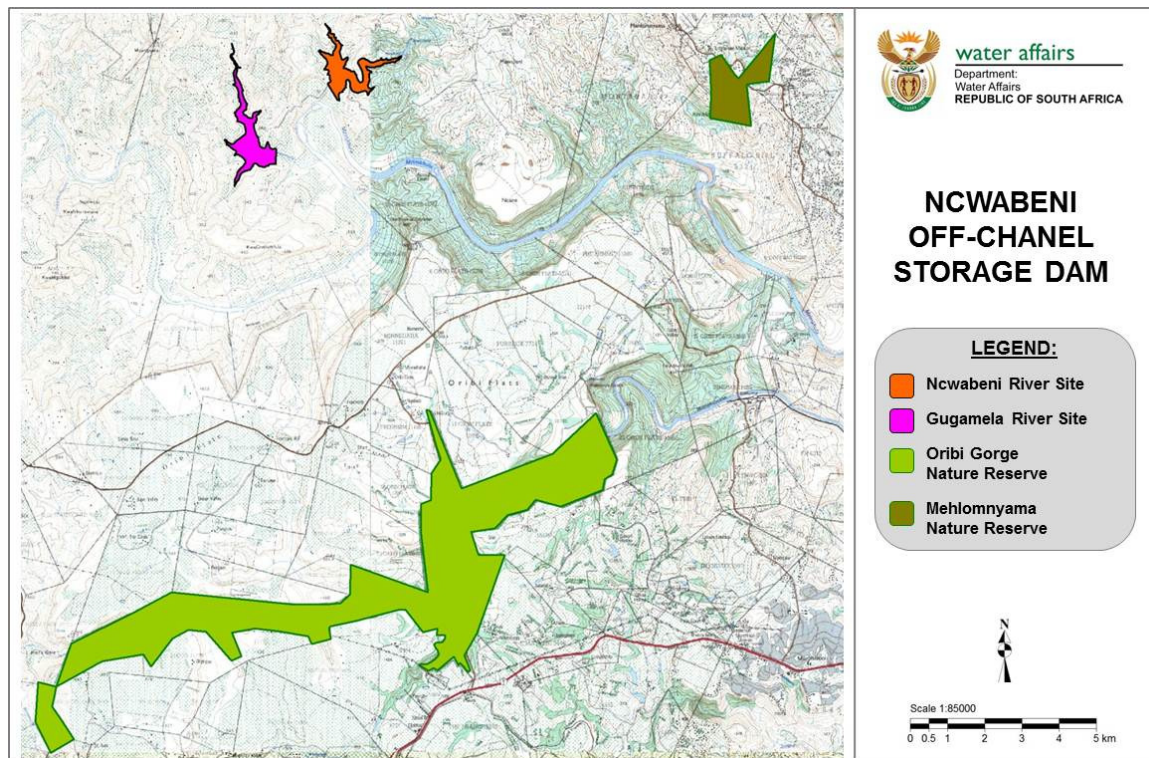
private and communal land and in order to conserve representative samples of such vulnerable biodiversity, it must be incorporated in a formal land-based Protected Area network. KwaZulu Natal, in support of the National Protected Area Expansion Strategy (NPAES) (**Figure 9**), is under a mandate to expand its formal protected area network. Using nationally developed guidelines, an acquisition target of 9% has been set for KwaZulu Natal's for purchase by 2028. The nearest proposed Stewardship site, namely Umgano Community Project, lies approximately 80Km north east of the two proposed dam sites.



**Figure 9. Map showing Protected Area Expansion**

## 9. PROTECTED AREAS

The nearest protected areas to the dam sites include two provincial nature reserves, namely the Oribi Gorge Nature Reserve (approximately 7km to the south of D3A) and the Mehlomnyama Nature Reserve (approximately 7km to the east of D2) (see **Figure 10**).



**Figure 10.: Protected areas nearest to dam sites**

## 10. THREATENED ECOSYSTEMS

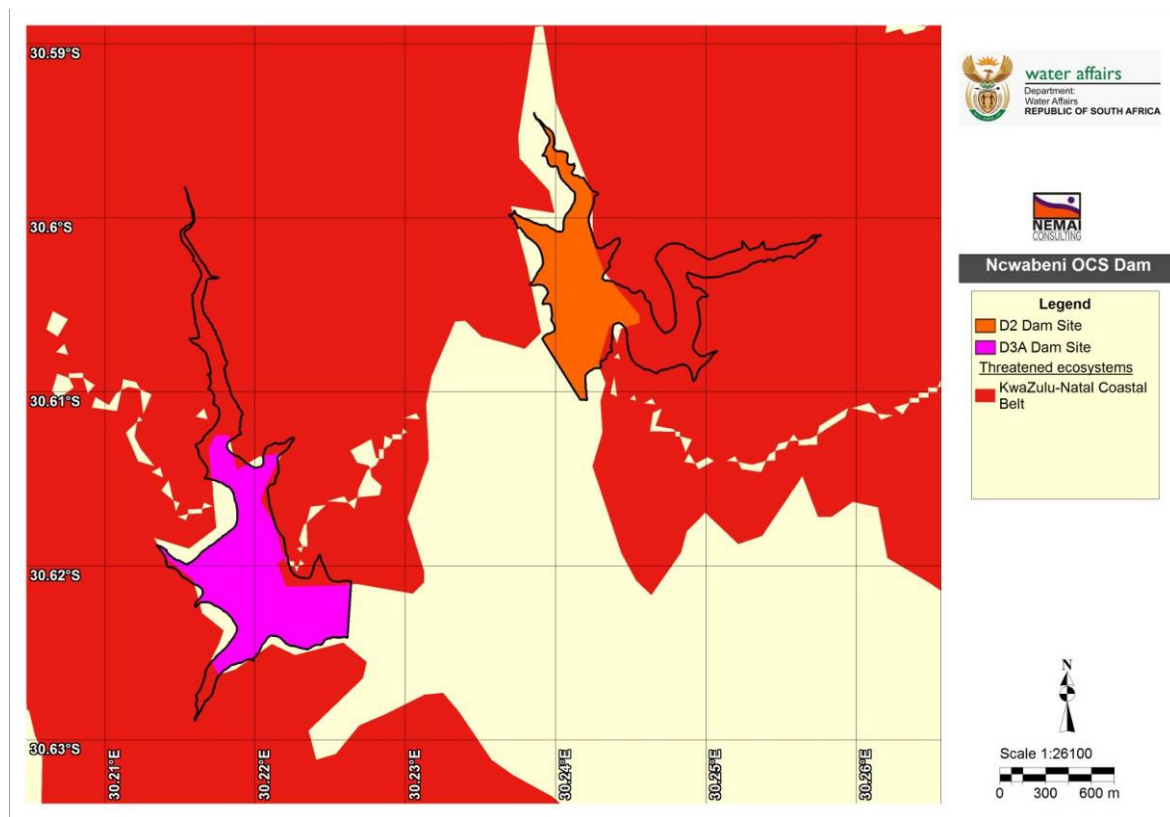
The first national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). It listed all the threatened or protected ecosystems in South Africa in terms of four categories; critically endangered (CR), endangered (EN), vulnerable (VU), or protected. The purpose of listing these ecosystems is primarily to reduce the rate of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems. It is estimated that threatened ecosystems make up 9.5% of the country, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% (SANBI, 2011).

The South African National Biodiversity Institute (SANBI) in conjunction with the Department of Environmental Affairs and Tourism (DEAT) released a draft report in 2009 entitled “Threatened Ecosystems in South Africa: Descriptions and Maps”, to provide background information on the above List of Threatened Ecosystems. The purpose of this report was to present a detailed description of each of South Africa’s ecosystems and to determine their

status using a credible and practical set of criteria. The following criteria were used in determining the status of threatened ecosystems:

- Irreversible loss of natural habitat.
- Ecosystem degradation and loss of integrity.
- Limited extent and imminent threat.
- Threatened plant species associations.
- Threatened animal species associations.
- Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan.

The KwaZulu-Natal Coastal Belt is listed as Vulnerable under these criteria and occurs within both proposed sites (**Figure 11**).



**Figure 11. Listed threatened terrestrial ecosystem recorded in the two proposed dam sites**

## 11. METHODOLOGY

The White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997) and the National Environmental Management Act (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.

### 11.1 Flora

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Flora assessment consisted of two complementary approaches:

- A desktop analysis of literature review, photographs, topographical maps, and Google Earth imagery; and
- Site visits were conducted from 14-16 March 2012.

Satellite imagery of the area was obtained from Google Earth and was studied in order to get a three dimensional impression of the topography and land use and also to identify potential “hot-spots” or specialised habitats e.g. patches of undisturbed vegetation, river crossings and riparian vegetation.

The Pretoria Computerised Information System (PRECIS) lists of Red Data plants recorded in the 3030CA and 3030CB quarter degree grid squares were obtained from South African National Biodiversity Institute (SANBI) (<http://posa.sanbi.org/searchsp.php>). The lists were consulted to verify the record of occurrence of the plant species seen in the vicinity of the proposed dam sites. The sites sampled are also only a very small portion of the whole grid and so habitats suitable for certain species in the PRECIS lists may not be present at the areas sampled. The vegetation map published in Mucina & 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 and other species of conservation importance known to occur in the area was conducted before the site visits.

The study sites were visited in March 2012. The habitats of the study areas 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 trees, shrubs, grasses and herbs (forbs). 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 alien species and declared weeds. Field guides such as Pooley (1998), Pooley (2005), van Wyk *et al.*, (1997) and van Oudshoorn (1999) were utilised during the field work.

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 ornamentals, as sources of timber, or may have other benefits (Henderson, 2001). These plants need to be managed and prevented from spreading.

Alien and invasive plant species can be grouped three categories:

- Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.
- Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.
- Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.

The planting of Category 2 and 3 plants should be confined to demarcated areas under controlled conditions of cultivation (Bromilow, 1995 & 2010).

## 11.2 Mammals

Site visits were conducted in March 2012 and during this visit, the observed and derived presences of mammals associated with the recognized habitat types of the study site were recorded during the day. No nocturnal surveys were undertaken. This was done with due regard to the well recorded global distributions of Southern African mammals, coupled with qualitative and quantitative nature of recognized habitats. Adjoining properties were also scanned for important faunal habitats. During site visits, mammals were identified by 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 12**) 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. In addition, mammals were also identified by means of spoor, droppings, or burrows. Locals were interviewed to confirm

occurrences or absences of species. In addition, mammals were also identified by means of spoor, droppings, or burrows.



**Figure 12. Sherman traps used for small mammals such as rats and mice**

According to the data provided by EKZNW, no Red Data mammal species are known to occur in or near the study area.

### **11.3 Avifauna**

The presence of suitable habitat was used to deduce the likelihood of presence or absence of species, based on scientific literature, field guides and databases.

The likely occurrence of key bird species was verified according to Southern African Bird Atlas Project 2 from the University of Cape Town's Animal Demographic Unit for the grid cells 3030CA and 3030CB. However, the specific habitat(s) found on site may not suit the particular Red Data species, even though it has been recorded for the quarter degree cells. Red Data bird species were selected and categorised according to Barnes (2000).

Site visits were conducted to record the presence of bird species associated with the habitat systems on the study site and to identify possible sensitive areas. Birds were identified visually, by call, roosting sites and feathers and by also using a 10X42 Bushnell Waterproof binocular and where necessary verified from *Sasol Birds of Southern Africa* (Sinclair *et al.*, 2005) and *The Chamberlain guide to birding Gauteng* (Marais & Peacock, 2008). The study

sites were surveyed on foot and in the process sightings were recorded through random transects walks. The adjoining properties were also scanned for important bird habitats and species.

#### **11.4 Reptiles**

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The majority of reptiles are secretive, or seasonal, and as such distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on scientific literature, field guides, atlases and databases.

A list of reptile species that could possibly occur within the study area was adopted from the South African Reptile Conservation Assessment (SARCA), within the Avian Demographic Unit (ADU) in University of Cape Town. The list includes the entire reptile species recorded in grid cells 3030CA and 3030CB. Branch (1988) was used to provide a probable reptile species list according to their distribution ranges as well as their habitat preferences/availability.

A reptile assessment was conducted during the day. During field visits, the observed and derived presence of reptiles associated with the recognised habitat types of the study site was recorded by active sampling techniques. Reptiles were identified by sightings during random transect walks. Possible burrows or other reptile retreats (stumps or rocks) were inspected for any inhabitants. Field guides by Branch (1998, 2001) and Alexander & Marais (2007) were utilised during the field assessment.

#### **11.5 Amphibians**

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According to Carruthers (2001), amphibians are extremely sensitive to habitat transformation and degradation. The dam will have a high negative impact on the majority of frog species occurring within the inundation zone as well as the dam acting as a potential dispersal or migratory barrier. Most frogs cannot cross large open bodies of water as well as the alteration of the fish communities results in increased predation especially by introduced fish species such as the Large and Small-mouthed Bass.

## **12. RESULTS AND DISCUSSION**

### **12.1 Flora**

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### 12.1.1 PROTECTED TREES

In terms of the National Forests Act 1998 (Act No 84 of 1998) certain tree species can be identified and declared as protected. The Department of Water Affairs and Forestry (now Department of Forestry and Fisheries) developed a list of protected tree species. In terms of Section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization. The protected trees that have a geographical distribution that includes the two sites are *Prunus africana*, *Rhizophora mucronata*, *Sideroxylon inerme subsp inerme*, *Mimusops caffra*, *Ocotea bullata*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *P. henkelii*, *P. latifolius*, *Colubrina nicholsonii*, *Curtis dentate*, *Barringtonia racemosa*, and *Bruguiera gymnorrhiza*.

### 12.1.2 DESKTOP RESULTS

#### **D2 (Ncwabeni) Off-Channel Storage Dam**

The proposed dam site is located within the 3030CA and 3030CB quarter degree squares in terms of the 1:50 000 grid of South Africa. SANBI used this grid system as a point of reference to determine any Red Data plant species or any species of conservation importance occurring in South Africa. This can be used to determine lists of species which could potentially occur within an area. **Table 3** provides details on the Red Data plant species which have been recorded for this quarter degree square. The statuses allocated to the species are defined in **Table 4** below. It is, therefore, imperative, during the construction phase, that detailed searches for these rare/threatened and protected species are made during the appropriate time of year when plants are likely to be visible.



**Table 3.** Red Data Plant species recorded in grid cell 3030CA and 3030CB which potentially occur in the study area (Raimondo *et. al.* (2009).

| Family         | Species                                    | Threat status | SA Endemic | Growth forms        | Habitat suitability  | Probability of Occurrence |
|----------------|--|---------------|------------|---------------------|--|---------------------------|
| Amaryllidaceae | <i>Haemanthus deformis</i> Hook.f.         | NT            | Yes        | Geophyte, succulent | Grows in moist, shaded conditions amongst bushy undergrowth or between rocks on shady slopes   | Likely                    |
| Anacardiaceae  | <i>Loxostylis alata</i> A.Spreng. ex Rchb. | Declining     | Yes        | Shrub, tree         | Occurs along forest margins, beside rivers and on outcrops of quartz and sandstone   | Likely                    |
| Apocynaceae    | <i>Brachystelma tenellum</i> R.A.Dyer      | VU            | Yes        | Geophyte, succulent | Coastal grasslands, in shallow soil pockets in rocky outcrops and on cliffs  | Possible                  |
| Arecaceae      | <i>Jubaeopsis caffra</i> Becc.             | EN            | Yes        | Tree                | Grows naturally on the banks of rivers   | Likely                    |
| Asphodelaceae  | <i>Aloe cooperi</i> Baker subsp. cooperi   | Declining     | No         | Herb, succulent     | It occurs in moist habitats and in dry rocky areas, mainly in Natal, Swaziland and Mpumalanga  | Possible                  |
| Asphodelaceae  | <i>Aloe linearifolia</i> A.Berger          | NT            | Yes        | Herb, succulent     | Found in the grassland of southern and central KwaZulu-Natal   | Unlikely                  |
| Asphodelaceae  | <i>Aloe thraskii</i> Baker                 | NT            | Yes        | Shrub, tree         | Can be found in coastal bush on the dunes on the coastline from the northern Parts of the Eastern Cape into the southern parts of KwaZulu-Natal. | Unlikely                  |

| Family        | Species   | Threat status | SA Endemic | Growth forms            | Habitat suitability  | Probability of Occurrence |
|---------------|---|---------------|------------|-------------------------|--|---------------------------|
| Asphodelaceae | <i>Kniphofia coddiana</i> Cufod.                        | NT            | Yes        | Herb                    | Occurs in Pondoland coastal grassland  | Unlikely                  |
| Asteraceae    | <i>Callilepis leptophylla</i> Harv.                     | Declining     | No         | Herb                    | Grassland or open woodland, often on rocky outcrops or rocky hill slopes   | Possible                  |
| Asteraceae    | <i>Senecio erubescens</i> Aiton var. <i>incisus</i> DC. | Threatened    | Yes        | Herb                    | In seasonally wet grassland and marshes  | Possible                  |
| Celastraceae  | <i>Elaeodendron croceum</i> (Thunb.) DC.                | Declining     | No         | Tree                    | occurs on the margins of coastal and other moist inland forests  | Possible                  |
| Celastraceae  | <i>Gymnosporia bachmannii</i> Loes.                     | VU            | Yes        | Shrub, tree             | It occurs on sandstone outcrops on the rocky banks and beds of rivers and streams.                                   | Likely                    |
| Celastraceae  | <i>Pseudosalacia streyi</i> Codd                        | EN            | Yes        | Shrub, tree             | It is found along sandstone streams or in moist places in evergreen forests, sometimes in small groves.              | Likely                    |
| Colchicaceae  | <i>Sandersonia aurantiaca</i> Hook.                     | Declining     | No         | Climber, geophyte, herb | Grassland and forest margin distribution range in the Eastern Cape, KwaZulu-Natal, Swaziland and southern Mpumalanga | Possible                  |
| Euphorbiaceae | <i>Euphorbia woodii</i> N.E.Br.                         | EN            | Yes        | Dwarf shrub, succulent  | Coastal grasslands and low dune bush   | Unlikely                  |
| Fabaceae      | <i>Aspalathus gerrardii</i> Bolus                       | VU            | Yes        | Shrub                   | Coastal grasslands, forest margins, often in   | Possible                  |

| Family        | Species  | Threat status | SA Endemic | Growth forms                 | Habitat suitability  | Probability of Occurrence |
|---------------|--|---------------|------------|------------------------------|--|---------------------------|
|               |  |               |            |                              | damp or marshy sites   |                           |
| Fabaceae      | <i>Podalyria velutina</i> Burch. ex Benth.                 | NT            | Yes        | Shrub                        | Moist, sheltered sites in Pondoland coastal grassland and forest margins, often along streams  | Possible                  |
| Fabaceae      | <i>Tephrosia bachmannii</i> Harms                          | VU            | Yes        | herb, shrub                  | Occurs in a variety of habitats including open grasslands, rocky sites and forest margins.   | Possible                  |
| Hyacinthaceae | <i>Bowiea volubilis</i> Harv. ex Hook.f. subsp. volubilis  | VU            | No         | Climber, geophyte, succulent | Usually found along mountain ranges, in thickly vegetated river valleys, under bush clumps and in boulder screes   | Possible                  |
| Hypoxidaceae  | <i>Hypoxis hemerocallidea</i> Fisch., C.A.Mey. & Avé-Lall. | Declining     | No         | Geophyte                     | Occurs in open grassland and woodland and is widespread in South Africa in the eastern summer rainfall provinces (Eastern Cape, Free State, KwaZulu-Natal, Mpumalanga, Gauteng and Limpopo). | Unlikely                  |
| Lamiaceae     | <i>Plectranthus oertendahlii</i> T.C.E.Fr.                 | Rare          | Yes        | Herb, succulent              | Its natural habitat is along the wooded river valleys on the coast of southern KwaZulu-Natal and Pondoland   | Possible                  |

| Family      | Species                                    | Threat status | SA Endemic | Growth forms         | Habitat suitability  | Probability of Occurrence |
|-------------|--|---------------|------------|----------------------|--|---------------------------|
|             |  |               |            |                      | and is endemic to a small area from the Oribi Gorge northwards to Uvongo   |                           |
| Lamiaceae   | <i>Plectranthus oribiensis</i> Codd        | Rare          | Yes        | Herb                 | Occurs at forest margins and in wooded kloofs  | Possible                  |
| Lauraceae   | <i>Cryptocarya latifolia</i> Sond.         | Declining     | Yes        | Tree                 | Occurs in green forests along streams and rivers, coastal forests and coastal plateaus   | Likely                    |
| Lauraceae   | <i>Cryptocarya wyliei</i> Stapf            | NT            | Yes        | Shrub, tree          | It is abundant in coastal bush, forest margins, as well as riverine fringe forest and thicket.                                     | Possible                  |
| Lauraceae   | <i>Ocotea bullata</i> (Burch.) Baill.      | EN            | Yes        | Tree                 | Occurs naturally in most of the high forests of South Africa, from the kloofs of Table Mountain to the mountain forests of Limpopo | Possible                  |
| Malvaceae   | <i>Grewia pondoensis</i> Burret            | NT            | Yes        | Climber, shrub, tree | Occurs in forest margins, cliffs and rocky places  | Possible                  |
| Myrtaceae   | <i>Eugenia simii</i> Dummer                | VU            | Yes        | Shrub                | Occurs on rocky banks of rivers  | Likely                    |
| Orchidaceae | <i>Disperis woodii</i> Bolus               | Declining     | Yes        | Geophyte, herb       | Occurs in damp grassland, usually sandy soils, sometimes within grass tussocks   | Possible                  |
| Orchidaceae | <i>Eulophia speciosa</i> (R.Br. ex Lindl.) | Declining     | No         | Geophyte,            | The plants normally  | Likely                    |

| Family         | Species   | Threat status | SA Endemic | Growth forms       | Habitat suitability   | Probability of Occurrence |
|----------------|---|---------------|------------|--------------------|---|---------------------------|
|                | Bolus   |               |            | succulent          | grow in savanna grassland, bushland and wooded grassland, and have also been recorded from marshy coastal grassland and montane grassland                         |                           |
| Passifloraceae | <i>Adenia gummifera</i> (Harv.) Harms var. <i>gummifera</i>                                       | Declining     | No         | Climber, succulent | Occurs in Forested ravines, forest patches and forest margins, forest scrub, miombo woodland, savanna, dune forest, on stony slopes, termitaria and littoral bush | Possible                  |
| Prioniaceae    | <i>Pronium serratum</i> (L.f.) Drège ex E.Mey.  | Declining     | Yes        | Herb, hyperhydate  | It is found in marshy areas, streams, rivers and riverbanks, in large dense stands  | Likely                    |
| Proteaceae     | <i>Faurea macnaughtonii</i> E.Phillips  | Rare          | No         | Tree               | Occurs in Forests and forest margins.   | Likely                    |
| Proteaceae     | <i>Leucadendron spissifolium</i> (Salisb. ex Knight) I.Williams subsp. <i>oribinum</i> I.Williams | VU            | Yes        | Dwarf shrub        | Occurs in sandy soil on steep, stony, grassy slopes above the cliffs of the Oribi Gorge near Port Shepstone and on grassland slopes nearby                        | Unlikely                  |
| Rhamnaceae     | <i>Phylica natalensis</i> Pillans   | VU            | Yes        | Dwarf shrub        | Occurs in Pondoland coastal grassland, in rocky sites   | Unlikely                  |
| Rhizophoraceae | <i>Cassipourea gummiflua</i> Tul. var.  | VU*           | No         | Tree               | Occurs in evergreen   | Likely                    |

| Family           | Species  | Threat status | SA Endemic | Growth forms    | Habitat suitability  | Probability of Occurrence |
|------------------|--|---------------|------------|-----------------|--|---------------------------|
|                  | <i>verticillata</i> (N.E.Br.) J.Lewis              |               |            |                 | and riverine forest  |                           |
| Rhynchoalycaceae | <i>Rhynchoalycx lawsonioides</i> Oliv.             | NT            | Yes        | Tree            | Found on forest margins and along streams and rivers.  | Likely                    |
| Rubiaceae        | <i>Canthium vanwykii</i> Tilney & Kok              | NT            | Yes        | Shrub           | Found in forest margins or more rarely in fire protected rocky crevices in grassland   | Possible                  |
| Stangeriaceae    | <i>Stangeria eriopus</i> (Kunze) Baill.            | VU            | No         | Geophyte, herb  | occurs in coastal grassland and inland forests along the east coast of South Africa  | Possible                  |
| Zamiaceae        | <i>Encephalartos caffer</i> (Thunb.) Lehm.         | NT            | Yes        | Geophyte, shrub | Occurs in coastal belt grassland, often among rocks, in the districts of Humansdorp, Albany, Bathurst and East London, in the former Transkei in the district of Kentani, and as far east as Willowvale. | Unlikely                  |
| Zamiaceae        | <i>Encephalartos ghellinckii</i> Lem.              | VU            | Yes        | Shrub, tree     | Found in grasslands on rocky slopes and ridges   | Unlikely                  |
| Zamiaceae        | <i>Encephalartos natalensis</i> R.A.Dyer & I.Verd. | NT            | Yes        | Shrub, tree     | It grows on cliffs, in forests and on rocky outcrops   | Possible                  |

**Table 4.** Definitions of Red Data status (SANBI, 2010)

|    |                 |   |
|----|-----------------|---|
| EN | Endangered      | A taxon is <b>Endangered</b> when the best available evidence indicates that it meets any of the five IUCN criteria for Endangered, and is therefore facing a very high risk of extinction in the wild.   |
| VU | Vulnerable      | A taxon is <b>Vulnerable</b> when the best available evidence indicates that it meets any of the criteria any if the five IUCN criteria for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.                                     |
| NT | Near Threatened | A taxon is <b>Near Threatened</b> when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.   |
| CR | Critically Rare | A taxon is <b>Critically Rare</b> when it is known to occur only at a single site, 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.  |
|    | Rare            | A taxon is <b>Rare</b> when it meets any of the four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and doesn't not qualify for a category of threat according to five criteria.   |
|    | Declining       | A taxon is <b>Declining</b> when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population. |

### 12.1.3 Plant communities recorded in the D2 (Ncwabeni) Off-Channel Storage Dam

The following plant communities were identified during the field visits:

#### Bushland thicket community

The plant cover present on this community comprises closed woodland with mixed bushveld averaging 3-8m in height (**Figure 13**). The vegetation is primarily bushland thicket with clumped grasses, and is a mixture of indigenous and invasive alien species. Although the density of woody plants is fairly high in parts, tracts exist where this woody component is scattered and open. The vegetation has a high prevalence of broadleaf trees and shrubs

which contribute to an increase in species-richness. These include *Euclea crispa* subsp. *crispa* (Blue Guarri), *Gymnosporia senegalensis* (Confetti Spikethorn), *Mundulea sericea* subsp. *sericea* (Cork-bush), *Vangueria infausta* (Wild Medlar) and *Ziziphus mucronata* (Buffalo Thorn). As is typical of savanna habitats the herb layer is pronounced, albeit secondary and species-poor in this case. Grasses dominate the basal cover, of which *Digitaria eriantha* (Common Finger Grass), *Panicum maximum* (Guinea Grass) and *Urochloa mossambicensis* (Bushveld Signal Grass) occur in greatest abundance. Also present are *Themeda triandra* (Red Grass) and *Setaria sphacelata* (Bristle Grass). Two sensitive biodiversity features were identified using the EKZNW C-Plan, these being the Southern Forest and Thornveld and the Coastal Valley Bushveld (DWAF, 2007c). **Table 5** indicates the species recorded in this community.



**Figure 13.** Bushland thicket community in the D2 (Ncwabeni) Off-Channel Storage Dam

**Table 5.** Species found in the Bushland thicket community

| Scientific name              | Common name  | Ecological status | Form |
|------------------------------|--------------|-------------------|------|
| <i>Acacia ataxacantha</i>    |              |                   | Tree |
| <i>Acacia karroo</i>         | Sweet thorn  |                   | Tree |
| <i>Acacia mearnsii</i>       | Black wattle | Invader 2         | Tree |
| <i>Albizia adianthifolia</i> | Flat-crown   |                   | Tree |
| <i>Acacia nilotica</i>       |              |                   | Tree |



| Scientific name                                       | Common name                  | Ecological status          | Form           |
|---|------------------------------|----------------------------|----------------|
| <i>Aloe ferox</i>                                     | Cape Aloe                    | Medicinal                  | Succulent      |
| <i>Argemone ochroleuca</i><br>subsp <i>ochroleuca</i> | White-flowered Mexican poppy | Declared Weed (Category 1) | Herb           |
| <i>Ageratina adenophora</i>                           | Crofton weed                 | Declared Weed (Category 1) | Herb           |
| <i>Alternanthera pungens</i>                          | Khakiweed                    | Exotic                     | Herbs          |
| <i>Achyranthes aspera</i>                             | Burweed                      | Declared Invader 1         | Shrub          |
| <i>Argemone ochroleuca</i>                            | White-flowered Mexican poppy | Declared Weed (Category 1) | Herb           |
| <i>Asparagus aethiopicus</i>                          |                              |                            | Shrub          |
| <i>Bidens pilosa</i>                                  | Blackjack                    | Weed                       | Herb           |
| <i>Berkheya setifera</i>                              | Buffalo-tongue Berkheya      | Medicinal                  | Herb           |
| <i>Brachylaena discolor</i>                           | Coast silver oak             |                            | Tree           |
| <i>Bryophyllum delagoense</i>                         | Chandelier plant             | Declared Weed (Category 1) | Succulent      |
| <i>Cannabis sativa</i>                                | Dagga                        | Exotic                     | Herb           |
| <i>Caesalpinia decapetala</i>                         | Mauritius thorn              | Declared Weed (Category 1) | Shrub          |
| <i>Canthium kuntzeanum</i>                            |                              |                            |                |
| <i>Celtis africana</i>                                | White stnkwood               |                            | Tree           |
| <i>Conyza bonariensis</i>                             | Flax-leaf fleabane           | Weed                       | Herb           |
| <i>Combretum erythrophyllum</i>                       | River bushwillow             |                            | Tree           |
| <i>Crassula species</i>                               |                              |                            | Succulent      |
| <i>Cynodon dactylon</i>                               | Couch Grass                  | Increaser 2                | Grass          |
| <i>Cymopogon excavatus</i>                            |                              |                            | Grass          |
| <i>Chromolaena discolor</i>                           | Triffid weed                 | Declared Weed (Category 1) | Shrub          |
| <i>Digitaria eriantha</i>                             | Common Finger Grass          | Decreaser                  | Grass          |
| <i>Dichroystachys cineria</i>                         | Sickle bush                  |                            | Tree           |
| <i>Dalbergia obovata</i>                              |                              |                            | Tree           |
| <i>Datura stramonium</i>                              | Common thorn apple           | Declared Weed (Category 1) | Shrub          |
| <i>Datura ferox</i>                                   | Large thorn apple            | Declared Weed (Category 1) | Shrub          |
| <i>Euphorbia ingens</i>                               | Common tree euphorbia        |                            | Succulent tree |
| <i>Euphorbia tirucalli</i>                            | Rubber Euphorbia             |                            | Shrub          |
| <i>Euphorbia tetragona</i>                            | Honey Euphorbia              |                            | Shrub          |
| <i>Enneapogon scoparius</i>                           | Bottlebrush Grass            | Increaser 3                | Grass          |
| <i>Eragrostis capensis</i>                            | Heart-seed love grass        | Increaser 2                | Grass          |

| Scientific name                                   | Common name            | Ecological status             | Form           |
|---|------------------------|-------------------------------|----------------|
| <i>Eragrotis chloromelas</i>                      |                        |                               | Grass          |
| <i>Euclea crispa</i> subsp. <i>Crispa</i>         | Blue Guarri            |                               | Grass          |
| <i>Eragrostis plana</i>                           |                        |                               | Grass          |
| <i>Gerbera piloselloides</i>                      | Small yellow gerbera   | Medicinal                     | Herb           |
| <i>Gomphrena celosioides</i>                      | Batchelor's Button     | Weed                          | Herb           |
| <i>Gymnosporia senegalensis</i>                   | Confetti Spikethorn    |                               | Tree           |
| <i>Harpochloa falx</i>                            | Caterpillar Grass      | Increaser 1                   | Grass          |
| <i>Helichrysum aureonitens</i>                    | Golden everlasting     | Medicinal                     | Herb           |
| <i>Hibiscus trionum</i>                           | Bladder Hibiscus       | Medicinal                     | Herb           |
| <i>Hyparrhenia hirta</i>                          | Common Thatching Grass | Increaser 1                   | Grass          |
| <i>Hypoxis hemerocallidea</i>                     | Star-flower            | Medicinal                     | Herb           |
| <i>Kalanchoe rotundifolia.</i>                    | Common Kalanchoe       | Medicinal                     | Succulent herb |
| <i>Lantana camara</i>                             | Lantana                | Declared Weed (Category 1)    | Shrub          |
| <i>Lippia javanica</i>                            | Lemon bush             | Medicinal                     | Shrub          |
| <i>Melia azedarach</i>                            | Syringa                | Declared Invader (Category 3) | Tree           |
| <i>Melinis repens</i>                             | Natal Red Top          | Increaser 2                   | Grass          |
| <i>Morus alba</i>                                 | White mulbery          | Invader 3                     | Tree           |
| <i>Mundulea sericea</i> subsp. <i>Sericea</i>     | Cork-bush              |                               | Shrub          |
| <i>Opuntia ficus-indica</i>                       | Sweet prickly pear     | Declared Weed (Category 1)    | Shrub          |
| <i>Panicum maximum</i>                            | Guinea Grass           |                               | Grass          |
| <i>Plantago lanceolata</i>                        | Buckhorn plantain      | Exotic                        | Shrub          |
| <i>Plumbago auriculata</i>                        | Plumbago               | Medicinal                     | Shrub          |
| <i>Psidium guajava</i>                            | Guava tree             | Invader 2                     | Tree           |
| <i>Ricinus communis</i>                           | Caster-oil plant       | Invader 2                     | Tree           |
| <i>Rumex acetosella</i> subsp. <i>angiocarpus</i> | Sheep sorrel           | Exotic                        | Herb           |
| <i>Rhoicissus tridentata</i>                      |                        |                               | Shrub          |
| <i>Searsia pyroides</i>                           | Common wild currant    |                               | Tree           |
| <i>Setaria sphacelata</i> var. <i>Sphacelata</i>  | Common Bristle Grass   | Decreaser                     | Grass          |
| <i>Searsia lancea</i>                             | Karee                  |                               | Tree           |
| <i>Searsia chirindensis</i>                       |                        |                               | Tree           |
| <i>Sonchus asper</i>                              | Spiny sowthistle       | Weed                          | Shrub          |
| <i>Solanum mauritianum</i>                        | Bugweed                | Declared Weed (Category 1)    | Shrub          |
| <i>Sporobolus africanus</i>                       | Ratstail Dropseed      | Increaser 3                   | Grass          |

| Scientific name                | Common name           | Ecological status          | Form  |
|--------------------------------|-----------------------|----------------------------|-------|
| <i>Tagetes minuta</i>          | Tall Khaki Weed       | Weed                       | Herb  |
| <i>Tecomaria capensis</i>      | Cape honeysuckle      |                            | Tree  |
| <i>Themeda triandra</i>        | Red Grass             | Decreaser                  | Grass |
| <i>Tristachya leucothrix</i>   | Hairy Trident Grass   | Increaser 1                | Grass |
| <i>Urochloa mossambicensis</i> | Bushveld signal grass | Increaser 2                | Grass |
| <i>Vangueria infausta</i>      | Wild Medlar           |                            | Shrub |
| <i>Verbena bonariensis</i>     | Tall Verbena          | Weed                       | Herb  |
| <i>Verbena officinalis</i>     | Common vervain        | Declared Weed (Category 1) | Herb  |
| <i>Xanthium strumarium</i>     | Large cocklebur       | Declared Weed (Category 1) | Herb  |
| <i>Zanthoxylum davyi</i>       |                       |                            | Tree  |
| <i>Zinnia peruviana</i>        | Redstar zinnia        | Exotic                     | Herb  |
| <i>Ziziphus mucronata</i>      | Buffalo Thorn         |                            | Shrub |

#### Riparian vegetation community

The extent of the study area includes the nCwabeni River. Natural vegetation occurring along the river included *Combretum erythrophyllum* (River Bushwillow), *Celtis africana* (White Stinkwood), and *Leucosidea sericea* (Oldwood). This vegetation is important as it stabilises the riverbank and provide a degree of protection during floods.

Numerous exotic and invasive weeds colonised and dominated the river banks, including plant species such as *Canna indica* (Garden Canna), *Phragmites australis* (common reed). Other alien invasive species include *Tipuana tipu* (Tipu tree), *Chromolaena discolor* (Paraffin weed), *Sesbania punicea* (Red sesbania) (**Figure 14**) and *Rubus* species (Bramble). These species invade riparian and seep zones with disastrous impacts on water resources, especially within catchments regions (Henderson, 2001). Riparian vegetation is known reduce the severity of droughts and floods by regulating the flow of the streams as they purify water by trapping pollutants and control soil erosion (Pfab, 2009). **Table 6** below indicates the plant species recorded in this riparian community.



**Figure 14.** Common reed and Red sesbania observed within the riparian vegetation.

**Table 6.** Species found in the riparian vegetation community.

| Scientific name               | Common name      | Ecological status          | Form      |
|-------------------------------|------------------|----------------------------|-----------|
| <i>Albizia adianthifolia</i>  | Flat-crown       |                            | Tree      |
| <i>Aloe ferox</i>             | Cape Aloe        | Medicinal                  | Succulent |
| <i>Arundo donax</i>           |                  | Weaving                    | Reed      |
| <i>Bryophyllum delagoense</i> | Chandelier plant | Declared Weed (Category 1) | Succulent |
| <i>Caesalpinia decapetala</i> | Mauritius thorn  | Declared Weed (Category 1) | Shrub     |
| <i>Celtis africana</i>        | White Stinkwood  |                            | Tree      |
| <i>Crassula species</i>       |                  |                            | Succulent |
| <i>Euphorbia teragona</i>     | Honey Euphorbia  |                            | Shrub     |
| <i>Ficus sycomorus</i>        | Sycamore Fig     |                            | Tree      |
| <i>Imperata cylindrica</i>    | Cottonwool grass | Increaser 1                | Grass     |
| <i>Leucosidea sericea</i>     | Old wood         |                            | shrub     |
| <i>Melinis repens</i>         | Natal Red Top    | Increaser 2                | Grass     |

| Scientific name                                  | Common name             | Ecological status             | Form         |
|--|-------------------------|-------------------------------|--------------|
| <i>Mirabilis jalapa</i>                          | Four-o'clocks           | Invader 3                     | Herb         |
| <i>Nephrolepis exaltata</i>                      | Sword fern              | Invader 3                     | Herb         |
| <i>Olea africana</i>                             | Wild olive,             |                               | Tree         |
| <i>Phragmites australis</i>                      | Common reed             | Decreaser                     | Reed         |
| <i>Persicaria lapathifolia</i>                   | Spotted knotweed        | Declared Weed (Category 1)    | Herb         |
| <i>Phoenix canariensis</i>                       | Canary Island date palm | Weed                          | Tree         |
| <i>Psidium guajava</i>                           | Guava tree              | Invader 2                     | Tree         |
| <i>Pteridium aquilinum</i>                       | Bracken                 | weed                          | Herb         |
| <i>Ricinus communis</i>                          | Caster-oil plant        | Invader 2                     | Tree         |
| <i>Senna occidentalis</i>                        | Stinking weed           | Declared Weed (Category 1)    | Shrub        |
| <i>Schoenoplectus corymbosus</i>                 |                         | Cultural-weaving              | Reed         |
| <i>Sesbania punicea</i>                          | Red sesbania            | Declared Weed (Category 1)    | Shrub        |
| <i>Setaria sphacelata</i> var. <i>Sphacelata</i> | Common Bristle Grass    | Decreaser                     | Grass        |
| <i>Solanum mauritianum</i>                       | Bugweed                 | Declared Weed (Category 1)    | Shrub        |
| <i>Syzygium cordatum</i>                         |                         |                               | Tree         |
| <i>Tipuana tipu</i>                              | Tipu tree               | Declared Invader (Category 3) | Tree         |
| <i>Typha capensis</i>                            | Bulrush                 |                               | Aquatic herb |
| <i>Verbena bonariensis</i>                       | Tall Verbena            | Weed                          | Herb         |
| <i>Zantedeschia</i> sp.                          |                         |                               | Herb         |

### **D3A (Gugamela) Off-Channel Storage.**

The proposed dam site is located within the 3030CA quarter degree square in terms of the 1:50 000 grid of South Africa. SANBI used this grid system as a point of reference to determine any Red Data plant species or any species of conservation importance occurring in South Africa. This can be used to determine lists of species which could potentially occur within an area. **Table 7** provides details on the Red Data plant species which have been

recorded for this quarter degree square. The statuses allocated to the species are defined in **Table 4** above. It is, therefore, imperative, during the construction phase, that detailed searches for these rare/threatened and protected species are made during the appropriate time of year when plants are likely to be visible.

**Table 7.** Red Data Plant species recorded in grid cell 3030CA which could potentially occur in the study area (Raimondo *et al.* 2009).

| Family        | Species                                    | Threat status | SA Endemic | Growth forms             | Habitat suitability   | Probability of Occurrence |
|---------------|--|---------------|------------|--------------------------|---|---------------------------|
| Anacardiaceae | <i>Loxostylis alata</i> A.Spreng. ex Rchb. | Declining     | Yes        | Shrub, tree              | Occurs along forest margins, beside rivers and on outcrops of quartz and sandstone  | Likely                    |
| Anacardiaceae | <i>Searsia acocksii</i> (Moffett) Moffett  | NT            | Yes        | Climber, shrub           | Pondoland scarp forest, understory shrub in forest margins or rocky outcrops above river gorges   | Unlikely                  |
| Asphodelaceae | <i>Gasteria croucheri</i> (Hook.f.) Baker  | VU            | Yes        | Herb, succulent          | It is mainly confined to cliff faces, growing in quartzitic sandstone rock formations (rarely on shale), also on rocky outcrops among leaf litter in subtropical shrub forest adjacent to the river valleys | Unlikely                  |
| Asphodelaceae | <i>Kniphofia pauciflora</i> Baker          | CR            | Yes        | Herb                     | Marshy grassland  | Unlikely                  |
| Celastraceae  | <i>Elaeodendron croceum</i> (Thunb.) DC.   | Declining     | No         | Tree                     | occurs on the margins of coastal and other moist inland forests   | Possible                  |
| Fabaceae      | <i>Aspalathus gerrardii</i> Bolus          | VU            | Yes        | Shrub                    | Coastal grasslands, forest margins, often in damp or marshy sites   | Possible                  |
| Fabaceae      | <i>Tephrosia bachmannii</i> Harms          | VU            | Yes        | Dwarf shrub, herb, shrub | Occurs in a variety of habitats including open grasslands, rocky sites and forest margins.  | Possible                  |
| Lamiaceae     | <i>Plectranthus ernstii</i> Codd           | NT            | Yes        | Herb, succulent          | occurs in Scarp Forest in humus-rich pockets of soil in rock crevices on exposed to semi-exposed, sheer   | Unlikely                  |

| Family         | Species  | Threat status | SA Endemic | Growth forms             | Habitat suitability   | Probability of Occurrence |
|----------------|--|---------------|------------|--------------------------|---|---------------------------|
|                |  |               |            |                          | quartzitic sandstone rock faces in river gorges from the Msikaba River in the northern part of the Eastern Cape to Oribi Gorge in southern KwaZulu-Natal                            |                           |
| Lamiaceae      | <i>Plectranthus oertendahlia</i><br>T.C.E.Fr.                  | Rare          | Yes        | Herb,<br>succulent       | Its natural habitat is along the wooded river valleys on the coast of southern KwaZulu-Natal and Pondoland and is endemic to a small area from the Oribi Gorge northwards to Uvongo | Possible                  |
| Lamiaceae      | <i>Plectranthus oribiensis</i> Codd                            | Rare          | Yes        | Herb                     | Occurs at forest margins and in wooded kloofs   | Possible                  |
| Lauraceae      | <i>Cryptocarya wyliei</i> Stapf                                | NT            | Yes        | Shrub, tree              | It is abundant in coastal bush, forest margins, as well as riverine fringe forest and thicket.  | Possible                  |
| Myrtaceae      | <i>Eugenia erythrophylla</i> Strey                             | NT            | Yes        | Shrub, tree              | Pondoland scarp forest. Occurs in kloof forest margins near streams   |                           |
| Passifloraceae | <i>Adenia gummifera</i> (Harv.)<br>Harms var. <i>gummifera</i> | Declining     | No         | Climber,<br>succulent    | Occurs in Forested ravines, forest patches and forest margins, forest scrub, miombo woodland, savanna, dune forest, on stony slopes, termitaria and littoral bush                   | Possible                  |
| Restionaceae   | <i>Restio zuluensis</i> H.P.Linder                             | VU            | No         | Dwarf shrub,<br>restioid | Grows on the margins of wetlands in short coastal grassland.  | Unlikely                  |
| Rhizophoraceae | <i>Cassipourea malosana</i> (Baker)                            | Declining     | No         | Shrub, tree              | In the understorey of   | Unlikely                  |



| Family    | Species                               | Threat status | SA Endemic | Growth forms | Habitat suitability   | Probability of Occurrence |
|-----------|---------------------------------------|---------------|------------|--------------|---|---------------------------|
|           | Alston                                |               |            |              | Afromontane forest or in thickets on rocky outcrops in Mpumalanga, also in coastal and midland forests in KwaZulu-Natal |                           |
| Rubiaceae | <i>Anthospermum streyi</i> Puff       | Rare          | Yes        | Dwarf shrub  | Occurs in the edges of cliffs and along forest margins  | Unlikely                  |
| Rubiaceae | <i>Canthium vanwykii</i> Tilney & Kok | NT            | Yes        | Shrub        | Found in forest margins or more rarely in fire protected rocky crevices in grassland                                    | Possible                  |

#### 12.1.4 Plant communities recorded in the D3A (Gugamela) Off-Channel Storage Dam

The following plant communities were identified during the field visits to D3A:

##### Bushland thicket community

The plant cover present in this community comprises short open woodland and wooded grassland communities with mixed bushveld averaging 2-4m in height. The veld is mostly degraded and shows increasing encroachment by opportunist tree species, mainly *Acacia karroo* (Sweet Thorn) and *Dichyrostachys cinerea* (Sickle Bush) (**Figure 15**). Encroachment by these species is generally associated with overgrazing and improper fire regimes which alter the vegetation dynamics over time, as was observed to be the case at the site (DWAF, 2007c). The land surrounding the site comprises of extensive communal and agricultural land. Indigenous plant species such as *Acroceras macrum*, *Cynodon dactylon*, *Sporobolus africanus*, *Eragrostis curvula*, *Dichrostachys cinerea*, *Acacia karroo*, *Acacia nilotica*, *Aloe spp.* and the exotic plant species *Melia azedarach* (Syringa trees), *Chromolaena odorata* (Triffid weed), *Lantana camara* and *Solanum mauritianum* (Bugweed) were common at the site. **Table 8** below indicates the plant species recorded in this bushland thicket community.



**Figure 15. Degraded area encroached by opportunist species such as *Solanum mauritianum* and *Dichyrostachys cinerea*.**

**Table 8.** Species found in the Bushland thicket community

| Scientific name         | Common name  | Ecological status | Form   |
|-------------------------|--------------|-------------------|--------|
| <i>Acacia karroo</i>    | Sweet thorn  |                   | Tree   |
| <i>Acacia mearnsii</i>  | Black wattle | Invader 2         | Tree   |
| <i>Acroceras macrum</i> |              |                   | Grass  |
| <i>Acacia nilotica</i>  |              |                   | Tree   |
| <i>Aloe ferox</i>       | Cape Aloe    | Medicinal         | Succul |

| Scientific name                                       | Common name                  | Ecological status             | Form                  |
|---|------------------------------|-------------------------------|-----------------------|
|   |                              |                               | ent                   |
| <i>Argemone ochroleuca</i><br>subsp <i>ochroleuca</i> | White-flowered Mexican poppy | Declared Weed<br>(Category 1) | Herb                  |
| <i>Ageratina adenophora</i>                           | Crofton weed                 | Declared Weed<br>(Category 1) | Herb                  |
| <i>Alternanthera pungens</i>                          | Khakiweed                    | Exotic                        | Herbs                 |
| <i>Achyranthes aspera</i>                             | Burweed                      | Declared Invader<br>1         | Shrub                 |
| <i>Argemone ochroleuca</i>                            | White-flowered Mexican poppy | Declared Weed<br>(Category 1) | Herb                  |
| <i>Asparagus aethiopicus</i>                          |                              |                               | Shrub                 |
| <i>Bidens pilosa</i>                                  | Blackjack                    | Weed                          | Herb                  |
| <i>Berkheya setifera</i>                              | Buffalo-tongue Berkheya      | Medicinal                     | Herb                  |
| <i>Brachylaena discolor</i>                           | Coast silver oak             |                               | Tree                  |
| <i>Bryophyllum delagoense</i>                         | Chandelier plant             | Declared Weed<br>(Category 1) | Succul<br>ent         |
| <i>Cannabis sativa</i>                                | Dagga                        | Exotic                        | Herb                  |
| <i>Caesalpinia decapetala</i>                         | Mauritius thorn              | Declared Weed<br>(Category 1) | Shrub                 |
| <i>Canthium kuntzeanum</i>                            |                              |                               | Shrub                 |
| <i>Celtis africana</i>                                | White stnkwood               |                               | Tree                  |
| <i>Cereus jamacara</i>                                | Queen of night               | Declared Weed<br>(Category 1) | Shrub                 |
| <i>Conyza bonariensis</i>                             | Flax-leaf fleabane           | Weed                          | Herb                  |
| <i>Combretum<br/>erythrophyllum</i>                   | River bushwillow             |                               | Tree                  |
| <i>Crassula species</i>                               |                              |                               | Succul<br>ent         |
| <i>Cynodon dactylon</i>                               | Couch Grass                  | Increaser 2                   | Grass                 |
| <i>Cymopogon excavatus</i>                            |                              |                               | Grass                 |
| <i>Chromolaena discolor</i>                           | Triffid weed                 | Declared Weed<br>(Category 1) | Shrub                 |
| <i>Digitaria eriantha</i>                             | Common Finger Grass          | Decreaser                     | Grass                 |
| <i>Dichroystachys cineria</i>                         | Sickle bush                  |                               | Tree                  |
| <i>Datura stramonium</i>                              | Common thorn apple           | Declared Weed<br>(Category 1) | Shrub                 |
| <i>Datura ferox</i>                                   | Large thorn apple            | Declared Weed<br>(Category 1) | shrub                 |
| <i>Euphorbia ingens</i>                               | Common tree euphorbia        |                               | Succul<br>ent<br>tree |
| <i>Euphorbia tirucalli</i>                            | Rubber Euphorbia             |                               | Shrub                 |
| <i>Euphorbia tetragona</i>                            | Honey Euphorbia              |                               | Shrub                 |
| <i>Eragrostis curvula</i>                             |                              | Increaser 2                   | Grass                 |
| <i>Euclea crispa</i> subsp.<br><i>Crispa</i>          | Blue Guarri                  |                               | Grass                 |
| <i>Eragrostis plana</i>                               |                              |                               | Grass                 |
| <i>Gerbera piloselloides</i>                          | Small yellow gerbera         | Medicinal                     | Herb                  |
| <i>Gomphrena celosioides</i>                          | Batchelor's Button           | Weed                          | Herb                  |
| <i>Gymnosporia<br/>senegalensis</i>                   | Confetti Spikethorn          |                               | Tree                  |

| Scientific name                                     | Common name            | Ecological status             | Form  |
|---|------------------------|-------------------------------|-------|
| <i>Harpochloa falx</i>                              | Caterpillar Grass      | Increaser 1                   | Grass |
| <i>Helichrysum aureonitens</i>                      | Golden everlasting     | Medicinal                     | Herb  |
| <i>Hibiscus trionum</i>                             | Bladder Hibiscus       | Medicinal                     | Herb  |
| <i>Hyparrhenia hirta</i>                            | Common Thatching Grass | Increaser 1                   | Grass |
| <i>Lantana camara</i>                               | Lantana                | Declared Weed (Category 1)    | Shrub |
| <i>Lippia javanica</i>                              | Lemon bush             | Medicinal                     | Shrub |
| <i>Melia azedarach</i>                              | Syringa                | Declared Invader (Category 3) | Tree  |
| <i>Melinis repens</i>                               | Natal Red Top          | Increaser 2                   | Grass |
| <i>Morus alba</i>                                   | White mulberry         | Invader 3                     | Tree  |
| <i>Opuntia ficus-indica</i>                         | Sweet prickly pear     | Declared Weed (Category 1)    | Shrub |
| <i>Panicum maximum</i>                              | Guinea Grass           |                               | Grass |
| <i>Plantago lanceolata</i>                          | Buckhorn plantain      | Exotic                        | Shrub |
| <i>Prunus persica</i>                               | Peach tree             |                               | Tree  |
| <i>Psidium guajava</i>                              | Guava tree             | Invader 2                     | Tree  |
| <i>Ricinus communis</i>                             | Caster-oil plant       | Invader 2                     | Tree  |
| <i>Rumex acetosella</i> subsp<br><i>angiocarpus</i> | Sheep sorrel           | Exotic                        | Herb  |
| <i>Rhoicissus tridentata</i>                        |                        |                               | Shrub |
| <i>Searsia pyroides</i>                             | Common wild currant    |                               | Tree  |
| <i>Setaria sphacelata</i> var.<br><i>Sphacelata</i> | Common Bristle Grass   | Decreaser                     | Grass |
| <i>Searsia lancea</i>                               | Karee                  |                               | Tree  |
| <i>Sonchus asper</i>                                | Spiny sowthistle       | Weed                          | Shrub |
| <i>Solanum mauritianum</i>                          | Bugweed                | Declared Weed (Category 1)    | Shrub |
| <i>Spirostachys africana</i>                        | Tamboti                |                               | Tree  |
| <i>Sporobolus africanus</i>                         | Ratstail Dropseed      | Increaser 3                   | Grass |
| <i>Tagetes minuta</i>                               | Tall Khaki Weed        | Weed                          | Herb  |
| <i>Tecomaria capensis</i>                           | Cape honeysuckle       |                               | Tree  |
| <i>Themeda triandra</i>                             | Red Grass              | Decreaser                     | Grass |
| <i>Tristachya leucothrix</i>                        | Hairy Trident Grass    | Increaser 1                   | Grass |
| <i>Urochloa mossambicensis</i>                      | Bushveld signal grass  | Increaser 2                   | Grass |
| <i>Vangueria infausta</i>                           | Wild Medlar            |                               | Shrub |
| <i>Verbena bonariensis</i>                          | Tall Verbena           | Weed                          | Herb  |
| <i>Verbena officinalis</i>                          | Common vervain         | Declared Weed (Category 1)    | Herb  |
| <i>Xanthium strumarium</i>                          | Large cocklebur        | Declared Weed (Category 1)    | Herb  |
| <i>Zanthoxylum davyi</i>                            |                        |                               | Tree  |
| <i>Zinnia peruviana</i>                             | Redstar zinnia         | Exotic                        | Herb  |
| <i>Ziziphus mucronata</i>                           | Buffalo Thorn          |                               | Shrub |

### Riparian vegetation community

The extent of the study area includes the Gugamela River. Natural vegetation occurring along the river included *Typha capensis*, *Syzgium cordatum*, and *Celtis africana* (White Stinkwood), and *Leucosidea sericea* (Oldwood). This vegetation is important as it stabilises the riverbank and provide a degree of protection during floods. Numerous exotic and invasive weeds colonised and dominated the river banks, including species such as *Canna indica* (Garden Canna), *Phragmites australis* (Common reed). Other alien invasive species include *Bambusa vulgaris* (Common bamboo) (**Figure 16**), *Chromolaena discolor* (Paraffin weed), *Sesbania punicea* (Red sesbania) and *Senna occidentalis* (**Figure 17**). Various invasive exotic species such as *Agave americana*\*, *Ageratum conyzoides*\*, *Arundo donax*\*, *Caesalpinia decapetala*\*, *Campuloclinium macrocephalum*\*, *Chromolaena odorata*\*, *Ipomoea indica*\*, *Ipomoea purpurea*\*, *Lantana camara*\*, *Leucaena leucocephala*\*, *Montanoa hibiscifolia*\*, *Canna indica*\*, *Jacaranda mimosifolia*\*, *Rubus fruticosus*\*, *Rubus cuneifolius*\*, *Psidium guajava*\*, *Melia azedarach*\*, *Mimosa pigra*\*, *Ricinus communis*\*, *Senna didymobotrya*\*, *Solanum mauritianum*\*, *Tithonia diversifolia* \* were also recorded on this community. These species invade riparian and seep zones with disastrous impacts on water resources, particularly within catchment regions (Henderson, 2001). Riparian vegetation is known reduce the severity of droughts and floods by regulating the flow of the streams as they purify water by trapping pollutants and control soil erosion (Pfab, 2009). **Table 9** below indicates the plant species recorded in this riparian community.



**Figure 16. Bamboo tree growing along the Gugamela river.**



**Figure 17. *Senna occidentalis*, an alien invader dominating vegetation along the Gugamela River.**

**Table 9.** Species found in the riparian vegetation community.

| Scientific name               | Common name      | Ecological status                | Form      |
|-------------------------------|------------------|----------------------------------|-----------|
| <i>Arundo donax</i>           |                  | Declared Category 1 weed Weaving | Reed      |
| <i>Bambusa vulgaris</i>       | Bamboo tree      |                                  | Tree      |
| <i>Bryophyllum delagoense</i> | Chandelier plant | Declared Weed (Category 1)       | Succulent |
| <i>Caesalpinia decapetala</i> | Mauritius thorn  | Declared Weed (Category 1)       | Shrub     |
| <i>Celtis africana</i>        | White Stinkwood  |                                  | Tree      |
| <i>Crassula obovata</i>       |                  |                                  | Succulent |
| <i>Euphorbia teragona</i>     | Honey Euphorbia  |                                  | Shrub     |
| <i>Ficus sycomorus</i>        | Sycamore Fig     |                                  | Tree      |
| <i>Imperata cylindrica</i>    | Cottonwool grass | Increaser 1                      | Grass     |
| <i>Melinis repens</i>         | Natal Red Top    | Increaser 2                      | Grass     |
| <i>Mirabilis jalapa</i>       | Four-o'clocks    | Invader 3                        | Herb      |

| Scientific name                                  | Common name             | Ecological status             | Form         |
|--|-------------------------|-------------------------------|--------------|
| <i>Olea africana</i>                             | Wild olive,             |                               | Tree         |
| <i>Phragmites australis</i>                      | Common reed             | Decreaser                     | Reed         |
| <i>Phoenix canariensis</i>                       | Canary Island date palm | Weed                          | Tree         |
| <i>Persicaria lapathifolia</i>                   | Spotted knotweed        | Weed                          | Herb         |
| <i>Psidium guajava</i>                           | Guava tree              | Invader 2                     | Tree         |
| <i>Pteridium aquilinum</i>                       | Bracken                 | weed                          | Herb         |
| <i>Ricinus communis</i>                          | Caster-oil plant        | Invader 2                     | Tree         |
| <i>Senna occidentalis</i>                        | Stinking weed           | Declared Weed (Category 1)    | Shrub        |
| <i>Schoenoplectus corymbosus</i>                 |                         | Cultural-weaving              | Sedge        |
| <i>Sesbania punicea</i>                          | Red sesbania            | Declared Weed (Category 1)    | Shrub        |
| <i>Setaria sphacelata</i> var. <i>Sphacelata</i> | Common Bristle Grass    | Decreaser                     | Grass        |
| <i>Solanum mauritianum</i>                       | Bugweed                 | Declared Weed (Category 1)    | Shrub        |
| <i>Syzygium cordatum</i>                         |                         |                               | Tree         |
| <i>Tipuana tipu</i>                              | Tipu tree               | Declared Invader (Category 3) | Tree         |
| <i>Typha capensis</i>                            | Bulrush                 |                               | Aquatic Herb |
| <i>Verbena bonariensis</i>                       | Tall Verbena            | Weed                          | Herb         |
| <i>Zantedeschia</i> sp.                          |                         |                               | Herb         |

### 12.1.5 Important Plant Taxa

Plant species of special conservation concern which may occur in the two proposed dam sites are listed in **Table 3**. The study area is known to contain many species of conservation importance such as *Hypoxis hemerocallidea* but is known to be harvested by locals (Mr Ngwazi, 2012). *Celtis africana* (White stinkwood) is listed as Least concern on the National Red list of plants and occurs on two proposed sites.

## 12.1.6 Alien invasive species recorded in the two proposed dam sites

Alien invasive plant species within the study area were observed to occur in clumps, scattered on the site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of the invader species be removed and eradicated (Henderson, 2001). The exotic plant species *Melia azedarach* (Syringa trees), *Chromolaena odorata* (Triffid weed), *Lantana camara* and *Solanum mauritianum* (Bugweed) were common at the proposed D3A site while *Chromolaena odorata* (Triffid weed) and *Lantana camara* were the dominant exotic vegetation on proposed D2 dam site. Some of the species recorded in the study area are listed in **Figure 18**.



Figure 18. Alien invasive species recorded in the two proposed dam sites



The district is currently infested with Invasive Alien Species (IASs), specifically plants, which are not only a threat to the natural environment, but also to various other aspects of human livelihood. For instance invade agricultural land, making it impossible to farm, and they invade grazing land thereby destroying or intoxicating the existing grazing material for livestock, both of which affect food security. The IAS at the sites will have to be controlled through methods specified in the legislation, which are also area suitable (Ugu District Municipality IDP 2007/08 To 2011/12).

#### 12.1.7 Medicinal plants recorded in the two proposed dam sites

There are a number of plants that are used to provide medicinal products. In some cases there is merit in protecting or translocating these plants before the proposed development commences. Many plants used in traditional medicine are slow-growing and, once lost, are unlikely to return to an area so their presence depends on sustainable harvesting as well as on the maintenance of vegetation condition (Pooley, 2005). These plants often have a low incidence of occurrence and are the component of vegetation that declines under heavy utilization. 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, others are considered to have high economic value and are considered in need of protection (Pooley, 2005). According to the National Environmental Management Biodiversity Act (Act 10 of 2004), there is a dire need to conserve biodiversity in each province and, as such, natural or indigenous resources must be utilised sustainably. The Nyamande Tribal Authority representative (Mr Ngwazi) assisted with the identification of the many medicinal plants recorded on site.

#### 12.1.8 Red Data Listed plant species recorded in the two proposed dam sites

*Hypoxis hemerocallidea* (commonly known as Star-flower or African potato), a Red Data plant species, was recorded in the D2 proposed dam site. This species is listed as **Declining** (Raimondo *et al.*, 2009) and should be removed from the site before construction. Traditional healers use Star-flower/African potato in traditional medicine to treat dizziness, headaches, and mental disorders and in western medicine, this species is used to treat cancers, inflammation and HIV (Pooley, 1998) and Pooley, 2005). Even though only one RDL species was recorded, other species may occur or have been overlooked during the brief field survey. Several of the terrestrial orchid species for example would have completed their flowering periods in early summer months between October and January; and are highly cryptic when not flowering.

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## 12.2 Fauna

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The dam basin of the proposed D2 site on the Ncwabeni River is in a more natural state than that of the proposed D3A site on the Gugamela River, due to some human settlement and associated activities (e.g. subsistence farming, livestock grazing) in D3A. It is thus anticipated that more abundant and possibly more different and diverse habitat types occur in the D2 basin than at the D3A site. The land surrounding the D3A site comprises of extensive communal and agricultural land.

This faunal survey focused on mammals, birds, reptiles and amphibians of the two proposed dam sites. Mammal names are as used by Stuart & Stuart, (1998), Skinner & Chimimba (2005), bird names by Hockey *et al.* (2006); reptile names by Branch (1988, 2001) and terrestrial invertebrates by Henning & Henning (1989).

### 12.2.1 Mammals

KwaZulu-Natal province is exceptionally rich in mammal diversity especially when considering the number of different biotypes created by the different vegetation types and climatic regions and it represents 65 larger and 103 smaller mammal species with more than 50% of all mammal species recorded from the Southern African subregion (Goodman, 2000). Some sections of the study areas have been largely transformed, mostly through alien invasion. This habitat transformation, together with elevated human presence and impacts such as disturbance, hunting and persecution, has negatively impacted on large mammal occurrence, particularly ungulates and predators. However, untransformed areas still remain within the study area and potentially hold mammal species.

#### Desktop results

Initially a desktop study was undertaken to gather background information regarding the site and its surrounding areas. All the latest available literature were consulted and utilised to gain a thorough understanding of the area and its surrounding habitats. This information and further literature reviews were then used to determine the potential biodiversity lists for the two proposed dam sites and surrounding areas.

A list of potential mammal species in the study area was compiled from a desktop survey from Skinner & Chimimba (2005) and Cillié (2009) (**Table 10**). This list is therefore based on all historical recordings of mammalian species relevant to the area. The probability of occurrence is based on suitable habitat and the associated threats. Due to the habitat degradation and disturbance, especially D3A proposed site, the list is likely to overestimate the occurrence of mammal species in the area and thus should be viewed with a degree of caution.

Table 10. Mammal species that could occur in the study area based on suitable habitat.

| COMMON NAME              | SCIENTIFIC NAME                           |
|--------------------------|---|
| Common Molerat           | <i>Cryptomys hottentotus</i>              |
| Natal Multimammate Mouse | <i>Mastomys natalensis</i>                |
| Scrub Hare               | <i>Lepus saxtalis</i>                     |
| Striped Mouse            | <i>Rhabdomys pumilio</i>                  |
| Grey Climbing Mouse      | <i>Dendromus melanotis</i>                |
| Brant's Climbing Mouse   | <i>Dendromus mesomelas</i>                |
| Highveld Gerbil          | <i>Tatera brantsii</i>                    |
| Namaqua Rock Mouse       | <i>Aethomys namaquensis</i>               |
| *House mouse             | <i>Mus musculus</i>                       |
| *House Rat               | <i>Rattus rattus</i>                      |
| *Domestic Dog            | <i>Canis familiaris</i>                   |
| *Feral Cat               | <i>Felis catus</i>                        |
| Common Duiker            | <i>Sylvicapra grimmia</i>                 |
| Oribi                    | <i>Ourebia ourebi</i>                     |
| Aardvark                 | <i>Orycteropus afer</i>                   |
| Aardwolf                 | <i>Proteles cristatus</i>                 |
| Honey badger             | <i>Mellivora capensis</i>                 |
| Blesbok                  | <i>Damaliscus pygargus phillipsi</i>      |
| Caracal                  | <i>Caracal caracal</i>                    |
| Bushbuck                 | <i>Tragelaphus scriptus</i>               |
| Vervet Monkey            | <i>Cercopithecus aethiops pygerythrus</i> |
| Water Mongoose           | <i>Atilax paludinosus</i>                 |
| Cape Clawless Otter      | <i>Aonyx capensis</i>                     |
| Cape Hare                | <i>Lepus capensis</i>                     |
| Slender Mongoose         | <i>Galarella sanguinea</i>                |
| Warthog                  | <i>Phacochoerus africanus</i>             |

| COMMON NAME               | SCIENTIFIC NAME                 |
|---------------------------|---------------------------------|
| Serval                    | <i>Leptailurus serval</i>       |
| Bushpig                   | <i>Potamochoerus larvatus</i>   |
| Southern African Hedgehog | <i>Aterlerix frontalis</i>      |
| Striped Polecat           | <i>Ictonyx striatus</i>         |
| Large-spotted Genet       | <i>Genetta tigrina</i>          |
| Porcupine                 | <i>Hystrix africaeaustralis</i> |
| Reedbuck mountain         | <i>Redunca fulvorufula</i>      |

\* introduced species

### Mammals recorded on the two proposed dam sites

Mammal species diversity was low across the two proposed dam sites. Good habitat cover is present, especially along the rivers, and therefore a wide diversity of small mammalian species is expected to flourish. The river forms an ecological corridor that highly-mobile species would utilize for migratory purposes, and therefore this riparian vegetation promotes ecological functionality. The presence of dogs in the study area, especially D3A, poses a threat to the presence of mammals on sites. Some small rodent species were observed on the study area but the identity of these species could not be verified. The only species of conservation importance recorded during the brief field survey was the Cape Clawless Otter (*Aonyx capensis*). Scats were observed within the macro-channel banks of the Gugamela river in which the D3A site is situated (**Figure 19**). 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. **Table 11** indicates the species recorded on site while the species that were confirmed to occur by Mr Josh Ngwazi (Nyamande Tribal Authority) are indicated by an asterix (\*). According to Rowe-Rowe (1990), both South African otters, *Lutra maculicollis* and *Aonyx capensis*, have previously been recorded in the vicinity of the proposed dam sites (Rowe-Rowe, 1990). The traps set did not yield any positive results as no mammals were captured.



Figure 19. Scat of Cape Clawless Otter observed along the Gugamela (D3A) River

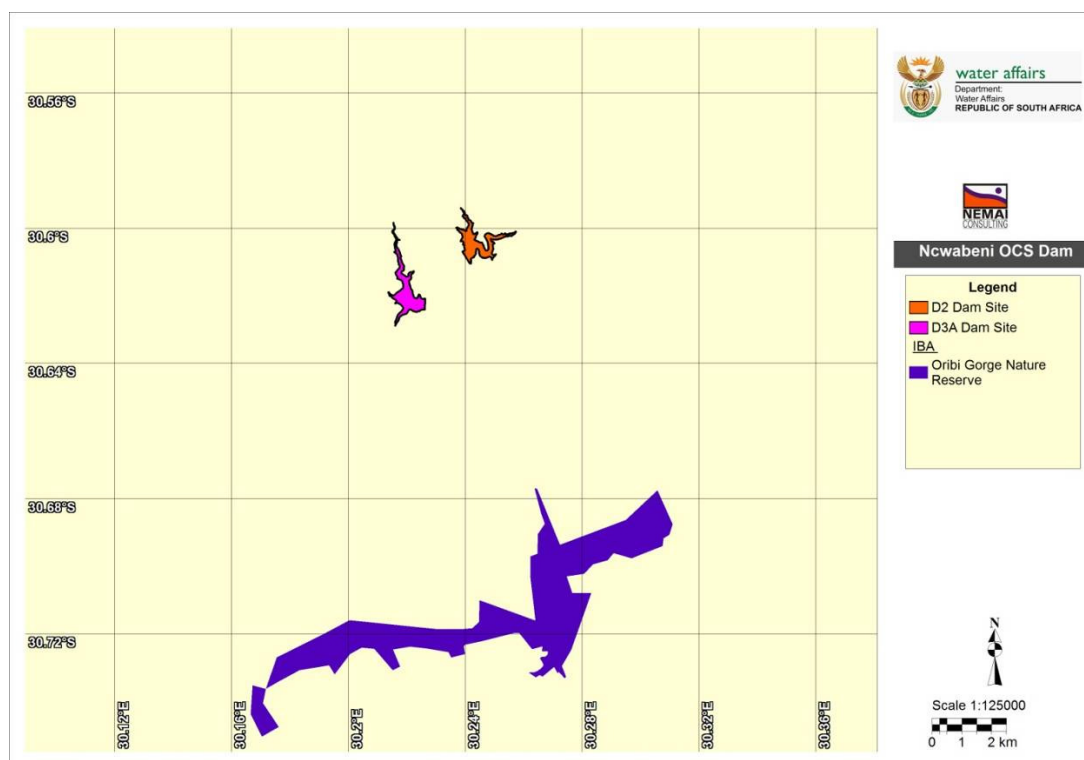
**Table 11.** Composition of the mammals that were recorded at the two proposed dam sites.

| Common name          | Species                         | Site   |
|----------------------|---------------------------------|--------|
| Cape clawless otter  | <i>Aonyx capensis</i>           | D3A    |
| Cape Porcupine*      | <i>Hystrix africaeaustralis</i> | D2     |
| Common Duiker*       | <i>Sylvicapra grimmia</i>       | D2/D3A |
| Warthog*             | <i>Phacochoerus africanus</i>   | D2/D3A |
| Black-backed jackal* | <i>Canis mesomelas</i>          | D2/D3A |
| Bushbuck*            | <i>Tragelaphus scriptus</i>     | D2/D3A |
| Chacma Baboon        | <i>Papio ursinus</i>            | D2/D3A |

### 12.2.2 Avifauna

Conservation and planning tools were consulted for relevancy for this project, and found that no Important Bird Area (IBA) occurs in the study area (**Figure 20**). IBAs form a network of sites, at a biogeographic scale, which are critical for the long-term viability of naturally occurring bird populations (Barnes, 1998). The nearest IBA was the Oribi Gorge Nature Reserve (SA085). Human activities have transformed habitats in South Africa to a point

where few pristine examples exist (Low & Rebelo, 1996). Continuing pressure on sensitive riparian vegetation and surrounding open grassland habitat are largely responsible for the decline of avifaunal species. As the areas surveyed in this study contain riparian and grassland habitats, more intensive surveys conducted over longer periods over several seasons are required in order to ascertain the current status of potential threatened bird species at the sites.



**Figure 20. Important Bird Areas near the two proposed dam sites**

### Desktop results

**Appendix A** is a bird species list of the grid cells 3030CA and 3030CB (Southern African Bird Atlas Project 2). This list includes all the species that have previously been recorded in the area (and their frequency), and this includes species that are conserved in the Oribi Nature Reserves or Bird Sanctuary. **Table 12** below indicates the Red Data Bird species that could be found in the study area (Barnes, 2000 and SABAP2).

Table 12. Red Data bird species that could occur in the study (Barnes, 2000 and SABAP2).

| Species               | Conservation Status | Preferred Micro habitat              |
|-----------------------|---------------------|--------------------------------------|
| African Crowned Eagle | Near Threatened     | Forest, Dense Woodland               |
| Cape Vulture          | Vulnerable          | Grassland, Savanna, Hills and Ridges |
| Lanner Falcon         | Near Threatened     | Open grassland, woodland             |

| Species                       | Conservation Status | Preferred Micro habitat                |
|-------------------------------|---------------------|--|
| African Finfoot               | Vulnerable          | Slow-flowing streams                   |
| Half-collared Kingfisher      | Near Threatened     | Coastal lagoons, Wooded streams        |
| Southern Ground Hornbill      | Vulnerable          | Savanna, Woodland, Grassland           |
| Grey-crowned Crane            | Vulnerable          | Marshes, pans, grasslands, wetlands    |
| African Marsh Harrier         | Vulnerable          | Wetlands, grasslands                   |
| Martial Eagle                 | Vulnerable          | Savanna, woodlands, semiarid shrubland |
| Spotted (Natal) Ground Thrush | Endangered          | Coastal Forest                         |

### Field work results

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). Due to high levels of human disturbance (especially the proposed D3A dam site); the sites offer limited suitable habitat for any larger terrestrial birds as well as certain smaller raptor species. Potential nesting sites for raptors were searched for during fieldwork but none found. Within the vegetation types found in the study area and immediate surrounding areas, two major bird habitat systems were identified:

**1. Gugamela and nCwabeni rivers and associated riparian zone:** The study area includes one of the significant sensitive faunal habitats – riparian vegetation, which could be suitable habitat for bird species that utilise this habitat type. Riparian habitats (**Figure 21**) are of particular importance for birds in the study area, especially on D3A proposed site where the area around is largely transformed. Areas with reeds, sedges or grassy tangles are suitable for Common Waxbills (*Estrilda astrilda*), Bishops and various warblers (Marais & Peacock, 2008). Water bodies also represent sensitive areas because they provide habitat for a wide variety of terrestrial and aquatic species, particularly avifauna. Very little birdlife was observed along the two rivers during the site visit, but species such as kingfishers, cormorants and herons are expected to frequent the river, with African Fish-Eagle also likely to be present from time to time. The reed beds will provide important potential breeding sites for many of the bishops and weavers that were observed.



**Figure 21. nCwabeni and Gugamela rivers provide suitable habitat for water-dependent bird species**

**2. Woodland:** The savanna biome is the most species-rich biome in southern Africa, but very few bird species are restricted to savanna (Barnes, 2000). Woodland areas in the two proposed sites vary from relatively intact in places (e.g., **Figure 22**) to a relatively poor state with significant bush encroachment (e.g., **Figure 23**), partly due to sustained overgrazing for more than a century (Young *et al.* 2003). The woodland habitat is generally less sensitive than savanna (SABAP2 2012). The woodland habitat forms the stronghold of Red Data raptors species such as Martial Eagle (*Polemaetus bellicosus*), White-backed Vulture (*Gyps africanus*), Cape Vulture (*Gyps coprotheres*), Lappet-faced Vulture (*Torgos tracheliotis*) and Tawny Eagle (*Aquila rapax*) (Hockey *et al.* 2005; SABAP2, 2012)).



**Figure 22. Intact woodland in D2 proposed dam site**





**Figure 23. Woodland with significant bush encroachment in D3A**

#### Bird species observed and recorded in the study area

A comprehensive bird species list requires intensive surveys compiled over several years. Seventeen (17) bird species (**Table 12**) were recorded during the field survey. Species recorded were common and widespread.

**Table 13.** Bird species recorded during the two proposed dam sites

| Species number | Common name                   | Scientific name                  | Proposed Dam Site |
|----------------|-------------------------------|----------------------------------|-------------------|
| 62             | Grey Heron                    | <i>Ardea cinerea</i>             | D3A               |
| 71             | Cattle Egret                  | <i>Bubulcus ibis</i>             | D3A               |
| 94             | Hadedda ibis                  | <i>Bostrychia hagedash</i>       | D2/D3A            |
| 258            | Blacksmith Lapwing/<br>Plover | <i>Vanellus armatus</i>          | D2/D3A            |
| 349            | Rock pigeon                   | <i>Columba guinea</i>            | D3A               |
| 352            | Red-eyed Dove                 | <i>Streptopelia semitorquata</i> | D2/D3A            |
| 355            | Laughing Dove                 | <i>Streptopelia senegalensis</i> | D2/D3A            |
| 520            | White-throated Swallow        | <i>Hirundo albigularis</i>       | D2/D3A            |

| Species number | Common name                  | Scientific name             | Proposed Dam Site |
|----------------|------------------------------|-----------------------------|-------------------|
| 526            | Greater Striped Swallow      | <i>Hirundo cucullata</i>    | D2/D3A            |
| 548            | Pied crow                    | <i>Corvus albus</i>         | D3A               |
| 568            | Red-eyed Bulbul              | <i>Pycnonotus nigricans</i> | D2/D3A            |
| 732            | Common fiscal                | <i>Lanius collaris</i>      | D2/D3A            |
| 804            | Southern grey-headed sparrow | <i>Passer diffusus</i>      | D2/D3A            |
| 814            | Southern Masked-Weaver       | <i>Ploceus velatus</i>      | D2/D3A            |
| 824            | Southern Red Bishop          | <i>Euplectes orix</i>       | D2/D3A            |
| 846            | Common waxbill               | <i>Estrilda astrild</i>     | D2/D3A            |
| 860            | Pin-tailed Whydah            | <i>Vidua macroura</i>       | D2/D3A            |

### Habitat requirements for Red Data bird species

**Appendix A** indicates the bird species that could occur in the study area as they were historically recorded in grid cells 3030CA and 3030CB. The limited number of birds on D3A compared to D2 could be attributed to the destruction and transformation of habitat and disturbance in D3A. Another possible cause of destruction of habitat is frequent burning, overgrazing and trampling by livestock (Barnes, 2000). Road mortalities are also threats to bird species populations. An extract from Ezemvelo KZN Wildlife's Strategic Environmental Assessment Plan indicated that the Denham's bustard (*Neotis denhami*) could be encountered at the D3A site. Stanley's bustard is classified as Near Threatened (NT) on the IUCN Red List (December, 2007), and listed on Appendix II of CITES (December, 2007). This species inhabits grassland of up to the altitudes of 3,000 metres, including dense shrubland, light woodland, farmland, dried marsh and arid plains (del Hoyo *et al.*, 1996). No Red Data bird species associated with the two proposed sites were recorded within the study area. However, due to the suitable nature of the habitats, occasional visits cannot be discounted without long-term intensive surveys.

### 12.2.3 Reptiles

#### Desktop results

Only four reptile species were recorded for the grid cell 3030CB (**Table 13**) while no species were recorded on grid cell 3030CA, according to the South African Reptile Conservation Assessment, which falls within the Avian Demography Unit, University Of Cape Town.

**Table 14.** Reptile species recorded in grid cell 3030CB

| Family      | Scientific Name                    | Pictures   |
|-------------|------------------------------------|--|
| Gekkonidae  | <i>Hemidactylus mabouia</i>        |    |
| Scincidae   | <i>Trachylepis varia</i>           |    |
| Typhlopidae | <i>Afrotyphlops bibronii</i>       |  |
| Colubridae  | <i>Lycophidion capense capense</i> |  |

**Table 14** below indicates the reptile species that occur or are likely to occur in the study area due to suitable habitat, and may therefore be present and this list was adopted from Branch (1988).

**Table 15.** Reptile species that occur or are likely to occur in the study area due to suitable habitat, and may therefore be present.

| COMMON NAME | SCIENTIFIC NAME |
|-------------|-----------------|
|-------------|-----------------|

| COMMON NAME                   | SCIENTIFIC NAME                           |
|-------------------------------|---|
| Cape Skink                    | <i>Trachylepis (Mabuya) capensis</i>      |
| Striped Skink                 | <i>Trachylepis (Mabuya) punctatissima</i> |
| Variable Skink                | <i>Trachylepis (Mabuya) varia</i>         |
| Yellow-throated Plated Lizard | <i>Gerrhosaurus flavigularis</i>          |
| Flap-Necked Chameleon         | <i>Chamaeleo dilepis</i>                  |
| Nile Monitor                  | <i>Varanus niloticus</i>                  |
| Herald or Red-lipped Snake    | <i>Crotaphopeltis hotamboeia</i>          |
| Green Mamba                   | <i>Dendroaspis angusticeps</i>            |
| Common or Rhombic Night Adder | <i>Causus rhombeatus</i>                  |
| Boomslang                     | <i>Dispholidus typus</i>                  |
| Spotted Bush Snake            | <i>Philothamnus senivariegatus</i>        |
| Common or Rhombic Egg Eater   | <i>Dasypeltis scabra</i>                  |
| Dusky-Bellied Water Snake     | <i>Lycodonomorphus laevisissimus</i>      |
| Brown Water Snake             | <i>Lycodonomorphus rufulus</i>            |
| Brown House Snake             | <i>Lamprophis fuliginosus</i>             |
| Green Water Snake             | <i>Philothamnus hoplogaster</i>           |
| Common Slug-eater             | <i>Duberria lutrix</i>                    |
| Bibron's Blind Snake          | <i>Typhlops bibronii</i>                  |
| Cape and Eastern Thread Snake | <i>Leptotyphlops conjunctus</i>           |
| Peters' Thread Snake          | <i>Leptotyphlops scutifrons</i>           |

#### Reptile species observed in the study area

Searching for reptiles took place through turning of logs along vegetation transects, although this did not yield much data. Sites were walked, covering as many habitats as possible. Habitat characteristics were surveyed to note potential occurrences of reptiles. **Table 15**

shows species recorded on site and the species that were confirmed to occur by Mr Josh Ngwazi are indicated by an asterisk (\*) According to Mr Ngwazi (pers.comm. 2012), two pythons were killed last year as their skins are utilised by the locals.

**Table 16.** Reptile species recorded in the two proposed dam sites

| Species Name                   | Common Name             | IUCN Status  | Habitat requirements   | Proposed Dam Site |
|--------------------------------|-------------------------|--|--|-------------------|
| <i>Dendroaspis angusticeps</i> | Green Mamba             | Least Concern;<br>Vulnerable<br>(Branch 1988a)   | Forests and forested drainage lines  | D2                |
| <i>Dendroaspis polylepis</i>   | Black mamba             | Least Concern  | Variety of climates, ranging from savanna, woodlands, farmlands, rocky slopes, dense forests and humid swamps. | D3A               |
| <i>Python natalensis</i> *     | Southern African Python | Vulnerable<br>(Branch 1988a)<br>Protected under<br><b>Status</b><br><b>(NEMBA, 2007)</b> | Savanna and drainage lines in savanna  | D2/D3A            |
| <i>Varanus albigularis</i>     | Rock monitor            | Least Concern  | Arboreal   | D3A               |

Riparian habitat is traditionally rich in herpetofauna diversity and densities due to the habitat unit supporting a high abundance of prey species such as frogs, birds and small mammals. Species are also very often “forced” into riparian zones due to the lack of suitable habitat elsewhere within catchment areas that have been transformed such as in large agricultural regions (Ross & Ross, 2009).

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe during field surveys. The majority of reptile species are sensitive to severe habitat alteration and fragmentation. The indiscriminate killing of all snake species as well as the illegal collecting of certain species for private and the commercial pet industry reduces reptile populations (especially snake populations) drastically (Jacobsen, 2005). Frequent burning of the site, especially on D3A proposed dam site, can have a significant impact on reptiles. Trees including stumps, bark and holes are

vital habitats for numerous arboreal reptiles (chameleons, snakes, agamas, geckos and monitors).

### **Habitat requirements for Red Data reptile species**

Southern African Python (*Python natalensis*), is listed as Vulnerable according to Barnes (1988). *Python natalensis* occurs from east Africa to southern Africa (Broadley, 1983; Broadley, 1999) including the eastern parts of South Africa (Branch, 1998, Marais, 2004). According to Jacobsen (2005), pythons inhabit a variety of habitats from grassland to bushveld but prefer rocky hill and areas closer to water.

Eastern green mambas are an arboreal species and thus are almost always found in trees. Very rarely are they found on the ground unless driven by prey or for their need to bask. Although *Dendroaspis angusticeps* (Green mamba) is currently unlisted on the IUCN Red List (IUCN, 2010) or by Branch (1988), it has been provisionally listed as Endangered (EN) (Regional) in the SARCA database (ADU, 2011). This is due to the very specific habitat requirements of the species, its rarity and the restricted range in South Africa. Green Mambas are generally only found in Northern Coastal Forest (FOz7) in South Africa, a vegetation type that has a total area of less than 500 km<sup>2</sup> in South Africa and is also under threat from mining, agriculture and illegal logging (Mucina & Rutherford, 2006). Preliminary data presented by Pook *et al.* (2005) suggest that the South African populations of *D. angusticeps* may represent a different and (endemic) species, and so is likely to be listed as EN (Global) on the IUCN database in the near future.

The black mamba (*Dendroaspis polylepis*) is adapted to a variety of climates, ranging from savanna to woodlands, farmlands, rocky slopes, dense forests and humid swamps. The grassland and savanna woodland/shrubs that extend all the way from southern and eastern Africa to central and western Africa, eastern and southern Africa are the black mamba's typical habitat (Marais, 2004). This species is classified as Least Concern (LC) on the IUCN Red List of Threatened Species (v3.1, 2011). The conservation status of this species was last assessed in 2010 and it was classed as such due to its very large distribution throughout sub-Saharan Africa.

#### 12.2.4 Amphibians

Amphibians are an important component of South Africa's exceptional biodiversity and are such worthy of both research and conservation effort. This is made additionally relevant by

international concern over globally declining amphibian populations, a phenomenon currently undergoing intensive investigation but as yet is poorly understood (Wyman 1990; Wake 1991). Amphibians have declined dramatically in many areas of the world. These declines seem to have worsened over the past 25 years and amphibians are now more threatened than either mammals or birds, though comparisons with other taxa are confounded by a shortage of reliable data.

Most frogs have a biphasic life cycle, where eggs laid in water develop into tadpoles and these live in the water until they metamorphose into juvenile frogs living on the land. This fact, coupled with being covered by a semi-permeable skin makes frogs particularly vulnerable to pollutants and other environmental stresses. Consequently frogs are useful environmental bio-monitors (bio-indicators) and may act as an early warning system for the quality of the environment. According to BKS (2011), the nCwabeni River seems to have a good water quality due to the number of frogs and tadpoles found on site. Frogs and tadpoles are good species indicators of water quality, because they have permeable, exposed skins that readily absorb toxic substances. Tadpoles are aquatic and greatly exposed to pollutants (Blaustein, 2003).

As the survey was undertaken for only three days during daylight hours of the late summer wet months (March 2012), only a small proportion of species are present. Ideally, a herpetological survey should be undertaken throughout the duration of the wet season (November-March) including several nocturnal surveys. It is only during this period that accurate frog species lists can be compiled. During this survey, fieldwork was augmented with species lists compiled from personal records; data from the South African Frog Atlas Project (SAFAP)(1999-2003) and published data, and the list provided below is therefore regarded as likely to be fairly comprehensive (**Table 17**).

**Table 17.** Frog species recorded on the actual site or are likely to occur on the site.

| Common Name   | Scientific Name                        | Status/<br>Distribution                    | Habitat  |
|---------------|--|--|--|
| Guttural Toad | <i>Amietophrynus (Bufo) gutturalis</i> | Common in southern Africa north of Gariep. | Permanent and semi-permanent ponds and backwaters in open grassland. Backwaters and pools within rivers. |

| Common Name               | Scientific Name                         | Status/<br>Distribution   | Habitat  |
|---------------------------|---|---|--|
| Natal Tree Frog           | <i>Leptopelis natalensis</i>            | Common in Kwazulu-Natal   | Permanent and Seasonal ponds situated in coastal forest, sand forest or coastal bushveld and occasionally grassland.                                 |
| Greater Leaf-Folding Frog | <i>Afrixalus fornasinii</i>             | Common along the coast of Kwazulu-Natal as far south as Port Edward   | Stagnant water bodies containing large stands of saw grass <i>Cyperus immensus</i> and bulrushes <i>Typha capensis</i> in Coastal Bushveld-Grassland |
| Painted Reed Frog         | <i>Hyperolius marmoratus marmoratus</i> | Common along Kwazulu-Natal Coast  | Reeds and other emergent vegetation along a wide variety of waterbodies including pans and rivers  |
| Water Lily Frog           | <i>Hyperolius pusillus</i>              | Common in the low-lying coastal areas (Eastern Cape and Kwazulu-Natal) but further inland in the southern parts of Limpopo it is found at higher altitudes. | Shallow pans, ponds, vleis and dams with water lilies ( <i>Nymphaea sp.</i> ) or at least some floating vegetation.                                  |
| Tinker Reed Frog          | <i>Hyperolius tuberilinguis</i>         | Common in the Eastern parts of Southern Africa from Swaziland up to Port Edward   | Reed beds on the periphery of rivers or dense vegetation surrounding seasonal pans   |
| Bubbling Kassina          | <i>Kassina senegalensis</i>             | Common throughout Southern Africa   | Grassy margins of seasonally inundated pans as well as dams  |
| Snoring Puddle Frog       | <i>Phrynobatrachus natalensis</i>       | Widely distributed along the eastern sections of  | Shallow to fairly deep water in temporary pans and pools, vleis, dams and even   |



| Common Name            | Scientific Name               | Status/<br>Distribution                               | Habitat  |
|------------------------|-------------------------------|---|--|
|                        |                               | Southern Africa                                       | slow-flowing streams   |
| Sharp-Nosed Grass Frog | <i>Ptychadena oxyrynchus</i>  | Eastern Parts of South Africa                         | Vleis, inundated grassland and sedge pans, temporary roadside pools and rock puddles         |
| Natal Sand Frog        | <i>Tompoterna natalensis</i>  | Common species in Kwazulu-Natal, Mpumalanga, Gauteng. | Streams, rivers or other places where water flows slowly but also in lotic or standing water |
| Bronze Caco            | <i>Cacosternum nanum</i>      | Common species in Kwazulu-Natal                       | Vleis, inundated grassland and sedge pans, temporary roadside pools and rock puddles         |
| Plaintive Rain Frog    | <i>Breviceps verrucosus</i>   | Eastern Parts of South Africa                         | Terrestrial breeder with eggs laid in moist leaf litter.                                     |
| Bush Squeaker          | <i>Arthroleptis wahlbergi</i> | Endemic to the East Coast of South Africa             | Terrestrial breeder with eggs laid in moist leaf litter.                                     |

### Habitat requirements for Red Data amphibian species

Two red listed frog species are known from the 3030CA and 3030CB Quarter Degree Grid Cell (QDGC) including Natal Kloof Frog (*Natalobatrachus bonebergi*) and Natal Leaf-folding Frog (*Afrivalus natalensis*). The Natal Kloof Frog is classified as **Endangered** and is restricted to the coastal forests of southern Kwazulu-Natal and southern Eastern Cape provinces, at altitudes below 900 m (Minter *et al.* 2004). Suitable habitat in the form of perennial forest streams and pools with rocky beds especially, but not exclusively in ravines remains within certain perennial streams for Natal Kloof Frog. Natal Kloof Frogs have been recorded in the Oribi Gorge Nature Reserve (Minter *et al.* 2004).

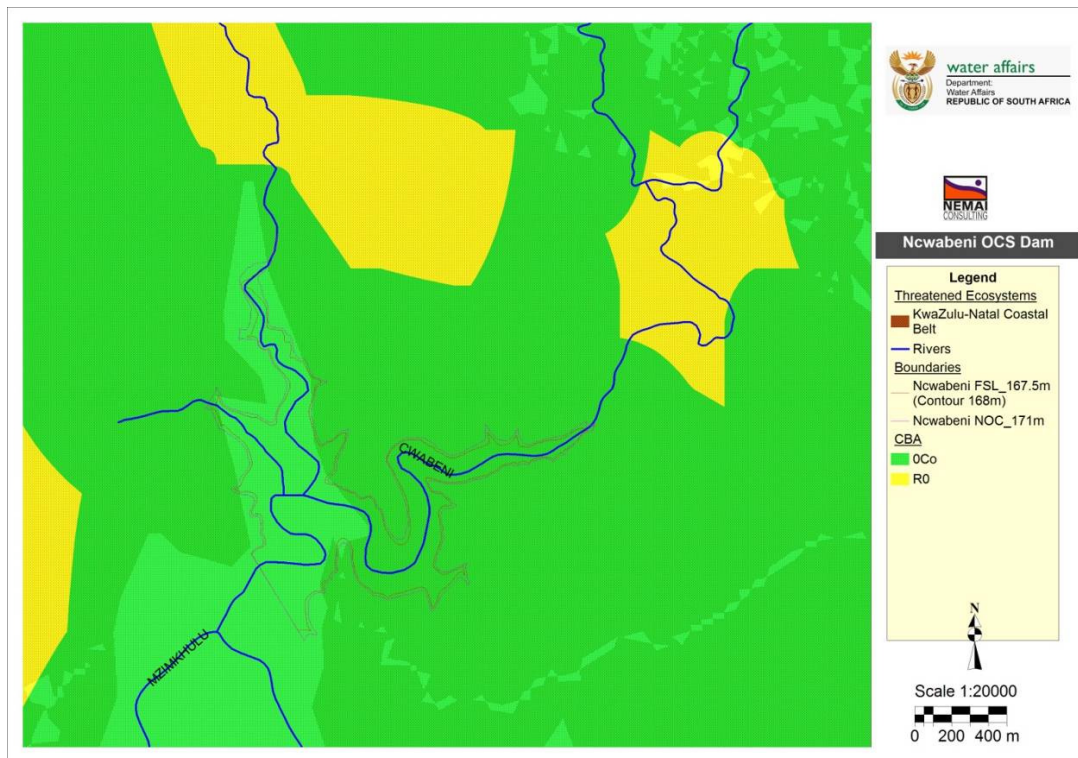
The Natal Leaf-Folding Frog (*Afrivalus spinifrons*) which is classified as **Vulnerable** has been recorded within the 3030CA and 3030CB Quarter Degree Grid Cell (QDGC) (Minter *et al.* 2004). The majority of records are pre 1996 although additional populations were discovered during the South African Frog Atlas Project (SAFAP) near Mtata (3128DB).

*Afrivalus spinifrons* breeds in low-lying areas adjacent to the coast and breeds in standing water, in dense sedge beds and inundated grassy wetlands with abundant surface vegetation. At higher altitudes it inhabits marshes, dams, floodplains and riverbanks (Lambiris 1989; Pickersgill 1996). During the day Leaf-folding frogs are often found in the leaf axils of grasses, rushes and arum lilies; particularly those standing in or immediately adjacent to water. Suitable habitat remains for Natal-Leaf-Folding Frog in the sedge and grass dominated valley bottom wetlands with large clumps of White Arums (*Zantedeschia aethiopica*). More intensive surveys conducted over extended periods are required in order to ascertain the current conservation status of Kloof Frogs and Natal Leaf-Folding Frogs in the area.

### 13. ECOLOGICAL SENSITIVITY

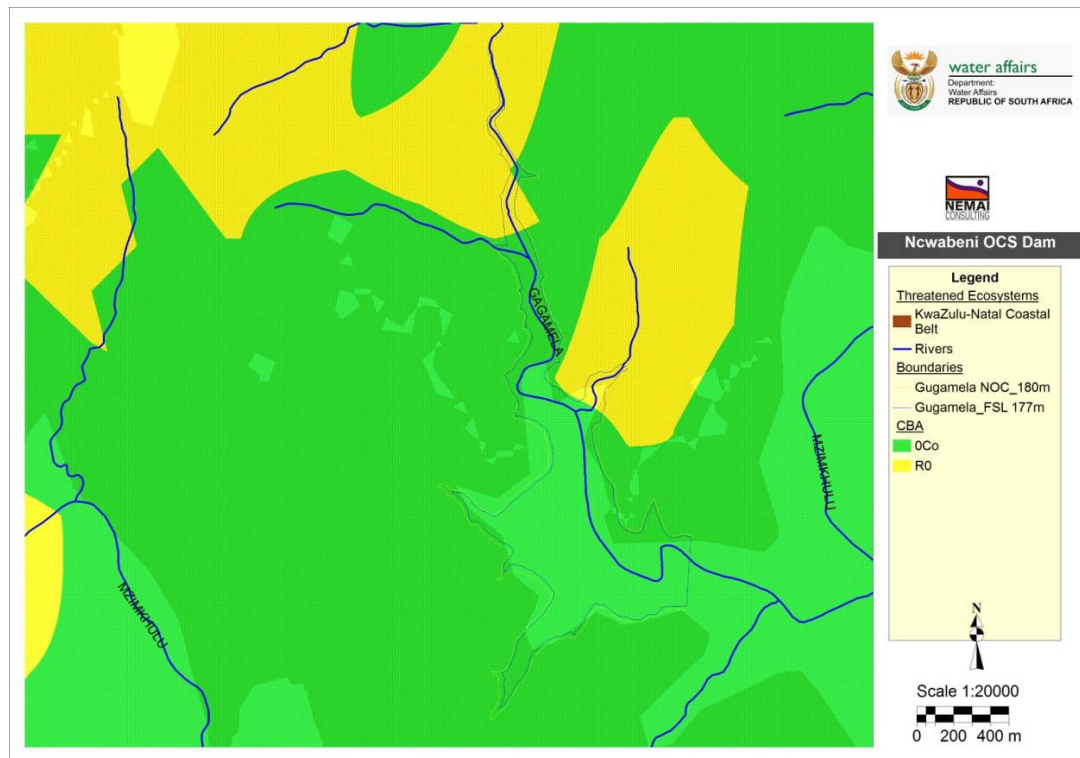
The objective of the ecological sensitivity analysis is to specify the location and extent of all sensitive areas on site that must be protected from transforming land uses. The study area falls within an Endangered- KwaZulu-Natal Coastal Belt and this vegetation type has been listed as one of the Threatened Ecosystems types in KZN and requires protection. The study area also lies within the Maputaland-Pondoland terrestrial priority conservation area, which lies along the east coast of southern Africa, below the Great Escarpment.

According to the Terrestrial Systematic Conservation Plan: Minimum Selection Surface (MINSET), the proposed Ncwabeni Scheme falls within the Areas of Not Conservation Significance (0Co) (Available) as indicated in **Figure 24** below.



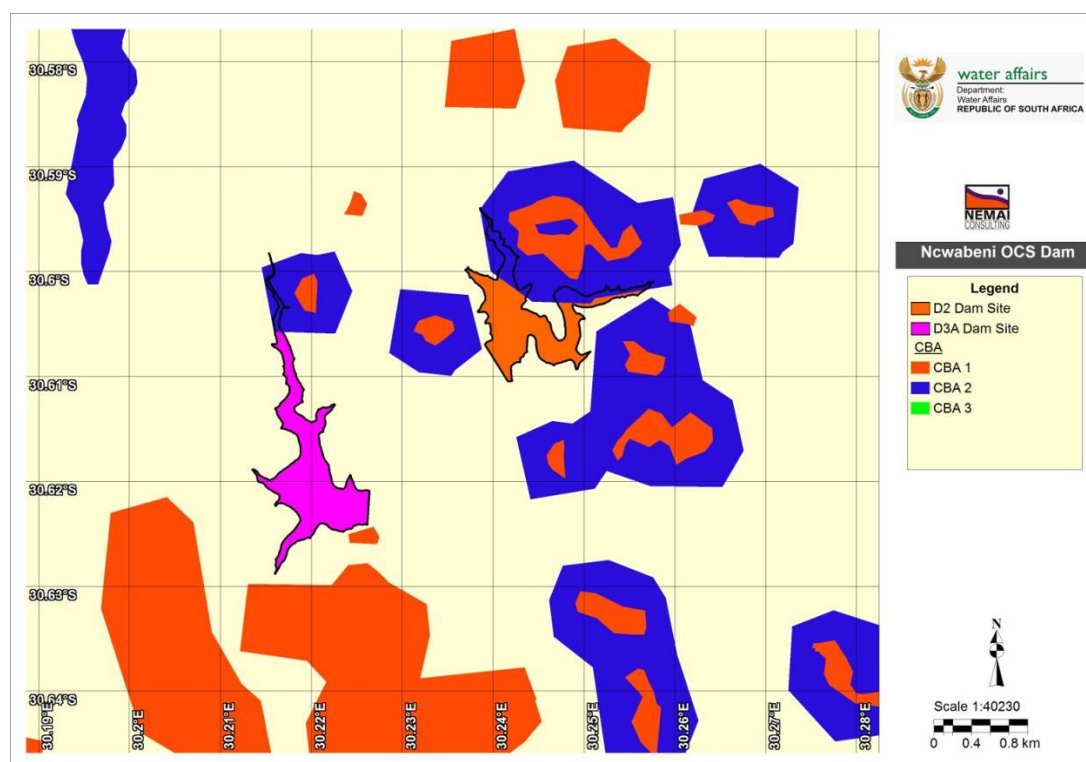
**Figure 24. Sensitivity Map of the Ncwabeni Scheme**

The Gugamela scheme falls within the Areas of Not Conservation Significance (OCo) (Available) and R0, which is the Critical Biodiversity Area (CBA) or Biodiversity Priority Area (BPA) 3, and these are **Optimal** areas (Figure 25). CBA 3 areas reflect the negotiable sites with an Irreplaceability score of less than 0.8 but this does not mean they are of a lower biodiversity value however, only that there are more alternate options available within which the features located within can be met.



**Figure 25. Sensitivity Map of the Gugamela scheme**

On the contrary, the data provided by South African National Biodiversity Institute (SANBI) on terrestrial CBAs around the southern parts of KwaZulu Natal indicates that the two proposed dam sites fall within CBA 2 (**Figure 26**). CBA 2 are **Mandatory** areas which represent areas of significantly high biodiversity value, and this means that there are alternate sites within which the targets can be met for the biodiversity features contained within, but there aren't many.



**Figure 26. Sensitivity Map of the two proposed dam sites**

## 14. COMPARISON OF THE TWO OCS DAM SITES

**Table 15** below indicates the comparative analysis of the two proposed OCS dam sites and indicates which site will be preferred in terms of the dam construction based on the attributes given below.

**Table 18.** Comparative analysis of two dam alternatives

| Feature  | Ncwabeni OCS  | Gugamela OCS  |
|--|---------------|---------------|
| Existing human habitation  | Not preferred | Preferred     |
| Potential occurrence of the Red Data millipede species.  | Preferred     | Not preferred |
| Construction of alternative routes will cover a smaller area and the rehabilitation will be on a lesser scale  | Preferred     | Not preferred |
| Abundant alien invasive plant species  | Not preferred | Preferred     |
| Mammal species of conservation importance recorded on sites (Cape clawless otter)  | Preferred     | Not preferred |
| Natural state of the area  | Not preferred | Preferred     |
| A new (not 'existing') quarry will need to be created at site D2 if D3A is selected, as the possibility exists that material is not available within the D3A basin | Preferred     | Not preferred |
| Destruction of green mamba and pythons and their associated habitats   | Not preferred | Preferred     |
| Critical Biodiversity Area   | Preferred     | Not preferred |

| Feature | Ncwabeni OCS         | Gugamela OCS     |
|---------|----------------------|------------------|
|         | <b>Not preferred</b> | <b>Preferred</b> |

## 15. ENVIRONMENTAL IMPACT ASSESSMENT

### 15.1 Methodology

All impacts are analysed in the section to follow (**Table 16**) with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions apply:

#### **Nature (/Status)**

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

#### **Extent**

- Local – extend to the site and its immediate surroundings.
- Regional – impact on the region but within the province.
- National – impact on an interprovincial scale.
- International – impact outside of South Africa.

#### **Magnitude**

Degree to which impact may cause irreplaceable loss of resources.

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

#### **Duration**

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

#### **Probability**

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

#### **Significance**

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

- 0 – Impact will not affect the environment. No mitigation necessary.
- 1 – No impact after mitigation.

- 2 – Residual impact after mitigation.
- 3 – Impact cannot be mitigated.

## **15.2 Assessment of Environmental Impacts and Suggested Mitigation Measures**

The possible impacts of proposed development on the study area are divided into three phases of activities: Pre-Construction, Construction phase and Operational phase of the development. Mitigation measures are provided to prevent (first priority), reduce or remediate adverse environmental impacts.

**Table 19.** Recommended mitigation measures with significance rating before and after mitigation for the two proposed dam sites, D2 and D3A.

| FLORA<br>PRE – CONSTRUCTION PHASE |          |                   |  |
|-----------------------------------|----------|-------------------|--|
| Impact                            | Nature   | Description       | Mitigation   |
| Direct                            | Negative | Search and Rescue | A qualified and / or appropriately experienced Botanist or an experienced person who knows the specific vegetation types well should mark any species of conservation importance and medicinal plants when the route is pegged and the necessary permits to transplant them must be obtained if avoidance is not possible. |



| FLORA<br>PRE – CONSTRUCTION PHASE |        |           |             |                |              |
|-----------------------------------|--------|-----------|-------------|----------------|--------------|
| Impact                            |        | Nature    |             | Description    | Mitigation   |
| Without Mitigation                | Extent | Magnitude | Duration    | Probability    | Significance |
|                                   | Local  | Medium    | Medium-term | Almost certain | 2            |
| With Mitigation                   | Extent | Magnitude | Duration    | Probability    | Significance |
|                                   | Local  | Medium    | Short-term  | Likely         | 2            |

| FLORA<br>PRE – CONSTRUCTION PHASE |          |                  |  |
|-----------------------------------|----------|------------------|--|
| Impact                            | Nature   | Description      | Mitigation   |
| Direct                            | Negative | Site preparation | <p>During site preparation topsoil must be removed and stored separately from organic material and spoil material for use in the rehabilitation phase.</p> <p>Records of all environmental incidents</p> |

| FLORA<br>PRE – CONSTRUCTION PHASE |        |           |             |             |   |
|-----------------------------------|--------|-----------|-------------|-------------|---|
| Impact                            |        | Nature    |             | Description | Mitigation  |
|                                   |        |           |             |             | must be maintained and a copy of these records must be made available to authorities on request throughout the project execution. |
| Without Mitigation                | Extent | Magnitude | Duration    | Probability | Significance  |
|                                   | Local  | Medium    | Medium-term | Likely      | 2   |
| With Mitigation                   | Extent | Magnitude | Duration    | Probability | Significance  |
|                                   | Local  | Medium    | Short-term  | Likely      | 2   |

| FLORA<br>PRE – CONSTRUCTION PHASE |          |                         |                         |
|-----------------------------------|----------|-------------------------|-------------------------|
| Impact                            | Nature   | Description             | Mitigation              |
| Direct                            | Negative | Establishment of Labour | During site preparation |

| <p style="text-align: center;"><b>FLORA</b><br/><b>PRE – CONSTRUCTION PHASE</b></p> |        |             |  |
|---|--------|-------------|--|
| Impact  | Nature | Description | Mitigation   |
|   |        | Camps       | topsoil must be removed and stored separately from organic material and spoil material for use in the rehabilitation phase.<br>A qualified and / or appropriately experienced Botanist or an experienced person who knows the specific vegetation types well should mark any species of conservation importance and medicinal plants when the route is |

| FLORA<br>PRE – CONSTRUCTION PHASE |        |           |             |             |  |
|-----------------------------------|--------|-----------|-------------|-------------|--|
| Impact                            |        | Nature    |             | Description | Mitigation   |
|                                   |        |           |             |             | pegged and the necessary permits to transplant them must be obtained if avoidance is not possible. |
| Without Mitigation                | Extent | Magnitude | Duration    | Probability | Significance   |
|                                   | Local  | Medium    | Medium-term | Likely      | 2  |
| With Mitigation                   | Extent | Magnitude | Duration    | Probability | Significance   |
|                                   | Local  | Medium    | Medium-term | Likely      | 2  |

| FAUNA<br>PRE – CONSTRUCTION PHASE |  |          |                   |  |
|-----------------------------------|--|----------|-------------------|--|
| Impact                            |  | Nature   | Description       | Mitigation                                     |
| Direct                            |  | Positive | Search and Rescue | A qualified and / or appropriately experienced |

| FAUNA<br>PRE – CONSTRUCTION PHASE |        |             |   |
|-----------------------------------|--------|-------------|---|
| Impact                            | Nature | Description | Mitigation  |
|                                   |        |             | Zoologist or an experienced person who knows the animals in the region well will identify any possible Red Data fauna on site and the necessary permits to relocate fauna will be obtained if avoidance is not possible. Species of conservation importance identified on sites such as Cape clawless otters and Pythons must be relocated. Training of construction workers to |

| FAUNA<br>PRE – CONSTRUCTION PHASE |        |           |             |             |  |
|-----------------------------------|--------|-----------|-------------|-------------|--|
| Impact                            |        | Nature    |             | Description | Mitigation   |
|                                   |        |           |             |             | recognise threatened animal species will reduce the probability of fauna being harmed unnecessarily. |
| Without Mitigation                | Extent | Magnitude | Duration    | Probability | Significance   |
|                                   | Local  | Medium    | Medium-term | Likely      | 2  |
| With Mitigation                   | Extent | Magnitude | Duration    | Probability | Significance   |
|                                   | Local  | Medium    | Medium-term | Likely      | 2  |

| FAUNA<br>PRE – CONSTRUCTION PHASE |          |                  |   |
|-----------------------------------|----------|------------------|---|
| Impact                            | Nature   | Description      | Mitigation  |
| Direct                            | Negative | Site preparation | During site preparation special care must be taken during |

| <b>FAUNA<br/>PRE – CONSTRUCTION PHASE</b> |        |             |  |
|---|--------|-------------|--|
| Impact                                    | Nature | Description | Mitigation   |
|   |        |             | the clearing of the works area to minimise damage or disturbance of roosting and nesting sites.<br><br>Before construction commences, all sensitive habitats, such as riparian vegetation or forests, must be clearly demarcated with fencing or orange mesh netting. Barricading measures to be utilised should not restrict the movement |

| FAUNA<br>PRE – CONSTRUCTION PHASE |        |           |             |             |                           |
|-----------------------------------|--------|-----------|-------------|-------------|---------------------------|
| Impact                            |        | Nature    |             | Description | Mitigation                |
|                                   |        |           |             |             | of the fauna in the area. |
| Without Mitigation                | Extent | Magnitude | Duration    | Probability | Significance              |
|                                   | Local  | Medium    | Medium-term | Likely      | 2                         |
| With Mitigation                   | Extent | Magnitude | Duration    | Probability | Significance              |
|                                   | Local  | Medium    | Medium-term | Likely      | 2                         |

| FAUNA<br>PRE – CONSTRUCTION PHASE |        |           |             |                                |   |
|-----------------------------------|--------|-----------|-------------|--------------------------------|---|
| Impact                            |        | Nature    |             | Description                    | Mitigation  |
| Direct                            |        | Negative  |             | Disturbance to animals on site | Stringent and dedicated control not to disturb animals on site. |
| Without Mitigation                | Extent | Magnitude | Duration    | Probability                    | Significance  |
|                                   | Local  | Medium    | Medium-term | Likely                         | 2   |



| FAUNA<br>PRE – CONSTRUCTION PHASE |        |           |             |             |              |
|-----------------------------------|--------|-----------|-------------|-------------|--------------|
| Impact                            |        | Nature    |             | Description | Mitigation   |
| With Mitigation                   | Extent | Magnitude | Duration    | Probability | Significance |
|                                   | Local  | Medium    | Medium-term | Likely      | 2            |

| FLORA<br>CONSTRUCTION PHASE |  |          |   |   |
|-----------------------------|--|----------|---|---|
| Impact                      |  | Nature   | Description   | Mitigation  |
| Direct                      |  | Negative | Habitat lost during clearing for the abstraction works, borrow areas and re-alignment of the access road. | Removal of vegetation during stripping and construction will be minimised to reduce the erosion potential. Topsoil will only be removed off areas proposed for borrow areas, access roads and abstraction works. All soils should |

| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |  |
|-----------------------------|--------|-----------|-------------|-------------|--|
| Impact                      |        | Nature    |             | Description | Mitigation   |
|                             |        |           |             |             | be stored and managed correctly for rehabilitation.<br><br>Careful planning of access roads in order to prevent excessive removal of trees and prevent soil erosion. |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability | Significance   |
|                             | Local  | Medium    | Medium-term | Likely      | 2  |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance   |
|                             | Local  | Medium    | Medium-term | Likely      | 2  |

**FLORA  
CONSTRUCTION PHASE**

| Impact | Nature   | Description  | Mitigation   |
|--------|----------|--|--|
| Direct | Negative | Destruction of species of conservation importance and their natural habitats | <ul style="list-style-type: none"> <li>• The removal of any plant material from site, including flowers or bulbs is strictly prohibited unless unavoidable and essential for the purposes of construction.</li> <li>• Cordon off the protected and orange list plant species and protect from construction activities and vehicles.</li> <li>• Relocation of plants of conservation importance (such as <i>Hypoxis hemerocallidea</i>) should be implemented by a qualified specialist.</li> </ul> |

| FLORA<br>CONSTRUCTION PHASE |        |           |          |             |  |
|-----------------------------|--------|-----------|----------|-------------|--|
| Impact                      |        | Nature    |          | Description | Mitigation   |
|                             |        |           |          |             | <ul style="list-style-type: none"> <li>• The contractor for vegetation clearing must have the knowledge to be able to identify different species, declared weeds and alien species.</li> <li>• Leave as much of the natural vegetation intact in order to maintain ecological corridors for the movement of species and make an effort to increase the natural areas outside full supply level.</li> </ul> |
| Without Mitigation          | Extent | Magnitude | Duration | Probability | Significance   |

| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |              |
|-----------------------------|--------|-----------|-------------|-------------|--------------|
| Impact                      |        | Nature    |             | Description | Mitigation   |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |

| FLORA<br>CONSTRUCTION PHASE |          |  |  |
|-----------------------------|----------|--|--|
| Impact                      | Nature   | Description  | Mitigation   |
| Direct                      | Negative | Vegetation and soil disturbance around construction sites due to general construction activities | <ul style="list-style-type: none"> <li>• Minimise topsoil disturbance as far as possible.</li> <li>• Level and landscape disturbed topsoil areas to facilitate plant succession.</li> <li>• Erosion control measures, such as</li> </ul> |

| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |   |
|-----------------------------|--------|-----------|-------------|-------------|---|
| Impact                      |        | Nature    |             | Description | Mitigation  |
|                             |        |           |             |             | stone packing, brush packing and reseeded, should be included on disturbed areas. |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability | Significance  |
|                             | Local  | Medium    | Medium-term | Likely      | 2   |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance  |
|                             | Local  | Medium    | Medium-term | Likely      | 2   |

| FLORA<br>CONSTRUCTION PHASE |          |  |   |
|-----------------------------|----------|--|---|
| Impact                      | Nature   | Description  | Mitigation  |
| Direct                      | Negative | Soil contamination, vegetation loss and vegetation | <ul style="list-style-type: none"> <li>Employ on site personnel responsible for preventing and</li> </ul> |

| FLORA<br>CONSTRUCTION PHASE |        |  |  |
|-----------------------------|--------|--|--|
| Impact                      | Nature | Description                                  | Mitigation   |
|                             |        | disturbance due to fuel and chemical spills. | controlling potential soil pollution through fuel and oil leaks and spills. <ul style="list-style-type: none"> <li>• Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks. On-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations.</li> <li>• Equipment must be prepared in case of accidental contamination with fuel or</li> </ul> |

| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |              |
|-----------------------------|--------|-----------|-------------|-------------|--------------|
| Impact                      |        | Nature    |             | Description | Mitigation   |
|                             |        |           |             |             | chemicals.   |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability | Significance |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |

| FLORA<br>CONSTRUCTION PHASE |        |           |          |                                   |   |
|-----------------------------|--------|-----------|----------|-----------------------------------|---|
| Impact                      |        | Nature    |          | Description                       | Mitigation  |
| Direct                      |        | Negative  |          | Construction of alternative roads | <ul style="list-style-type: none"> <li>• Construction of alternative roads must be limited to areas with high invasion of alien species.</li> <li>• Roads should be limited to outside of the riparian areas</li> </ul> |
| Without                     | Extent | Magnitude | Duration | Probability                       | Significance  |



| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |              |
|-----------------------------|--------|-----------|-------------|-------------|--------------|
| Impact                      |        | Nature    |             | Description | Mitigation   |
| Mitigation                  |        |           |             |             |              |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |

| FLORA<br>CONSTRUCTION PHASE |          |  |  |
|-----------------------------|----------|--|--|
| Impact                      | Nature   | Description  | Mitigation   |
| Direct                      | Negative | Vegetation disturbance in and around construction camps. | <ul style="list-style-type: none"> <li>Fencing off of construction camps.</li> <li>Erect construction camps on previously disturbed areas, preferably near residential areas.</li> </ul> |

| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |   |
|-----------------------------|--------|-----------|-------------|-------------|---|
| Impact                      |        | Nature    |             | Description | Mitigation  |
|                             |        |           |             |             | <ul style="list-style-type: none"> <li>Erect construction camps on level surfaces only</li> </ul> |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability | Significance  |
|                             | Local  | Medium    | Medium-term | Likely      | 2   |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance  |
|                             | Local  | Medium    | Medium-term | Likely      | 2   |

| FLORA<br>CONSTRUCTION PHASE |          |   |  |
|-----------------------------|----------|---|--|
| Impact                      | Nature   | Description   | Mitigation   |
| Direct                      | Negative | Vegetation and habitat disturbance due to the accidental introduction of alien species. | <ul style="list-style-type: none"> <li>Promote awareness of all personnel.</li> <li>After construction monitoring and control</li> </ul> |

| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |   |
|-----------------------------|--------|-----------|-------------|-------------|---|
| Impact                      |        | Nature    |             | Description | Mitigation  |
|                             |        |           |             |             | of alien weeds and invaders through hand removal; slashing (annuals) or chemical control (perennials) |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability | Significance  |
|                             | Local  | Medium    | Medium-term | Likely      | 2   |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance  |
|                             | Local  | Medium    | Medium-term | Likely      | 2   |

| FLORA<br>CONSTRUCTION PHASE |          |                        |  |
|-----------------------------|----------|------------------------|--|
| Impact                      | Nature   | Description            | Mitigation   |
| Direct                      | Negative | Vegetation and habitat | <ul style="list-style-type: none"> <li>Employ personnel</li> </ul> |

| FLORA<br>CONSTRUCTION PHASE |        |           |          |   |   |
|-----------------------------|--------|-----------|----------|---|---|
| Impact                      |        | Nature    |          | Description   | Mitigation  |
|                             |        |           |          | disturbance due to pollution and littering during construction phase. | on site responsible for preventing and controlling of litter. <ul style="list-style-type: none"> <li>• Before construction commences, construction workers should be educated with regards to littering, <i>ad hoc</i> veld fires, and dumping. Fires must be limited to designated areas and monitored closely.</li> </ul> |
| Without Mitigation          | Extent | Magnitude | Duration | Probability   | Significance  |

| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |              |
|-----------------------------|--------|-----------|-------------|-------------|--------------|
| Impact                      |        | Nature    |             | Description | Mitigation   |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |

| FLORA<br>CONSTRUCTION PHASE |        |           |          |  |   |
|-----------------------------|--------|-----------|----------|--|---|
| Impact                      |        | Nature    |          | Description  | Mitigation  |
| Direct                      |        | Negative  |          | Damage to plant life outside of the proposed dam site area | <ul style="list-style-type: none"> <li>Measures must be taken to penalise construction workers who damage plants intentionally or remove plants accidentally without reporting the incident.</li> </ul> |
| Without                     | Extent | Magnitude | Duration | Probability  | Significance  |

| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |              |
|-----------------------------|--------|-----------|-------------|-------------|--------------|
| Impact                      |        | Nature    |             | Description | Mitigation   |
| Mitigation                  |        |           |             |             |              |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance |
|                             | Local  | Medium    | Medium-term | Likely      | 2            |

| FLORA<br>CONSTRUCTION PHASE |          |   |   |
|-----------------------------|----------|---|---|
| Impact                      | Nature   | Description   | Mitigation  |
| Direct                      | Negative | Vegetation disturbance due to increased dust during construction phase. | <ul style="list-style-type: none"> <li>Wetting down of work areas can be used to reduce dust levels but not to a degree that causes runoff and contamination.</li> <li>Cultivate awareness among</li> </ul> |

| FLORA<br>CONSTRUCTION PHASE |        |           |             |             |  |
|-----------------------------|--------|-----------|-------------|-------------|--|
| Impact                      |        | Nature    |             | Description | Mitigation   |
|                             |        |           |             |             | personnel to limit excessive and unnecessary dust. |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability | Significance                                       |
|                             | Local  | Medium    | Medium-term | Likely      | 2  |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance                                       |
|                             | Local  | Medium    | Medium-term | Likely      | 2  |

| FAUNA<br>CONSTRUCTION PHASE |          |                        |   |
|-----------------------------|----------|------------------------|---|
| Impact                      | Nature   | Description            | Mitigation  |
| Direct                      | Negative | Disturbance to animals | <ul style="list-style-type: none"> <li>Animals residing within the designated area shall not be unnecessarily disturbed.</li> <li>Before</li> </ul> |

| FAUNA<br>CONSTRUCTION PHASE |        |             |  |
|-----------------------------|--------|-------------|--|
| Impact                      | Nature | Description | Mitigation   |
|                             |        |             | construction starts, construction workers should be educated with regards to littering and poaching. <ul style="list-style-type: none"> <li>• The Contractor and his/her employees shall not bring any domestic animals onto site.</li> <li>• Photographs of sensitive animals must be displayed in the construction camp to heighten awareness of the creatures.</li> <li>• Toolbox talks should be provided to contractors regarding snakes.</li> </ul> Reptiles on site must be |



| FAUNA<br>CONSTRUCTION PHASE |        |           |             |             |  |
|-----------------------------|--------|-----------|-------------|-------------|--|
| Impact                      |        | Nature    |             | Description | Mitigation   |
|                             |        |           |             |             | removed by a qualified reptile handler and all attempts should be made to ensure reptiles are not killed or collected. |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability | Significance   |
|                             | Local  | Medium    | Medium-term | Likely      | 2  |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance   |
|                             | Local  | Medium    | Medium-term | Likely      | 2  |

| FAUNA<br>CONSTRUCTION PHASE |          |  |  |
|-----------------------------|----------|--|--|
| Impact                      | Nature   | Description  | Mitigation   |
| Direct                      | Negative | Destruction of riparian vegetation during construction | This would lead to displacement of breeding individuals to potentially |

| FAUNA<br>CONSTRUCTION PHASE |        |           |             |             |   |
|-----------------------------|--------|-----------|-------------|-------------|---|
| Impact                      |        | Nature    |             | Description | Mitigation  |
|                             |        |           |             |             | less suitable breeding areas leading to a population decline as well as increased competition for resources within other areas. |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability | Significance  |
|                             | Local  | Medium    | Medium-term | Likely      | 2   |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance  |
|                             | Local  | Medium    | Medium-term | Likely      | 2   |

| FAUNA<br>CONSTRUCTION PHASE |          |                             |                     |
|-----------------------------|----------|-----------------------------|---------------------|
| Impact                      | Nature   | Description                 | Mitigation          |
| Direct                      | Negative | Transportation of materials | Construction trucks |

| FAUNA<br>CONSTRUCTION PHASE |        |           |             |             |  |
|-----------------------------|--------|-----------|-------------|-------------|--|
| Impact                      |        | Nature    |             | Description | Mitigation   |
|                             |        |           |             |             | should travel 40Km/h on access roads and 10Km/h on site in order to avoid unnecessary killings of animals found on site. |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability | Significance   |
|                             | Local  | Medium    | Medium-term | Likely      | 2  |
| With Mitigation             | Extent | Magnitude | Duration    | Probability | Significance   |
|                             | Local  | Medium    | Medium-term | Likely      | 2  |

| FAUNA<br>CONSTRUCTION PHASE |        |             |            |
|-----------------------------|--------|-------------|------------|
| Impact                      | Nature | Description | Mitigation |

| FAUNA<br>CONSTRUCTION PHASE |        |           |             |  |  |
|-----------------------------|--------|-----------|-------------|--|--|
| Impact                      |        | Nature    |             | Description  | Mitigation   |
|                             |        |           |             | To protect sensitive fauna (Cape clawless Otter, Millipede etc) and to maintain their habitat and biological requirements species. | Efforts should be made during construction that no sensitive fauna or any species of conservation importance is destroyed during construction of dam site. |
| Without Mitigation          | Extent | Magnitude | Duration    | Probability  | Significance   |
|                             | Local  | Medium    | Medium-term | Likely   | 2  |
| With Mitigation             | Extent | Magnitude | Duration    | Probability  | Significance   |
|                             | Local  | Medium    | Medium-term | Likely   | 2  |

**FLORA  
OPERATIONAL PHASE**

| Impact             |        | Nature    | Description   | Mitigation   |              |
|--------------------|--------|-----------|---|--|--------------|
| Direct             |        | Negative  | Damage to plant life outside of the proposed dam sites. | Measures must be taken to penalise workers who damage plants intentionally or remove plants accidentally without reporting the incident. |              |
| Without Mitigation | Extent | Magnitude | Duration  | Probability  | Significance |
|                    | Local  | Medium    | Medium-term   | Likely   | 2            |
| With Mitigation    | Extent | Magnitude | Duration  | Probability  | Significance |
|                    | Local  | Medium    | Medium-term   | Likely   | 2            |

| FAUNA OPERATIONAL PHASE |          |             |             |
|-------------------------|----------|-------------|-------------|
| Impact                  | Nature   | Description | Mitigation  |
| Direct                  | Negative | Impacts on  | This impact |

| FAUNA OPERATIONAL PHASE |        |   |   |
|-------------------------|--------|---|---|
| Impact                  | Nature | Description   | Mitigation  |
|                         |        | Local and National Conservation Obligations & Targets | affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas. Impacts that could potentially affect the status of protected areas are regarded unacceptable and should be avoided at all costs. Kwazulu-Natal |

| FAUNA OPERATIONAL PHASE |        |           |             |             |  |
|-------------------------|--------|-----------|-------------|-------------|--|
| Impact                  |        | Nature    |             | Description | Mitigation   |
|                         |        |           |             |             | Coastal Belt vegetation type is listed as Endangered and any further negative impacts on this vegetation type should be avoided. |
| Without Mitigation      | Extent | Magnitude | Duration    | Probability | Significance   |
|                         | Local  | Medium    | Medium-term | Likely      | 2  |
| With Mitigation         | Extent | Magnitude | Duration    | Probability | Significance   |
|                         | Local  | Medium    | Medium-term | Likely      | 2  |

| FAUNA OPERATIONAL PHASE |          |             |            |
|-------------------------|----------|-------------|------------|
| Impact                  | Nature   | Description | Mitigation |
| Direct                  | Negative | To protect  | No         |

| FAUNA<br>OPERATIONAL PHASE |        |           |             |  |   |
|----------------------------|--------|-----------|-------------|--|---|
| Impact                     |        | Nature    |             | Description  | Mitigation  |
|                            |        |           |             | sensitive fauna and to maintain the habitat and biological requirements of such species outside the dam. | sensitive fauna must be removed outside the dam and their habitats must not be destroyed during operation of the dam. |
| Without Mitigation         | Extent | Magnitude | Duration    | Probability  | Significance  |
|                            | Local  | Medium    | Medium-term | Likely   | 2   |
| With Mitigation            | Extent | Magnitude | Duration    | Probability  | Significance  |
|                            | Local  | Medium    | Medium-term | Likely   | 2   |

| FAUNA<br>OPERATIONAL PHASE |          |  |                         |
|----------------------------|----------|--|-------------------------|
| Impact                     | Nature   |  | Mitigation              |
| Direct                     | Negative |  | Poaching is prohibited. |



| <b>FAUNA<br/>OPERATIONAL PHASE</b> |        |           |             |             |              |
|------------------------------------|--------|-----------|-------------|-------------|--------------|
| Impact                             |        | Nature    |             | Description | Mitigation   |
| Without Mitigation                 | Extent | Magnitude | Duration    | Probability | Significance |
|                                    | Local  | Medium    | Medium-term | Likely      | 2            |
| With Mitigation                    | Extent | Magnitude | Duration    | Probability | Significance |
|                                    | Local  | Medium    | Medium-term | Likely      | 2            |

## 16. CONCLUSIONS AND RECOMMENDATIONS

Flora and Fauna surveys were carried out to determine the impact of the proposed construction of Ncwabeni Off-Channel Storage (OCS) Dam and the two alternative schemes were Ncwabeni OCS (D2) and the Gugamela OCS (D3A).

The study area falls within two biomes, Savanna and Indian Ocean Coastal Belt. The vegetation types at the dam localities (D2 and D3A) include Kwazulu-Natal Coastal Belt (Endangered) and Eastern Valley Bushveld (Least threatened). The majority of the inundated areas and footprint of the physical infrastructure are located within Eastern Valley Bushveld. It is expected that similar habitat as encountered within the dam basin is readily available in the greater area (characterised by a rural landscape) to allow for the habitation of relocated species, with limited competition with similar species for resources. The distribution ranges of the species recorded during the field assessment are not restricted to the project area and could be found throughout the region.

According to the Terrestrial Systematic Conservation Plan: Minimum Selection Surface (MINSET), the two proposed dam sites fall within the Critical Biodiversity Area 2, which is Mandatory areas that represent areas of significantly high biodiversity value. In C-Plan analyses, these areas are identifiable as having an Irreplaceability scores of  $\geq 0.8$  and  $< 1.0$  and within the KNZ C-Plan MINSET analysis this does not mean they are of a lower biodiversity value however, only that there are more alternate options available within which the features located within can be met..

One Red Data plant species was found on the study site (D2) during the preliminary site inspection namely *Hypoxis hemerocallidea* (Star-flower or commonly known as African potato). This species is listed as **Declining** and will have to be relocated to another area of the same habitat during construction. The exotic plant species *Melia azedarach* (Syringa trees), *Chromolaena odorata* (Triffid weed), *Lantana camara* and *Solanum mauritianum* (Bugweed) were common at the proposed D3A site while *Chromolaena odorata* (Triffid weed) and *Lantana camara* were the dominant exotic vegetation on proposed D2 dam site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of the invader species be removed and eradicated. According to EKZNW Threatened or Protected Species programme, *Celtis africana* (White stinkwood), which is currently listed as Vulnerable (VU) on the National Threatened or Protected Species was recorded on both proposed sites. The Department of Agriculture,

Forestry and Fisheries (DAFF) will have to be approached to obtain the required permits for the removal of this species.

The protected trees, according to National Forests Act 1998 (Act No 84 of 1998, that have a geographical distribution that includes the two sites are *Prunus africana*, *Rhizophora mucronata*, *Sideroxylon inerme* subsp *inerme*, *Mimusops caffra*, *Ocotea bullata*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *P. henkelii*, *P. latifolius*, *Colubrina nicholsonii*, *Curtis dentata*, *Barringtonia racemosa* and *Bruguiera gymnorrhiza*. These species, if located on site during search and rescue operation, a permit should be obtained from DAFF for their removal off site.

The presence of dogs in the study area, especially on D3A site, poses a threat to the presence of mammals on sites. Some small rodent species were observed on the study area but these species could not be verified due to the lack of close-up observation. The only species of conservation importance which was recorded on D3A was the Cape Clawless Otter (*Aonyx capensis*).

An avifauna study indicated that while the riparian habitats and bushland thickets should provide natural habitats for bird species, no Red data bird species were observed during the initial site investigation of the two proposed sites. The riparian habitats on the proposed sites provide the most suitable habitat for birds in the area. Species recorded during field survey are common and widespread. The creation of a dam will alter the avifaunal (bird) composition. The loss of the riparian (wooded) habitat will have a significant impact on remaining bird species. The newly formed riparian zone around the margins of the dam will take several years to establish.

Four reptile species were recorded on the two proposed sites, Green Mamba, Black mamba, Southern African Python (Red Data Vulnerable (Branch, 1988), and Rock monitor. According to the local people, two pythons were killed last year (2011) as their skins are utilised by the locals. A major trapping and relocation operation should be implemented before any construction commences, targeting threatened, endemic and protected species where possible, particularly reptiles and scientific institutions should be invited to collect live specimens.

Two red listed frog species are known from the 3030CA and 3030CB Quarter Degree Grid Cell (QDGC) including Natal Kloof Frog (*Natalobatrachus bonebergi*) and Natal Leaf-folding Frog (*Afrixalus natalensis*). The Natal Kloof Frog is classified as **Endangered** and is

restricted to the coastal forests of southern Kwazulu-Natal and southern Eastern Cape provinces. Suitable habitat in the form of perennial forest streams and pools with rocky beds especially, but not exclusively in ravines remains within certain perennial streams for Natal Kloof Frog.

The Natal Leaf-Folding Frog (*Afrivalus spinifrons*) which is classified as **Vulnerable** has been recorded within the 3030CA and 3030CB Quarter Degree Grid Cell (QDGC). *Afrivalus spinifrons* breeds in low-lying areas adjacent to the coast and breeds in standing water, in dense sedge beds and inundated grassy wetlands with abundant surface vegetation. Suitable habitat remains for Natal-Leaf-Folding Frog in the sedge and grass dominated valley bottom wetlands with large clumps of White Arums (*Zantedeschia aethiopica*). More intensive surveys conducted over extended periods are required in order to ascertain the current conservation status of Kloof Frogs and Natal Leaf-Folding Frogs in the area.

It is recommended that search and rescue be conducted prior to the construction of the dam to confirm the presence or absence of species of special concern in the project area. This could be done through formalised trapping studies in the case of reptiles, and small mammals. The dam basin of the proposed D2 on the Ncwabeni River is in a more natural state than that of the proposed D3A site on the Gugamela River, due to some human settlement in the Gugamela dam basin. The human settlement in the area increases the invasion of alien plants as it was evident during the site visits. Due to the inundation of large area during the operation of the dam will lead to total loss of species and their habitats on either site of the proposed dam. The areas that are closer to the CBA 1 need to be protected by a suitable buffer zone. If the D3A proposed scheme were to go ahead, then a new (not 'existing') quarry will need to be created at the D2 site as the possibility exists that rock material is not available within the D3A basin. This will enlarge the footprint of D3A and create a large area outside on the FSL that will require rehabilitation. The inundation of ecosystems inevitably leads to the loss of habitat and terrestrial wildlife.

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**APPENDIX A:**

## Bird species recorded in grid cells 3030CA and 3030CB

| <b>Common Name</b>          | <b>Scientific Name</b>         | <b>Rarity regions</b> | <b>Sightings</b> | <b>Reporting rate</b> |
|-----------------------------|--------------------------------|-----------------------|------------------|-----------------------|
| African Black Duck          | <i>Anas sparsa</i>             |                       | 2                | 40.00%                |
| (Swarteend)                 |                                |                       |                  |                       |
| African Crowned Eagle       | <i>Stephanoaetus coronatus</i> | NW                    | 1                | 20.00%                |
| (Kroonarend)                |                                |                       |                  |                       |
| African Firefinch           | <i>Lagonosticta rubricata</i>  | WC                    | 5                | 100.00%               |
| (Kaapse Vuurvinkie)         |                                |                       |                  |                       |
| African Goshawk             | <i>Accipiter tachiro</i>       | GP,NW                 | 1                | 20.00%                |
| (Afrikaanse Sperwer)        |                                |                       |                  |                       |
| African Hoopoe              | <i>Upupa africana</i>          |                       | 2                | 40.00%                |
| (Hoephoep)                  |                                |                       |                  |                       |
| African Jacana              | <i>Actophilornis africanus</i> | WC                    | 1                | 20.00%                |
| (Grootlangtoon)             |                                |                       |                  |                       |
| African Olive-Pigeon        | <i>Columba arquatrix</i>       |                       | 1                | 20.00%                |
| (Geelbekbosduif)            |                                |                       |                  |                       |
| African Paradise-Flycatcher | <i>Terpsiphone viridis</i>     | NC                    | 1                | 20.00%                |

| Common Name            | Scientific Name                | Rarity regions | Sightings | Reporting rate |
|------------------------|--------------------------------|----------------|-----------|----------------|
| (Paradysvlieevanger)   |                                |                |           |                |
| African Pied Wagtail   | <i>Motacilla aguimp</i>        | WC             | 3         | 60.00%         |
| (Bontkwikkie)          |                                |                |           |                |
| African Stonechat      | <i>Saxicola torquatus</i>      |                | 2         | 40.00%         |
| (Gewone Bontrokkie)    |                                |                |           |                |
| Amethyst Sunbird       | <i>Chalcomitra amethystina</i> | FS             | 1         | 20.00%         |
| (Swartsuikerbekkie)    |                                |                |           |                |
| Ashy Flycatcher        | <i>Muscicapa caerulescens</i>  | GP,NW          | 1         | 20.00%         |
| (Blougrysvlieevanger)  |                                |                |           |                |
| Bar-throated Apalis    | <i>Apalis thoracica</i>        |                | 3         | 60.00%         |
| (Bandkeelkleinjantjie) |                                |                |           |                |
| Barn Swallow           | <i>Hirundo rustica</i>         |                | 1         | 20.00%         |
| (Europese Swael)       |                                |                |           |                |
| Black Cuckoo           | <i>Cuculus clamosus</i>        | FS,WC          | 1         | 20.00%         |
| (Swartkoekoek)         |                                |                |           |                |
| Black Cuckooshrike     | <i>Campephaga flava</i>        | WC             | 1         | 20.00%         |

| Common Name            | Scientific Name                  | Rarity regions | Sightings | Reporting rate |
|------------------------|----------------------------------|----------------|-----------|----------------|
| (Swartkatakoeroe)      |                                  |                |           |                |
| Black Saw-wing         | <i>Psalidoprocne holomelaena</i> | GP             | 1         | 20.00%         |
| (Swartsaagvlerkswael)  |                                  |                |           |                |
| Black-backed Puffback  | <i>Dryoscopus cubla</i>          |                | 2         | 40.00%         |
| (Sneeubal)             |                                  |                |           |                |
| Black-bellied Starling | <i>Lamprotornis corruscus</i>    | NP,WC,MP       | 2         | 40.00%         |
| (Swartpensglansspreeu) |                                  |                |           |                |
| Black-collared Barbet  | <i>Lybius torquatus</i>          | NC             | 2         | 40.00%         |
| (Rooikophoutkapper)    |                                  |                |           |                |
| Black-crowned Tchagra  | <i>Tchagra senegalus</i>         |                | 3         | 60.00%         |
| (Swartkroontjagra)     |                                  |                |           |                |
| Black-headed Oriole    | <i>Oriolus larvatus</i>          |                | 1         | 20.00%         |
| (Swartkopwielewaal)    |                                  |                |           |                |
| Blacksmith Lapwing     | <i>Vanellus armatus</i>          |                | 1         | 20.00%         |
| (Bontkiewiet)          |                                  |                |           |                |
| Blue Waxbill           | <i>Uraeginthus angolensis</i>    | NC             | 2         | 40.00%         |

| Common Name             | Scientific Name              | Rarity regions | Sightings | Reporting rate |
|-------------------------|------------------------------|----------------|-----------|----------------|
| (Gewone Blousysie)      |                              |                |           |                |
| Brimstone Canary        | <i>Crithagra sulphuratus</i> | FS,GP          | 3         | 60.00%         |
| (Dikbekkanarie)         |                              |                |           |                |
| Bronze Mannikin         | <i>Spermestes cucullatus</i> |                | 1         | 20.00%         |
| (Gewone Fret)           |                              |                |           |                |
| Brown Scrub-Robin       | <i>Cercotrichas signata</i>  |                | 1         | 20.00%         |
| (Bruinwipstert)         |                              |                |           |                |
| Brown-hooded Kingfisher | <i>Halcyon albiventris</i>   |                | 3         | 60.00%         |
| (Bruinkopvisvanger)     |                              |                |           |                |
| Brown-throated Martin   | <i>Riparia paludicola</i>    |                | 2         | 40.00%         |
| (Afrikaanse Oewerswael) |                              |                |           |                |
| Burchell's Coucal       | <i>Centropus burchellii</i>  |                | 3         | 60.00%         |
| (Gewone Vleiloerie)     |                              |                |           |                |
| Cape Batis              | <i>Batis capensis</i>        | NW             | 1         | 20.00%         |
| (Kaapse Bosbontrokkie)  |                              |                |           |                |

| Common Name          | Scientific Name              | Rarity regions | Sightings | Reporting rate |
|----------------------|------------------------------|----------------|-----------|----------------|
| Cape Glossy Starling | <i>Lamprotornis nitens</i>   | WC             | 3         | 60.00%         |
| (Kleinglansspreeu)   |                              |                |           |                |
| Cape Grassbird       | <i>Sphenoeacus afer</i>      |                | 1         | 20.00%         |
| (Grasvoel)           |                              |                |           |                |
| Cape Robin-Chat      | <i>Cossypha caffra</i>       |                | 1         | 20.00%         |
| (Gewone Janfrederik) |                              |                |           |                |
| Cape Turtle-Dove     | <i>Streptopelia capicola</i> |                | 2         | 40.00%         |
| (Gewone Tortelduif)  |                              |                |           |                |
| Cape Vulture         | <i>Gyps coprotheres</i>      | WC             | 3         | 60.00%         |
| (Kransaasvoel)       |                              |                |           |                |
| Cape Wagtail         | <i>Motacilla capensis</i>    |                | 4         | 80.00%         |
| (Gewone Kwikkie)     |                              |                |           |                |
| Cape Weaver          | <i>Ploceus capensis</i>      |                | 1         | 20.00%         |
| (Kaapse Wewer)       |                              |                |           |                |
| Cape White-eye       | <i>Zosterops virens</i>      |                | 3         | 60.00%         |
| (Kaapse Glasogie)    |                              |                |           |                |

| Common Name                | Scientific Name                | Rarity regions | Sightings | Reporting rate |
|----------------------------|--------------------------------|----------------|-----------|----------------|
| Cardinal Woodpecker        | <i>Dendropicos fuscescens</i>  |                | 2         | 40.00%         |
| (Kardinaalspeg)            |                                |                |           |                |
| Chinspot Batis             | <i>Batis molitor</i>           |                | 4         | 80.00%         |
| (Witliesbosbontrokkie)     |                                |                |           |                |
| Collared Sunbird           | <i>Hedydipna collaris</i>      | WC,NW          | 2         | 40.00%         |
| (Kortbeksuikerbekkie)      |                                |                |           |                |
| Common Fiscal              | <i>Lanius collaris</i>         |                | 2         | 40.00%         |
| (Fiskaallaksman)           |                                |                |           |                |
| Common Waxbill             | <i>Estrilda astrild</i>        |                | 1         | 20.00%         |
| (Rooibeksysie)             |                                |                |           |                |
| Crested Barbet             | <i>Trachyphonus vaillantii</i> | WC             | 1         | 20.00%         |
| (Kuifkophoutkapper)        |                                |                |           |                |
| Crowned Hornbill           | <i>Tockus alboterminatus</i>   | WC,MP          | 1         | 20.00%         |
| (Gekroonde Neushoringvoel) |                                |                |           |                |
| Dark-backed Weaver         | <i>Ploceus bicolor</i>         | WC,MP          | 2         | 40.00%         |
| (Bosmusikant)              |                                |                |           |                |
| Dark-capped Bulbul         | <i>Pycnonotus tricolor</i>     |                | 5         | 100.00%        |
| (Swartoogtiptol)           |                                |                |           |                |



| Common Name               | Scientific Name               | Rarity regions | Sightings | Reporting rate |
|---------------------------|-------------------------------|----------------|-----------|----------------|
| Diderick Cuckoo           | <i>Chrysococcyx caprius</i>   |                | 1         | 20.00%         |
| (Diederikkie)             |                               |                |           |                |
| Dusky Indigobird          | <i>Vidua funerea</i>          | GP             | 1         | 20.00%         |
| (Gewone Blouvinkie)       |                               |                |           |                |
| Egyptian Goose            | <i>Alopochen aegyptiacus</i>  |                | 3         | 60.00%         |
| (Koligans)                |                               |                |           |                |
| Emerald-spotted Wood-Dove | <i>Turtur chalcospilos</i>    | WC             | 5         | 100.00%        |
| (Groenvlekduifie)         |                               |                |           |                |
| Fork-tailed Drongo        | <i>Dicrurus adsimilis</i>     |                | 3         | 60.00%         |
| (Mikstertbyvanger)        |                               |                |           |                |
| Giant Kingfisher          | <i>Megaceryle maximus</i>     |                | 1         | 20.00%         |
| (Reusevisvanger)          |                               |                |           |                |
| Gorgeous Bush-Shrike      | <i>Telophorus quadricolor</i> |                | 1         | 20.00%         |
| (Konkoit)                 |                               |                |           |                |
| Green Wood-Hoopoe         | <i>Phoeniculus purpureus</i>  | NC             | 2         | 40.00%         |
| (Rooibekkekelaar )        |                               |                |           |                |

| Common Name              | Scientific Name              | Rarity regions | Sightings | Reporting rate |
|--------------------------|------------------------------|----------------|-----------|----------------|
| Green-backed Camaroptera | <i>Camaroptera brachyura</i> | NW;GP          | 2         | 40.00%         |
| (Groenrugkwekwevoel)     |                              |                |           |                |
| Grey Sunbird             | <i>Cyanomitra veroxii</i>    |                | 1         | 20.00%         |
| (Gryssuikerbekkie)       |                              |                |           |                |
| Grey-headed Bush-Shrike  | <i>Malaconotus blanchoti</i> |                | 1         | 20.00%         |
| (Spookvoel)              |                              |                |           |                |
| Hadedda Ibis             | <i>Bostrychia hagedash</i>   |                | 2         | 40.00%         |
| (Hadedda)                |                              |                |           |                |
| Hamerkop                 | <i>Scopus umbretta</i>       |                | 3         | 60.00%         |
| (Hamerkop)               |                              |                |           |                |
| Jackal Buzzard           | <i>Buteo rufofuscus</i>      |                | 2         | 40.00%         |
| (Rooiborsjakkalsvoel)    |                              |                |           |                |
| Knysna Turaco            | <i>Tauraco corythaix</i>     |                | 2         | 40.00%         |
| (Knysnaloerie)           |                              |                |           |                |
| Kurrichane Buttonquail   | <i>Turnix sylvaticus</i>     |                | 1         | 20.00%         |
| (Bosveldkwarteltjie)     |                              |                |           |                |

| Common Name            | Scientific Name                  | Rarity regions | Sightings | Reporting rate |
|------------------------|----------------------------------|----------------|-----------|----------------|
| Lanner Falcon          | <i>Falco biarmicus</i>           |                | 2         | 40.00%         |
| (Edelvalk)             |                                  |                |           |                |
| Laughing Dove          | <i>Streptopelia senegalensis</i> |                | 1         | 20.00%         |
| (Rooiborsduifie)       |                                  |                |           |                |
| Lazy Cisticola         | <i>Cisticola aberrans</i>        | WC             | 1         | 20.00%         |
| (Luitinktinkie)        |                                  |                |           |                |
| Lesser Striped Swallow | <i>Hirundo abyssinica</i>        | WC             | 1         | 20.00%         |
| (Kleinstreepswael)     |                                  |                |           |                |
| Little Bee-eater       | <i>Merops pusillus</i>           | NC             | 2         | 40.00%         |
| (Kleinbyvreter)        |                                  |                |           |                |
| Little Grebe           | <i>Tachybaptus ruficollis</i>    |                | 1         | 20.00%         |
| (Kleindobbertjie)      |                                  |                |           |                |
| Little Rush-Warbler    | <i>Bradypterus baboecala</i>     |                | 1         | 20.00%         |
| (Kaapse Vleisanger)    |                                  |                |           |                |
| Little Sparrowhawk     | <i>Accipiter minullus</i>        | WC             | 1         | 20.00%         |
| (Kleinsperwer)         |                                  |                |           |                |
| Long-tailed Widowbird  | <i>Euplectes progne</i>          |                | 1         | 20.00%         |
| (Langstertflap)        |                                  |                |           |                |

| Common Name                 | Scientific Name                  | Rarity regions | Sightings | Reporting rate |
|-----------------------------|----------------------------------|----------------|-----------|----------------|
| Malachite Kingfisher        | <i>Alcedo cristata</i>           |                | 1         | 20.00%         |
| (Kuifkopvisvanger)          |                                  |                |           |                |
| Narina Trogon               | <i>Apaloderma narina</i>         |                | 1         | 20.00%         |
| (Bosloerie)                 |                                  |                |           |                |
| Natal Spurfowl              | <i>Pternistis natalensis</i>     | NC             | 1         | 20.00%         |
| (Nataalse Fisant)           |                                  |                |           |                |
| Neddicky                    | <i>Cisticola fulvicapilla</i>    |                | 4         | 80.00%         |
| (Neddikkie)                 |                                  |                |           |                |
| Olive Bush-Shrike           | <i>Telophorus olivaceus</i>      |                | 1         | 20.00%         |
| (Olyfboslaksman)            |                                  |                |           |                |
| Olive Sunbird               | <i>Cyanomitra olivacea</i>       | MP             | 1         | 20.00%         |
| (Olyfsuikerbekkie)          |                                  |                |           |                |
| Orange-breasted Bush-Shrike | <i>Telophorus sulfureopectus</i> |                | 2         | 40.00%         |
| (Oranjeborsoslaksman)       |                                  |                |           |                |
| Pied Crow                   | <i>Corvus albus</i>              |                | 1         | 20.00%         |
| (Witborskraai)              |                                  |                |           |                |
| Pied Kingfisher             | <i>Ceryle rudis</i>              |                | 2         | 40.00%         |

| Common Name            | Scientific Name                  | Rarity regions | Sightings | Reporting rate |
|------------------------|----------------------------------|----------------|-----------|----------------|
| (Bontvisvanger)        |                                  |                |           |                |
| Purple-crested Turaco  | <i>Gallirex porphyreolophus</i>  |                | 3         | 60.00%         |
| (Bloukuifloerie)       |                                  |                |           |                |
| Red-capped Robin-Chat  | <i>Cossypha natalensis</i>       |                | 3         | 60.00%         |
| (Nataljanfrederik)     |                                  |                |           |                |
| Red-collared Widowbird | <i>Euplectes ardens</i>          |                | 1         | 20.00%         |
| (Rooikeelflap)         |                                  |                |           |                |
| Red-eyed Dove          | <i>Streptopelia semitorquata</i> |                | 3         | 60.00%         |
| (Grootringduif)        |                                  |                |           |                |
| Red-winged Starling    | <i>Onychognathus morio</i>       |                | 3         | 60.00%         |
| (Rooivlerkspreu)       |                                  |                |           |                |
| Reed Cormorant         | <i>Phalacrocorax africanus</i>   |                | 3         | 60.00%         |
| (Rietduiker)           |                                  |                |           |                |
| Rock Martin            | <i>Hirundo fuligula</i>          |                | 1         | 20.00%         |
| (Kransswael)           |                                  |                |           |                |
| Sombre Greenbul        | <i>Andropadus importunus</i>     |                | 3         | 60.00%         |
| (Gewone Willie)        |                                  |                |           |                |

| Common Name                  | Scientific Name               | Rarity regions | Sightings | Reporting rate |
|------------------------------|-------------------------------|----------------|-----------|----------------|
| Southern Black Flycatcher    | <i>Melaenornis pammelaina</i> |                | 3         | 60.00%         |
| (Swartvlieevanger)           |                               |                |           |                |
| Southern Black Tit           | <i>Parus niger</i>            |                | 3         | 60.00%         |
| (Gewone Swartmees)           |                               |                |           |                |
| Southern Boubou              | <i>Laniarius ferrugineus</i>  |                | 5         | 100.00%        |
| (Suidelike Waterfiskaal)     |                               |                |           |                |
| Southern Grey-headed Sparrow | <i>Passer diffusus</i>        |                | 4         | 80.00%         |
| (Gryskopmossie)              |                               |                |           |                |
| Southern Tchagra             | <i>Tchagra tchagra</i>        | NP,MP          | 2         | 40.00%         |
| (Grysborstjagra)             |                               |                |           |                |
| Speckled Mousebird           | <i>Colius striatus</i>        |                | 4         | 80.00%         |
| (Gevlekte Muisvoel)          |                               |                |           |                |
| Spectacled Weaver            | <i>Ploceus ocularis</i>       | WC,GP,NW       | 3         | 60.00%         |
| (Brilwewer)                  |                               |                |           |                |

| Common Name              | Scientific Name                   | Rarity regions | Sightings | Reporting rate |
|--------------------------|-----------------------------------|----------------|-----------|----------------|
| Streaky-headed Seedeater | <i>Crithagra gularis</i>          |                | 1         | 20.00%         |
| (Streepkopkanarie)       |                                   |                |           |                |
| Swee Waxbill             | <i>Coccygia melanotis</i>         | GP,NW          | 1         | 20.00%         |
| (Suidelike Swie)         |                                   |                |           |                |
| Tambourine Dove          | <i>Turtur tympanistria</i>        | WC             | 2         | 40.00%         |
| (Witborsduifie)          |                                   |                |           |                |
| Tawny-flanked Prinia     | <i>Prinia subflava</i>            |                | 3         | 60.00%         |
| (Bruinsylangstertjie)    |                                   |                |           |                |
| Terrestrial Brownbul     | <i>Phyllastrephus terrestris</i>  | GP,NW          | 1         | 20.00%         |
| (Boskrapper)             |                                   |                |           |                |
| Three-banded Plover      | <i>Charadrius tricollaris</i>     |                | 3         | 60.00%         |
| (Driebandstrandkiewiet)  |                                   |                |           |                |
| Village Weaver           | <i>Ploceus cucullatus</i>         |                | 2         | 40.00%         |
| (Bontrugwewer)           |                                   |                |           |                |
| Violet-backed Starling   | <i>Cinnyricinclus leucogaster</i> | NC             | 1         | 20.00%         |
| (Witborsspreeu)          |                                   |                |           |                |
| White-bellied Sunbird    | <i>Cinnyris talatala</i>          |                | 3         | 60.00%         |

| Common Name              | Scientific Name                | Rarity regions | Sightings | Reporting rate |
|--------------------------|--------------------------------|----------------|-----------|----------------|
| (Witpenssuikerbekkie)    |                                |                |           |                |
| White-browed Scrub-Robin | <i>Cercotrichas leucophrys</i> |                | 3         | 60.00%         |
| (Gestreepte Wipstert)    |                                |                |           |                |
| White-throated Swallow   | <i>Hirundo albigularis</i>     |                | 1         | 20.00%         |
| (Witkeelswael)           |                                |                |           |                |
| Willow Warbler           | <i>Phylloscopus trochilus</i>  | WC             | 1         | 20.00%         |
| (Hofsanger)              |                                |                |           |                |
| Wing-snapping Cisticola  | <i>Cisticola ayresii</i>       |                | 1         | 20.00%         |
| (Kleinste Klopkloppie)   |                                |                |           |                |
| Yellow Weaver            | <i>Ploceus subaureus</i>       |                | 3         | 60.00%         |
| (Geelwewer)              |                                |                |           |                |
| Yellow-billed Kite       | <i>Milvus aegyptius</i>        |                | 1         | 20.00%         |
| (Geelbekwou)             |                                |                |           |                |
| Yellow-fronted Canary    | <i>Crithagra mozambicus</i>    |                | 5         | 100.00%        |
| (Geellogkanarie)         |                                |                |           |                |
| Yellow-throated Longclaw | <i>Macronyx croceus</i>        |                | 1         | 20.00%         |



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| <b>Common Name</b>    | <b><i>Scientific Name</i></b> | <b>Rarity regions</b> | <b>Sightings</b> | <b>Reporting rate</b> |
|-----------------------|-------------------------------|-----------------------|------------------|-----------------------|
| (Geelkeelkalkoentjie) |                               |                       |                  |                       |