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Attention: Mr. Guillaume Nel

Dear Sir,

FAUNAL SPECIALIST INPUTS FOR THE PROPOSED REHABILITATION, MAINTENANCE AND MANAGEMENT ACTIONS WITHIN THE LARGER PEARL VALLEY GOLF ESTATE, SOUTHERN PAARL, WESTERN CAPE PROVINCE.

1. INTRODUCTION

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed in March 2022 to assist with faunal specialist inputs to be considered as part of the Maintenance and Management Plan (MMP) compiled for the Pearl Valley Golf Estate, southern Paarl, Western Cape Province (**Appendix A: Figure A1**).

This memorandum is prepared specifically to address concerns on the well-being of various faunal species that utilise the Pearl Valley Golf Estate, mentioning the open space areas within the estate as well as the dams and channels that are utilised for breeding and foraging. The actions stated herein are to ensure that no contamination of the water occurs with any herbicide usage that could impact aquatic fauna and no terrestrial areas are unnecessarily disturbed that could displace faunal species. The Pearl Valley Golf Estate has various open space areas wherein natural fynbos vegetation has been restored and remains interspersed with the golf course, residential households as well as twelve (12) dams. These dams are all considered off-stream dams, none of which are located within any watercourses, and all have been licenced for storage and/or aesthetics by the Department of Water and Sanitation (DWS) and store a combination of pumped Berg River water and groundwater (Water Use Licence (WUL) number 20/G10C/AB/4712 dated the 8th of July 2016). The dams have been referenced 1 – 12 ease of reference and all open space corridors that would be useable by faunal species have been mapped (**Appendix A: Figure 2A**).

The Pearl Valley Golf Estate comprises a total of 212 hectares (ha) and is used for agriculture, industrial and urban usage. Various natural areas remain within the estate where indigenous fynbos species have been reintroduced alongside the various golf course greens. Similarly, most of the storage dams are

interconnected via artificial channels that were excavated as part of the dam network to allow stormwater and overflow water to move between dams and once full capacity has been reached. These channels were created to meander and create smaller ponds that have been vegetated with indigenous wetland species, creating ideal niche habitat for various fauna (such as avifauna and amphibians).

2. PROPOSED MAINTENANCE WORKS

As part of the maintenance of the larger estate, ongoing clearing of encroacher vegetation, Alien and Invasive Plant (AIP) management and ensuring connectivity and capacity is maintained within the open space areas, dams and connected artificial channels, all of which are utilised by various faunal species. As such the following activities are proposed as part of the maintenance and management activities for the Pearl Valley Golf Estate (to name a few) whereby the faunal assemblages must be considered:

- Lawn mowing of the areas adjacent to the open space areas (associated with the Golf Course)
- Removal and control of AIP species such as *Acacia saligna* in open space areas throughout the estate;
- Removal of sediment build-up from dams;
- Removal of sediment build-up in artificial channels;
- Removal and management of *Typha capensis* and *Cyperus papyrus* (collectively referred to as reeds) within the dams and channels; and
- Control of aquatic floating plants (such as water lilies) within the open water of the dams.

Furthermore, as part of the enhancement of faunal communities within the estate various other initiatives can be implemented to maximise species diversity within the study area. As such, specialist input was required on some initiatives that could be undertaken across the larger estate.

3. SITE SPECIFIC FAUNAL CONSIDERATIONS

A desktop review[1] was undertaken to investigate the various fauna that may utilise the study area, followed by a site visit, undertaken on the 24th of March 2022, to determine what faunal species were currently utilising the study area, specifically available open space areas, dams and artificial drainage channels (please refer to **Appendix B** for the assumptions and limitation applicable to this study). The field investigation initially entailed a reconnaissance 'walkabout' to determine the general habitat types found throughout the Pearl Valley Golf Estate. Furthermore, a list of identified faunal species was also provided by the Pearl Valley Golf Estate[2] to further guide this study (Please refer to **Appendix D** for a detailed list).

3.1 Terrestrial Environment

Various open space areas (Figure 1) are available for faunal species throughout the Pearl Valley Golf Estate, providing movement corridors to the various dams as well as to the surrounding landscape (predominantly south west of the estate, associated with the Berg River). Various common mammal faunal species have been identified within the estate, including Cape Fox (*Vulpes chama*), Cape grysbok (*Raphicerus melanotis)*, Common Duiker (*Sylvicapra grimmia*), Marsh Mongoose (*Atilax paludinosus)* and Porcupine (*Hystrix cristata*) to name a few (although not observed during the site assessments undertaken for this write-up. Refer to Appendix D for list). It should be noted that both antelope species as listed are considered solitary and will roam throughout their home range. Should any works be undertaken, the antelope will move out of the disturbed area and return once the disturbance has passed. The main mitigation for these species is thus to increase available movement corridors through the fencing and to maximise indigenous vegetation, as per the recommendations in Table 1 below.

[1] iNaturalist (https://www.inaturalist.org/observations?place_id=any&subview=map) and the online museum (https://vmus.adu.org.za/)
[2] G. Palmer. 2015. Mammals of the Pearl Valley Golf and Country Estate

Figure 1: Open space corridors located within the Pearl Valley Golf Estate, adjacent to the Golf Course.

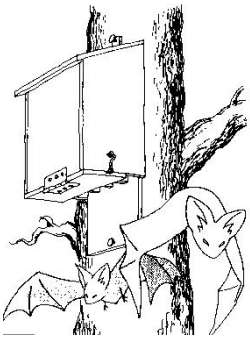
It is noted that the Hawequa Nature Reserve conservation area is located approximately 2.2 km to the north-east of the Pearl Valley Golf Estate, with various recorded sightings therein[3]. The Pearl Valley Golf Estate is largely fenced off, limiting movement of mammalian species (except for those small enough to get through the fencing or species capable of digging under the fence) thus limiting the species that may utilise the study area.

Additional initiatives can be undertaken by the Pearl Valley Golf Estate (the relevant Homeowners Association or by individual landowners) to maximise faunal utilisation of the study area are included in Table 1 below. This will likely increase faunal presence and result in additional natural biological control, reducing the need for herbicides and pesticides throughout the estate.

Table 1: Activities and measures that can be implemented to maximise habitat for fauna.

Additional initiatives for fauna	
Increase Movement Corridors 	Allowing faunal movement through fencing of the estate, between the Hawequa Nature Reserve and the Berg River will likely improve faunal utilisation within the study area. Initiatives including not electrifying the bottom strands of the fencing as well as tunnels and culverts below the perimeter fencing specifically in areas where open space corridors are located (see Appendix A: Figure A2) can assist in allowing mammal species to move through the perimeter fencing. Similarly converting as much open space as possible to indigenous fynbos habitat will increase food resources and habitat availability for various faunal species within the study area (see below for more information). Any areas adjacent to the Golf Course must not be mowed or sprayed with any pesticides and vegetation composition and structure should be maximised.
Owl Boxes 	An increase in predatory avifaunal species will also assist with natural 'pest" control (such as rodents, pigeons and smaller lizards) that can be considered a nuisance for residential life. As such the following are recommended to increase predatory species to reside in the study area: ➢ As many large trees as possible should be retained within the study area, especially those near to the dams and other open space areas; ➢ Owl boxes should be installed within large trees throughout the estate. The owl rescue centre is an example of a non-profit organisation that supplies owl boxes and can assist with identifying ideal locations for placement of such boxes; ➢ No poisons are to be used for small mammal pest control as poisoned small mammals may be consumed by raptors, owls or scavenging species which may lead to the death of such avifauna; and

[3] the online museum (https://vmus.adu.org.za/)

Additional initiatives for fauna	
	➢ As much indigenous vegetation as possible should be utilised as part of the landscape design to provide suitable food resources for avifaunal species.
Bat Boxes 	As with moving habitat for predatory birds, providing suitable habitat for bat species can greatly assist with natural pest control within the estate and reduce the need for pesticides. An individual bat can consume up 5 000 invertebrate species in one night (including mosquitoes, cockroaches, moths, stink bugs etc. that are considered to be pests). Providing additional roosting areas for bats during daylight hours can significantly increase their likelihood to reside within the estate. The following should be considered: ➢ Boxes should be placed in areas that provide better thermal protection during the hot, daytime temperatures but receive some late afternoon sunlight to warm the box; and ➢ Bats like small, warm, dry roosting areas so all bat boxes should be leakproof and provide various chambers, with access from the bottom. Various options are available within South Africa for purchase.
Managing other open space areas across the estate  	As part of the Golf Estate, various other natural corridors (refer to Appendix A; Figure A2 for map of all identified corridors) remain adjacent to golf courses and the Pearl Valley (PV) dams that have been revegetated with natural indigenous species. The following additional aspects should be considered as part of the maintenance for the larger estate (and not just the PV dams): ➢ All open space areas should be maintained and Alien and Invasive Plants (AIP) species controlled; ➢ Maximise indigenous vegetation areas within the corridors. These open space areas function as migratory corridors for many faunal species and can maximise movement of species throughout the estate, thus resulting in better utilisation and reducing competition for resources; ➢ The adjacent (located to the north of the Pearl Valley Golf Estate) Val de Vie 2 estate has a biodiversity corridor within (comprising approximately 120 ha). It is strongly recommended that suitable corridors be created, where possible, and these areas linked so fauna can maximise use of available habitat in the adjacent landscape, rather than being segmented by roads and houses; ➢ Reduce the need for vegetation cutting and herbicide/pesticide application as far as feasibly possible. Dense vegetation gives cover to various faunal species, specifically more cryptic species that will reside within the study area; and ➢ Rocky outcrop areas or stumps and logs (ad indicated in the example photographs to the left) can be left in open space areas to create additional habitat for more cryptic faunal species (such as reptiles and amphibians), including various invertebrates. For example, solitary bee species are known to build their nests in wooden crevices where a compartment is created with a single egg laid therein.
Reptiles 	➢ No reptiles should be trapped or killed within the Pearl Valley Golf Estate. Puff Adders may frequent some of the households on occasion, seeking food or warmth (during colder days). Individuals should be humanely removed by a trained snake handler and released into the open space areas. It is recommended that snake species remain within the larger estate as they provide pest control services through preying on various rodent species. ➢ Gecko species will likely be found in or outside the various households, attracted to the increased insect activity as a result of artificial lighting. No Geckos should be injured/removed as they pose no threat to any residents. ➢ Rocky outcrop areas should be created within the open space areas to create additional suitable habitat and basking areas for reptile species.

3.2 Aquatic Environment

The dams located within the Pearl Valley Golf Estate (Figure 2 below) house various faunal assemblages including amphibians, avifauna, insects as well as various fish species. The dams are stocked with Carp species (Common Carp and Grass Carp), likely introduced into the dams as fry, pumped in from the Berg River. It must be noted that this species is considered an invasive freshwater fish species in accordance with the alien and invasive species lists (2020) as it relates to the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (Category 3[4]) and populations within dams should be controlled. As such, maintenance works within the dams and the artificial channels need to take cognisance of the existing faunal species therein and ensure no significant impacts occur to the resident fauna.

Figure 2: Images of some of the dams located within the Pearl Valley Golf Estate that house various faunal species.

This section will consider the maintenance requirements within the dams and associated artificial channels which are considered suitable habitat for various faunal species. The following table (Table 2) provides a list of potential impacts to various faunal classes as well as key mitigation measures that must be implemented as part of any maintenance activities that occur within these areas.

It is noted that the removal of reed species as well as the proposed mechanisms to undertake the removal were addressed in a separate document (project number FEN 22-5006, 2022[5]), which should be considered in conjunction to this MMP with regards to understanding the various removal methodologies.

[4] Listed Category 3 in catchment systems in which it already occurs. Category 3 implies that these species cannot be owned, bred, imported or sold however, it is considered exempted from catch and release.

[5] FEN Consulting (Pty) Ltd. 2022. Freshwater specialist rehabilitation, maintenance and management actions required for the removal of reed species and revegetation of the various dams within the Pearl Valley Golf Estate, southern Paarl, Western Cape. FEN 22-5006

Table 2: Potential faunal impacts and mitigation measures applicable to the dams and artificial channels.

Activity	Mitigation Measures
Use of chemical herbicides for vegetation within the dams.	 **Potential Impact:** The use of chemical herbicides can be toxic to aquatic species if dosages are exceeded and improper application is done.
	If herbicides are incorrectly used, they can be toxic to aquatic fauna, disrupting biological functioning (through build up of toxic residue in kidneys of fish as well as increased stress proteins) and can result in reduced breeding and ultimate death of individuals. Furthermore, fish death can occur due to deoxygenation of the water by either the inhibition of photosynthesis and/or decay of killed vegetation (should this not be removed). The following is thus applicable for all pesticide and herbicide use during maintenance works associated with emergent and bankside vegetation associated with the PV dams: ➢ All recommendations as per the Rehabilitation, Maintenance and Management Plan compiled for the removal of reed species (FEN 22-5006) must be strictly adhered to; ➢ Should herbicides be used, the dosage and mixing instructions as per the type of herbicide must be strictly adhered to at all times. Herbicides containing the active ingredient glysophate have been known to be toxic and their use should be avoided/carefully controlled in areas directly adjacent to the dams. Preference should be given to herbicides that are safe to use near water sources; ➢ Foliar applications of herbicides should not be undertaken during wet weather as the risk of run-off into the dams is significantly higher; ➢ All emergent vegetation should be manually removed, and no dead/decaying vegetation should be left within the dams; ➢ Complete removal of emergent and bankside vegetation is not recommended. Areas should be left to maintain food chains and provide shelter for fish, fry as well as invertebrates; and ➢ Should machinery be required for removal of sediment build-up or large reed clearing, it is recommended that as far as feasibly possible turbidity be kept to a minimum and work be finished as quickly as possible to allow free-floating sediments to settle.
Disturbance of breeding avifauna during manual cutting of reeds.	 **Potential Impact:** During manual reed cutting, breeding avifauna may be distrurbed, resulting in adults abandoning nests, damage to eggs or fatalities of chicks.
	Various common aquatic avifaunal species were recorded within the PV dams (refer to **Appendix D** for a comprehensive list) that are likely to breed in areas adjacent to the dams. The following provides a brief sumamry of the breeding habits of commonly occuring avifauna identified within the dams: **Common moorhen** (*Gallinula chloropus*) will utilise well-vegetated areas (such as the *Typha capensis* reeds associated with the banksides of the various PV dams) for breeding, creating basket-built nests on the ground. Laying of eggs usually occurs year round, with peaks from August - March (summer season) with incubation lasting around 3 weeks. Both parents incubate the eggs and the chicks will leave the nest upon hatching with the parents, but may utilise the nest during roosting until fledged. **Red-knobbed Coot** (*Fulica cristata)* will utilise floating vegetation mats (specifically dead reeds) near the water's edge or more commonly build floating nests using sedges, reeds and grasses. Laying of eggs usually occurs year round, with peaks from July- November (spring season) with incubation lasting around 3 weeks. Chicks will leave the nest within a day of hatching and are cared for by both parents.  **Egyptian Geese** (*Alopochen aegyptiaca)* will built nests near the water, within vegetation clumps, in a hole or in fairly open areas (near grass areas for grazing) at ground level using grass, reeds and leaves lined with down feathers. Laying of eggs usually occurs between July- March (spring and summer seasons) with

Activity	Mitigation Measures
	incubation lasting around 4 weeks. Chicks will leave the nest within a day of hatching and are cared for by both parents. Parents and chicks may wander between dams and forage on land. **Yellow-Billed Duck** (*Anas undulata)* is a monogamous, solitary nester, building a nest in a shallow depression in the ground which is usually lines with fine grass and weeds within dense cover, never more than 20 m from the water. Laying of eggs is year round and incubation is done solely by the female for 3-4 weeks. The female may leave the nest to forage and will cover the eggs with a scrap of nest lining, making them less visible. Chicks leave the nest on hatching but may return with the female during night-time roosting. **Long-tailed Comorant** (*Microcarbo africanus)* is monogamous and breed colonially, adjacent with other species (usually between 10 to 50 breeding pairs thus it is unlikely the PV dams will be utilised for breeding). Nests are a platform of twigs and other vegetation, which is built approximately 50 cm (and up to 6 m) above ground-level (the height of the nest is influenced by water -levels). Nests are located within forked trees (often partially submerged by water, over water or on islands), in reedbeds and tufts of vegetation on the ground. Laying of eggs occurs year round, but most commonly between October and April. Incubation of eggs takes approximately 3-4 weeks and chicks are brown naked, growing black down and will fledge approximately 28-35 days after hatching. **Cape Weaver** (*Ploceus capensis)* is a polygynous and territorial colonial nester, the males creating multiple hanging nests often in tall trees near a water source or in reeds (such as *Phragmites australis* and *Typha capensis)*. Egg laying is between June and February, with peak laying in August-October (spring season). Eggs are incubated by the female for about 2 weeks. The young will fledge the nest at about 17 days old.  Based on the above information, the following must be considered when plannning maintenance so as to minimise disturbance to nests and chicks (species as observed during the site visit were specifically mentioned but similar approaches are deemed applicable for other species): ➢ No reed clearing should be undertaken during the high breeding season (spring season between August- November is the highest for all species). Reed clearing should rather be done in Autumn season (starting March); ➢ All dense reed areas (bankside) should be checked before manual cutting commences. Care must be taken to check that no nests have been covered (such as that done by the Yellow-billed duck) which reduces visibility. If nests with eggs are identified this area should not be cut/have herbicides applied until all chicks have fledged; ➢ Patches of *Typha capensis* and other emergent reeds must remain intact and total cutting/removal is not recommended as this will reduce all available breeding and roosting habitat for aquatic avifauna. Areas are to be planned beforehand and it must be ensured that at least 40 % of the reed beds remain unchanged; and ➢ All vegetation is to be manually removed from the area.
Manual removal of sediment and floating vegetation within the dams.	 **<u>Potential Impact:</u>** During manual removal of floating vegetation, amphibians may be disturbed/ collected along with the plant material. Removal of too much vegetation may result in increased predation of tadpoles by fish species due to reduced vegetation cover.
	Amphibian species largely utilise water bodies for breeding as tadpoles are solely reliant on water until metamorphosis is completed, after which they can utilise the adjacent terrestrial habitat for foraging. As part of the reed and emergent vegetation management, care must be taken to not disturb breeding individuals that may utilise the PV dams. The following provides a brief sumamry of the breeding habits of commonly occuring amphibians within the dams and associated channels: **Clicking Stream Frog** (*Strongylopus grayii*) were observed (via vocalisation) within the adjoining channels between the PV dams. This species is known to breed in dams and has a wide tolerance for water quality. Breeding occurs during the winter period (western cape rainfall season) where 250-350 eggs are laid out of the water but within 30 cm from the edge. Eggs are usually in a single layer of moss, under leaves, on

Activity	Mitigation Measures
	mud or in crevices under rocks. In wet weather the tadpoles emerge after 5 days and enter the adjacent water. Development takes between 3-6 months after which froglets are not bound to the water body. **Common Platanna** (*Xenopus laevis)* is a solely aquatic species (only leaving the water when forced to migrate) that required a permanent water body all year around. They can tolerate a wide variation in water quality. Mating occurs throughout the year but most common in spring, during the night-time. Females can release hundreds of eggs in a 3-4 hour vent, which usually attach to aquatic plants for anchorage. Metamorphosis from egg to froglet stage takes 4-6 weeks. **Raucous Toad** (*Sclerophrys capensis)* are large toads that are known to roam widely throughout the year while foraging on land and often breed in large dams associated with artificial grasslands (such as those created as part of the PV Golf Course). Breeding individuals show fidelity to breeding sites (water bodies) within seasons (during the summer months- mainly in December) but breed site shift up to 5 km have been noted. Female toads will lay spiralling strings of eggs within a water body (with strings of up to 10 000 eggs having been recorded), which gets entangled around aquatic vegetation. Metamorphosis from egg to froglet stage takes 2-3 months.  **Cape River Frog** (*Amietia fuscigula)* are common amongst vegetation within or directly adjacent to waterbodies, especially in reeds and areas (ponds, dams and swales) where water lilies are present. This species is fairly tolerant of water quality variation and has been known to survive in altered habitats. Breeding occurs in shallow waters along the edge of dams or in slow-moving streams. Breeding is active throughout the year where clutches of 400-500 eggs are laid. Metamorphosis is fairly slow, taking between 9 months to 2 years to reach maturity (measuring 80 mm in length) from egg. **Painted reed Frog** *(Hyperolius marmoratus)* occupies a variety of habitat types and breeds in dams and reed beds. Adults with aestivate during the high summer months (Western Cape dry season) in vegetation, under logs or stones and sometimes in households (concealing themselves behind cupboards, pictures or toilet cisterns). Breeding normally takes place in Spring, between October- February. Individuals can be seen basking on emergent vegetation before dawn, with emergent plants (*Typha capensis*) and sedge species noted as favoured call sites for breeding males. Females will lay 150-650 eggs in flattened clumps of the surface of submerged leaves, stalks or stones or amongst roots of aquatic plants. Metamorphosis from egg to froglet stage takes 6-8 weeks.  Based on the above information, the following must be considered when plannning maintenance so as to minimise disturbance to breeding amphibians: ➢ No reed clearing or sediment removal should be undertaken during the high breeding season (spring season). Areas where high vocalisations can be heard (usually during night-time) (specifically within *Typha capensis* clumps or sedges) should be marked and these areas not scheduled for clearing untila fter the breeding season. Reed clearing should rather be done in Autumn season (starting March), prior to onset of rainfall; ➢ Mowing of vegetation should not be undertaken right to the dam edge. Vegetation for at least 1 m from the edge of the dam should remain for adequate cover for amphibians; ➢ All dense areas of aquatic emergent vegetation should be manually cleared (by hand) and removed vegetation checked for any attached egg strings or individual amphibians prior to removal from the dam (this is specifically important for species that breed year round); and ➢ Areas of fairly dense aquatic vegetation, espceically along the edge of the dams should be left, with only “thinning” of vegetation (and not complete removal of all vegetation within an area) being undertaken to ensure available vegetation remains for resident amphibians. Total removal of submergent and emergent vegetation will leave amphians explosed to high predation which can significantly reduce populaiton sizes.

Activity	Mitigation Measures
Introduction of exotic species into the environment due to residential development	 **Potential Impact:** Increased competition for resources with indigenous fish species and increased predation on indignous prey (such as tadpoles). Unsustaibale populations can result in decreased water quality which will deteriorate the habitat quality for other species (plants and fauna).
	People often get bored of "pet fish" species and release them into larger dams (with the best intentions for the fish), however, this has been noted to have detrimental impacts to indigenous fish and other faunal taxa (such as amphibians and invertebrates that form a large component of the food resource for these exotic fish species) through competition for resources as well as potential release of exotic diseases (such as *herpesviral haematopoietic necrosis* common in goldfish) to indigenous species. As such no residents should be allowed to release ornamental fish species into the Val de Vie dams as this can significantly alter the environment of the dams and thus affect the local fauna and there is risk that exotic fry may enter the Berg River via the network of swales. The following should be undertaken regarding control of exotic species: ➢ Residents must be made aware to not release any pet, exotic species into the dams and be educated of the potential risks; and ➢ Numbers of exotic individuals (as it is noted that Koi already reside in some of the dams) should be monitored and should population numbers increase dramatically the following steps could be undertaken as part of the management of this species: o Removal all exotic species from the larger, interconnected dams and keep them in isolated dams (that have no outlets to other water bodies). These fish can be fed with store purchased Koi feeds; and o Offer Koi species to residents as stock for any private ponds. Fish should be removed using large nets and placed in buckets. Indigenous species should remain within the dams.

4. CONCLUSION

This faunal MMP is compiled for the Pearl Valley Golf Estate with consideration to maintenance activities as well as creation of suitable habitat for fauna species to reside within and move through the Pearl Valley Golf Estate. This MMP promotes the recovery of indigenous faunal species as well as the ecological integrity of their habitat, with specific focus on the available open space areas and dams and measures that must be considered and incorporated into the Maintenance and Management protocols for the Pearl Valley Golf Estate. Any maintenance works to be undertaken within the estate must ensure minimal impacts to the local fauna that utilize these areas, and it is the responsibility of the proponent to ensure all the measures proposed herein are carried out.

It is the opinion of the consultant that should the activities as presented in this MMP be executed in a cogent and well-managed fashion the water quality and aquatic fauna that utilise the dams will not be negatively impacted during annual maintenance and the terrestrial habitat available within the estate can be maximised. Similarly, with the implementation of movement corridors below the boundary fences, additional faunal species may utilise the Pearl Valley Golf Estate to move between the Berg River located to the south-west and the Hawequa Nature Reserve located in the north-east. Links should also be facilitated with the adjacent Val de Vie 2 estate, wherein a biodiversity corridor has been developed. This further maximises movement for fauna in the larger landscape.

Kind Regards,

Kim Marais
Pr. Sci. Nat
Peer reviewed by Chris du Preez (Pr. Sci. Nat) and C. Hooton

Appendix A: Maps associated with the study area

Figure A1: Location of the study area in relation to the surroundings

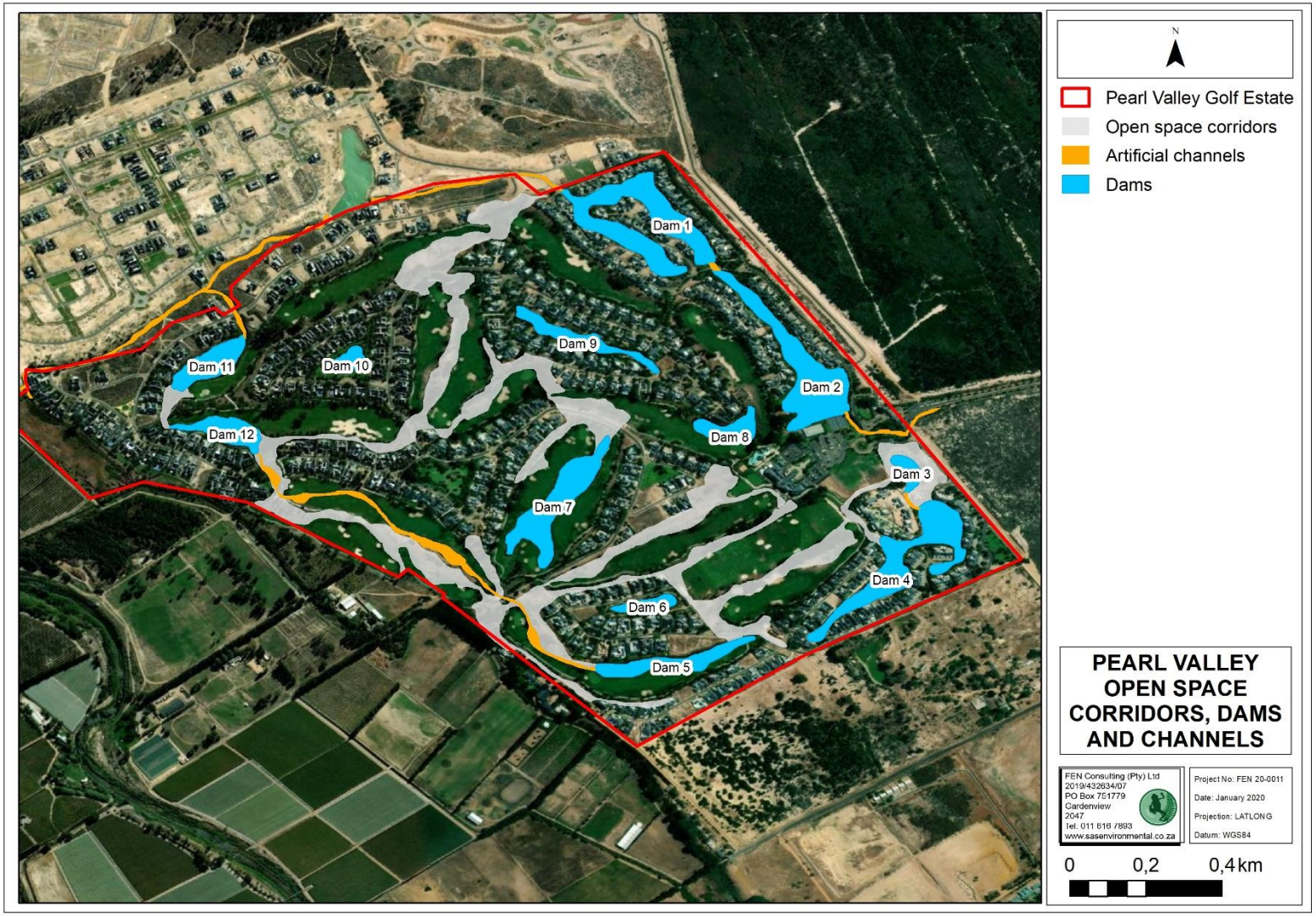


Figure A2: Location of open space corridors, dams and artificial channels utilised by fauna within the Pearl Valley Golf Estate.

Appendix B: Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal communities have been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management;
- Due to the nature and habits of most faunal taxa, it is highly unlikely that all species would have been observed during a field assessment of limited duration (one day in the middle of summer). Therefore, site observations were compared with literature studies where necessary;
- This assessment was limited to the Pearl Valley Golf Estate dams and associated channels, with only a drive through of the remaining study area and did not consider the surrounding properties or open space areas (such as the Berg River corridor);
- A field assessment was undertaken on the 24th of March 2022 (summer season), to determine the faunal ecological status of the study area and to "ground-truth" the results of the desktop assessment (see list in Appendix C). A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data and specialist experience in the area, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the survey area; and
- At the time of the field assessment lawn mowing and general vegetation maintenance was being undertaken surrounding the dams. This will likely have disturbed local fauna, causing them to temporarily relocate to less disturbed areas until mowing activities were finalised (i.e. avifauna or mammals) while less mobile fauna would likely go into hiding (reptiles) thus reducing the visual observations during the site visit.

Indemnity of Use of this report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by seasonality, time and budgetary constraints relevant to the type and level of investigation undertaken as well as the project program and FEN Consulting (Pty) Ltd and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information June become available from ongoing research or further work in this field or pertaining to this investigation.

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Appendix C: Faunal Species of Conservation Concern for the Western Cape Province

Table C1: Threatened Mammal Species associated with the Western Cape (CapeNature, 2017)

Common Name	Taxon Name	2016 Regional IUCN Assessments
CRITICALLY ENDANGERED		
Riverine rabbit	*Bunolagus monticularis*	Critically Endangered C2a(i)
Antarctic true blue whale	*Balaenoptera musculus intermedia*	Critically Endangered A1abd
Boosmansbos long-tailed forest shrew	*Myosorex longicaudatus boosmani*	Critically Endangered B1ab(ii,iii)+2ab(ii,iii)
ENDANGERED		
	Cryptochloris zyli	Endangered B1ab(iii)+2ab(iii)
African wild dog	*Lycaon pictus*	Endangered D
Sei whale	*Balaenoptera borealis*	Endangered A1d
Southern Hemisphere fin whale	*Balaenoptera physalus*	Endangered A1d
Mountain reedbuck	*Redunca fulvorufula fulvorufula*	Endangered A2b
Indian hump-backed dolphin	*Sousa plumbea*	Endangered A4cd; B1ab(iii,v)
Long-tailed forest shrew	*Myosorex longicaudatus*	Endangered B1ab(ii,iii)+2ab(ii,iii)
Southwestern black rhinoceros	*Diceros bicornis bicornis*	Endangered D
VULNERABLE		
Bryde's whale	*Balaenoptera edeni*	Vulnerable
Sperm whale	*Physeter macrocephalus*	Vulnerable A1d
Grant's golden mole	*Eremitalpa granti granti*	Vulnerable B1ab(iii)+B2ab(iii)
Bontebok	*Damaliscus pygargus pygargus*	Vulnerable B2ab(ii)+D1
Cheetah	*Acinonyx jubatus*	Vulnerable C2a(i)+D1
Cape Marsh Rat	*Dasymys capensis*	Vulnerable B1ab(ii,iii,iv)+B2ab(ii,iii,iv)
Duthie's golden mole	*Chlorotalpa duthieae*	Vulnerable B1ab(iii)+2ab(iii)
Blue duiker	*Philantomba monticola monticola*	Vulnerable B2ab(ii,iii,v)+C2a(i)
Leopard	*Panthera pardus*	Vulnerable C1
Black-footed cat	*Felis nigripes*	Vulnerable C2a(i)
White-tailed mouse	*Mystromys albicaudatus*	Vulnerable C2a(i)
Humpback whale	*Megaptera novaeangliae*	Vulnerable D1
Namib long-eared bat	*Laephotis namibensis*	Vulnerable D1
NEAR THREATENED		
Grey rhebok	*Pelea capreolus*	Near Threatened A2b
Southern elephant seal	*Mirounga leonina*	Near Threatened A2b
Spectacled dormouse	*Graphiurus ocularis*	Near Threatened A2bc
Laminate vlei rat	*Otomys laminatus*	Near Threatened B2ab(i,ii,iii,iv)+C1+C2a(i)
Serval	*Leptailurus serval serval*	Near Threatened B2ab(ii,iii,iv,v)+C2a(i)
Fynbos golden mole	*Amblysomus corriae*	Near Threatened B2ab(iii)
Indian Ocean bottlenosed dolphin	*Tursiops aduncus*	Near Threatened B2ab(iii,v)
Littledale's whistling rat	*Parotomys littledalei*	Near Threatened B2b(iii,iv),c(iii)
African striped weasel	*Poecilogale albinucha*	Near Threatened C1
African clawless otter	*Aonyx capensis*	Near Threatened C2a(i)
Brown hyaena	*Parahyaena brunnea*	Near Threatened C2a(i)+D1
Spotted hyaena	*Crocuta crocuta*	Near Threatened C2a(ii)

CR = Critically Endangered, EN = Endangered, NT = Near Threatened, VU = Vulnerable, P=Protected

Table C2: List of conservation priority bird species for the Western Cape (CapeNature, 2017)

Table 2: List of species classified as Endangered at a regional scale. Corresponding statuses as at 2007 and 2012 SOB report as well as the global statuses are including for comparison.

Common Name	Scientific Name	Regional Status			Global Status		
		2007	2012	2017	2007	2012	2017
Roseate Tern	*Sterna dougallii*	EN	EN	EN	LC	LC	LC
African Marsh-Harrier	*Circus ranivorus*	V	V	EN	LC	LC	LC
African Penguin	*Spheniscus demersus*	V	V	EN	V	EN	EN
Bank Cormorant	*Phalacrocorax neglectus*	V	V	EN	EN	EN	EN
Cape Vulture	*Gyps coprotheres*	V	V	EN	V	V	EN
Ludwig's Bustard	*Neotis ludwigii*	V	V	EN	LC	EN	EN
Martial Eagle	*Polemaetus bellicosus*	V	V	EN	LC	NT	V
Black Harrier	*Circus maurus*	NT	NT	EN	V	V	V
Cape Cormorant	*Phalacrocorax capensis*	NT	NT	EN	NT	NT	EN
Antarctic Tern	*Sterna vittata*	LC	LC	EN	LC	LC	LC
Hottentot Buttonquail	*Turnix hottentottus*	NE	NE	EN	LC	LC	EN

Common Name	Scientific Name	Regional Status			Global Status		
		2007	2012	2017	2007	2012	2017
African Finfoot	*Podica senegalensis*	V	V	V	LC	LC	LC
African Grass-Owl	*Tyto capensis*	V	V	V	LC	LC	LC
Cape Gannet	*Morus capensis*	V	V	V	V	V	V
Denham's Bustard	*Neotis denhami*	V	V	V	NT	NT	NT
Knysna Warbler	*Bradypterus sylvaticus*	V	V	V	V	V	V
Striped Flufftail	*Sarothrura affinis*	V	V	V	LC	LC	LC
African Crowned Eagle	*Stephanoaetus coronatus*	NT	NT	V	NT	LC	LC
Black Stork	*Ciconia nigra*	NT	NT	V	LC	LC	LC
Caspian Tern	*Sterna caspia*	NT	NT	V	LC	LC	LC
Great White Pelican	*Pelecanus onocrotalus*	NT	NT	V	LC	LC	LC
Lanner Falcon	*Falco biarmicus*	NT	NT	V	LC	LC	LC
Secretarybird	*Sagittarius serpentarius*	NT	NT	V	LC	V	V
Burchell's Courser	*Cursorius rufus*	LC	LC	V	LC	LC	LC
Verreaux's Eagle	*Aquila verreauxii*	LC	LC	V	LC	LC	LC
Southern Black Korhaan	Afrotis afra	NE	NE	V	NE	NE	V

Common Name	Scientific Name	Regional Status			Global Status		
		2007	2012	2017	2007	2012	2017
Blue Crane	*Anthropoides paradiseus*	V	V	NT	V	V	V
Kori Bustard	*Ardeotis kori*	V	V	NT	LC	LC	NT
Agulhas Long-billed Lark	*Certhilauda brevirostris*	NT	NT	NT	NR	NR	NE
Black-winged Lapwing	*Vanellus melanopterus*	NT	NT	NT	LC	LC	LC
Chestnut-banded Plover	*Charadrius pallidus*	NT	NT	NT	NT	NT	NT
Crowned Cormorant	*Phalacrocorax coronatus*	NT	NT	NT	NT	NT	NT
Greater Flamingo	*Phoenicopterus roseus*	NT	NT	NT	LC	LC	LC
Greater Painted-snipe	*Rostratula benghalensis*	NT	NT	NT	LC	LC	NR
Half-collared Kingfisher	*Alcedo semitorquata*	NT	NT	NT	LC	LC	LC
Knysna Woodpecker	*Campethera notate*	NT	NT	NT	NT	NT	NT
Lesser Flamingo	*Phoeniconaias minor*	NT	NT	NT	LC	LC	NT
Peregrine Falcon	*Falco peregrinus*	NT	NT	NT	LC	LC	LC
Sclater's Lark	*Spizocorys sclateri*	NT	NT	NT	NT	NT	NT
African Rock Pipit	*Anthus crenatus*	LC	LC	NT	LC	LC	LC
Cape Rock-jumper	*Chaetops frenatus*	LC	LC	NT	LC	LC	LC
Eurasian Curlew	*Numenius arquata*	LC	LC	NT	LC	NT	NT
European Roller	*Coracias garrulous*	LC	LC	NT	NT	NT	LC
Karoo Korhaan	*Eupodotis vigorsii*	LC	LC	NT	LC	LC	LC
Maccoa Duck	*Oxyura maccoa*	LC	LC	NT	NT	NT	NT

NYBA = Not yet been assessed, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, EN = Endangered, Ad mon = Additional Monitoring, End and N-end = Endemic and Near endemic

Table C3: Threat status of Reptile Species for the Western Cape (CapeNature, 2017).

Species	English name	Regional IUCN	Global IUCN
Psammobates geometricus	geometric tortoise	Critically Endangered (A2acde)	Critically Endangered (A2acde+4acde)
*Lepidochelys olivacea**	olive ridley turtle	Data Deficient	Vulnerable (A2bd)
*Dermochelys coriacea**	leatherback sea turtle	Endangered (D)	Vulnerable (A2bd)
*Crocodylus niloticus**	Nile crocodile	Vulnerable (A2ac)	Least Concern
Homopus signatus	speckled padloper	Vulnerable (A2acde)	Vulnerable (A2acde)
Bradypodion pumilum	Cape dwarf chameleon	Vulnerable (B1ab)	Vulnerable (B1ab)
Psammophis leightoni	fork-marked whip snake	Vulnerable (B1ab)	Vulnerable (B1ab)
Bitis armata	southern adder	Vulnerable (B1ab+2ab)	Vulnerable (B1ab+2ab)
*Caretta caretta**	loggerhead turtle	Vulnerable (D1)	Endangered (A1abd)
Hemicordylus nebulosus	dwarf crag lizard	Vulnerable (D1+2)	Vulnerable (D1+2)
Afroedura hawequensis	Hawequa flat gecko	Near Threatened	Near Threatened
*Chelonia mydas**	green turtle	Near Threatened	Endangered (A2bd)
Cordylus macropholis	large-scaled girdled lizard	Near Threatened	Near Threatened
Cordylus niger	black girdled lizard	Near Threatened	Near Threatened
Cordylus oelofseni	Oelofsen's girdled lizard	Near Threatened	Near Threatened
*Eretmochelys imbricata**	hawksbill sea turtle	Near Threatened	Critically Endangered (A2bd)
Goggia braacki	Braack's dwarf leaf-toed gecko	Near Threatened	Near Threatened
Homopus boulengeri	Karoo padloper	Near Threatened	Near Threatened
Scelotes gronovii	Gronovi's dwarf burrowing skink	Near Threatened	Near Threatened
Scelotes kasneri	Kasner's dwarf burrowing skink	Near Threatened	Near Threatened
Scelotes montispectus	Bloubergstrand dwarf burrowing skink	Near Threatened	Near Threatened

Table C4: List of all amphibian species noted for the western cape, including their regional and global conservation status (CapeNature. 2017)

Taxon	English Name	Regional IUCN	Global IUCN
Afrixalus knysnae	Knysna leaf-folding frog	Endangered (B1ab+2ab)	Endangered (B1ab+2ab)
Amietia delalandii	Queckett's river frog	Least Concern	Least Concern
Amietia fuscigula	Cape river frog	Least Concern	Least Concern
Amietia poyntoni	Poynton's river frog	Least Concern	Least Concern
Amietia vandijki	van Dijk's river frog	Least Concern	Least Concern
Arthroleptella bicolor	Bain's Kloof moss frog	Least Concern	Least Concern
Arthroleptella drewesii	Drewes's moss frog	Near Threatened	Near Threatened
Arthroleptella landdrosia	Landdroskop moss frog	Near Threatened	Near Threatened
Arthroleptella lightfooti	Cape Peninsula moss frog	Near Threatened	Near Threatened
Arthroleptella rugosa	rough moss frog	Critically Endangered (B1ab+2ab)	Critically Endangered (B1ab+2ab)
Arthroleptella subvoce	northern moss frog	Critically Endangered (B1bc+2bc)	Critically Endangered (B1bc+2bc)
Arthroleptella villiersi	De Villiers's moss frog	Least Concern	Least Concern
Breviceps acutirostris	strawberry rain frog	Least Concern	Least Concern
Breviceps fuscus	plain rain frog	Least Concern	Least Concern
Breviceps gibbosus	Cape rain frog	Near Threatened	Near Threatened
Breviceps montanus	Cape mountain rain frog	Least Concern	Least Concern
Breviceps namaquensis	Namaqua rain frog	Least Concern	Least Concern
Breviceps rosei	sand rain frog	Least Concern	Least Concern
Cacosternum aggestum	Klipheuwel dainty frog	Least Concern	Least Concern
Cacosternum australis	southern dainty frog	Least Concern	Least Concern
Cacosternum boettgeri	common dainty frog	Least Concern	Least Concern
Cacosternum capense	Cape dainty frog	Near Threatened	Near Threatened
Cacosternum karooicum	Karoo dainty frog	Least Concern	Least Concern
Cacosternum namaquense	Namaqua dainty frog	Least Concern	Least Concern
Cacosternum nanum	bronze dainty frog	Least Concern	Least Concern
Cacosternum platys	Flat dainty frog	Near Threatened	Near Threatened
Capensibufo deceptus	Deception Peak mountain toadlet	Data Deficient	Data Deficient
Capensibufo magistratus	Landdroskop mountain toadlet	Data Deficient	Data Deficient
Capensibufo rosei	Rose's mountain toadlet	Critically Endangered (B1abc+2ab)	Critically Endangered (B1abc+2ab)
Capensibufo selenophos	moonlight mountain toadlet	Data Deficient	Data Deficient
Capensibufo tradouwi	Tradouw mountain toadlet	Least Concern	Least Concern
*Chiromantis xerampelina**	foam nest frog	Least Concern	Least Concern
Heleophryne depressa	NULL	NULL	Not Evaluated
Heleophryne orientalis	eastern ghost frog	Least Concern	Least Concern
Heleophryne purcelli	Cape ghost frog	Least Concern	Least Concern
Heleophryne regis	southern ghost frog	Least Concern	Least Concern
Heleophryne rosei	Table Mountain ghost frog	Critically Endangered (B1ab+2ab)	Critically Endangered (B1ab+2ab)
Hyperolius horstockii	arum lily frog	Least Concern	Least Concern
Hyperolius marmoratus	painted reed frog	Least Concern	Least Concern
Kassina senegalensis	bubbling kassina	Least Concern	Least Concern
Microbatrachella capensis	micro frog	Critically Endangered (B2ab)	Critically Endangered (B2ab)
Poyntonia paludicola	montane marsh frog	Near Threatened	Near Threatened
Poyntonophrynus vertebralis	southern pigmy toad	Least Concern	Least Concern
Pyxicephalus adspersus	African giant bullfrog	Least Concern	Least Concern
*Sclerophrys gutturalis**	guttural toad	Least Concern	Least Concern
Sclerophrys pantherina	western leopard toad	Endangered (B1ab+2ab)	Endangered (B1ab+2ab)
Sclerophrys pardalis	eastern leopard toad	Least Concern	Least Concern
Sclerophrys capensis	raucous toad	Least Concern	Least Concern
Semnodactylus wealii	rattling frog	Least Concern	Least Concern
Strongylopus bonaespei	banded stream frog	Least Concern	Least Concern
Strongylopus fasciatus	striped stream frog	Least Concern	Least Concern
Strongylopus grayii	clicking stream frog	Least Concern	Least Concern
Tomopterna delalandii	Cape sand frog	Least Concern	Least Concern
Tomopterna tandyi	Tandy's sand frog	Least Concern	Least Concern
Vandijkophrynus angusticeps	Cape sand toad	Least Concern	Least Concern
Vandijkophrynus gariepensis	Karoo toad	Least Concern	Least Concern
Vandijkophrynus robinsoni	paradise toad	NULL	Least Concern
Xenopus gilli	Cape platanna	Endangered (B1ab+2ab)	Endangered (B1ab+2ab)
Xenopus laevis	common platanna	Least Concern	Least Concern

Appendix D: List of fauna identified in the study area

Species list provided by the Pearl Valley Golf Estates Environmental Officer, and confirmed during site visit.

Table D1: Avifauna identified that utilise the dams (drinking/bathing)

Common name	Scientific name	Conservation Status	Identified during site visit
*African Black Duck	*Anas sparsa*	Least Concern	
*African Darter	*Anhinga rufa*	Least Concern	
*African Dusky Flycatcher	*Muscicapa adusta*	Least Concern	
*African Fish Eagle	*Haliaeetus vocifer*	Least Concern	
*African Harrier Hawk	*Polyboroides typus*	Least Concern	
African Jacana	*Actophilornis africanus*	Least Concern	
African Malachite Kingfisher	*Corythornis cristatus*	Least Concern	
African Paradise-flycatcher	*Terpsiphone viridis*	Least Concern	
*African Sacred Ibis	*Threskiornis aethiopicus*	Least Concern	
African Spoonbill	*Platalea alba*	Least Concern	
Alpine Swift	*Tachymarptis melba*	Least Concern	
Amethyst Sunbird	*Chalcomitra amethystina*	Least Concern	
*Barn Swallow	*Hirundo rustica*	Least Concern	
Black Crake	*Zapornia flavirostra*	Least Concern	
Black Harrier	*Circus maurus*	Near Threatened	
*Black Saw-wing	*Psalidoprocne pristoptera*	Least Concern	
*Black-crowned Night Heron	*Nycticorax nycticorax*	Least Concern	
*Black-headed Heron	*Ardea melanocephala*	Least Concern	
*Blacksmith Lapwing	*Vanellus armatus*	Least Concern	
Bokmakierie	*Telophorus zeylonus*	Least Concern	
Brimstone Canary	*Crithagra sulphurata*	Least Concern	
*Cape Batis	*Batis capensis*	Least Concern	
*Cape Bulbul	*Pycnonotus capensis*	Least Concern	X
*Cape Canary	*Serinus canicollis*	Least Concern	X
Cape Crow	*Corvus capensis*	Least Concern	
*Cape Robin Chat	*Cossypha caffra*	Least Concern	
*Cape Shoveler	*Spatula smithii*	Least Concern	
Cape Siskin	*Crithagra totta*	Least Concern	
*Cape Sparrow	*Passer melanurus*	Least Concern	
*Cape Sugarbird	*Promerops cafer*	Least Concern	
Cape Teal	*Anas capensis*	Least Concern	
*Cape Wagtail	*Motacilla capensis*	Least Concern	
*Cape Weaver	*Ploceus capensis*	Least Concern	X
*Cape White-eye	*Zosterops virens*	Least Concern	X
*Cattle Egret	*Bubulcus ibis*	Least Concern	
*Common Moorhen	*Gallinula chloropus*	Least Concern	X
Common Reed Warbler	*Acrocephalus scirpaceus*	Least Concern	X
Common Sandpiper	*Actitis hypoleucos*	Least Concern	
*Common Starling	*Sturnus vulgaris*	Least Concern	
*Common Waxbill	*Estrilda astrild*	Least Concern	
Crowned Lapwing	*Vanellus coronatus*	Least Concern	X
Dusky Sunbird	*Cinnyris fuscus*	Least Concern	
*Egyptian Goose	*Alopochen aegyptiaca*	Least Concern	X
Familiar Chat	*Oenanthe familiaris*	Least Concern	
*Fiscal Flycatcher	*Sigelus silens*	Least Concern	

Common name	Scientific name	Conservation Status	Identified during site visit
*Fork-tailed Drongo	*Dicrurus adsimilis*	Least Concern	
*Giant Kingfisher	*Megaceryle maxima*	Least Concern	
Great Cormorant	*Phalacrocorax carbo*	Least Concern	
*Great Egret	*Ardea alba*	Least Concern	
*Grey Heron	*Ardea cinerea*	Least Concern	
*Hadada Ibis	*Bostrychia hagedash*	Least Concern	
Half-collared Kingfisher	*Alcedo semitorquata*	Least Concern	
*Hamerkop	*Scopus umbretta*	Least Concern	
Hartlaub's Gull	*Chroicocephalus hartlaubii*	Least Concern	
Helmeted Guineafowl	*Numida meleagris*	Least Concern	X
Hottentot Teal	*Spatula hottentota*	Least Concern	
*House Sparrow	*Passer domesticus*	Least Concern	
Intermediate Egret	*Ardea intermedia*	Least Concern	
*Jackal Buzzard	*Buteo rufofuscus*	Least Concern	
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	Least Concern	
Levaillant's Cisticola	*Cisticola tinniens*	Least Concern	
*Little Bittern	*Ixobrychus minutus*	Least Concern	
*Little Grebe	*Tachybaptus ruficollis*	Least Concern	
*Long-tailed Cormorant	*Microcarbo africanus*	Least Concern	X
*Malachite Sunbird	*Nectarinia famosa*	Least Concern	
Mallard Duck	*Anas platyrhynchos*	Least Concern	
*Olive Thrush	*Turdus olivaceus*	Least Concern	
*Orange-breasted Sunbird	*Anthobaphes violacea*	Least Concern	
*Pearl-breasted Swallow	*Hirundo dimidiata*	Least Concern	
Pied Kingfisher	*Ceryle rudis*	Least Concern	
*Pin-tailed Whydah	*Vidua macroura*	Least Concern	
Protea Canary	*Crithagra leucoptera*	Least Concern	
*Purple Heron	*Ardea purpurea*	Least Concern	
Red-billed Teal	*Anas erythrorhyncha*	Least Concern	
Red-headed Finch	*Amadina erythrocephala*	Least Concern	
*Red-knobbed Coot	*Fulica cristata*	Least Concern	X
Red-winged Starling	*Onychognathus morio*	Least Concern	
Rock Martin	*Ptyonoprogne fuligula*	Least Concern	
Rufous Sparrow	*Passer motitensis*	Least Concern	
South African Shelduck	*Tadorna cana*	Least Concern	
Southern Boubou	*Laniarius ferrugineus*	Least Concern	
*Southern Double-collared Sunbird	*Cinnyris chalybeus*	Least Concern	
Southern Fiscal	*Lanius collaris*	Least Concern	
Southern Pochard	*Netta erythrophthalma*	Least Concern	
Spotted Eagle Owl	*Bubo africanus*	Least Concern	
*Spotted Thick-knee	*Burhinus capensis*	Least Concern	X
*Spur-winged Goose	*Plectropterus gambensis*	Least Concern	
*Swee Waxbill	*Coccopygia melanotis*	Least Concern	
*Water Thick-knee	*Burhinus vermiculatus*	Least Concern	
*White-backed Duck	*Thalassornis leuconotus*	Least Concern	
*White-faced Whistling Duck	*Dendrocygna viduata*	Least Concern	
White-rumped Swift	*Apus caffer*	Least Concern	
White-throated Canary	*Crithagra albogularis*	Least Concern	
White-throated Swallow	*Hirundo albigularis*	Least Concern	
Wood Sandpiper	*Tringa glareola*	Least Concern	
*Yellow Bishop	*Euplectes capensis*	Least Concern	

Common name	Scientific name	Conservation Status	Identified during site visit
*Yellow-billed Duck	*Anas undulata*	Least Concern	X
*Yellow-billed Kite	*Milvus migrans parasitus*	Least Concern	
Zitting Cisticola	*Cisticola juncidis*	Least Concern	

**Species with an asterix were also listed on the available online databases*

Table D2: Mammals identified within the larger study area

Common name	Scientific name	Conservation Status
[P] African clawless otter	*Aonyx capensis*	Near Threatened
[P] Cape fox	*Vulpes chama*	Least Concern
Cape Grysbok	*Raphicerus melanotis*	Least Concern
[P] Caracal	*Caracal caracal*	Least Concern
Common duiker	*Sylvicapra grimmia*	Least Concern
[P] Marsh Mongoose	*Atilax paludinosus*	Least Concern
[P] Porcupine	*Hystrix cristata*	Least Concern
[P] Scrub hare	*Lepus saxatilis*	Least Concern
[P] Small Spotted Genet	*Genetta genetta*	Least Concern
[P] Striped polecat	*Ictonyx striatus*	Least Concern

African clawless otter remain largely within the Berg River corridor, located xx m east of the study area
[P] Species were also listed by Palmer (2015).

Table D3: Reptiles identified within the surrounding area of the dams

Common name	Scientific name	Conservation Status
*Cape Cobra	*Naja nivea*	Least Concern
*Puff Adder	*Bitis arietans*	Least Concern
Marsh Terrapin	*Pelomedusa subrufa*	Least Concern
Red-lipped Herald	*Crotaphopeltis hotamboeia*	Least Concern
Spotted Skaapsteker	*Psammophylax rhombeatus*	Least Concern

**Species with an asterix were also listed on the available online databases.*

Table D4: Fish species identified or have the potential to be within the PV dams

Common name	Scientific name	Conservation Status
Common Carp	*Cyprinus carpio*	Least Concern (Category 3 invasive)
Grass Carp	*Ctenopharyngodon idella*	Least Concern (Category 3 invasive)
**Small mouth Bass	*Micropterus dolomieu*	Least Concern
Koi		Exotic- introduced
**Mozambique Tilapia	*Oreochromis mossambicus*	Least Concern
**Red breasted Tilapia	*Coptodon rendalli*	Least Concern
**Sharp-toothed catfish	*Clarias gariepinus*	Least Concern

***Species with double asterix are mainly in the Berg River but may be pumped into the dams as fry/migrate up through the stormwater channels.*

Species identified by the various databases[6&7] that may utilise the study area

Table D5: Additional avifauna identified within the study area and QDS (3318DD)

Common name	Scientific name	Conservation Status
White Stork	*Ciconia ciconia*	Least Concern
Booted Eagle	*Aquila pennatus*	Least Concern
Great White Pelican	*Pelecanus onocrotalus*	Least Concern
Brown-throated Martin	*Riparia paludicola*	Least Concern
Southern Masked weaver	*Ploceus capensis*	Least Concern
Kelp Gull	*Larus dominicanus*	Least Concern
Blue Crane	*Anthropoides paradiseus*	Vulnerable
Black- winged Stilt	*Himantopus himantopus*	Least Concern
White-breasted Cormorant	*Phalacrocorax lucidus*	Least Concern
Grey Headed Gull	*Larus cirrocephalus*	Least Concern
Greater Flamingo	*Phoenicopterus roseus*	Least Concern
Black Sparrow Hawk	*Accipiter melanoleucus*	Least Concern
Goliath Heron	*Ardea goliath*	Least Concern
Rock Kestrel	*Falco rupicolus*	Least Concern
Steppe buzzard	*Buteo buteo*	Least Concern
Whiskered tern	*Chlidonias hybridus*	Least Concern
Black-shouldered Kite	*Elanus caeruleus*	Least Concern
Cape Spurfowl	*Pternistis capensis*	Least Concern

Table D6: Additional mammals identified within the study area and QDS (3318DD) as well as those that may potentially utilise the study area as indicated by Palmer (2015)

Common name	Scientific name	Conservation Status
Chacma Baboon	*Papio ursinus*	Least Concern
[P]Cape Dune Molerat	*Bathyergus suillus*	Least Concern
[P]Cape Gerbil	*Gerbilliscus afra*	Least Concern
[P]Cape Golden Mole	*Chrysochloris asiatica*	Least Concern
[P]Cape Grey Mongoose	*Herpestes pulverulentus*	Least Concern
Cape Rock Hyrax	*Provia capensis*	Least Concern
[P]Forest Shrew	*Myosorex longicaudatus*	Endangered
[P]Giant Musk Shrew	*Crocidura olivieri*	Least Concern
[P]Grey Climbing Mouse	*Dendromus melanotis*	Least Concern
[P]Grey Squirrel	*Sciurus carolinensis*	Introduced exotic
Hewitt's Red Rock Rabbit	*Pronolagus saundersiae*	Least Concern
[P]Kreb's Fat Mouse	*Steatomys krebsii*	Least Concern
[P]Laminate Vlei Rat	*Otomys laminatus*	Near Threatened
[P]Large Grey Mongoose	*Herpestes ichneumon*	Least Concern
[P]Large Spotted genet	*Genetta tigrina*	Least Concern
Leopard	*Panthera pardus*	Vulnerable
[P]Lesser Dwarf Shrew	*Suncus varilla*	Least Concern
[P]Pygmy Mouse	*Mus minutoides*	Least Concern
[P]Reddish-grey Musk Shrew	*Crocidura cyanea*	Least Concern
[P]Striped Mouse	*Apodemus agrarius*	Least Concern
Four striped Grass Mouse	*Phabdomys pumilio*	Least Concern
Smith's Red Rock Hare	*Pronolagus rupestris*	Least Concern
[P]Striped Weasel	*Poecilogale albinucha*	Near Threatened
[P]Vlei Rat	*Otomys irroratus*	Least Concern
Bats		
[P]Egyptian Fruit Bat	*Rousettus aegyptiacus*	Least Concern

[6] *The Biodiversity and Development Institute Virtual Museum: FitzPatrick Institute of African ornithology*

[7] *iNaturalist observations of the study area and direct surroundings*

[P]Egyptian Slit-faced Bat	*Nycteris thebaica*	Least Concern
[P]Geoffrey's Horseshoe Bat	*Rhinolophus clivosus*	Least Concern
[P]Cape Horseshoe Bat	*Rhinolophus capensis*	Least Concern
[P]Schreibers's Long-fingered Bat	*Miniopterus schreibersii*	Least Concern
[P]Cape Serotine Bat	*Laephotis capensis*	Least Concern
[P]Temminck's Hairy Bat	*Myotis tricolor*	Least Concern
[P]Egyptian Free-tailed Bat	*Tadarida aegyptiaca*	Least Concern

Table D6: Reptiles identified within the QDS (3318DD)

Common name	Scientific name	Conservation Status
Angulate Tortoise	*Chersina angulata*	
Aurora House Snake	*Lamprophis aurora*	Least Concern
Boomslang	*Dispholidus typus typus*	Least Concern
Brahminy Blind Snake	*Indotyphlops braminus*	Least Concern
Brown Water Snake	*Lycodonomorphus rufulus*	Least Concern
Cape Dwarf Chameleon	*Bradypodion pumilum*	Near Threatened
Cape Dwarf Gecko	*Lygodactylus capensis*	Least Concern
Cape legless Skink	*Acontias meleagris*	Least Concern
Cape Long-tailed Seps	*Tatradactylus tetradactylus*	Least Concern
Cape Skink	*Trachylepis capensis*	Least Concern
Marble Leaf-toed Gecko	*Afrogecko porphyreus*	Least Concern
Mole Snake	*Pseudaspis cana*	Least Concern
Ocellated Gecko	*Pachydactylus geitje*	Least Concern
Olive House snake	*Lycodonomorphus inornatus*	Least Concern
South African Slug-eater	*Duberria lutrix lutrix*	Least Concern
Southern Rock Agama	*Agama atra*	Least Concern

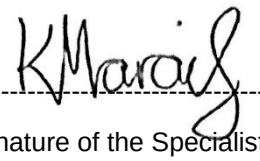
Table D7: Amphibians identified within the QDS (3318DD)

Common name	Scientific name	Conservation Status	Identified during site visit
Raucous Toad	*Sclerophrys capensis*	Least Concern	
Clicking Stream Frog	*Strongylopus grayii*	Near Threatened	X
Painted Reed Frog	*Hyperolius marmoratus*	Least Concern	
Cape River Frog	*Amietia fuscigula*	Least Concern	
Common Platanna	*Xenopus laevis*	Least Concern	
Cape Rain Frog	*Breviceps gibbosus*	Near Threatened	
Cape Ghost Frog	*Heleophryne purcelli*	Least Concern	
Cape Mountain Rain Frog	*Breviceps montanus*	Least Concern	

Appendix E: Declaration of independence and CVs of the specialists that compiled this MMP

I, Kim Marais, declare that -

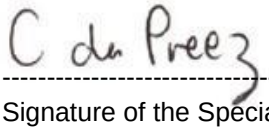
- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Christel du Preez, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct.



Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

FRESHWATER ECOLOGIST NETWORK CONSULTING – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF CHRISTEL DU PREEZ

PERSONAL DETAILS

Position in Company	Freshwater Ecologist
Date of Birth	22 March 1990
Nationality	South African
Languages	English, Afrikaans
Joined SAS	January 2016

EDUCATION

Qualifications

- MSc Environmental Sciences (North West University) 2017
- BSc Hons Environmental Sciences (North West University) 2012
- BSc Environmental and Biological Sciences (North West University) 2011

Additional training and courses

- Wetland and Aquatic plant Identification presented by Carin van Ginkel February 2019
- Wetland Management: Introduction and Delineation presented by the Centre of Environmental Management University of the Free State November 2018
- Tools for Wetland Assessment presented by Prof. F. Ellery and Rhodes University February 2018
- Basic Principles of ecological rehabilitation and mine closure presented by the Centre for Environmental Management North West University October 2015

COUNTRIES OF WORK EXPERIENCE

South Africa – Western Cape, Eastern Cape, Northern Cape, Gauteng and Mpumalanga

SELECTED PROJECT EXAMPLES

Watercourse Ecological Assessments

- Freshwater resource and aquatic ecological assessment for the proposed West Wits Mining project, in Soweto, Gauteng Province
- Freshwater resource assessment and hydropedological assessment as part of the Water Use License process for the proposed Vlaklaagte 2 Seam, Block 6 coal mining operation, near Kriel, Mpumalanga Province
- Freshwater resource assessment as part of the Water Use License application process for the proposed Middelvlei Mine Project, situated on the remaining extent of portion 2 and 3 of the farm Middelvlei 255-Iq, Randfontein, Gauteng Province
- Freshwater resource assessment as part of the Environmental Assessment and Water Use Authorisation process for the proposed Cygnus Mining Project, Limpopo Province
- Watercourse impact assessment as part of the Environmental Impact Assessment (EIA) for the proposed Hyperion Solar Development 1 - 4, near Kathu, Northern Cape Province
- Freshwater resource ecological assessment as part of the Environmental Assessment and Water Use Authorisation process for the proposed industrial development on farm Cumberland No. 915, Simondium, near Paarl, Western Cape Province

- Watercourse ecological assessment as part of the Environmental Assessment and authorisation process for the proposed periodic maintenance of the MR201 Road (Bain's Kloof Pass), between Wellington and Breederivier, Western Cape Province
- Freshwater resource ecological assessment as part of the Environmental Assessment and Authorisation Processes for the proposed development on portion 12 of the Vergenoegd Farm, Western Cape Province

Watercourse Rehabilitation, Implementation and Management Plans

- Residual wetland impact compensation plan for the proposed extension of Erica Drive from Belhar to Oakdene over the R300 and dualling of Erica Drive / Belhar Main Road, east of Reuter Street, over the Kuils River, Western Cape Province
- Surface water Rehabilitation and Management Plan for the proposed development of portion 204 of the farm Alewynspoort145, Near Alberton Gauteng Province
- Surface water Rehabilitation and Management Plan as part of the Water Use Authorisation requirements for the Twickenham Platinum Mine, Limpopo Province
- Surface water Rehabilitation and Management Plan as part of the Water Use License Application process for the United Manganese of Kalahari (UMK) Mine, near Hotazel, Northern Cape Province

Landscape Plans

- Landscape Plan as part of the WUL application and Environmental authorisation for the proposed extension of the Twickenham Mine, Limpopo Province
- Landscape and Plant Species Plan as part of the proposed Avianto Function development, Gauteng Province
- Landscape and Plant Species Plan for the Mokala Mine, near Black Rock, Northern Cape Province
- Landscape Plan as part of the Rehabilitation and Management Plan for the proposed road upgrade near Vlakfontein, Gauteng Province

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

Position in Company	Senior Scientist Water Resource Manager
Joined SAS Environmental Group of Companies	2015

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 117137/17)
Member of the Western Cape Wetland Forum (WCWF)

EDUCATION

Qualifications

BSc (Hons) Zoology (University of the Witwatersrand)	2012
BSc (Zoology and Conservation) (University of the Witwatersrand)	2011

Short Courses

Aquatic and Wetland Plant Identification (Cripsis Environment)	2019
Tools for Wetland Assessment (Rhodes University)	2018
Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, KwaZulu-Natal, Northern Cape, Eastern Cape,
Africa - Uganda

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Biodiversity Action Plans (BAP)
- Alien and Invasive Control Plans (AICP)
- Faunal Eco Scans
- Faunal Impact Assessments

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Freshwater Offset Plans

Aquatic Ecological Assessment and Water Quality Studies

- Riparian Vegetation Integrity (VEGRAI)
- Water quality Monitoring
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Public Participation processes