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**Annexure A: Red List Species (confidential)**

The following Red and Orange List species are listed for the quarter degree square 2628AA. An indication is also provided if the species was recorded on site and whether suitable habitat occurs in the study site.

<b>SPECIES</b>	<b>FLOWERING SEASON</b>	<b>SUITABLE HABITAT</b>	<b>CONSERVATION STATUS</b> ( <sup>1</sup> global; <sup>2</sup> national)	<b>RESIDENT AT THE SITE</b>
<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>	September-January	Rocky crevices on rocky ridges, usually south-facing, or in shallow gravel on top of rocks, but often in shade of other vegetation.	Near Threatened <sup>1</sup>	Not found – Suitable habitat
<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	September-April	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	Vulnerable <sup>2</sup>	Not found - Suitable habitat
<i>Callilepis leptophylla</i>	August-January & May	Grassland or open woodland, often on rocky outcrops or rocky hillslopes.	Declining <sup>2</sup>	Not found – Suitable habitat
<i>Cineraria austrotransvaalensis</i>	March - June	Amongst rocks on steep slopes of hills and ridges, as well as at the edge of thick bush or under trees; on all aspects and on a range of	Near Threatened <sup>1</sup>	Not found

		rock types: quartzite, dolomite and shale; 1400 – 1700 m		
<i>Cineraria longipes</i>	March - May	Grassland, on koppies, amongst rocks and along seepage lines, exclusively on basalt on south-facing slopes	Vulnerable <sup>1</sup>	Not found
<i>Delosperma purpureum</i>	November-April	South facing slopes grows in shallow soils among quartzitic rocks of crystalline or conglomerate type, in open or in broken shade, rarely in shade, in grassland with some trees.	Endangered <sup>1</sup>	Not found
<i>Eucomis autumnalis</i>	November-April	Damp, open grassland and sheltered places	Declining <sup>2</sup>	Not found – Suitable habitat
<i>Gunnera perpensa</i>	October-March	In cold or cool, continually moist localities, mainly along upland streambanks.	Declining <sup>2</sup>	Not found
<i>Habenaria bicolor</i>	January - April	Well-drained grasslands at around 1600m.	Near Threatened <sup>2</sup>	Not found
<i>Habenaria mossii</i>	March-April	Open grassland on dolomite or in black	Endangered <sup>1</sup>	Not found



		sandy soil.		
<i>Holothrix micrantha</i>	October	Terrestrial on grassy cliffs, recorded from 1500 to 1800m.	Endangered <sup>1</sup>	Not found
<i>Holothrix randii</i>	September-October	Grassy slopes and rock ledges, usually southern aspects.	Near Threatened <sup>2</sup>	Not found
<b><i>Hypoxis hemerocallidea</i></b>	September-March	Occurs in a wide range of habitats, from sandy hills on the margins of dune forests to open rocky grassland; also grows on dry, stony, grassy slopes, mountain slopes and plateaux; appears to be drought and fire tolerant.	Declining <sup>2</sup>	<b>Found on site</b>
<i>Khadia beswickii</i>	July-April	Open areas on shallow surfaces over rocks in grassland.	Vulnerable <sup>1</sup>	Not found
<i>Stenostelma umbelluliferum</i>	September-March	Deep black turf in open woodland mainly in the vicinity of drainage lines.	Near Threatened <sup>1</sup>	Not found

## Fauna Habitat Assessment for the remaining extent of Portion 1 of the Farm Waterfall 5-IR, Gauteng Province



**March 2016**



**Landscape Architects &**

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**Reviewed by:**        **Reinier F. Terblanche**

## Review of

### Fauna Habitat Assessment for the remaining extent of Portion 1 of the Farm Waterfall 5-IR, Gauteng Province of March 2016

**Review: May 2016**

**Reviewer: Reinier F. Terblanche**

(M.Sc, *Cum Laude*; Pr.Sci.Nat, Reg. No. 400244/05)

#### **APPROACH OF REVIEWER TO ECOLOGICAL REVIEWS**

Ecological studies and applied ecology comprise the consideration of a diversity of factors, even more so in South Africa with its exceptional high floral and faunal diversities, various soil types, geological formations and diversity of habitats in all its biomes. Therefore it would be easy to add onto or show gaps in any ecological impact assessment, rehabilitation actions or management plans stemming from ecological assessments. The approach followed here is to review the ecological study in a reasonable context and focus on the successful fulfillment of the aims of the study within the limits of cost and time.

## Fauna Assessment Report: LP 10

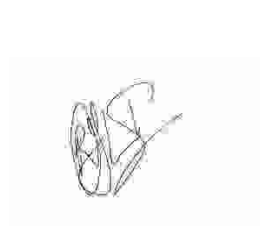
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### ECOLOGICAL REVIEW: FAUNA HABITAT ASSESSMENT FOR THE REMAINING EXTENT OF PORTION 1 OF THE FARM WATERFALL 5-IR, GAUTENG PROVINCE OF MARCH 2016

#### Findings of the review

- The report contains details of the expertise of the persons who prepared the report and a declaration that the person who prepared the report is acting independently.
- The aims of the report are clear.
- The report provides references and descriptions of the principles and guidelines to be taken into account for fauna habitat assessment.
- Acceptable methods and limitations have been given in detail to reach the goal of the assessment.
- Relevant laws and guidelines have been mentioned and integrated.
- The report gives a clear assessment of the status fauna at the site and also added an extensive literature survey and existing knowledge survey.
- The recommendations and the conclusion are consistent with the aims of the report.
- It is to be commended that the report is economical and practical so that it adds value to the team effort of addressing the management and future of the habitats at the site, in this case in particular noting the drainage line sensitivity in a mostly disturbed and modified area.

Overall the report appears to be relevant, detailed enough for the purposes of this study and complete and finally addressing the key issues at stake.



Reinier F. Terblanche M.Sc. Ecology; Pr.Sci.Nat, Reg. No. 400244/05

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## 1. INTRODUCTION

Bokamoso Environmental Consultants CC; Specialist Division was appointed to conduct a Basic Faunal Assessment for the proposed mixed used development on the remaining extent of Portion 1 of the Farm Waterfall 5-IR, Gauteng Province, also known as Land Parcel 10 (hereafter referred to as the study area).

This report is based on the faunal species present on the study area as well as species that could potentially occur. The report acts as an overview of the probable and/or known occurrence for following faunal groups; Mammals, Reptiles, Amphibians and Invertebrates. Avifauna is not included in this report, as a separate avifaunal assessment was conducted for the study area. The primary focus of this report falls on Red Data species and other species with conservation importance occurring on or near the study area to ensure that, should any such species exists, the appropriate actions are taken to guarantee the well-being of these species.

## 2. SCOPE AND OBJECTIVE OF ASSESSMENT

- To qualitatively and quantitatively assess the significance of the mammal habitat components and current general conservation status of the property
- Comment on ecological sensitive areas within the study area
- Comment on connectivity with natural vegetation and habitats on adjacent site
- To provide a list of mammals which occur or might occur, and to identify species of conservation importance
- To highlight potential impacts of the proposed development on the mammals of the study site, and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

## 3. STUDY AREA

The study area is situated on the remaining extent of Portion 1 of the farm Waterfall 5-IR, Gauteng Province and also known as Land Parcel 10. The size of the property is approximately 103 ha and is located within the 2628AA quarter degree square (QDS) (26°01'24.74"S; 28°06'35.73"E). The study area is located within the Soweto Highveld Grassland vegetation unit (Mucina and Rutherford, 2006) and the Klipriver Highveld Grassland (GP5; SANBI, 2011). The study area is located north of the N1 highway and west of Allandale road. The study area largely consists of open grassland with small scattered trees and a drainage line cutting through the center, flowing from the north to the south. A small rocky outcrop is situated on the South-eastern part of the study area. The Jukskei River directly borders the study area on the most Southerly border. The property is located approximately 1468 meters above sea level and slopes gently to the South-west (Figures 1 and 2).

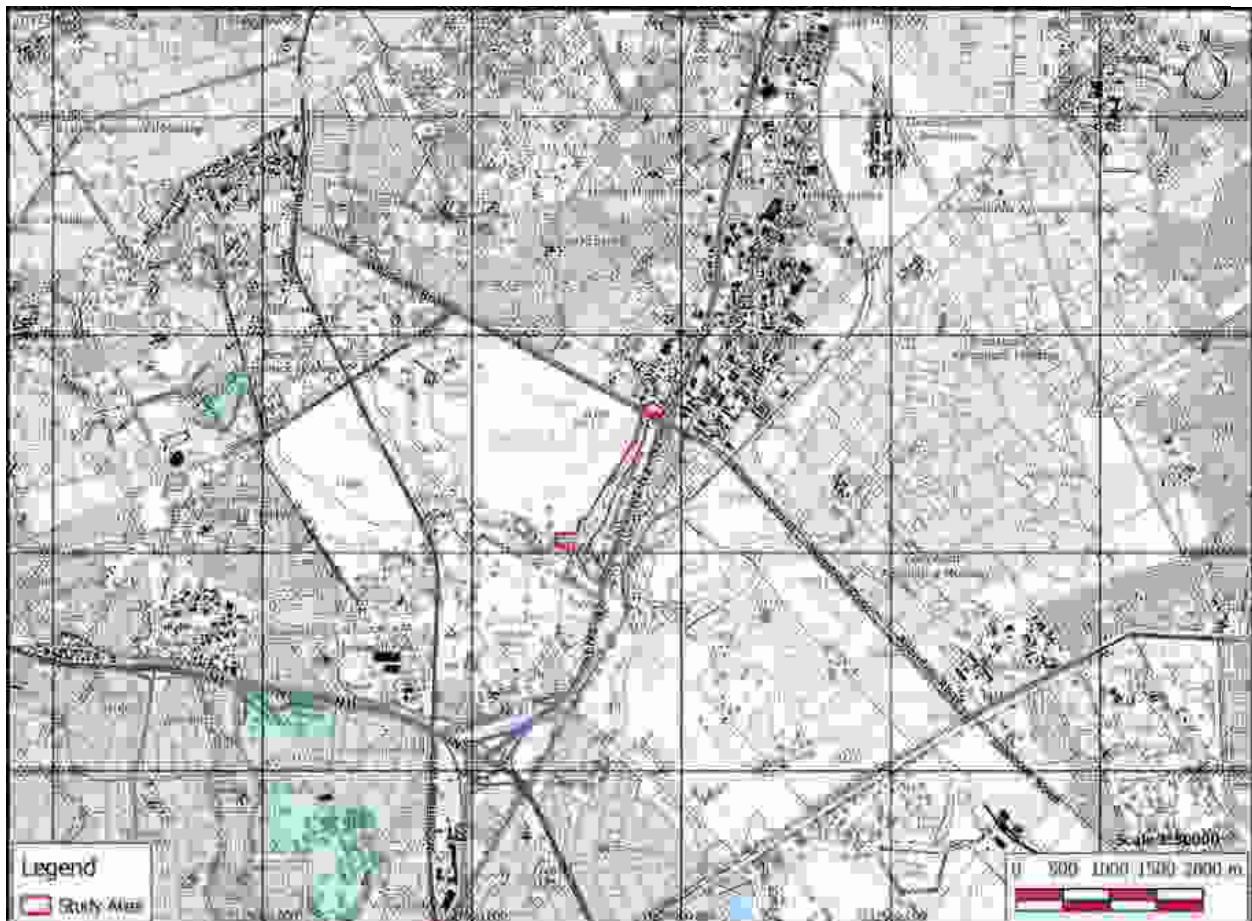


Figure 1: Locality Map





Figure 2: Aerial photo of study area

## 4. METHODS

Before conducting a field survey on the study area a desktop assessment was conducted to note the prevalent faunal species occurring on or near the site. A list of expected species was compiled and used as a reference during the field survey to ensure that species that should theoretically occur were not overlooked. All distinct faunal habitats were identified on site, after which each habitat was assessed to record the associated faunal species for each of the respective faunal group (Herpetofauna, Invertebrates and Mammals) present in that specific habitat.

## 5. RESULTS

During the habitat assessment five distinct habitats were identified within the study area. These habitats include: Disturbed Area, Drainage Line, Grassland, Rocky Outcrop, and Riverine Area (Figure 3).

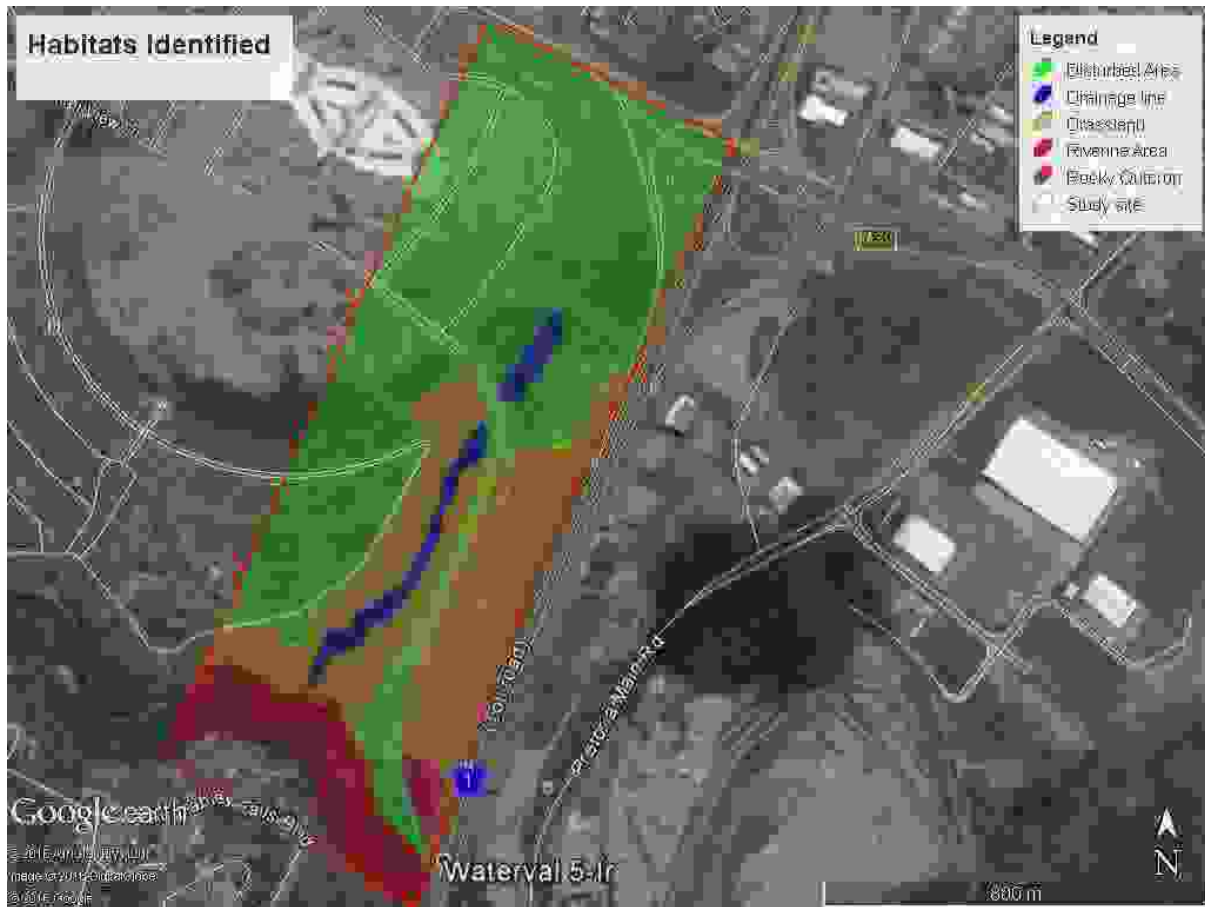


Figure 3: Different habitats in the study area

## 5.1 Drainage Line

A drainage line cuts through the center of the study area from the North to the South. The Drainage Line area encompasses the ideal habitat for wetland-associated fauna (**Figure 4**). The largest part of this area has been transformed as a result of bank stabilization and erosion protection through the use of gabions, berms and stilling basins in order to control and channel the flow of water. It is evident that rehabilitation of the drainage line is still an ongoing process and that this habitat will gradually improve over time. Although the current state of this area as a sensitive faunal habitat can be debated owing to its fairly recent completion, the evidence of a potentially ideal wetland/drainage line habitat is apparent when attention is paid to the wetland vegetation and faunal species currently present. Over time this area should provide the preferred habitat for various fauna species once the current vegetation proliferates and connectivity to the natural drainage network is restored.



Figure 4: Drainage Line

### 5.2 Disturbed Area

This area contains various disturbances in the form of roads, degraded grassland and general disturbances as a result of trampling and degradation as result of heavy vehicle activity. Large parts of this area have been transformed by means of trampling, to such an extent that only bare ground remains (**Figure 5**). Further disturbance in the form of alien vegetation encroachment is also evident. The area contains a limited amount of natural vegetation; instead a large number of invasive plants including herbaceous plants (*Verbena bonariensis*) and alien trees (*Acacia mearnsii*). The reason for the inclusion of this area as a habitat in its own right is due to the large number of faunal species that have adapted to this unique environment.



**Figure 5: Disturbed Area**

### 5.3 Grassland

The Grassland habitat contains two distinct floristic compositions (**Figure 6**). The Eastern grassland contains a well established population of various grass species and grassland vegetation communities, whereas the Western grassland contains large numbers of alien vegetation and other disturbances such as trampling and evidence of heavy vehicle activity. The Eastern grassland is thought to supports a few widespread fauna species. As a result of the current near natural state of the Eastern part of the grassland habitat, this section of the grassland was deemed moderately sensitive from a faunal perspective as it is likely to support a number of widespread species. The rest of the grassland habitat (Western part of grassland) is already degraded and was deemed to have a low faunal sensitivity.



**Figure 6: Grassland**

### 5.4 Riverine Area

The southernmost part of the study area borders the Jukskei River (**Figure 7**). Due to large number of faunal species preferring this unique habitat type, the riverine area was expected to produce the highest species richness in comparison with the other habitats within the study area. The state of the riverine habitat was however very poor on account of the high amount of alien vegetation encroachment as well as the highly polluted river water (both chemical and solid waste) (**Figure 8**). The low species richness of this habitat is a direct result of the polluted river. While the riverine area provides the optimal habitat for a few Red-Data faunal species, the polluted state of the river compromises the probable occurrence of these species. If this section of the river is to be properly rehabilitated it could potentially be a highly diverse habitat and would most probably support a number of sensitive fauna. Due to the afore mentioned reasons this habitat is deemed highly sensitive, not on account of faunal species present within the habitat, but rather as a result of its connectivity functions and the potential that this area holds if proper rehabilitation thereof is implemented.





**Figure 7: Riverine Area**



**Figure 8: Highly polluted section of the Jukskei River.**

### 5.5 Rocky Outcrop

This habitat is situated on the South-eastern side of the study area and is directly adjacent the Eastern grassland habitat (**Figure 9**). Although it encompasses a fairly small part of the larger study area, it is expected to support a large number of faunal species. The reason for the expected high species richness in this small area is a direct result of the occurrence of a number of large indigenous trees (mainly *Vachellia karroo* and *Celtis africana*), which provides foraging and roosting habitat for a variety of arboreal, grassland and savanna species. The rocky outcrop itself also provides all the desirable nooks and crannies which will favor rupicolous faunal species.



**Figure 9: Rocky Outcrop.**

## **6. MAMMAL HABITAT ASSESSMENT**

**This part of the report focuses on the probable and/or known occurrence of Threatened mammal species as well as mammal species with conservation concern based on the habitats present on the study area.**

Special attention was paid to the evaluation of the quantitative and qualitative habitat conditions of Red Data species judged to have a probable occurrence on the site. Mitigation measures to lessen the impacts and effects of the proposed development were suggested where applicable. The secondary objective of this investigation was to gauge which mammals might still reside in the study area and to compile a complete list of mammal diversity.

### **6.1 Methods**

A three and a half hour field survey was conducted on the 23<sup>rd</sup> of April 2016 during which all observed mammal species as well as all the potential mammal habitats on the study site were identified. Following the field survey a desktop assessment was conducted to add additional mammal species expected to occur on the study site on account of their individual habitat preferences in accordance with the habitats identified on the study area. Mammal occurrence probability can be attributed to the well recorded and known distributions of South African mammals as well as the quantitative and qualitative nature of the habitats present on site. Moreover the 500 meters surrounding the study area were scanned for any additional faunal habitats.

#### **Field Survey**

Before the commencement of the field survey a list of expected mammal species was compiled to use as a reference in the field. All the threatened and sensitive mammals with distribution ranges overlapping the study area were included in the afore mentioned reference list. These species were prioritized and special attention was paid in terms of identifying their associated habitat preferences and noting signs of their occurrence. The field survey was conducted by means of random transect walks within each habitat. During the field survey mammal species were identified in accordance with individual habitat preferences as well as actual observations and signs such as; spoor, droppings, burrows and roosting sites indicating their presents (Chris & Tilde Stuart, 2011).



## Desktop Survey

Due to the fact that the majority of mammals are either nocturnal, hibernators, secretive and/or seasonal it is increasingly difficult to confirm their presence or absence by means of actual observations alone. Therefore a number of authoritative tomes such as field guides, databases and scientific literature were utilized to deduce the probable occurrence of mammal species. The Animal Demography Unit: Virtual Museum (<http://vmus.adu.org.za/>) was consulted to verify the records and occurrence of recorded mammal species within the QDS 2628AA. The Gauteng Conservation Plan (C-plan v3.3) was consulted to evaluate ecologically sensitive areas associated with mammals. A comprehensive list of probable mammalian occurrence with reference to the study area was compiled on account of the well-known and documented distributions of mammals in South Africa, especially in the Gauteng province.

The occurrence probability of mammal species was deduced in accordance with a species' distribution and habitat preferences. Where a species' distribution range was found to overlap with the study area and its preferred habitat was present, the applicable species was deemed to have a high occurrence probability on or near the study area.

In the case where the preferred habitat of a species' were found to be suboptimal on the study area however its distribution range still overlapped the study area, the applicable species' occurrence probability was deemed to be medium.

When the habitat preferences of a species were absent from the site, the applicable species was deemed to have a low occurrence probability regardless of its distribution range.

## 6.2 Specific Requirements

During the field survey attention was paid to note any signs of potential occurrence of threatened and sensitive species as well as species associated with wetlands and ridges.

These species include:

Vlei rat (*Otomys irroratus*), Angoni vlei rat (*Otomys angoniensis*), African march rat (*Dasymys incomtus*), Water mongoose (*Atilax paludinosus*), African clawless otter (*Aonyx capensis*), Spotted-necked otter (*Lutra maculicollis*), Juliana's golden mole (*Neamblysomus julianae*), Rough-haired golden mole (*Chrysospalax villosus*), Highveld golden mole (*Amblysomus septentrionalis*), Rock dormouse (*Graphiurus murinus*), Forest shrew (*Myosorex varius*), other

shrew species, White-tailed rat (*Mystromys albicaudatus*), Short-eared trident bat (*Cloeotis percivali*) and other cave-dwelling bats.

### 6.3 Results

#### 6.3.1 Mammal habitats identified

During the habitat assessment four distinct mammalian habitats were identified within the study area. These habitats include: Drainage Line, Grassland, Rocky Outcrop, and Riverine Area (**Figure 4**).

The majority of the drainage line is artificial and was constructed during 2014 to control and channel the flow of storm water through the use of berms, stilling basins and gabion walls. As a result of the relatively recent construction that took place within the drainage line no mammal species with conservation concerns are expected to occur due to their reliance on permanent wetland conditions. Due to the ongoing rehabilitation of the drainage line, it contains clusters of dense vegetation stands in the form of *Typha capensis* beds and other palustrine vegetation such as sedges and rushes. These dense vegetation stands (**Figure 4**) provide excellent refuge and nourishment for a number of robust small mammals such as Marsh Mongoose, marsh rats and cane rats. Small interconnected man-made pools (stilling basins) within the drainage line provide an excellent source of food for wetland bound mammals in the form of nutritious vegetation, various aquatic invertebrates and amphibians. Although no sensitive mammal species are currently thought to occur in this habitat, the ongoing rehabilitation could provide the optimal habitat for sensitive species such as Vlei Rats in the near future.

The Rocky Outcrop on the study area could potentially provide the preferred habitat for a number of small mammals such as elephant shrews and rock mice as it contains large boulders with suitable crevices as well as being situated next to undisturbed grassland (Stuart *et al.*, 2015). No pockets of deep sand were found to be present on the study area; as such the occurrence of golden moles is highly unlikely. Due to the isolated nature and small surface area of the rocky outcrop it was not deemed to be an area of high ecological sensitivity.

The grassland habitat provides excellent habitat for smaller rodents and insectivorous mammals such as shrews. No robust terrestrial mammals are expected to occur in the grassland habitat due to the fact that it is highly isolated with very little to no connectivity to similar grasslands.

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The aforementioned, together with the small surface area of the grassland, drastically lowers the occurrence probability of nomadic mammal species such as the African Hedgehog. None of the small mammals expected to occur in the grassland habitat were observed during the field survey. Species such as Slender and Yellow Mongoose, which could potentially prey on these smaller mammals, were however observed.

The riverine area was found to be highly polluted with both solid and chemical waste (**Figure 9**). The entire riverbank was scoured for signs of otter presence but no such signs were observed. This could be as a result of the lack of their primary food source (fish and crabs) on account of the polluted state of the Jukskei River (Sibali *et al.*, 2008). The associated riparian vegetation mainly consists of large alien trees with a dense undergrowth of invasive weeds. No threatened mammals can be expected to occur within this habitat. The riverine area was deemed to be highly sensitive in terms of a mammalian habitat due to its potential to provide the preferred habitat for threatened mammals, one of which is the Spotted-necked Otter. Although no Red Data species were found to be present in this habitat, the river still provides the necessary connectivity for species such as otters to move from one stretch of the river to another. As a result of the important connectivity function, the entire riverine habitat was deemed to be highly sensitive despite its polluted state.

### 6.3.2 Expected and observed Mammal species

**Table 1:** Mammals observed or expected to occur.

	<i>Scientific Name</i>	Common Name	Red List Category	Occurrence Probability
1.	<i>Cryptomys hottentotus</i>	Common African Mole-rat	Least Concern	5
2.	<i>Sylvicapra grimmia</i>	Common Duiker	Least Concern	1
3.	<i>Galago moholi</i>	Southern Lesser Bushbaby	Least Concern	2
4.	<i>Atilax paludinosus</i>	Marsh Mongoose	Least Concern	5
5.	<i>Galerella sanguineus</i>	Slender Mongoose	Least Concern	5
6.	<i>Cynictis penicillata</i>	Yellow Mongoose	Least Concern	5
7.	<i>Hystrix africaeaustralis</i>	Cape Porcupine	Least Concern	3
8.	<i>Lepus saxatilis</i>	Scrub Hare	Least Concern	5
9.	<i>Neoromicia capensis</i>	Cape serotine bat	Least Concern	4
10.	<i>Crocidura cyanea</i>	Reddish-grey musk shrew	Data Deficient	3
11.	<i>Crocidura hirta</i>	Lesser musk shrew	Data Deficient	3
12.	<i>Scotophilus dinganii</i>	African Yellow house bat	Least Concern	4
13.	<i>Scotophilus viridis</i>	Greenish yellow house bat	Least Concern	3
14.	<i>Dendromus melanotis</i>	Grey pygmy climbing mouse	Least Concern	3
15.	<i>Dendromus mystacalis</i>	Chestnut climbing mouse	Least Concern	3
16.	<i>Aethomys ineptus</i>	Tete Veld Rat	Least Concern	2
17.	<i>Gerbilliscus brantsii</i>	Highveld Gerbil	Least Concern	3

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18.	<i>Rhabdomys pumilio</i>	Four-striped grass mouse	Least Concern	4
19.	<i>Mastomys coucha</i>	Southern Multimammate Mouse	Least Concern	3
20.	<i>Mus minutoides</i>	Pygmy mouse	Least Concern	3
21.	<i>Mastomys natalensis</i>	Natal multimammate mouse	Least Concern	3
22.	<i>Aethomys namaquensis</i>	Namaqua rock mouse	Least Concern	3
23.	<i>Elephantulus myurus</i>	Eastern Rock Sengi	Least Concern	2
24.	<i>Otomys angoniensis</i>	Angoni vlei rat	Least Concern	3
25.	<i>Otomys irroratus</i>	Southern African Vlei Rat	Least Concern	3
26.	<i>Steatomys pratensis</i>	Common African Fat Mouse	Least Concern	3
27.	<i>Procavia capensis</i>	Rock Hyrax	Least Concern	1
28.	<i>Epomophorus wahlbergi</i>	Wahlberg's Epauletted Fruit-bat	Least Concern	2
29.	<i>Thryonomys swinderianus</i>	Greater Cane Rat	Least Concern	4
30.	<i>Neoromicia capensis</i>	Cape Serotine	Least Concern	2
31.	<i>Pipistrellus rusticus</i>	Rusty Pipistrelle	Least Concern	2
32.	<i>Civettictis civetta</i>	African Civet	Least Concern	1
33.	<i>Genetta genetta</i>	Common Genet	Least Concern	3
34.	<i>Genetta tigrina</i>	Cape Genet	Least Concern	2

\*The occurrence probability of the mammal species listed above is indicated as follows:

Not likely to occur - 1, Low occurrence probability - 2, Medium occurrence probability - 3, High occurrence probability - 4, **Confirmed occurrence - 5**.  
Red Data species ranked as defined in Friedmann and Daly's S.A. Red Data Book of the mammals of South Africa (2004).

### 6. 3.3 Threatened and Red Listed Mammal species

The listed shrews (**Table 1**) are not necessarily threatened; they are listed as a precautionary measure as a result of their unknown status. Musk shrews are widespread and commonly found in residential gardens throughout Gauteng, as such they are generally assumed to be abundant. The conservation status of musk shrews are however still to be determined and as such they are listed as Data Deficient. Vlei Rats are considered to be sensitive due to their intolerance to drought and their association with wetlands. Their reliance on wetlands serves as the main reason for their sensitive status.

Suitable habitat for otters were found on the study area at the southernmost boundary where the Jukskei River borders the property. Although the preferred habitat for otters are present within the study area, this specific stretch of the Jukskei River was found to be highly polluted with both solid and chemical waste. During the field survey no sign of otter activity was observed. As a result of the polluted state of the river, the otter's food source are thought to be scarce or possibly absent, thus its occurrence within this section of the river was deemed to be highly unlikely. Although the probable occurrence of otters are very low, the river still provides a

connectivity function and as such otters might move through this stretch of the river from time to time.

No suitable bat roosts were observed on the study site, thus it is not expected that any of the threatened bat species are resident, although the area might still be utilized by bats for foraging purposes.

No other threatened or sensitive mammal species are thought to be present within the study area due to various factors such as man-made disturbances, transformed habitats, suboptimal habitat and restricted distribution ranges.

### **6.4 Findings**

The majority of the terrestrial habitats present on the study area have been transformed and degraded to such an extent that it can no longer be regarded as Klipriver Highveld Grassland nor Soweto Highveld Grassland vegetation. The current terrestrial habitats do however provide good habitat for the small mammals deducted to be present. On account of the assemblage of mammals as well as the present terrestrial habitats, no evidence exists to consider the study area to be an area of high mammalian sensitivity.

The drainage line and riverine area have the potential to support sensitive species with conservation concerns (Vlei Rats and Otters). On the other hand, -none of these species are thought to occur at present on account of the fairly recent construction activities within with the drainage line as well as the polluted and degraded state of the riverine habitat. The drainage line is largely artificial resulting in low mammal diversity as a result of structures such as high gabion walls. Both the drainage line and riverine area provides important ecological functions in terms of connectivity, as such both are considered to be highly sensitive from a mammalian point of view regardless of their current state.

## **7. HERPETOFAUNA HABITAT ASESMENT**

### **7.1 Methods**

The study site was visited on 7/04/2016. Habitat types identified within the study site was recorded, and a combined species list was compiled of the possible presence of herpetofauna species, considering the knowledge of their preferred habitats. Field guides such as those of du

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Preez & Carruthers (2009), Marais (2004), and (Alexander & Marais 2007) were used for identification and habitat description of herpetofauna species.

A desktop study was done to identify suitable habitats for the Red List fauna species known to occur in the QDS 2628AA. The Animal Demography Unit: Virtual Museum (<http://vmus.adu.org.za/>) was consulted to verify the record of occurrence of herpetofauna species recorded within the QDS 2628AA. The Gauteng Conservation Plan (C-plan v3.3) was consulted to evaluate ecologically sensitive areas.

The majority of herpetofauna species are nocturnal, poikilothermic secretive and seasonal, which makes it difficult to observe them during field surveys. In this case the presence of herpetofauna species was examined on habitat preferred by selected species and respective documented ranges.

## 7.2 Specific Requirements

Adequate amount of random transect walks in the study site was attempted to identify herpetofauna and invertebrate species. Emphasis on specific Red List species that might occur on the study site:

- Striped Harlequin Snake (*Homoroselaps dorsalis*)
- Southern African Python (*Python natalensis*)

## 7.3 Results

### 7.3.1 Herpetofauna habitats identified

The open grassland, with no conspicuous standing or flowing water bodies in the study site, forms part of the terrestrial systems with ecological niche for both amphibians and reptiles (Du Preez & Carruthers). The Riverine systems provide a permanent flow of water in a natural channel, which forms a micro-habitat for various amphibians (**Table 2**).

The grassland is a suitable habitat for the Striped Harlequin Snake (*Homoroselaps dorsalis*). It can be found in old termite mounds and under rocks (Marais 2004), both of which occur in the grassland. Most records of this snake are subterranean (Marais 2004).

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### 7.3.2 Expected and observed Herpetofauna species

No amphibians or reptiles were observed during the survey. Eleven amphibian species and 26 reptile species are expected to occur in the QDS 2628AA (Tables 2 & 3).

**Table 2:** Amphibian species observed and/or deducted to occur in QDS 2628AA.

Family name	Species name	Common name	Conservation status	Occurrence
BUFONIDAE	<i>Schismaderma carens</i>	Red Toad	Least Concern	4
BUFONIDAE	<i>Sclerophrys capensis</i>	Raucous Toad	Least Concern	3
BUFONIDAE	<i>Sclerophrys gutturalis</i>	Guttural Toad	Least Concern	4
HYPEROLIIDAE	<i>Kassina senegalensis</i>	Bubbling Kassina	Least Concern	4
PIPIDAE	<i>Xenopus laevis</i>	Common Platanna	Least Concern	5
PYXICEPHALIDAE	<i>Amietia fuscigula</i>	Cape River Frog	Least Concern	3
PYXICEPHALIDAE	<i>Amietia queketti</i>	Quekett's River Frog	Least Concern	3
PYXICEPHALIDAE	<i>Cacosternum boettgeri</i>	Common Caco	Least Concern	4
PYXICEPHALIDAE	<i>Pyxicephalus adspersus</i>	Giant Bull Frog	Least Concern	3
PYXICEPHALIDAE	<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	Least Concern	2
PYXICEPHALIDAE	<i>Tomopterna natalensis</i>	Natal Sand Frog	Least Concern	2

\*The occurrence probability of the amphibian species listed above is indicated as follows:  
 Not likely to occur - 1, Low occurrence probability - 2, Medium occurrence probability - 3, High occurrence probability - 4, **Confirmed occurrence - 5**. The IUCN (2015) Red List of threatened species was used for conservation status of each species.

**Table 3:** Reptile species observed and/or deducted to occur in QDS 2628AA.

Family name	Species name	Common name	Conservation status	Occurrence
AGAMIDAE	<i>Agama aculeata</i> subsp. <i>distanti</i>	Distant's Ground Agama	Least Concern	2
AGAMIDAE	<i>Agama atra</i>	Southern Rock Agama	Least Concern	3
CHAMAELEONIDAE	<i>Bradypodion ventrale</i>	Eastern Cape Dwarf Chameleon	Least Concern	1
COLUBRIDAE	<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	Least Concern	4
COLUBRIDAE	<i>Dasypeltis scabra</i>	Rhombic Egg-eater	Least Concern	2
CORDYLIDAE	<i>Cordylus vittifer</i>	Common Girdled Lizard	Least Concern	3
ELAPIDAE	<i>Hemachatus haemachatus</i>	Rinkhals	Least Concern	3
GEKKONIDAE	<i>Hemidactylus mabouia</i>	Common Tropical House Gecko	Least Concern	3
GEKKONIDAE	<i>Lygodactylus capensis</i>	Common Dwarf Gecko	Least Concern	4
GEKKONIDAE	<i>Pachydactylus affinis</i>	Transvaal Gecko	Least Concern	3
GEKKONIDAE	<i>Pachydactylus capensis</i>	Cape Gecko	Least Concern	3



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GERRHOSOURIDAE	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	Least Concern	3
LAMPROPHIIDAE	<i>Aparallactus capensis</i>	Black-headed Centipede-eater	Least Concern	3
LAMPROPHIIDAE	<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	Least Concern	3
LAMPROPHIIDAE	<i>Boaedon capensis</i>	Brown House Snake	Least Concern	4
LAMPROPHIIDAE	<i>Lamprophis aurora</i>	Aurora House Snake	Least Concern	3
LAMPROPHIIDAE	<i>Lycodonomorphus inornatus</i>	Olive House Snake	Least Concern	3
LAMPROPHIIDAE	<i>Lycodonomorphus rufulus</i>	Brown Water Snake	Least Concern	3
LAMPROPHIIDAE	<i>Lycophidion capense</i>	Cape Wolf Snake	Least Concern	3
LAMPROPHIIDAE	<i>Psammophis subtaeniatus</i>	Western Yellow-bellied Sand Snake	Least Concern	3
PELOMEDUSIDAE	<i>Pelomedusa subrufa</i>	Central Marsh Terrapin	Least Concern	3
SCINCIDAE	<i>Trachylepis capensis</i>	Cape Skink	Least Concern	3
SCINCIDAE	<i>Trachylepis punctatissima</i>	Speckled Rock Skink	Least Concern	5
SCINCIDAE	<i>Trachylepis varia</i>	Variable Skink	Least Concern	3
TESTUDINIDAE	<i>Stigmochelys pardalis</i>	Leopard Tortoise	Least Concern	3
TYPHLOPIDAE	<i>Afrotyphlops bibronii</i>	Bibron's Blind Snake	Least Concern	2

\*The occurrence probability of the reptile species listed above is indicated as follows:

Not likely to occur - 1, Low occurrence probability - 2, Medium occurrence probability - 3, High occurrence probability - 4, Confirmed occurrence - 5. Bates et al. (2014) was used for the conservation status of each species.

### 7.3.3 Threatened and Red Listed Herpetofauna species

The Striped Harlequin Snake (*Homoroselaps dorsalis*) is the only IUCN Red Listed Species which may occur at this site although it was not observed during the site visit.

### 7.4 Findings

Suitable habitat for the Striped Harlequin Snake (*Homoroselaps dorsalis*) was identified. The occurrence probability of the Spotted Harlequin Snake was deemed highly unlikely on account of the small surface area of the habitat, along with the fact that the grassland is totally isolated from other similar grasslands. Five species of amphibians and three species of reptiles were given a high probability of being found in the riverine area present on the study site.



### 8. INVERTEBRATE HABITAT ASSESSMENT

#### 8.1 Methods

Surveys were conducted on 7/4/2016, which consisted of two random walked transects (10h18-11h08; 11h08-11h43). The dominant invertebrate species and possible suitable habitats for Red List invertebrate species were noted and sampled if necessary. Habitat characteristics for species present were derived from a survey and descriptions given in the field guide by Picker *et al.* (2004). The IUCN Red Listed Species were consulted online for conservation status of Red List species (IUCN 2015). All insects were identified *sensu*. Picker *et al.* (2004). IUCN Red Listed Butterflies were identified *sensu*. Henning *et al.* (2009) and Mecenero *et al.* (2013).

A desktop study was done to identify suitable habitats for the Red List invertebrate species known to occur in the QDS 2628AA. The Animal Demography Unit: Virtual Museum (<http://vmus.adu.org.za/>) was consulted to verify the record of occurrence of invertebrate species recorded within the QDS 2628AA.

The majority of invertebrate species are nocturnal, poikilothermic secretive and seasonal, which makes it difficult to observe them during field surveys. In this case the presence of invertebrate species was examined on habitat preferred by selected species and respective documented ranges.

#### 8.2 Specific Requirements

The survey took place during the end of the wet season, thus the probability of detecting identifiable life history stages was highest based on their biology.

#### 8.3 Results

##### 8.3.1 Invertebrate habitats identified

The major habitats of concern in this area were grassland and wetland habitats. The reason for this is because biodiversity in grasslands is only second to the Fynbos (WWF 2016). Wetlands are protected under the RAMSAR convention (<http://www.ramsar.org/>) and provide the habitat for many hemimetabolous insects to complete their life-cycles as they are amphibious and rely on water for breeding.

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### 8.3.2 Expected Invertebrate species

**Table 4:** Invertebrate species deducted to occur within QDS 2628AA.

Family name	Species name	Common name	Conservation status	occurrence
AGANAIDAE	<i>Asota speciosa</i> subsp. <i>speciosa</i>	Specious Tiger Moth	Not Evaluated	3
ARCTIIDAE	<i>Utetheisa pulchella</i> subsp. <i>pulchella</i>	Crimson-speckled Footman	Not Evaluated	4
BUTHIDAE	<i>Parabuthus transvaalicus</i>		Not listed	4
BUTHIDAE	<i>Pseudolychas ochraceus</i>		Not listed	2
CHRYSOPIDAE	<i>Chrysemosa jeanneli</i>		Not listed	3
CHRYSOPIDAE	<i>Chrysoperla</i> sp.	Green Lacewings	Not listed	3
CHRYSOPIDAE	<i>Dysochrysa furcata</i>		Not listed	3
COENAGRIONIDAE	<i>Africallagma glaucum</i>	Swamp Bluet	Not listed	4
COENAGRIONIDAE	<i>Pseudagrion</i>		Not listed	3
COENAGRIONIDAE	<i>Pseudagrion salisburyense</i>	Slate Sprite	Not listed	3
COENAGRIONIDAE	<i>Pseudagrion spernatum</i>	Upland Sprite	Not listed	3
CRAMBIDAE	<i>Spoladea recurvalis recurvalis</i>		Not Evaluated	3
CULICIDAE	<i>Culex</i> sp.	Mosquito	Not listed	4
CYDNIDAE	<i>Geocnethus plagiata</i>	Burrowing Bug	Not listed	4
GEOMETRIDAE	<i>Acanthovalva inconspicuaria</i> subsp. <i>inconspicuaria</i>		Not Threatened	2
GEOMETRIDAE	<i>Pingasa abyssinaria</i> subsp. <i>abyssinaria</i>		Not Threatened	2
GEOMETRIDAE	<i>Rhodometra sacraria</i> subsp. <i>sacraria</i>	Vestal	Not Threatened	4
GERRIDAE	<i>Gerris</i> sp.	Waterskater	Not listed	4
HESPERIIDAE	<i>Coeliades forestan</i> subsp. <i>forestan</i>	Striped policeman	Least Concern	1
HESPERIIDAE	<i>Coeliades pisistratus</i>	Two-pip policeman	Least Concern	1
HESPERIIDAE	<i>Gegenes niso</i> subsp. <i>Niso</i>	Common hottentot	Least Concern	3
HESPERIIDAE	<i>Gegenes pumilio</i> subsp. <i>gambica</i>	Dark hottentot	Least Concern	3
HESPERIIDAE	<i>Kedestes lepenula</i>	Chequered ranger	Least Concern	3
HESPERIIDAE	<i>Kedestes nerva</i> subsp. <i>nerva</i>	Scarce ranger	Least Concern	3
HESPERIIDAE	<i>Kedestes wallengrenii</i> subsp. <i>wallengrenii</i>	Wallengren's ranger	Least Concern	3
HESPERIIDAE	<i>Metisella malgacha</i> subsp. <i>malgacha</i>	Grassveld sylph	Least Concern	4
HESPERIIDAE	<i>Metisella willemi</i>	Netted sylph	Least Concern	3
HESPERIIDAE	<i>Tsitana tsita</i>	Dismal sylph	Least Concern	3
HESPERIIDAE	<i>Spialia diomus</i>	Common Sandman	Least Concern	4
HODOTERMITIDAE	<i>Hodotermes mossambicus</i>	Harvester termite	Not listed	4

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LIBELLULIDAE	<i>Brachythemis leucosticta</i>	Southern Banded Groundling	Not listed	3
LIBELLULIDAE	<i>Crocothemis erythraea</i>	Broad Scarlet	Not listed	4
LIBELLULIDAE	<i>Crocothemis sanguinolenta</i>	Small Scarlet	Least Concern	4
LIBELLULIDAE	<i>Diplacodes lefebvreii</i>	Black Percher	Not listed	3
LIBELLULIDAE	<i>Orthetrum</i>		Not listed	3
LIBELLULIDAE	<i>Orthetrum cafrum</i>	Two-striped Skimmer	Not listed	3
LIBELLULIDAE	<i>Orthetrum chrysostigma</i>	Epaulet Skimmer	Not listed	3
LIBELLULIDAE	<i>Orthetrum julia</i>	Julia Skimmer	Not listed	3
LIBELLULIDAE	<i>Orthetrum trinacria</i>	Long Skimmer	Not listed	3
LIBELLULIDAE	<i>Pantala flavescens</i>	Wandering Glider	Not listed	3
LIBELLULIDAE	<i>Tramea basilaris</i>	Keyhole Glider	Not listed	3
LIBELLULIDAE	<i>Trithemis</i>		Not listed	3
LIBELLULIDAE	<i>Trithemis dorsalis</i>	Highland Dropwing	Not listed	3
LIBELLULIDAE	<i>Trithemis kirbyi</i>	Orange-winged Dropwing	Not listed	3
LIBELLULIDAE	<i>Trithemis stictica</i>	Jaunty Dropwing	Not listed	3
LYCAENIDAE	<i>Actizera lucida</i>	Rayed blue	Least Concern	3
LYCAENIDAE	<i>Aloeides henningi</i>	Henning's copper	Least Concern	2
LYCAENIDAE	<i>Aloeides molomo</i> subsp. <i>molomo</i>	Molomo copper	Least Concern	2
LYCAENIDAE	<i>Aloeides taikosama</i>	Dusky copper	Least Concern	2
LYCAENIDAE	<i>Anthene amarah</i> subsp. <i>amarah</i>	Black striped hairtail	Least Concern	3
LYCAENIDAE	<i>Anthene definita</i> subsp. <i>definita</i>	Common hairtail	Least Concern	4
LYCAENIDAE	<i>Axiocerses tjoane</i> subsp. <i>tjoane</i>	Eastern scarlet	Least Concern	2
LYCAENIDAE	<i>Cacyreus fracta</i> subsp. <i>fracta</i>	Water geranium bronze	Least Concern	3
LYCAENIDAE	<i>Cacyreus marshalli</i>	Common geranium bronze	Least Concern	4
LYCAENIDAE	<i>Cacyreus virilis</i>	Mocker bronze	Least Concern	3
LYCAENIDAE	<i>Capys disjunctus</i>	Russet protea	Least Concern	3
LYCAENIDAE	<i>Chilades trochylus</i>	Grass jewel	Least Concern	2
LYCAENIDAE	<i>Cigaritis ella</i>	Ella's bar	Least Concern	2
LYCAENIDAE	<i>Cigaritis mozambica</i>	Mozambique bar	Least Concern	2
LYCAENIDAE	<i>Cigaritis natalensis</i>	Natal bar	Least Concern	2
LYCAENIDAE	<i>Cupidopsis cissus</i> subsp. <i>cissus</i>	Common meadow blue	Least Concern	3
LYCAENIDAE	<i>Euchrysops dolorosa</i>	Sabie smoky blue	Least Concern	2
LYCAENIDAE	<i>Euchrysops subpallida</i>	Ashen smoky blue	Least Concern	3
LYCAENIDAE	<i>Iolaus trimeni</i>	Trimen's sapphire	Least Concern	1
LYCAENIDAE	<i>Lachnocnema durbani</i>	D'Urban's woolly legs	Least Concern	2
LYCAENIDAE	<i>Lampides boeticus</i>	Pea blue	Least Concern	2
LYCAENIDAE	<i>Leptomyrina henningi</i> subsp. <i>henningi</i>	Henning's black-eye	Least Concern	2
LYCAENIDAE	<i>Leptotes species</i>		Not listed	2
LYCAENIDAE	<i>Myrina silenus</i> subsp. <i>ficedula</i>	Common fig tree blue	Least Concern	2

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LYCAENIDAE	<i>Oraidium barberae</i>	Dwarf blue	Least Concern	2
LYCAENIDAE	<i>Tarucus sybaris</i> subsp. <i>sybaris</i>	Dotted blue	Least Concern	1
LYCAENIDAE	<i>Tuxentius melaena</i> subsp. <i>melaena</i>	Black pie	Least Concern	2
LYCAENIDAE	<i>Uranothauma nubifer</i> subsp. <i>nubifer</i>	Black heart	Least Concern	2
LYCAENIDAE	<i>Zizeeria knysna</i> subsp. <i>knysna</i>	African grass blue	Least Concern	2
LYCAENIDAE	<i>Zizina otis</i> subsp. <i>antanossa</i>	Dark grass blue	Least Concern	2
LYCAENIDAE	<i>Zizula hylax</i>	Tiny grass blue	Least Concern	2
LYCOSIDAE		Wolf Spider	Not listed	4
LYNIPHIDAE	<i>Lyniphia</i> sp.	Sheet Orb Web Spider	Not listed	4
MYRMELEONTIDAE	<i>Creoleon mortifer</i>	Large Grassland Antlion	Not listed	3
MYRMELEONTIDAE	<i>Hagenomyia tristis</i>	Gregarious Antlion	Not listed	3
MYRMELEONTIDAE	<i>Macroleon quinquemaculatus</i>		Not listed	3
MYRMELEONTIDAE	<i>Palpares caffer</i>	Dotted Veld Antlion	Not listed	3
NOCTUIDAE	<i>Callopietria yerburii</i> subsp. <i>yerburii</i>		Not Evaluated	2
NOCTUIDAE	<i>Sphingomorpha chlorea</i> subsp. <i>chlorea</i>		Not Evaluated	2
NYMPHALIDAE	<i>Acraea horta</i>	Garden acraea	Least Concern	4
NYMPHALIDAE	<i>Acraea neobule</i> subsp. <i>neobule</i>	Wandering donkey acraea	Least Concern	3
NYMPHALIDAE	<i>Byblia ilithyia</i>	Spotted joker	Least Concern	4
NYMPHALIDAE	<i>Charaxes jasio</i> subsp. <i>saturnus</i>	Foxy charaxes	Least Concern	3
NYMPHALIDAE	<i>Danaus chrysippus</i> subsp. <i>orientis</i>	African monarch, Plain tiger	Least Concern	4
NYMPHALIDAE	<i>Hypolimnas misippus</i>	Common diadem	Least Concern	4
NYMPHALIDAE	<i>Junonia hierta</i> subsp. <i>cebre</i>	Yellow pansy	Least Concern	4
NYMPHALIDAE	<i>Junonia oenone</i> subsp. <i>oenone</i>	Blue pansy	Least Concern	4
NYMPHALIDAE	<i>Junonia orithya</i> subsp. <i>madagascariensis</i>	Eyed pansy	Least Concern	3
NYMPHALIDAE	<i>Melanitis leda</i>	Twilight Brown	Least Concern	2
NYMPHALIDAE	<i>Precis archesia</i> subsp. <i>archesia</i>	Garden commodore	Least Concern	3
NYMPHALIDAE	<i>Stygionympha wichgrafi</i> subsp. <i>wichgrafi</i>	Wichgraf's hillside brown	Least Concern	2
NYMPHALIDAE	<i>Telchinia rahira</i> subsp. <i>rahira</i>	Marsh acraea	Least Concern	2
NYMPHALIDAE	<i>Vanessa cardui</i>	Painted lady	Least Concern	4
PAPILIONIDAE	<i>Papilio demodocus</i> subsp. <i>demodocus</i>	Citrus swallowtail	Least Concern	4
PAPILIONIDAE	<i>Papilio nireus</i> subsp. <i>lyaeus</i>	Green-banded swallowtail	Least Concern	3
PIERIDAE	<i>Belenois aurota</i>	Brown-veined white	Least Concern	4
PIERIDAE	<i>Belenois creona</i> subsp. <i>severina</i>	African common	Least Concern	4

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		white		
PIERIDAE	<i>Belenois zochalia</i> subsp. <i>zochalia</i>	Forest white	Least Concern	2
PIERIDAE	<i>Catopsilia florella</i>	African migrant	Least Concern	4
PIERIDAE	<i>Colias electo</i> subsp. <i>electo</i>	African clouded yellow	Least Concern	3
PIERIDAE	<i>Colotis annae</i> subsp. <i>annae</i>	Scarlet tip	Least Concern	2
PIERIDAE	<i>Colotis evenina</i> subsp. <i>evenina</i>	Orange tip	Least Concern	
PIERIDAE	<i>Eurema brigitta</i> subsp. <i>brigitta</i>	Broad-bordered grass yellow	Least Concern	4
PIERIDAE	<i>Mylothris agathina</i> subsp. <i>agathina</i>	Common dotted border	Least Concern	1
PIERIDAE	<i>Pontia helice</i> subsp. <i>helice</i>	Common meadow white	Least Concern	4
PILLBUG	<i>Armadillidium vulgare</i>		Not listed	4
POTOMONAUTIDAE	<i>Potomonautes warreni</i>	Warren's	Not listed	4
PYRGOMORPHIDAE	<i>Phymateus viridipes</i>	Green Milkweed Locust	Not listed	4
SALTICIDAE		Jumping Spider	Not listed	4
SCARABAEIDAE	<i>Catharsius sesostris</i>	Three-horned Dung Beetle	Not listed	4
SCARABAEIDAE	<i>Liatongus militaris</i>		Not listed	3
SCARABAEIDAE	<i>Onitis caffer</i>	Bronze Dung Beetle	Not listed	4
SCARABAEIDAE	<i>Onthophagus ebeus</i>		Not listed	3
SCARABAEIDAE	<i>Onthophagus pugionatus</i>		Not listed	3
SPARASSIDAE	<i>Palystes superciliosus</i>	Rain spiders	Not listed	4
SPHINGIDAE	<i>Basiothia</i>		Not Evaluated	2
SPIROSTREPTIDAE	<i>Doratogonus</i> sp.	Spirostreptidan Millipede	Not listed	4
THERAPHOSIDAE	<i>Harpactira hamiltoni</i>		Not listed	4

\*The occurrence probability of the invertebrate species listed above is indicated as follows:

Not likely to occur - 1, Low occurrence probability - 2, Medium occurrence probability - 3, High occurrence probability - 4,

### 8.3.3 Threatened and Red Listed Invertebrate species

No Red Data invertebrate species were recorded or deducted to occur on or near the study area.

### 8.4 Findings

The presence of three wetland species alone provides immediate evidence for the existence of the wetland and its necessary preservation. These are all hemimetabolous species which are tied to the habitat for breeding and territorial reasons. Any developmental changes to this habitat would be detrimental to their existence. These are important as putative flagship or indicator species. The small scarlet (*Crocothemis sanguinolenta*) is easily confused with *Crocothemis erythraea* and until the possible breeding differences (alluded to by abdominal differences) between the two have been established, development of these systems should be carefully monitored. No sensitive invertebrate species were recorded or are expected to occur within the study area. Species such as *Crocothemis* which are dependent on wetland habitats are conservation priority.

## 9. OVERALL FINDINGS AND IMPLICATIONS

The majority of the terrestrial habitats present on the study area have been transformed and degraded. The current terrestrial habitats do however provide good habitat for a number of small mammals deducted to be present. Suitable habitat for the Striped Harlequin Snake (*Homoroselaps dorsalis*) was identified in the grassland habitat. The occurrence probability of the Striped Harlequin Snake was deemed highly unlikely on account of the small surface area of the habitat, along with the fact that the grassland is totally isolated from other similar grasslands. The aforementioned isolated nature of the grassland restricts the movement of fauna to and from similar habitats, as such the grassland habitat was deemed moderately sensitive from a faunal perspective. On account of the assemblage of fauna as well as the present terrestrial habitats, no evidence exists to consider the terrestrial habitats present within the study area to be of high ecological sensitivity.

The drainage line and riverine habitat have the potential to support sensitive species and/or species with conservation concerns (Vlei Rats and Otters). None of these species are believed

## Fauna Assessment Report: LP 10

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to occur at present on account of the fairly recent construction activities within with the drainage line as well as the polluted and degraded state of the riverine habitat. Five species of amphibians and three species of reptiles were given a high probability of occurring in the riverine area (**Tables 2 & 3**). The presence of three wetland invertebrate species provides immediate evidence for the existence of the wetland and its necessary preservation. Both the drainage line and the riverine habitat provide important ecological functions in terms of connectivity and as such both are considered to be highly sensitive from a faunal perspective regardless of their current state.

### 10. LIMITATIONS

The bulk of the data used to conclude the distribution of Red Data species were sourced by making use of the Animal Demography Unit: Virtual Museum data basis. Any limitations in the above mentioned data basis will in effect have implications on the findings and conclusion of this assessment. Furthermore this faunal assessment was conducted during April; hence the survey was done outside the main reproductive period of the local faunal species. Moreover, a lot of the hibernating fauna began with their hibernation period.

Limited time to conduct the survey could potentially result in not recording all species within the study area. Three and a half hours were spent on site while conducting this faunal assessment. As a result of the small size of the study area as well as the amount of disturbance on the study area, three hours was deemed sufficient time to record all the resident faunal habitats on and around the study area.

### 11. RECOMMENDATIONS

- An appropriate management authority that must be contractually bound to implement the EMP and ROD during the constructional and operational phase of the development should be identified and informed of their responsibilities in terms of the EMP and ROD.
- Prior to any activities commencing on site, all construction staff should be briefed in an environmental induction regarding the environmental status and requirements of the site. This should include providing general guidelines for minimizing environmental damage during construction, as well as education with regards to basic environmental ethics, such as the prevention of littering, lighting of fires, etc.

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- Induction should be done for all civil contractors and for each building contractor prior to them commencing on site.
- Construction should be restricted to areas deemed to have a low to medium ecological sensitivity (Please refer to **Figure 10**).
- Areas where construction is to take place should be clearly demarcated and fenced off, all areas outside that of the defined works should be deemed no-go areas.
- All construction activities must be restricted to the demarcated areas to ensure that no further disturbance into the surrounding vegetation or habitat takes place.
- It is recommended that prior to the commencement of construction activities' initial clearing of all alien vegetation should take place.
- No vehicles should be allowed to move in or through the drainage line. This will cause destruction of faunal habitat and will leave notable scares on site.
- The contractor must ensure that no faunal species are trapped, killed or in any way disturbed during the constructional phase.
- It is recommended that all concrete and cement works be restricted to areas of low ecological sensitivity and defined on site and clearly demarcated. Cement powder has a high alkalinity pH rating, which can contaminate and affect both soil and water pH dramatically. A shift in the pH can have serious consequences on the functioning of soil, vegetation and fauna.
- To ensure minimal disturbance of faunal habitat it is recommended that construction should take place during winter, outside the reproductive season of the species present on site.
- Construction, vegetation clearing and top soil clearing should commence from a predetermined location and gradually commence to ensure that fauna present on the site have enough time to relocate.
- When construction is completed, disturbed areas should be rehabilitated using vegetation cleared prior to construction to ensure that the habitat stays intact and that faunal species present on the site before construction took place, return to the area.
- It is recommended that the section of the Jukskei River bordering the study area on the Southern boundary should be rehabilitated and pollution prevention methods should be put in place to prevent further habitat degradation.
- It is recommended that no construction takes place within 32 meters of the Jukskei River.
- As a result of the artificial nature of the drainage line it was concluded that no additional buffers with respect to the upper section of the drainage line are necessary.



## 12. CONCLUSION

Due to the sensitive nature of the drainage line and riverine areas induction with all the partaking contractors, workers, road engineers and landowners is necessary, in order to make them aware of the areas deemed to be sensitive according to this report and act accordingly. Development should be restricted to areas deemed to have a low to medium ecological sensitivity (**Figure 10**).

Given the acceptance of the recommendations, the proposed development will not result in the destruction and/or loss of important or ecologically sensitive habitat units from a faunal perspective.

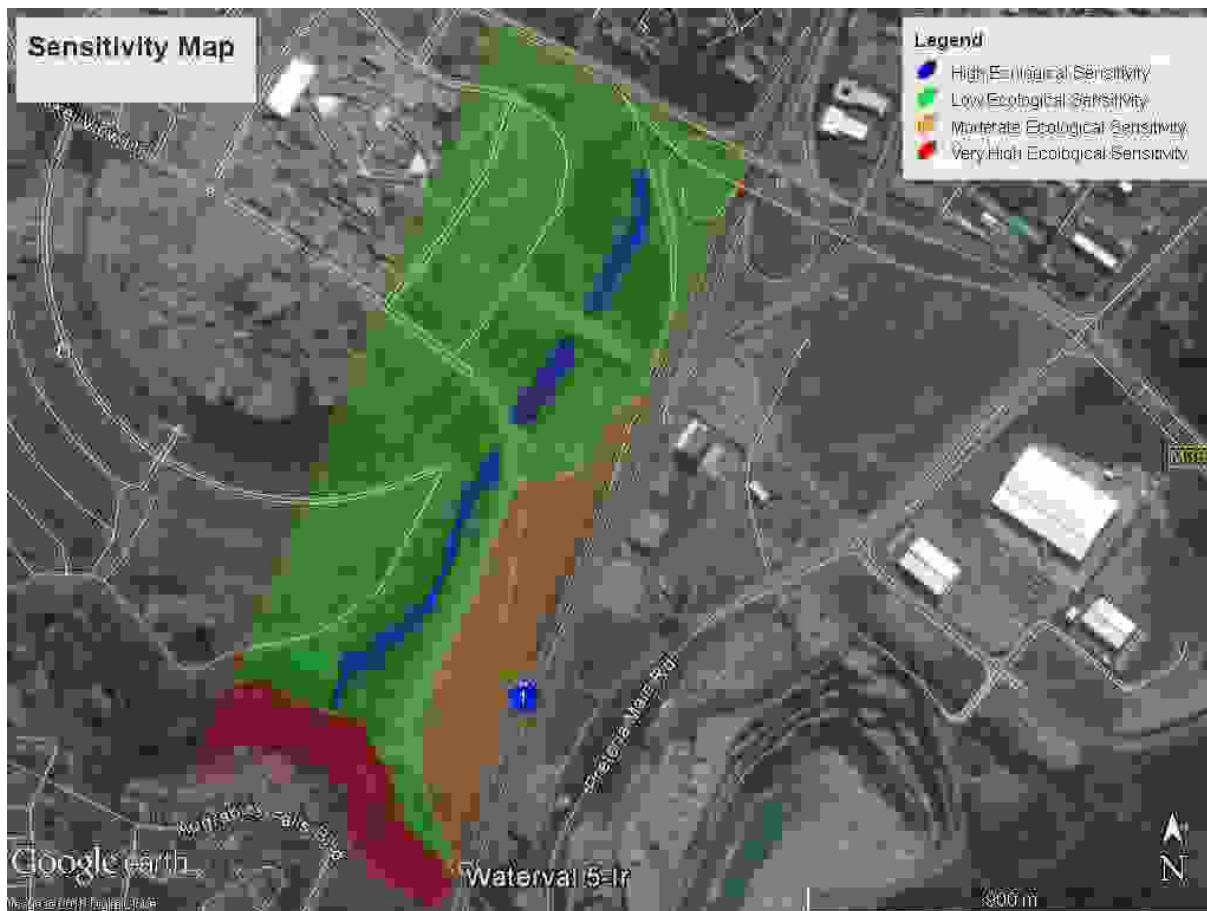


Figure 10: Faunal Sensitivity Map

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AVIFAUNAL ASSESSMENT  
OF  
THE REMAINING EXTENT OF PORTION 1 OF THE FARM WATERFALL 5-IR ALSO  
KNOWN AS LAND PARCEL 10



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07 May 2016

To whom it may concern,

**REVIEW OF SPECIALIST AVIFAUNAL ASSESSMENT:**

**THE REMAINING EXTENT OF PORTION 1 OF THE FARM WATERFALL 5-IR ALSO  
KNOWN AS LAND PARCEL 10**

I, Lukas Jurie Niemand, member and principal consultant of Pachnoda Consulting and registered professional scientist in the fields of Zoological and Ecological sciences, evaluated the avifaunal (bird) component of the abovementioned specialist assessment compiled by Mr CW Vermeulen of Bokamoso. The report was evaluated in accordance with the Gauteng Directorate of Nature Conservation (GDARD) Requirements for Biodiversity Assessments Version 3 and in terms of general content and avifaunal conservation.

In general, criticism lodged against avifaunal/ecological studies include: poor use of relevant scientific literature, lack of, or poor field surveys and associated data collection, poor use of regional information datasets, general poor knowledge of subject, failure to describe limitations or constraints on survey methodology, insufficient or inadequate data, vague generalisations with no indication of the relative importance of a particular component. With regards to the above criticism, none of it is relevant to the avifaunal assessment of the aforementioned report.

It is concluded that the report comply with the provincial requirements, and the content as discussed in the report is relevant and concise.



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Regards

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## 1. Introduction

Bokamoso Environmental Consultants CC; Specialist Division was appointed to conduct a Basic Faunal Assessment for the proposed mixed used development on the remaining extent of Portion 1 of the Farm Waterfall 5-IR, Gauteng Province, also known as Land Parcel 10 (hereafter referred to as the study area).

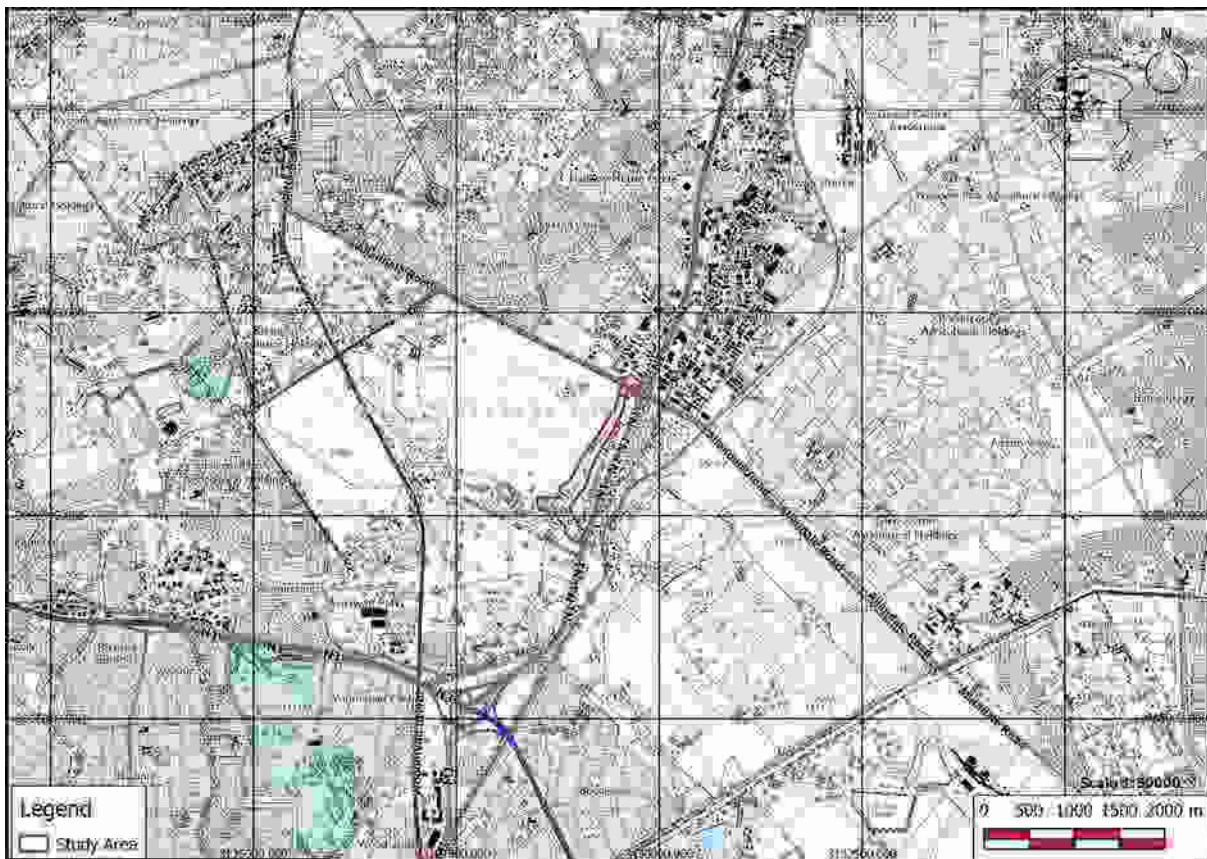
This report is based on the avifaunal species present on the study area as well as species that could potentially be present. The report primarily focuses on species with conservation concerns (**NT** = Near Threatened, **VU** = Vulnerable, **EN** = Endangered, **CR** = Critically Endangered) and other species with conservation importance occurring on or near the study area to ensure that, should any such species exists, the appropriate actions are taken to guarantee the well-being of these species.

## 2. Scope of the study

- To identify as many species as possible present on the study area.
- To identify all the distinct habitats on the study area.
- To compare the species occurring in and around the study area with all the species that has been recorded in that area in recent history.
- To identify ecologically sensitive areas in terms of species occurrence and/ or habitat.
- To provide lists of all the species occurring on the study area as well as species possibly occurring in the area as a result of habitat preferences and previous records.
- To provide a list of species with conservation importance.
- To provide recommendations in the form of mitigation of negative impacts, should the development be approved.

### 3. Study Area

The study area is situated on the remaining extent of Portion 1 of the farm Waterfall 5-IR, Gauteng Province and also known as Land Parcel 10. The size of the property is approximately 103 ha and is located within the 2628AA quarter degree square (QDS) ( $26^{\circ}01'24.74''S$ ;  $28^{\circ}06'35.73''E$ ) and within the 2600\_2805 pentad (A pentad is a 5 minute x 5 minute coordinate grid super-imposed over the continent for spatial reference, one QDGC comprises of 9 pentads) (SABP2). The study area is located within the Egoli Granite Grassland vegetation unit (Mucina and Rutherford, 2006). The study area is located north of the N1 highway and west of Allendale road. The property largely consists of open grassland with small scattered trees and a drainage line cutting through the center from the north to the south. Moreover, the drainage line is completely transformed as a result of the use of gabions as a form of stabilizing the steep banks and protection against erosion. A small rocky outcrop is situated on the South-eastern part of the study area. The Jukskei River directly borders the study area on the most Southerly boarder. The property is located approximately 1468 meters above sea level and slopes gently to the South-west (Figures 1 and 2).



**Figure 1: Locality Map**

An overhead map showing all the surrounding roads and open space as well as the location of the study area within the larger Midrand area.



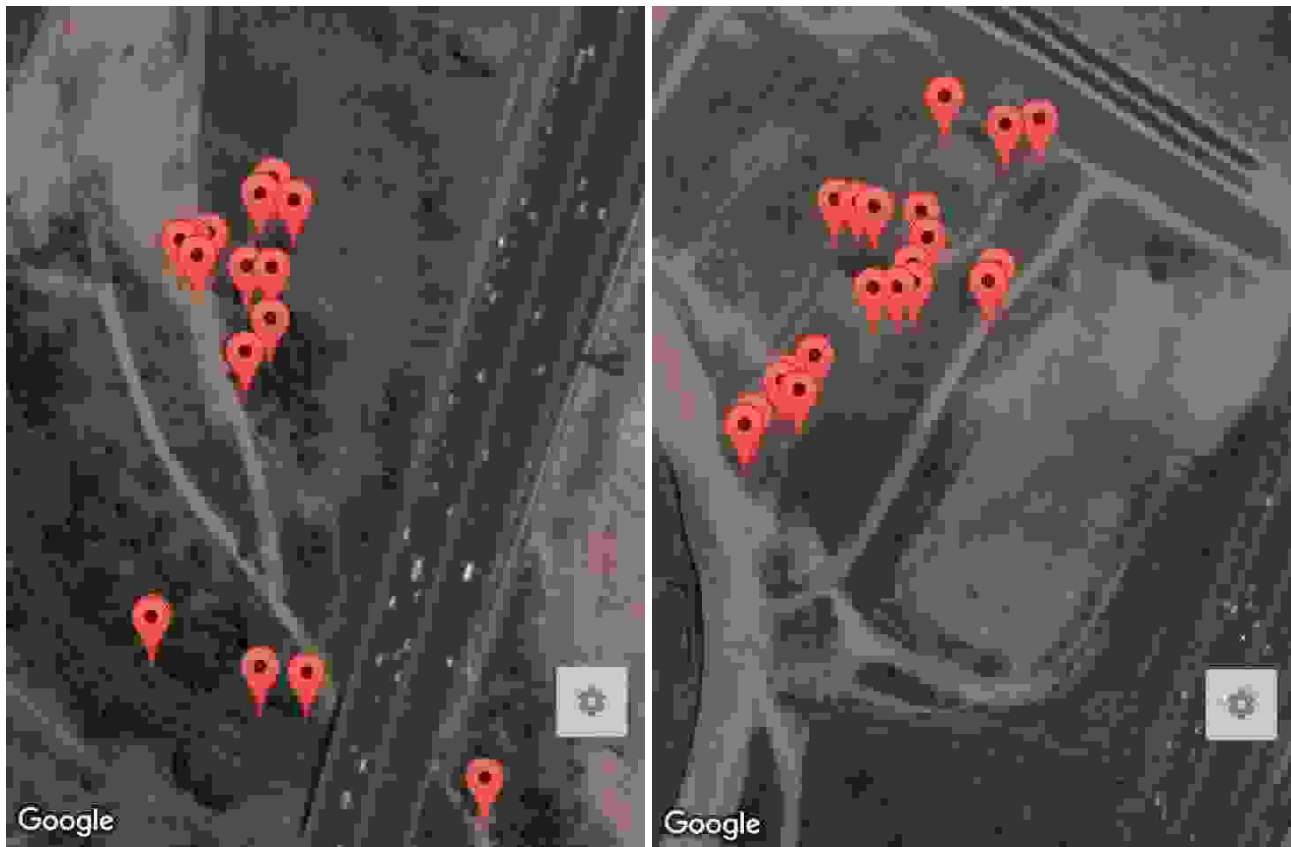
**Figure 2: Aerial photo**

An aerial photo showing the location of the study area. The Jukskei River, Mall of Africa as well as the Afrisam Aggregate Quarry are clearly visible.

## 4. Methods

### 4.1 Field Survey

A three and a half hour field survey was conducted on the 7<sup>th</sup> of April 2016, starting at 10:17 and ending at 12:50. Before conducting a field survey on the study area a desktop assessment was conducted to note the prevalent faunal species occurring on or near the site. A list of expected species was compiled and used as a reference during the field survey to ensure that species that should theoretically occur were not overlooked. All distinct avifaunal habitats were identified on site, after which each habitat was assessed to record the associated faunal species present in that specific habitat. Some species were identified by call as well as signs of presence in the form of eggshells, nests, droppings and feathers (Chris & Tilde Stuart., 2000). Where necessary, species were verified using Sasol Birds of Southern Africa (Sinclair *et al.*, 2011).



**Figure 3: GPS waypoints for each bird species recorded**

Each GPS waypoint accounts for a bird species recorded within the study area. These observed species are color coded and listed in Table 1 (**Recorded on site – 5**)

#### 4.2 Listing all the possible species occurring on site

By using Southern Africa Bird Atlas Project 1 and 2 (SABAP2) a comprehensive species list could be compiled for the 2628AA QDS / 2600\_2805 pentad. SABAP2 is the follow-up project to the Southern African Bird Atlas Project (for which the acronym was SABAP, and which is now referred to as SABAP1). This first bird atlas project took place from 1987-1991. The second bird atlas project started on 1 July 2007 and plans to run indefinitely. The project aims to map the distribution and relative abundance of birds in southern Africa. The field work for this project is done by more than one thousand nine hundred volunteers, known as citizen scientists. The unit of data collection is the pentad, five minutes of latitude by five minutes of longitude, squares with sides of roughly 9 km.

The initial list compiled for the species occurring in the QDS can however not be used as an accurate list in terms of the species occurring within the study area since it covers a larger area as well as a wider variety of habitats. In order to compile an accurate species list for the study area, all the species previously recorded in the 2628AA QDS were considered and added or eliminated on account of the

habitat present on the study area as well as the habitat preferences of each of the species previously recorded within the larger QDS.

#### 4.3 Red Data bird species

All the Red Data bird species occurring in or around the study area were reviewed (Roberts VII, Hockey *et al.* 2005; Taylor *et al.*, 2015) before conducting the field survey. During the field survey special attention was paid to identify any signs such as; actual sightings, suitable habitat, nest sites, suitable hunting/ foraging habitat or roosting spots pointing to the presence of these species.

A list was compiled to indicate the presence and/ or occurrence probability of Red Data bird species based on the above mentioned indicators.

#### 4.4 Specific Requirements in terms of Red Data Avifaunal species

According to the Gauteng Department of Agriculture and Rural Development's (GDARD) requirements for Biodiversity Assessments, Version 3.3 (March 2014), as well as for any other Red Data species: Eleven threatened bird species were prioritized for inclusion into the Gauteng C-Plan based on:

1. Threat status (2 Endangered (**EN**), 5 Vulnerable (**VU**) and 4 Near Threatened (**NT**)).
2. Whether the species was actually present, on a frequent basis, in the province. Vagrants, erratic visitors or erratic migrants to the province (Tarboton *et al.*, 1987) have been excluded from the conservation plan.
3. Whether the threat was due to issues related to land use planning. Species which are impacted on mostly by threats such as poisoning were excluded.

#### Threatened Bird species regional conservation status (Taylor *et al.*, 2015):

- Half-Collared Kingfisher (*Alcedo semitorquata*) **NT**
- Blue Crane (*Anthropoides paradiseus*) **NT**
- African Marsh-Harrier (*Circus ranivorus*) **EN**
- Blue Korhaan (*Eupodotis caerulescens*) **NT**
- White-bellied Korhaan (*Eupodotis senegalensis*) **VU**
- White-backed Night-Heron (*Gorsachius leuconotus*) **VU**
- Cape Vulture (*Gyps coprotheres*) **EN**
- Melodious Lark (*Mirafra cheniana*) **NT**
- African Finfoot (*Podica senegalensis*) **VU**
- Secretarybird (*Sagittarius serpentarius*) **VU**
- African Grass-Owl (*Tyto capensis*) **VU**

## 5. Results

### 5.1 Avifaunal Habitat Assessment:

During the habitat assessment five distinct bird habitats were identified within the study area. These habitats are: Disturbed Areas, Drainage Line, Grassland, Rocky Outcrop, and Riverine Area (**Figure 4**). All the habitats identified on the study area are individually discussed hereafter.



**Figure 4: Habitats Identified**

#### 5.1.1 Disturbed Area:

This area contains various disturbances in the form of roads, degraded grassland and general disturbances as a result of trampling and degradation as result of heavy vehicle activity. Large parts of this area have been transformed by means of trampling, to such an extent that only bare ground remains (**Figure 5**). Further disturbance in the form of alien vegetation encroachment is also evident. The area contains a limited amount of natural vegetation; instead a large number of invasive plants including herbaceous plants (*Verbena bonariensis*) and alien trees (*Acacia mearensii*). The reason for the inclusion of this area as a habitat in its own right, is due to the large number of bird species that have adapted to this unique environment. Species such as Sparrows,



Lapwings, Doves, Pigeons and Indian Mynas were present in large numbers in this habitat. Many of these species are non-specialised and transient.



**Figure 5: Disturbed Area**

### 5.1.2 Drainage Line:

A drainage line cuts through the center of the study area from the North to the South. The Drainage Line area encompasses the ideal habitat for Ralids, Plovers, Lapwings, Warblers, Bishops and Widowbirds. The largest part of this area has been transformed as a result of bank stabilization and erosion protection through the use of gabions to control and channel the flow of water. It is evident that rehabilitation of the drainage line is still an ongoing process and that this habitat will gradually improve in the near future. Although the current state of this area as an important avifaunal habitat can be debated owing to its fairly recent completion, the evidence of a potentially ideal wetland/drainage line habitat is apparent when attention is paid to the wetland vegetation and bird species currently present. Over time this area should provide the preferred habitat for various bird species once the current vegetation proliferates and connectivity to the natural drainage network is restored. Thus it is expected that this area will provide a favorable wetland habitat in the near future and as such can be earmarked as an area with high ecological sensitivity, please refer to sensitivity map.





**Figure 6: Drainage Line**

### 5.1.3 Grassland

The Grassland habitat contains two distinct floristic compositions (**Figure 7**). The Eastern grassland contains a well established population of various grass species and grassland vegetation communities, whereas the Western grassland contains large numbers of alien vegetation and other disturbances such as trampling and evidence of heavy vehicle activity. The Eastern grassland supports a large number of widespread bird species and could potentially provide the preferred habitat for three Red Data bird species namely; Blue Crane, White-bellied Korhaan and Secretarybird. Although the Eastern grassland is the preferred habitat of the afore mentioned species, their occurrence is highly unlikely due to the small size of the grassland as well as the disturbances caused by the adjacent road. As a result of the current near natural state of the Eastern part of the grassland habitat, this section of the grassland was deemed moderately sensitive from an avifaunal perspective as it is likely to support a number of more common species, like Spotted Thick-knee, Lapwings, Quails, Francolins and Spurfowl. The rest of the grassland habitat is already degraded and was deemed to have a low ecological and avifaunal sensitivity.



**Figure 7: Grassland**

#### 5.1.4 Rocky Outcrop:

This habitat is situated on the South-eastern side of the study area and is directly adjacent to the Eastern grassland habitat (**Figure 8**). Although it makes out a fairly small part of the larger study area, the largest number of bird species for the study area was recorded here. The reason for the large amount of species present in this small area is a direct result of the occurrence of a number of large indigenous trees (mainly *Vachelia karoo* and *Celtis africanus*), along with a healthy community of shrubs and other vegetation, which provides the perfect nesting, foraging and roosting habitat for a variety of grassland and savanna bird species. As a result, this area was deemed moderately sensitive from an avifaunal perspective.



**Figure 8: Rocky Outcrop**

### 5.1.5 Riverine Area:

The southernmost part of the study area borders the Jukskei River (**Figure 9**). Due to large number of bird species preferring this habitat type, the riverine area was expected to produce the highest species richness in comparison with the other habitats within the study area,. The state of the river was however very poor on account of the high amount of alien vegetation encroachment as well as the highly polluted river water (both chemical and solid waste) (Sibali *et al.*, 2008) (**Figure 10**). The low species count for this habitat is a direct result of the polluted river. The riverine area provides the optimal habitat for the Half-collared Kingfisher, with all the habitat preferences for this bird species present along this stretch of the river. These habitat preferences include clear, fast flowing perennial streams and/or rivers with dense marginal vegetation often near rapids (Roberts VII, Hockey *et al.*, 2005). All of these habitat preferences are present on the study area. If this section of the river is to be properly rehabilitated it could potentially be a highly diverse habitat and would most probably support the Red-listed Half-collared Kingfisher and also potentially the African Finfoot, although the chances of the latter occurring would be highly unlikely as a result of the polluted water. Due to the afore mentioned reasons this habitat is deemed highly sensitive, not on account of species currently present within the habitat, but rather as a result of the potential that this area holds if proper rehabilitation thereof is implemented.



**Figure 9: Riverine Area**

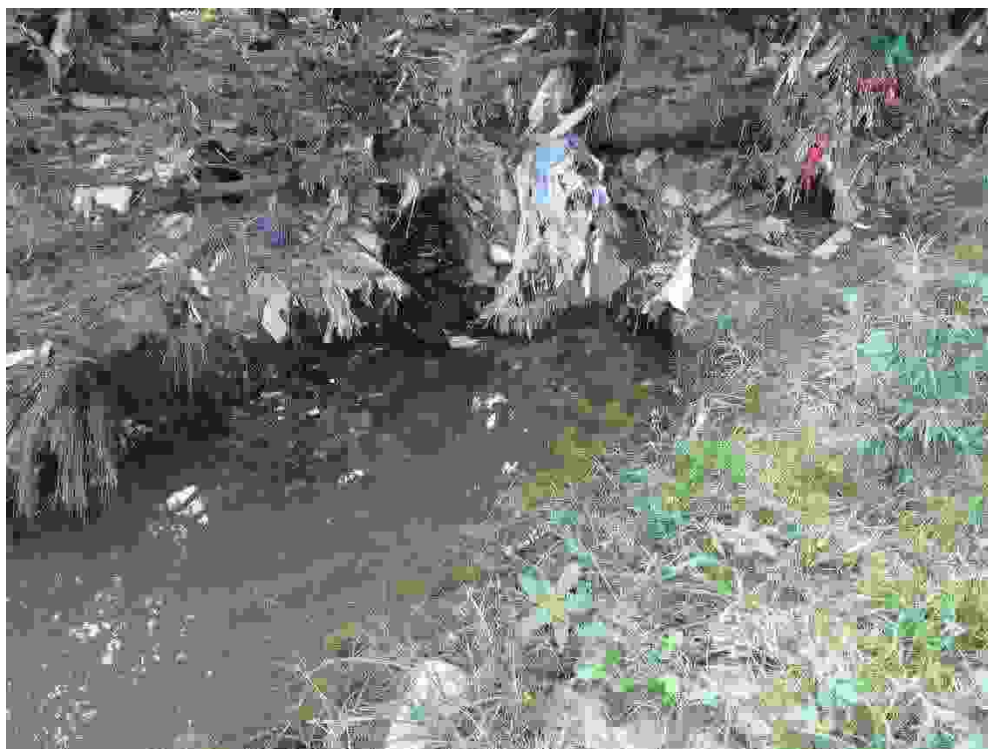


Figure 10: Highly polluted section of the Jukskei River.

**Table 1: Bird species observed within the study area during the field survey, as well as bird species potentially occurring on the study area as a result of habitat preferences and previous records.**

The biodiversity index indicates the probability of a species breeding (BR) within the study area and/or occurring within the study area according to the habitat preferences (HP) of that specific species. Very Low – 1, Low – 2, Medium – 3, High – 4, Recorded on site – 5, Not likely to occur/breed – 0, Red Data Species

	Species name	Afrikaans	Taxonomic name	Rep Rate (%)	HP	BR
1.	Apalis, Bar-throated	Bandkeelkleinjantjie	<i>Apalis thoracica</i>	2.515	3	3
2.	Avocet, Pied	Bontelsie	<i>Recurvirostra avosetta</i>	8.515	2	1
3.	Babbler, Arrow-marked	Pylvlekkatlagter	<i>Turdoides jardineii</i>	0.22	3	3
4.	Barbet, Acacia Pied	Bonthoutkapper	<i>Tricholaema leucomelas</i>	2.07	3	3
5.	Barbet, Black-collared	Rooikophoutkapper	<i>Lybius torquatus</i>	56.435	4	4
6.	Barbet, Crested	Kuifkophoutkapper	<i>Trachyphonus vaillantii</i>	75.28	5	4
7.	Batis, Chinspot	Witliesbosbontrokkie	<i>Batis molitor</i>	0.24	2	2
8.	Bee-eater, European	Europese Byvreter	<i>Merops apiaster</i>	27.92	4	1
9.	Bee-eater, Little	Kleinbyvreter	<i>Merops pusillus</i>	0.045	2	1

10.	Bee-eater, White-fronted	Rooikeelbyvreter	<i>Merops bullockoides</i>	5.95	3	3
11.	Bishop, Southern Red	Rooivink	<i>Euplectes orix</i>	71.62	5	5
12.	Bishop, Yellow-crowned	Goudgeelvink	<i>Euplectes afer</i>	10.385	4	4
13.	Bittern, Little	Kleinrietreier (Woudapie)	<i>Ixobrychus minutus</i>	3.865	3	3
14.	Bokmakierie, Bokmakierie	Bokmakierie	<i>Telophorus zeylonus</i>	30.86	3	3
15.	Boubou, Southern	Suidelike Waterfiskaal	<i>Laniarius ferrugineus</i>	8.595	4	4
16.	Brubru, Brubru	Bontroklaasman	<i>Nilaus afer</i>	0.13	2	1
17.	Bulbul, African Red-eyed	Rooioogtiptol	<i>Pycnonotus nigricans</i>	0.675	2	2
18.	Bulbul, Dark-capped	Swartoogtiptol	<i>Pycnonotus tricolor</i>	90.83	5	4
19.	Bunting, Cinnamon-breasted	Klipstreepkoppie	<i>Emberiza tahapisi</i>	2.125	2	2
20.	Buttonquail, Kurrichane	Bosveldkwarteltjie	<i>Turnix sylvaticus</i>	0.37	2	2
21.	Buzzard, Jackal	Rooiborsjakkalsvoel	<i>Buteo rufofuscus</i>	0.27	2	2
22.	Buzzard, Lizard	Akkedisvalk	<i>Kaupifalco monogrammicus</i>	1.33	1	1
23.	Buzzard, Steppe	Bruinjakkalsvoel	<i>Buteo vulpinus</i>	16.015	4	0
24.	Canary, Black-throated	Bergkanarie	<i>Crithagra atrogularis</i>	48.705	5	4
25.	Canary, Yellow	Geelkanarie	<i>Crithagra flaviventris</i>	0.885	2	2
26.	Canary, Yellow-fronted	Geeloogkanarie	<i>Crithagra mozambicus</i>	25.83	3	3
27.	Chat, Familiar	Gewone Spekvreter	<i>Cercomela familiaris</i>	14.05	3	3
28.	Cisticola, Cloud	Gevlekte Klopkloppie	<i>Cisticola textrix</i>	4.16	2	2
29.	Cisticola, Desert	Woestynklopkloppie	<i>Cisticola aridulus</i>	2.605	2	2
30.	Cisticola, Lazy	Luitinktinkie	<i>Cisticola aberrans</i>	0.22	1	1
31.	Cisticola, Levillant's	Vleitinktinkie	<i>Cisticola tinniens</i>	38.985	5	4
32.	Cisticola, Wailing	Huiltinktinkie	<i>Cisticola lais</i>	2.09	2	2
33.	Cisticola, Zitting	Landeryklopkloppie	<i>Cisticola juncidis</i>	23.565	3	3
34.	Cliff-swallow, South African	Familieswael	<i>Hirundo spilodera</i>	3.505	4	3
35.	Coot, Red-knobbed	Bleshoender	<i>Fulica cristata</i>	63.255	3	3
36.	Cormorant, Reed	Rietduiker	<i>Phalacrocorax africanus</i>	69.015	4	2
37.	Cormorant, White-breasted	Witborsduiker	<i>Phalacrocorax carbo</i>	37.85	2	1
38.	Coucal, Burchell's	Gewone Vleiloerie	<i>Centropus burchellii</i>	21.39	4	3
39.	Crake, Black	Swartriethaan	<i>Amaurornis</i>	5.22	4	4



			<i>flavirostris</i>			
40.	Crane, Blue	Bloukraanvoel	<i>Anthropoides paradiseus</i>	0.5	0	0
41.	Crombec, Long-billed	Bosveldstompstert	<i>Sylvietta rufescens</i>	0.14	1	1
42.	Crow, Cape	Swartkraai	<i>Corvus capensis</i>	2.915	1	1
43.	Crow, Pied	Witborskraai	<i>Corvus albus</i>	78.735	4	4
44.	Cuckoo, Black	Swartkoekoek	<i>Cuculus clamosus</i>	0.13	3	3
45.	Cuckoo, Diderick	Diederikkie	<i>Chrysococcyx caprius</i>	28.15	4	4
46.	Cuckoo, Klaas's	Meitjie	<i>Chrysococcyx klaas</i>	0.11	2	2
47.	Cuckoo, Red-chested	Piet-my-vrou	<i>Cuculus solitarius</i>	13.455	4	4
48.	Cuckoo-shrike, Black	Swartkatakoeroe	<i>Campephaga flava</i>	0.185	2	2
49.	Darter, African	Slanghalsvoel	<i>Anhinga rufa</i>	41.665	4	1
50.	Dove, Laughing	Rooiborsduifie	<i>Streptopelia senegalensis</i>	94.175	5	4
51.	Dove, Namaqua	Namakwaduifie	<i>Oena capensis</i>	1.025	1	1
52.	Dove, Red-eyed	Grootringduif	<i>Streptopelia semitorquata</i>	59.505	5	4
53.	Dove, Rock	Tuinduif	<i>Columba livia</i>	60.46	4	4
54.	Drongo, Fork-tailed	Mikstertbyvanger	<i>Dicrurus adsimilis</i>	6.905	3	3
55.	Duck, African Black	Swarteend	<i>Anas sparsa</i>	53.715	5	4
56.	Duck, Fulvous	Fluiteend	<i>Dendrocygna bicolor</i>	1.11	1	1
57.	Duck, Maccoa	Bloubekeend	<i>Oxyura maccoa</i>	1.08	1	1
58.	Duck, White-backed	Witrugeend	<i>Thalassornis leuconotus</i>	0.96	1	1
59.	Duck, White-faced	Nonnetjie-eend	<i>Dendrocygna viduata</i>	22.515	4	4
60.	Duck, Yellow-billed	Geelbekeend	<i>Anas undulata</i>	57.665	5	5
61.	Eagle, Long-crested	Langkuifarend	<i>Lophaelus occipitalis</i>	16.445	3	3
62.	Eagle, Martial	Breekoparend	<i>Polemaetus bellicosus</i>	0.02	0	0
63.	Eagle, Verreaux's	Witkruisarend	<i>Aquila verreauxii</i>	0.02	0	0
64.	Eagle-owl, Spotted	Gevlekte Ooruil	<i>Bubo africanus</i>	13.46	3	3
65.	Egret, Cattle	Veereier	<i>Bubulcus ibis</i>	65.34	4	0
66.	Egret, Great	Grootwitreier	<i>Egretta alba</i>	1.36	1	0
67.	Egret, Little	Kleinwitreier	<i>Egretta garzetta</i>	29.4	4	0
68.	Egret, Yellow-billed	Geelbekwitreier	<i>Egretta intermedia</i>	4.955	2	0
69.	Falcon, Amur	Oostelike Rooipootvalk	<i>Falco amurensis</i>	2.66	3	0
70.	Falcon, Lanner	Edelvalk	<i>Falco biarmicus</i>	0.62	1	0
71.	Falcon, Peregrine	Swervvalk	<i>Falco peregrinus</i>	0.6	1	0
72.	Falcon, Red-footed	Westelike Rooipootvalk	<i>Falco vespertinus</i>	0.14	1	0
73.	Finch, Cuckoo	Koekoekvink	<i>Anomalospiza imberbis</i>	0.13	1	1

74.	Finch, Red-headed	Rooikopvink	<i>Amadina erythrocephala</i>	14.15	4	4
75.	Firefinch, Jameson's	Jamesonse Vuurvinkie	<i>Lagonosticta rhodopareia</i>	7.72	5	4
76.	Firefinch, Red-billed	Rooibekvuurvinkie	<i>Lagonosticta senegala</i>	0.185	3	3
77.	Fiscal, Common (Southern)	Fiskaallaksman	<i>Lanius collaris</i>	87.725	5	4
78.	Fish-eagle, African	Visarend	<i>Haliaeetus vocifer</i>	17.785	3	3
79.	Flamingo, Greater	Grootflamink	<i>Phoenicopterus ruber</i>	1.96	1	0
80.	Flamingo, Lesser	Kleinflamink	<i>Phoenicopterus minor</i>	0.065	0	0
81.	Flufftail, Red-chested	Rooiborsvleikuiken	<i>Sarothrura rufa</i>	0.49	3	3
82.	Flycatcher, Fairy	Feevlieievanger	<i>Stenostira scita</i>	1.99	2	1
83.	Flycatcher, Fiscal	Fiskaalvlieievanger	<i>Sigelus silens</i>	45.735	5	4
84.	Flycatcher, Southern Black	Swartvlieievanger	<i>Melaenornis pammelaina</i>	6.64	2	2
85.	Flycatcher, Spotted	Europese Vlieievanger	<i>Muscicapa striata</i>	13.905	4	0
86.	Francolin, Coqui	Swempie	<i>Peliperdix coqui</i>	0.37	1	1
87.	Francolin, Orange River	Kalaharipatrys	<i>Scleroptila levaillantoides</i>	15.15	3	3
88.	Go-away-bird, Grey	Kwêvoel	<i>Corythaixoides concolor</i>	58.455	4	4
89.	Goose, Egyptian	Kolgans	<i>Alopochen aegyptiacus</i>	79.175	5	4
90.	Goose, Spur-winged	Wildemakou	<i>Plectropterus gambensis</i>	13.375	3	3
91.	Goshawk, Gabar	Kleinsingvalk	<i>Melierax gabar</i>	0.14	1	1
92.	Grass-owl, African	Grasuil	<i>Tyto capensis</i>	0.38	0	0
93.	Grassbird, Cape	Grasvoel	<i>Sphenoeacus afer</i>	0.405	1	1
94.	Grebe, Great Crested	Kuifkopdobbertjie	<i>Podiceps cristatus</i>	10.925	1	1
95.	Grebe, Little	Kleindobbertjie	<i>Tachybaptus ruficollis</i>	45.92	4	4
96.	Green-pigeon, African	Papegaaiduif	<i>Treron calvus</i>	0.36	3	3
97.	Greenshank, Common	Groenpootruiter	<i>Tringa nebularia</i>	4.215	3	0
98.	Guinea fowl, Helmeted	Gewone Tarentaal	<i>Numida meleagris</i>	61.68	5	5
99.	Gull, Grey-headed	Gryskopmeeu	<i>Larus cirrocephalus</i>	42.99	5	0
100.	Hamerkop, Hamerkop	Hamerkop	<i>Scopus umbretta</i>	21.615	4	4
101.	Harrier-Hawk, African	Kaalwangvalk	<i>Polyboroides typus</i>	0.48	2	1
102.	Heron, Black	Swartreier	<i>Egretta ardesiaca</i>	3.195	2	2
103.	Heron, Black-headed	Swartkopreier	<i>Ardea</i>	65.065	4	1

			<i>melanocephala</i>			
104	Heron, Goliath	Reusereier	<i>Ardea goliath</i>	3.9	3	1
105	Heron, Green-backed	Groenrugreier	<i>Butorides striata</i>	8.435	4	3
106	Heron, Grey	Bloureier	<i>Ardea cinerea</i>	35.05	4	1
107	Heron, Purple	Rooireier	<i>Ardea purpurea</i>	15.425	3	1
108	Heron, Squacco	Ralreier	<i>Ardeola ralloides</i>	6.905	3	1
109	Hobby, Eurasian	Europese Boomvalk	<i>Falco subbuteo</i>	3.685	1	0
110	Honey-buzzard, European	Wespedief	<i>Pernis apivorus</i>	1.2	1	0
111	Honeybird, Brown-backed	Skerpbekheuningvoel	<i>Prodotiscus regulus</i>	4.765	3	3
112	Honeyguide, Greater	Grootheuningwyser	<i>Indicator indicator</i>	7.485	3	3
113	Honeyguide, Lesser	Kleinheuningwyser	<i>Indicator minor</i>	15.25	4	4
114	Hoopoe, African	Hoephoep	<i>Upupa africana</i>	35.835	4	4
115	Hornbill, African Grey	Grysneushoringvoel	<i>Tockus nasutus</i>	7.685	3	3
116	House-martin, Common	Huisswael	<i>Delichon urbicum</i>	5.84	4	0
117	Ibis, African Sacred	Skoorsteenveer	<i>Threskiornis aethiopicus</i>	72.865	5	0
118	Ibis, Glossy	Glansibis	<i>Plegadis falcinellus</i>	28.055	4	1
119	Ibis, Hadeda	Hadeda	<i>Bostrychia hagedash</i>	91.07	5	4
120	Indigobird, Purple	Witpootblouvinkie	<i>Vidua purpurascens</i>	1.2	1	1
121	Indigobird, Village	Staalblouvinkie	<i>Vidua chalybeata</i>	0.045	1	1
122	Jacana, African	Grootlangtoon	<i>Actophilornis africanus</i>	1.535	1	1
123	Kestrel, Greater	Grootrooivalk	<i>Falco rupicoloides</i>	2.005	1	1
124	Kestrel, Lesser	Kleinrooivalk	<i>Falco naumanni</i>	0.195	1	0
125	Kingfisher, Brown-hooded	Bruinkopvisvanger	<i>Halcyon albiventris</i>	8.755	4	4
126	Kingfisher, Giant	Reusevisvanger	<i>Megaceryle maximus</i>	18.855	4	4
127	Kingfisher, Half-collared	Blouvisvanger	<i>Alcedo semitorquata</i>	0.405	2	2
128	Kingfisher, Malachite	Kuifkopvisvanger	<i>Alcedo cristata</i>	17.275	4	4
129	Kingfisher, Pied	Bontvisvanger	<i>Ceryle rudis</i>	23.27	4	4
130	Kingfisher, Woodland	Bosveldvisvanger	<i>Halcyon senegalensis</i>	6.505	3	3
131	Kite, Black	Swartwou	<i>Milvus migrans</i>	1.635	1	0
132	Kite, Black-shouldered	Blouvalk	<i>Elanus caeruleus</i>	56.655	5	4
133	Kite, Yellow-billed	Geelbekwou	<i>Milvus aegyptius</i>	9.93	2	0
134	Korhaan, Northern Black	Witvlerkkorhaan	<i>Afrotis afraoides</i>	17.37	2	2



135	Korhaan, White-bellied	Witpenskorhaan	<i>Eupodotis senegalensis</i>	1.195	0	0
136	Lapwing, African Wattled	Lelkiewiet	<i>Vanellus senegallus</i>	50.85	5	4
137	Lapwing, Blacksmith	Bontkiewiet	<i>Vanellus armatus</i>	72.99	5	4
138	Lapwing, Crowned	Kroonkiewiet	<i>Vanellus coronatus</i>	72.885	4	4
139	Lark, Eastern Clapper	Hoeveldklappertjie	<i>Mirafra fasciolata</i>	0.64	1	1
140	Lark, Melodious	Spotlewerik	<i>Mirafra cheniana</i>	0.15	1	1
141	Lark, Red-capped	Rooikoplewerik	<i>Calandrella cinerea</i>	1.915	1	1
142	Lark, Rufous-naped	Rooineklewerik	<i>Mirafra africana</i>	21.6	3	3
143	Lark, Spike-heeled	Vlaktelewerik	<i>Chersomanes albofasciata</i>	2.6	2	2
144	Longclaw, Cape	Oranjekeelkalkoentjie	<i>Macronyx capensis</i>	33.1	4	4
145	Mannikin, Bronze	Gewone Fret	<i>Spermestes cucullatus</i>	22.075	5	4
146	Marsh-harrier, African	Afrikaanse Vleivalk	<i>Circus ranivorus</i>	0.11	0	0
147	Martin, Banded	Gebande Oewerswael	<i>Riparia cincta</i>	1.1	1	1
148	Martin, Brown-throated	Afrikaanse Oewerswael	<i>Riparia paludicola</i>	33.825	5	4
149	Martin, Rock	Kransswael	<i>Hirundo fuligula</i>	19.415	3	3
150	Masked-weaver, Southern	Swartkeelgeelvink	<i>Ploceus velatus</i>	94.83	5	5
151	Moorhen, Common	Grootwaterhoender	<i>Gallinula chloropus</i>	55.98	5	4
152	Mousebird, Red-faced	Rooiwangmuisvoel	<i>Urocolius indicus</i>	44.42	4	4
153	Mousebird, Speckled	Gevlekte Muisvoel	<i>Colius striatus</i>	67.185	4	4
154	Mousebird, White-backed	Witkruisvoel	<i>Colius colius</i>	2.22	1	1
155	Myna, Common	Indiese Spreeu	<i>Acridotheres tristis</i>	92.975	5	4
156	Neddicky, Neddicky	Neddikkie	<i>Cisticola fulvicapilla</i>	34.185	4	4
157	Night-Heron, Black-crowned	Gewone Nagreier	<i>Nycticorax nycticorax</i>	6.06	3	1
158	Nightjar, European	Europese Naguil	<i>Caprimulgus europaeus</i>	0.415	1	0
159	Nightjar, Rufous-cheeked	Rooiwangnaguil	<i>Caprimulgus rufigena</i>	0.39	1	1
160	Olive-pigeon, African	Geelbekbosduif	<i>Columba arquatrix</i>	17.425	4	4
161	Oriole, Black-headed	Swartkopwielewaal	<i>Oriolus larvatus</i>	4.75	3	3
162	Owl, Barn	Nonnetjie-uil	<i>Tyto alba</i>	4.735	3	3
163	Owl, Marsh	Vlei-uil	<i>Asio capensis</i>	16.895	2	2
164	Painted-snipe, Greater	Goudsnip	<i>Rostratula benghalensis</i>	0.045	0	0
165	Palm-swift, African	Palmwindswael	<i>Cypsiurus parvus</i>	47.525	5	0
166	Paradise-flycatcher, African	Paradysvlievanger	<i>Terpsiphone viridis</i>	17.15	4	4

167	Parakeet, Rose-ringed	Ringnekparkiet	<i>Psittacula krameri</i>	2.41	4	4
168	Pigeon, Speckled	Kransduif	<i>Columba guinea</i>	50.815	5	4
169	Pipit, African	Gewone Koester	<i>Anthus cinnamomeus</i>	30.78	4	4
170	Pipit, Buffy	Vaalkoester	<i>Anthus vaalensis</i>	0.34	1	1
171	Pipit, Long-billed	Nicholsonse Koester	<i>Anthus similis</i>	0.47	1	1
172	Pipit, Plain-backed	Donkerkoester	<i>Anthus leucophrys</i>	0.87	1	1
173	Plover, Common Ringed	Ringnekstrandkiewiet	<i>Charadrius hiaticula</i>	0.11	2	0
174	Plover, Three-banded	Driebandstrandkiewiet	<i>Charadrius tricollaris</i>	35.41	5	4
175	Pochard, Southern	Bruineend	<i>Netta erythrophthalma</i>	20.62	2	2
176	Pratincole, Black-winged	Swartvlerksprinkaanvoel	<i>Glareola nordmanni</i>	0.02	0	0
177	Prinia, Black-chested	Swartbandlangstertjie	<i>Prinia flavicans</i>	36.425	5	4
178	Prinia, Tawny-flanked	Bruinsylangstertjie	<i>Prinia subflava</i>	57.425	5	4
179	Puffback, Black-backed	Sneeubal	<i>Dryoscopus cubla</i>	4.93	3	3
180	Pytilia, Green-winged	Gewone Melba	<i>Pytilia melba</i>	0.12	1	1
181	Quail, Common	Afrikaanse Kwartel	<i>Coturnix coturnix</i>	0.39	2	2
182	Quailfinch, African	Gewone Kwartelvinkie	<i>Ortygospiza atricollis</i>	3.715	3	3
183	Quelea, Red-billed	Rooibekkwelea	<i>Quelea quelea</i>	10.585	3	3
184	Rail, African	Grootriethaan	<i>Rallus caerulescens</i>	0.455	3	3
185	Reed-warbler, African	Kleinrietsanger	<i>Acrocephalus baeticatus</i>	11.815	4	4
186	Reed-warbler, Great	Grootrietsanger	<i>Acrocephalus arundinaceus</i>	4.355	2	0
187	Robin-chat, Cape	Gewone Janfrederik	<i>Cossypha caffra</i>	76.125	4	4
188	Roller, European	Europese Troupant	<i>Coracias garrulus</i>	0.15	0	0
189	Roller, Lilac-breasted	Gewone Troupant	<i>Coracias caudatus</i>	0.23	1	1
190	Ruff, Ruff	Kemphaan	<i>Philomachus pugnax</i>	2.975	3	0
191	Rush-warbler, Little	Kaapse Vleisanger	<i>Bradypterus baboecala</i>	9.405	4	3
192	Sandpiper, Common	Gewone Ruiters	<i>Actitis hypoleucos</i>	11.965	4	0
193	Sandpiper, Green	Witgatruiter	<i>Tringa ochropus</i>	1.2	1	0
194	Sandpiper, Marsh	Moerasruiter	<i>Tringa stagnatilis</i>	1.785	1	0
195	Sandpiper, Wood	Bosruiter	<i>Tringa glareola</i>	11.27	3	0
196	Scimitarbill, Common	Swartbekkakalear	<i>Rhinopomastus cyanomelas</i>	0.13	1	1
197	Secretarybird	Sekretarisvoel	<i>Sagittarius serpentarius</i>	0.37	0	0

198	Seedeater, Streaky-headed	Streepkopkanarie	<i>Crithagra gularis</i>	10.81	3	3
199	Shelduck, South African	Kopereend	<i>Tadorna cana</i>	0.195	3	3
200	Shoveler, Cape	Kaapse Slopeend	<i>Anas smithii</i>	5.25	3	3
201	Shrike, Lesser Grey	Gryslaksman	<i>Lanius minor</i>	1.43	1	0
202	Shrike, Red-backed	Rooiruglaksman	<i>Lanius collurio</i>	4.345	2	0
203	Snipe, African	Afrikaanse Snip	<i>Gallinago nigripennis</i>	7.78	4	3
204	Sparrow, Cape	Gewone Mossie	<i>Passer melanurus</i>	82.79	5	4
205	Sparrow, House	Huismossie	<i>Passer domesticus</i>	59.125	4	4
206	Sparrow, Southern Grey-headed	Gryskopmossie	<i>Passer diffusus</i>	34.565	4	4
207	Sparrowhawk, Black	Swartsperwer	<i>Accipiter melanoleucus</i>	2.26	3	3
208	Sparrowhawk, Little	Kleinsperwer	<i>Accipiter minullus</i>	1.59	3	3
209	Sparrowhawk, Ovambo	Ovambosperwer	<i>Accipiter ovampensis</i>	8.805	4	4
210	Spoonbill, African	Lepelaar	<i>Platalea alba</i>	11.07	3	0
211	Spurfowl, Swainson's	Bosveldfisant	<i>Pternistis swainsonii</i>	41.945	4	4
212	Starling, Cape Glossy	Kleinglansspreeu	<i>Lamprotonis nitens</i>	62.56	4	4
213	Starling, Pied	Witgatspreeu	<i>Spreo bicolor</i>	25.365	3	2
214	Starling, Red-winged	Rooivlerkspreeu	<i>Onychognathus morio</i>	15.315	4	1
215	Starling, Wattled	Lelspreeu	<i>Creatophora cinerea</i>	1.495	2	1
216	Stilt, Black-winged	Rooipootelsie	<i>Himantopus himantopus</i>	10.995	3	2
217	Stint, Little	Kleinstrandloper	<i>Calidris minuta</i>	2.77	3	0
218	Stonechat, African	Gewone Bontrokkie	<i>Saxicola torquatus</i>	50.925	4	4
219	Stork, Abdim's	Kleinswartooievaar	<i>Ciconia abdimii</i>	0.435	0	0
220	Stork, Black	Grootswartooievaar	<i>Ciconia nigra</i>	0.11	0	0
221	Stork, Marabou	Maraboe	<i>Leptoptilos crumeniferus</i>	0.14	0	0
222	Stork, Saddle-billed	Saalbekooievaar	<i>Ephippiorhynchus senegalensis</i>	0.02	0	0
223	Stork, White	Witooievaar	<i>Ciconia ciconia</i>	4.87	1	0
224	Stork, Yellow-billed	Nimmersat	<i>Mycteria ibis</i>	0.02	0	0
225	Sunbird, Amethyst	Swartsuikerbekkie	<i>Chalcomitra amethystina</i>	31.435	5	4
226	Sunbird, Malachite	Jangroentjie	<i>Nectarinia famosa</i>	0.98	1	1
227	Sunbird, White-bellied	Witpensuikerbekkie	<i>Cinnyris talatala</i>	14.68	4	4
228	Swallow, Barn	Europese Swael	<i>Hirundo rustica</i>	38.705	5	0
229	Swallow, Greater Striped	Grootstreepswael	<i>Hirundo cucullata</i>	42.695	5	4

230	Swallow, Lesser Striped	Kleinstreepswael	<i>Hirundo abyssinica</i>	24.11	4	4
231	Swallow, Red-breasted	Rooiborsswael	<i>Hirundo semirufa</i>	1.71	2	1
232	Swallow, White-throated	Witkeelswael	<i>Hirundo albigularis</i>	41.715	5	4
233	Swamp-warbler, Lesser	Kaapse Rietsanger	<i>Acrocephalus gracilirostris</i>	36.545	4	4
234	Swamphen, African Purple	Grootkoningriethaan	<i>Porphyrio madagascariensis</i>	10.385	2	2
235	Swift, African Black	Swartwindswael	<i>Apus barbatus</i>	1.97	2	0
236	Swift, Common	Europese Windswael	<i>Apus apus</i>	2.235	2	0
237	Swift, Horus	Horuswindswael	<i>Apus horus</i>	4.355	2	2
238	Swift, Little	Kleinwindswael	<i>Apus affinis</i>	38.185	4	4
239	Swift, White-rumped	Witkruiswindswael	<i>Apus caffer</i>	41.54	5	4
240	Tchagra, Black-crowned	Swartkroontjagra	<i>Tchagra senegalus</i>	2.265	2	2
241	Tchagra, Brown-crowned	Rooivlerktjagra	<i>Tchagra australis</i>	0.795	1	1
242	Teal, Cape	Teeleend	<i>Anas capensis</i>	1.405	1	1
243	Teal, Hottentot	Gevlekte Eend	<i>Anas hottentota</i>	1.25	1	1
244	Teal, Red-billed	Rooibekeend	<i>Anas erythrorhyncha</i>	5.87	3	3
245	Tern, Whiskered	Witbaardsterretjie	<i>Chlidonias hybrida</i>	4.01	2	0
246	Tern, White-winged	Witvlerksterretjie	<i>Chlidonias leucopterus</i>	1.94	1	0
247	Thick-knee, Spotted	Gewone Dikkop	<i>Burhinus capensis</i>	38.085	4	4
248	Thrush, Karoo	Geelbeklyster	<i>Turdus smithi</i>	72.53	4	4
249	Thrush, Kurrichane	Rooibeklyster	<i>Turdus libonyanus</i>	9.765	3	3
250	Tinkerbird, Yellow-fronted	Geelblestinker	<i>Pogoniulus chrysoconus</i>	0.045	3	3
251	Tit-babbler, Chestnut-vented	Bosveldtjeriktik	<i>Parisoma subcaeruleum</i>	13.99	2	2
252	Turtle-dove, Cape	Gewone Tortelduif	<i>Streptopelia capicola</i>	89.2	5	4
253	Vulture, Cape	Kransaasvoel	<i>Gyps coprotheres</i>	0.02	0	0
254	Wagtail, African Pied	Bontkwikkie	<i>Motacilla aguimp</i>	0.295	1	1
255	Wagtail, Cape	Gewone Kwikkie	<i>Motacilla capensis</i>	71.68	5	4
256	Warbler, Garden	Tuinsanger	<i>Sylvia borin</i>	2.485	1	0
257	Warbler, Marsh	Europese Rietsanger	<i>Acrocephalus palustris</i>	4.435	2	1
258	Warbler, River	Sprinkaansanger	<i>Locustella fluviatilis</i>	0.6	1	0
259	Warbler, Sedge	Europese Vleisanger	<i>Acrocephalus schoenobaenus</i>	0.905	1	0
260	Warbler, Willow	Hofsanger	<i>Phylloscopus trochilus</i>	19.83	4	0
261	Waxbill, Blue	Gewone Blousysie	<i>Uraeginthus</i>	0.22	2	2

			<i>angolensis</i>			
262	Waxbill, Common	Rooibeksysie	<i>Estrilda astrild</i>	25.825	5	4
263	Waxbill, Orange-breasted	Rooiassie	<i>Amandava subflava</i>	6.285	4	4
264	Weaver, Cape	Kaapse Wewer	<i>Ploceus capensis</i>	17.575	4	4
265	Weaver, Thick-billed	Dikbekwewer	<i>Amblyospiza albifrons</i>	26.125	4	4
266	Wheatear, Capped	Hoevelskaapwagter	<i>Oenanthe pileata</i>	4.4	2	2
267	Wheatear, Mountain	Bergwagter	<i>Oenanthe monticola</i>	16.625	2	2
268	White-eye, Cape	Kaapse Glasogie	<i>Zosterops virens</i>	78.16	5	4
269	White-eye, Orange River	Gariepglasogie	<i>Zosterops pallidus</i>	39.31	4	4
270	Whydah, Pin-tailed	Koningrooibekkie	<i>Vidua macroura</i>	28.25	5	4
271	Widowbird, Long-tailed	Langstertflap	<i>Euplectes progne</i>	26.705	4	4
272	Widowbird, Red-collared	Rooikeelflap	<i>Euplectes ardens</i>	12.365	4	4
273	Widowbird, White-winged	Witvlerkflap	<i>Euplectes albonotatus</i>	2.695	4	4
274	Wood-hoopoe, Green	Rooibekkekelaar	<i>Phoeniculus purpureus</i>	48.34	4	4
275	Woodpecker, Cardinal	Kardinaalspeg	<i>Dendropicos fuscescens</i>	9.875	4	4
276	Woodpecker, Golden-tailed	Goudstertspeg	<i>Campethera abingoni</i>	1.525	2	2
277	Wryneck, Red-throated	Draaihals	<i>Jynx ruficollis</i>	16.355	3	3
<b>Totals</b>				0	17 Species (6.2%)	60 Species (22.7%)
				1	52 Species (18.7%)	53 Species (19.2%)
				2	44 Species (15.9%)	29 Species (9.4%)
				3	53 Species (19.2%)	46 Species (16.6%)
				4	70 Species (25.2%)	85 Species (30.7%)
				5	41 Species (14.8%)	4 Species (1.4%)
<b>Total Red Data Species Recorded for 2628AA QDS</b>				23		

Habitat Preference – HP, Breeding –Br. Reporting Rate – Rep Rate %

The reporting rate is calculated as follows: Total number of cards on which a species was reported (SABAP1) x 100 ÷ total number of cards submitted for the particular grid cell + the total number of cards on which a species was reported (SABAP2) x 100 ÷ total number of cards submitted for the particular pentad ÷ 2.

**Red Data Bird Species**

Red Data bird species previously recorded within the 2628AA QDS according to Harrison et al (1997), Tarboton et al (1987) (Table 2).

**Table 2: Red Data bird species recorded for the 2628AA QDS to date.**

	Species name	Latest Date Record (Year)	Red Data: (Regional; Global)	Taxonomic name	Rep Rate (%)	HP	Br
1.	Crane, Blue	2016	NT, VU	<i>Anthropoides paradiseus</i>	0.5	0	0
2.	Duck, Maccoa	2015	NT, NT	<i>Oxyura maccoa</i>	1.08	1	1
3.	Eagle, Martial	Prior to 2007	EN, VU	<i>Polemaetus bellicosus</i>	0.02	0	0
4.	Eagle, Verreaux's	Prior to 2007	VU, LC	<i>Aquila verreauxii</i>	0.02	0	0
5.	Falcon, Lanner	2016	VU, LC	<i>Falco biarmicus</i>	0.62	1	0
6.	Falcon, Red-footed	2016	NT, NT	<i>Falco vespertinus</i>	0.14	1	0
7.	Flamingo, Greater	2015	NT, LC	<i>Phoenicopterus ruber</i>	1.96	1	0
8.	Flamingo, Lesser	Prior to 2007	NT, NT	<i>Phoenicopterus minor</i>	0.065	0	0
9.	Grass-owl, African	2012	VU, LC	<i>Tyto capensis</i>	0.38	0	0
10.	Kingfisher, Half-collared	2016	NT, LC	<i>Alcedo semitorquata</i>	0.405	2	2
11.	Korhaan, White-bellied	Prior to 2007	VU, LC	<i>Eupodotis senegalensis</i>	1.195	0	0
12.	Lark, Melodious	Prior to 2007	LC, NT	<i>Mirafrja cheniana</i>	0.15	1	1
13.	Marsh-harrier, African	Prior to 2007	EN, LC	<i>Circus ranivorus</i>	0.11	0	0
14.	Painted-snipe, Greater	Prior to 2007	NT, LC	<i>Rostratula benghalensis</i>	0.45	1	0
15.	Pratincole, Black-winged	Prior to 2007	NT, NT	<i>Glareola nordmanni</i>	0.02	0	0
16.	Roller, European	Prior to 2007	NT, LC	<i>Coracias garrulus</i>	0.15	0	0
17.	Secretarybird,	Prior to 2007	VU, VU	<i>Sagittarius serpentarius</i>	0.37	0	0
18.	Stork, Abdim's	Prior to 2007	VU, VU	<i>Ciconia abdimii</i>	0.435	0	0
19.	Stork, Black	Prior to 2007	VU, LC	<i>Ciconia nigra</i>	0.11	0	0
20.	Stork, Marabou	2015	NT, LC	<i>Leptoptilos crumeniferus</i>	0.14	0	0
21.	Stork, Saddle-billed	Prior to 2007	EN, LC	<i>Ephippiorhynchus senegalensis</i>	0.02	0	0
22.	Stork, Yellow-billed	Prior to 2007	EN, LC	<i>Mycteria ibis</i>	0.02	0	0
23.	Vulture, Cape	2013	EN, EN	<i>Gyps coprotheres</i>	0.02	0	0

**Red data species Categories for the Birds of Southern Africa (Birdlife South Africa 2015)**

LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered.

A total of 23 Red Data species have previously been recorded within the 2628AA QDS (**Table 2**). Fourteen of which have not yet been recorded within the 2600\_2805 pentad since the commencement of the South African Bird Atlas Project 2 in 2007; therefore these species are highly unlikely to recur as they have not been recorded in the pentad within the past 9 years. This could be as a result of various factors such as, habitat loss, degradation or fragmentation. Nine of the 23 species have been recorded during the past five years, however, the reporting rates of these species are extremely low and they are unlikely to occur on the study area. Of the above named Red Data species, only the Half-collared Kingfisher could potentially be resident on the study area. The southern boundary of the study area borders the Jukskei River which could be considered the preferred habitat for the Half-collared Kingfisher. The stretch of the Jukskei River bordering the study area is however highly polluted, thus the probability of this species occurring is unlikely, however it's occurrence cannot be ruled out entirely. The water quality itself does not affect this species directly but rather its food source which in turn has a negative effect, forcing it move. The unlikely occurrence of this species can also be as a result of the variability of water levels and un-deterministic flooding of the river due to inappropriate storm water management. This will invariably affect the breeding habitat which could deter this species from utilising the area.

## 6. Findings

The distinct habitats identified on the study area contain a large variety of bird species, approximately 135, with habitats ranging from grassland, savanna, riverine, wetland associated species as well as species adapted to a disturbed and/ or transformed environments. Although some parts of the study area can be deemed as the preferred habitat for certain Red Data species previously recorded within the QDS, the surrounding land use and disturbance in the form of roads, urbanization, pollution and habitat transformation through alien vegetation infestation and man-made barriers, significantly reduces the probable occurrence of these mostly specialized and localized species. Only the Half-collared Kingfisher can be expected to occur on the study area provided that proper rehabilitation of the stretch of the Jukskei River bordering the Southern part of the study area is carried out.

## 7. Limitations

The bulk of the data used to conclude the distribution of Red Data species were sourced by making use of the SABAP 1 and 2 data basis. Any limitations in the above mentioned studies will in effect have implications on the findings and conclusion of this assessment. Furthermore this avifaunal assessment was conducted during April; hence the survey was done outside the main breeding period of the local bird species. Moreover, most of the Palearctic and intra-Africa migratory bird species have started their migration to the North by this time. With respect to this assessment the implications of not being able to record migratory bird species will be minimal, seeing as most are threatened in their Northern hemisphere distributions.

Limited time to conduct the survey could potentially result in not recording all species within the study area. Three and a half hours were spent on site while conducting this avifaunal assessment. As a result of the small size of the study area as well as the amount of disturbance on the study area, three hours was deemed sufficient time to record all the resident bird species on and around the study area.



## 8. Recommendations

- Prior to any activities commencing on site, all construction staff should be briefed in an environmental induction regarding the environmental status and requirements of the site. This should include providing general guidelines for minimizing environmental damage during construction, as well as education with regards to basic environmental ethics, such as the prevention of littering, lighting of fires, etc.
- Induction should be done for all civil contractors and for each building contractor prior to them commencing on site.
- Areas where construction is to take place should be clearly demarcated and fenced off, all areas outside that of the defined works should be deemed no-go areas.
- All construction activities must be restricted to the demarcated areas to ensure that no further disturbance into the surrounding vegetation or habitat takes place.
- It is recommended that prior to the commencement of construction activities' initial clearing of all alien vegetation should take place.
- No vehicles should be allowed to move in or through the drainage line. This will cause destruction of faunal habitat and will leave notable scares on site.
- The contractor must ensure that no faunal species are trapped, killed or in any way disturbed during construction. Collecting of eggs such as Guineafowl and duck eggs present on site should not be tolerated.
- It is recommended that all concrete and cement works be restricted to areas of low ecological sensitivity and defined on site and clearly demarcated. Cement powder has a high alkalinity pH rating, which can contaminate and affect both soil and water pH dramatically. A shift in the pH can have serious consequences on the functioning of soil, vegetation and fauna.
- To ensure minimal disturbance of avifaunal species it is recommended that construction should take place during winter, outside the breeding season of the species present on site.
- Construction, vegetation clearing and top soil clearing should commence from a predetermined location and gradually commence to ensure that birds and other fauna present on the site have enough time to relocate.
- When construction is completed, disturbed areas should be rehabilitated using vegetation cleared prior to construction to ensure that the habitat stays intact and that faunal species present on the site before construction took place, return to the area.
- The section of the Jukskei River bordering the study area on the South should be rehabilitated and pollution prevention method must be put in place to prevent further degradation of the habitat.
- It is recommended that no construction takes place within 32 meters of the Jukskei River as well as within 32 meters of the western edge of the drainage line, as this area contains signs of a seasonal wetland. The Eastern side of the drainage line does not require a buffer.



## 9. Conclusion

The largest part of the study area supports a number of widespread grassland bird species such as Widowbirds, Bishops, Lapwings and Weaver with other species like African Stonechat, Pipits and Cape Longclaw scattered throughout the study area at a lower frequency. Other species such as Dark-capped Bulbul, Karoo Thrush, Barbets, Southern Boubou, Flycatchers, Honeyguides, etcetera occurring on the study area are mostly confined to the Rocky outcrop and the Riverine area where large indigenous and alien trees are present. These species include; Cisticolas, Prinias, Bulbuls, Dove's, Ducks, Ibis etc. None of the bird species recorded or considered to have a high occurrence probability is of conservation concern.

The Riverine area and the Drainage Line do however provide the optimal habitat for a number of widespread species and the Riverine area could potentially support the Red-listed Half-collared Kingfisher. For these reasons the Riverine area and Drainage line are considered to be of high ecological sensitivity.

Due to the near natural state of the habitat, the Eastern Grassland and the Rocky outcrop was deemed to have moderate sensitivity in terms of avifauna richness, the rest of the study area was judged to have a low ecological and avifaunal sensitivity level (**Figure 9**). Should development take place, it is suggested that no disturbance occurs within the Riverine and Drainage line areas. None of the 23 Red Data avifaunal species recorded for the 2628AA QDS are likely to occur on the study area, with the exception of the Half-collared Kingfisher, provided that proper rehabilitation of the Riverine area is implemented. Most of the Red Data species recorded for the 2628AA QDS were recorded before 2007 of which many of these species were probably not recorded on the study area. Although the Riverine habitat is the preferred habitat for the Half-collared Kingfisher, this bird is unlikely to occur as a result of the highly polluted state of the river. In conclusion, apart from the Half-collared Kingfisher, no evidence in the form of suitable breeding, roosting and foraging habitat was found on the study area to support the presence or probable occurrence of any Red Data avifaunal species.

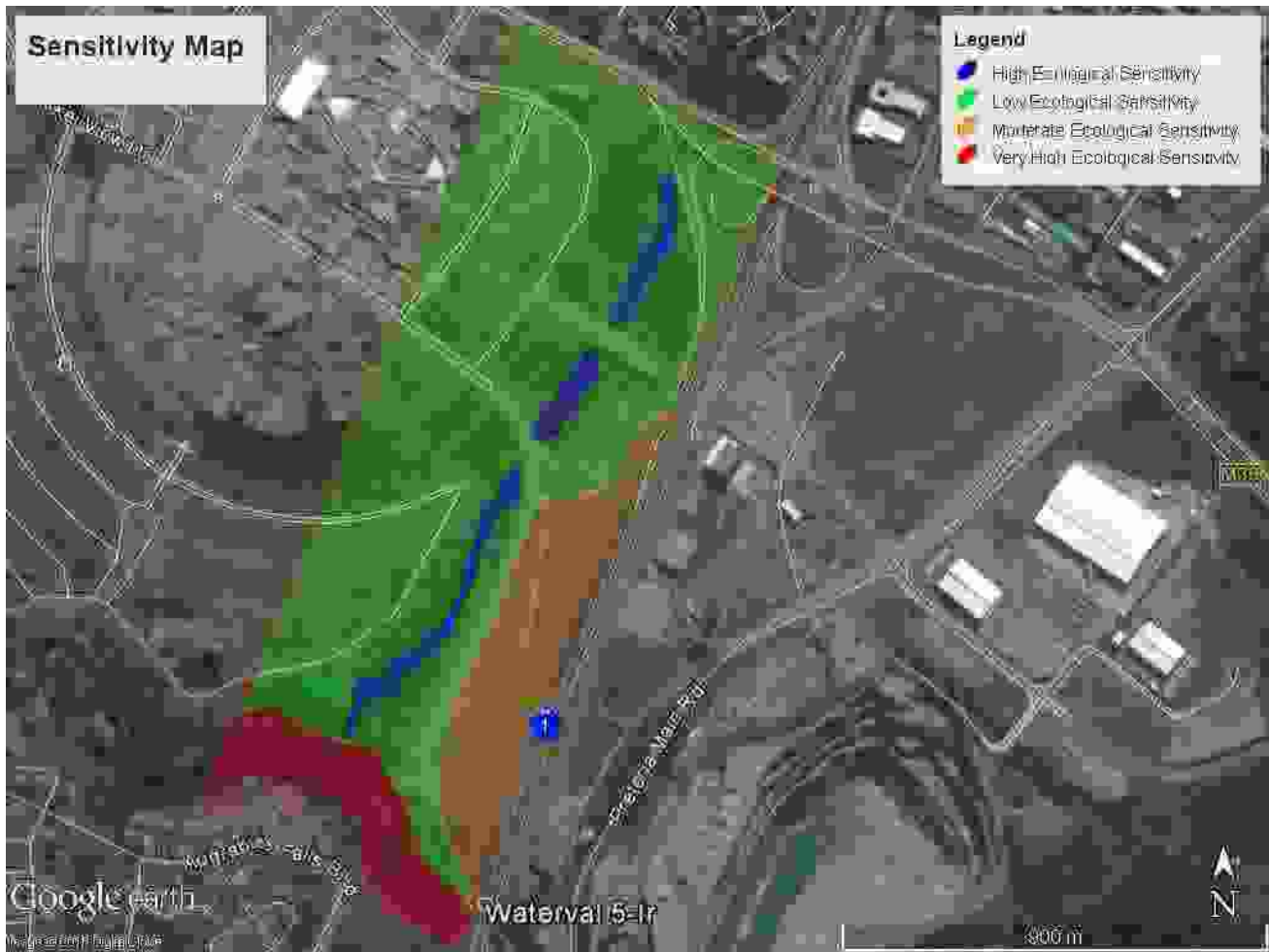


Figure 9: Avifaunal Sensitivity Map

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# Annexure N

## Environmental Management Plan



# DRAFT Environmental Management Programme (EMPr) For Portions of the Remainder of Portion 1 of the Farm Waterval 5IR



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**May 2016**

**Ref No: 006/16-17/E0010**

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## 1. Project Outline

### 1.1 Background

**Bokamoso Landscape Architects and Environmental Consultants CC** were appointed by Atterbury Waterfall Investment Company (PTY) LTD to conduct an Amendment **Environmental Authorisation** for the Proposed Mixed-use Development for which Environmental Authorisation was granted under Reference Number GAUT 002/05-06/1476.

This is a Draft Environmental Management Programme (EMPr), as part of the Amendment Application, and it will be finalised when the Impact Assessment has been completed and more detail on associated impacts are available.

### 1.2 Project description

The Proposed Mixed-use Development is situated on portions of the Remainder of Portion 1 of the Farm Waterval 5IR in Midrand, Gauteng, just south of Allandale Road and west of the N1 freeway. The study site falls in the jurisdiction of the City of Johannesburg Metropolitan Municipality. (*Refer to Figure 1 for the Locality Map and Figure 2 for the Aerial Map*).

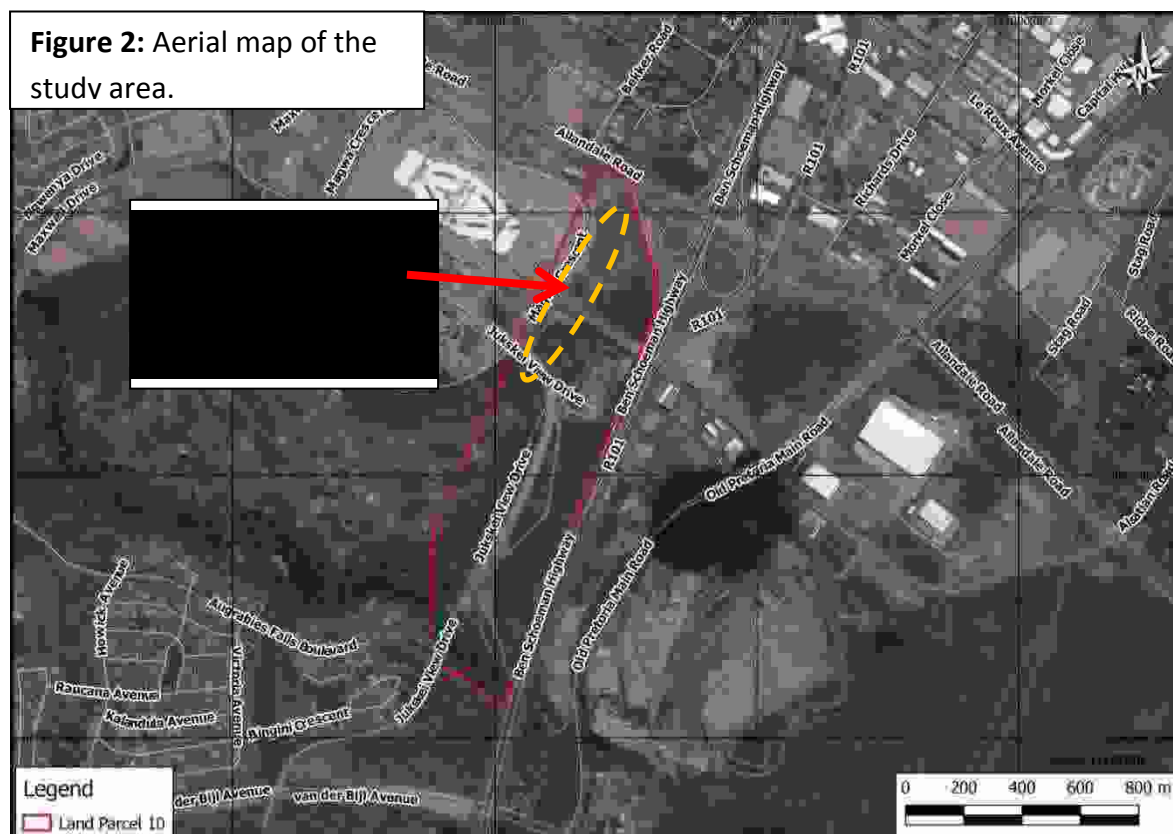
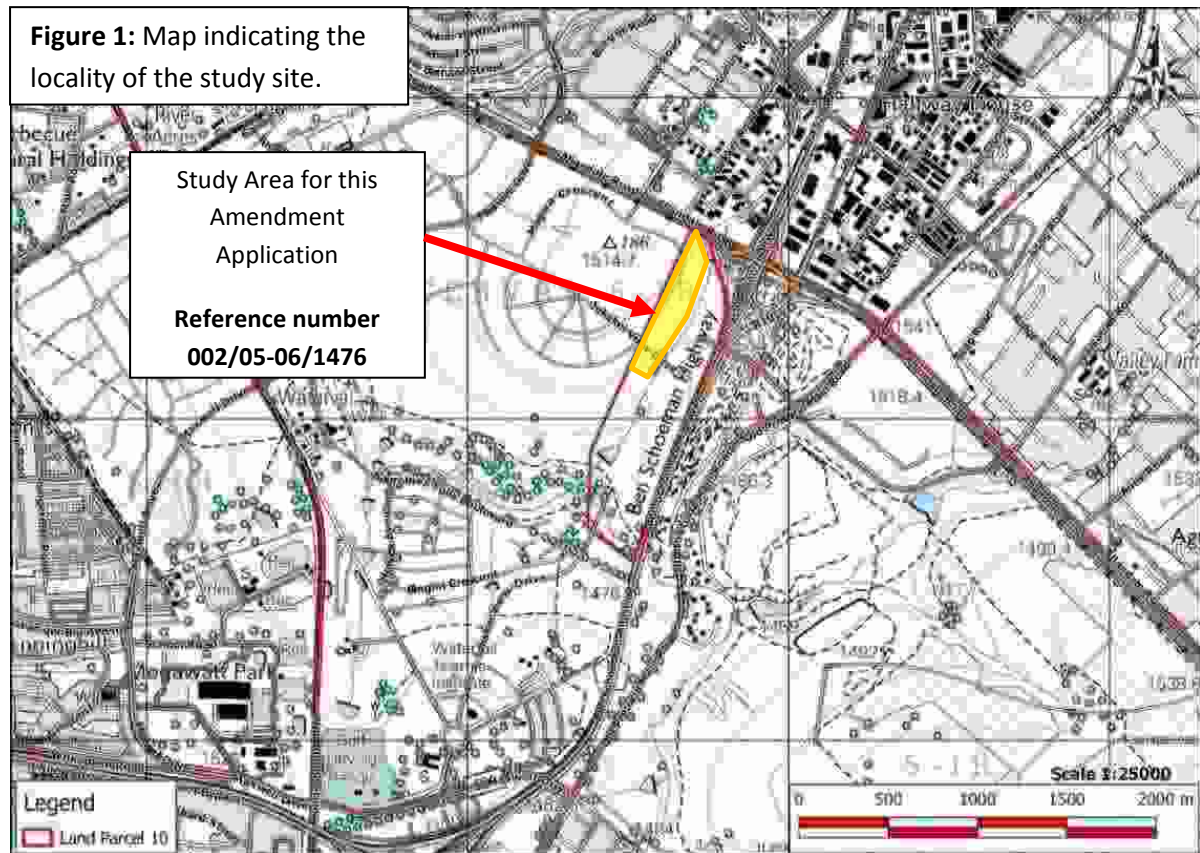
#### **Timeframe for construction:**

The construction timeframe for the development that will encroach onto the 30m wetland buffer will be determined by the potential tenants/ new occupants of the structures to be erected. The applicant already negotiated with several big tenants that are interested to occupy the proposed new structures, but the construction and occupation timeframes of the various tenants/ occupants can only be finalized once delegated authority agreed to the relaxation of the 30m buffer,

At this stage the applicant is planning to develop the area within the next 5-10 years and the storm water management and rehabilitation measures will be implemented per phase to be developed. It is also important to note that the some of the maintenance and rehabilitation measures will be applied from the outset and will be implemented in an on-going basis. The measures to be implemented in an on-going basis are highlighted in green in the EMPr to follow. This EMPr will be a binding document for purposes of compliance.

**Take note:** There is already an approved Rehabilitation Plan and EMPr for the study area and no amendments to these plans will be required. However, a new Rehabilitation Plan and EMPr which will specifically be applicable to the relaxation of the 30m buffer area, potential impacts associated with the proposed development activities within the 30m buffer and to additional rehabilitation works and proposed mitigation measures required within the watercourse to accommodate the hydrological changes. This will be submitted as part of the amendment environmental authorisation, Bokamoso therefore request that

GDARD regard this as supplementary documentation to the existing Rehabilitation Plan and EMPr which have already been approved and implemented in the former authorisations.



### 1.3 Receiving Environment

#### Hydrology:

- A perennial river and man-made/ artificial wetland occurs within the study area.
- The perennial river is situated downstream (south of the study area) of the wetland.

#### Wetland:

- The *Hydropedology based Wetland Buffer Assessment and Management Report* done by **TerraSoil Science** indicate that the wetland area has been transformed significantly through historical anthropological activities in the form of urban infrastructure development and storm water modifications
- The water course/wetland area towards the north of the study area has been rehabilitated to accommodate more water and attenuate water energy and flow.
- The site requires very significant and focussed storm water planning and intervention for the stabilisation of the watercourse as well as prevention of sediment generation.
- Further downstream rehabilitation might still be needed to compensate for the additional storm water runoff created by the removal of the wetland buffer.

#### Geology and Soils:

- The Halfway House Granite Dome Catena is a well-studied example of a quartz dominated Bb catena.
- The soils in the drainage feature are predominantly high clay content swelling soils with vertic properties.
- Vertic soils are highly erodible once disturbed which could cause rapid degradation of the watercourse once storm water volumes increase following surface sealing in the wetland buffer zone and its surrounding areas.

#### Flora:

The Proposed Development falls in the Egoli Granite Grassland vegetation unit which is regarded as Endangered (Mucina and Rutherford, 2006). According to **Bokamoso Environmental Specialist Division** the rehabilitated wetland area is dominated by *Cyperus* sp., *Fuirena* sp., *Imperata cylindrical*, *Schoenoplectus* sp., and *Typha capensis*. Some alien species such as *Ipomoea purpurea*, *Tagetes minuta*, *Verbena* spp. and *Xanthium spinosum* also occur. Indigenous trees such as *Celtis africana*, *Combretum erythrophyllum*, *Olea europaea* subsp. *africana*, *Searsia lancea* and *Vachellia karroo* were planted on the embankments of the wetland to stabilise the soil.

**Fauna:**

All the fauna studies were conducted by **Bokamoso Environmental: Specialist Division**. Both the drainage line and the riverine habitat provide important ecological functions in terms of connectivity and as such both are considered to be highly sensitive from a faunal perspective regardless of their current state.

**Birds**

Birds species that can possibly occur in and around the study area include Widowbirds, Bishops, Lapwings, Weaver, African Stonechat, Pipits Dark-capped Bulbul, Karoo Thrush, Barbets, Southern Boubou, Flycatchers, Honeyguides and Cape Longclaw. None of the bird species recorded or considered to have a high occurrence probability is of conservation concern; however the Jukskeiriver could potentially support the Red-listed Half-collared Kingfisher. None of the 23 Red Data avifaunal species recorded for the 2628AA QDS are likely to occur on the study area, with the exception of the Half-collared Kingfisher, provided that proper rehabilitation of the riverine area is implemented. In addition, the wetland area provides the optimal habitat for a number of widespread species. Both the riverine and wetland area is considered to be of high importance for the protection of avifauna species.

**Mammals**

The drainage line and riverine habitat have the potential to support sensitive species and/or species with conservation concerns (Vlei Rats and Otters). None of these species are believed to occur at present on account of the fairly recent construction activities within with the drainage line as well as the polluted and degraded state of the riverine habitat. No Red-listed mammal species was recorded for this site, however both the riverine and wetland area is considered to be of high importance for the protection of mammal species.

**Amphibians and Reptiles**

Five species of amphibians and three species of reptiles were given a high probability of occurring in the riverine area (**Refer to Annexure**). No threatened species is known to occur in the area.

**Invertebrates:**

The presence of aquatic invertebrate species provides immediate evidence for the existence of a watercourse. Species such as *Crocothemis* which are dependent on wetland habitats makes it necessary to preserve the wetland. No sensitive invertebrate species were recorded or are expected to occur within the study area.

**Visual:**

The Proposed Development will consist of numerous prominent building structures which will be highly visible to the surrounding area, including the Ben Schoeman N1 highway. However, the proposed development is situated on probably one of the busiest areas in the country (between Pretoria and Johannesburg in the highest economic province in the country) will improve the aesthetic value of the area and may even contribute to the 'sense of place' if adequate measures as described later in this document are taken into consideration.

## **2. EMPr Objectives and context**

### **Objectives**

The objectives of this plan are to:

- Identify the possible environmental impacts of the proposed activity;
- Develop measures to minimise, mitigate and manage these impacts;
- Meet the requirements of the Environmental Authorisation of GDARD and requirements of other Authorities; and
- Monitor the project.

### **EMPr context**

This EMPr fits into the overall planning process of the project by carrying out the conditions of consent set out by the Gauteng Department of Agriculture and Rural Development. In addition, all mitigation measures recommended in the Amended Environmental Authorisation report should also be adhered to.

This EMPr addresses the following two phases of the development:

- Construction phase; and
- Operational phase.

## **3. Monitoring**

In order for the EMPr to be successfully implemented all the role players involved must have a clear understanding of their roles and responsibilities in the project.

These role players may include the Authorities (A), other Authorities (OA), Developer/ Proponent (D), Environmental Control Officer (ECO), Project Manager (PM), Contractors (C),

Environmental Assessment Practitioner (EAP) and Environmental Site Officer (ESO). Landowners, Interested and Affected Parties (I&APs) and the relevant environmental and project specialists are also important role players.

### **3.1 Roles and responsibilities**

#### **Developer (D)**

The developer is ultimately accountable for ensuring compliance with the EMP and conditions contained in the Environmental Authorisation. The developer must appoint an independent Environmental Control Officer (ECO), for the duration of the pre-construction and construction phases, to ensure compliance with the requirements of this EMPr. The developer must ensure that the ECO is integrated as part of the project team.

#### **Project Manager (PM)**

The Project Manager is responsible for the coordination of various activities and ensures compliance with this EMPr through delegation of the EMPr to the contractors and monitoring of performance as per the Environmental Control Officer's monthly reports.

#### **Environmental Control Officer (ECO)**

An independent Environmental Control Officer (ECO) shall be appointed, for the duration of the pre-construction and construction phases of the development, by the developer to ensure compliance with the requirements of this EMPr.

- The Environmental Control Officer shall ensure that the contractor is aware of all the specifications pertaining to the project.
- Any damage to the environment must be repaired as soon as possible after consultation between the Environmental Control Officer, Consulting Engineer and Contractor.
- The Environmental Control Officer shall ensure that the developer staff and/or contractor are adhering to all stipulations of the EMPr.
- The Environmental Control Officer shall be responsible for monitoring the EMP throughout the project by means of site visits and meetings. This should be documented as part of the site meeting minutes.
- The Environmental Control Officer shall be responsible for the environmental training program.



- The Environmental Control Officer shall ensure that all clean up and rehabilitation or any remedial action required, are completed prior to transfer of properties.
- A post construction environmental audit is to be conducted to ensure that all conditions in the EMPr have been adhered to.

**Contractor (C):**

The contractors shall be responsible for ensuring that all activities on site are undertaken in accordance with the environmental provisions detailed in this document and that the sub-contractors and laborers are duly informed of their roles and responsibilities in this regard.

The contractor will be required, where specified to provide Method Statements setting out in detail how the management actions contained in the EMPr will be implemented.

The contractors will be responsible for the cost of rehabilitation of any environmental damage that may result from non-compliance with the environmental regulations.

**Environmental Site Officer (ESO):**

The ESO is appointed by the developer and then finally the home owner as his/her environmental representative to monitor, review and verify compliance with the EMPr by the contractor. The ESO is not an independent appointment but must be a member of the contractor's management team. The ESO must ensure that he/she is involved at all phases of the construction (from site clearance to rehabilitation).

**Authority (A):**

The authorities are the relevant environmental department that has issued the Environmental Authorization. The authorities are responsible for ensuring that the monitoring of the EMPr and other authorization documentation is carried out by means of reviewing audit reports submitted by the ECO and conducting regular site visits.

**Other Authorities (OA):**

Other authorities are those that may be involved in the approval process of the EMPr.

**Environmental Assessment Practitioner (EAP):**

According to Section 1 of NEMA the definition of an Environmental Assessment Practitioner is "the individual responsible for the planning, management and coordination of Environmental Impact Assessments, Strategic Environmental Assessments, Environmental Management Programmes or any other appropriate environmental instruments through regulations".



### **3.2 Lines of Communication**

The Environmental Control Officer in writing should immediately report any breach of the EMPr to the Project Manager. The Project Manager should then be responsible for rectifying the problem on-site after discussion with the contractor. Should this require additional cost, then the developer should be notified immediately before any additional steps are taken.

### **3.3 Reporting Procedures to the Developer**

Any pollution incidents must be reported to the Environmental Control Officer immediately (within 12 hours). The Environmental Control Officer shall report to the Developer on a regular basis (site meetings).

### **3.4 Site Instruction Entries**

The site instruction book entries will be used for the recording of general site instructions as they relate to the works on site. There should be issuing of stop work order for the purposes of immediately halting any activities of the contractor that may pose environmental risk.

### **3.5 ESA/ESO (Environmental Site Officer) Diary Entries**

Each of these books must be available in duplicate, with copies for the Engineer and Environmental Site Officer. These books should be available to the authorities for inspection or on request. All spills are to be recorded in the ESA/Environmental Site Officer's diary.

### **3.6 Methods Statements**

Methods statements from the contractor will be required for specific sensitive actions on request of the authorities or ESA/ESO (Environmental Site Officer). All method statements will form part of the EMPr documentation and are subject to all terms and conditions contained within the EMPr document. For each instance wherein it is requested that the contractor submit a method statement to the satisfaction of ESA/ESO, the format should clearly indicate the following:

- What – a brief description of the work to be undertaken
- How – a detailed description of the process of work, methods and materials
- Where – a description / sketch map of the locality of work; and
- When – the sequencing of actions with due commencement dates and completion date estimate.

The contractor must submit the method statement before any particular construction activity is due to start. Work may not commence until the method statement has been approved by the ESA/ESO.

### 3.7 Record Keeping

All records related to the implementation of this Management Programme (e.g. site instruction book, ESA/ESO dairy, methods statements etc.) must be kept together in an office where it is safe and can be retrieved easily. These records should be kept for two years at any time be available for scrutiny by any relevant authorities.

### 3.8 Acts

#### 3.8.1 The National Water Act, 1998 (Act No: 36 of 1998)

The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways that take into account, amongst other factors, the following:

- Meeting the basic human needs of present and future generations;
- Promoting equitable access to water;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Reducing and preventing pollution and degradation of water resources;
- Facilitating social and economic development; and
- Providing for the growing demand for water use.

#### **Impact on proposed Development:**

This impact is not considered significant. The site borders a perennial river system and a rehabilitated wetland occurs on site. It will be necessary to apply for an amendment of the existing Section 21 (c) and (i) water-use licenses issued for the study area.

#### 3.8.2 Atmospheric Pollution Prevention Act (Act 45 of 1965)

The NEM: AQA serves to repeal the Atmospheric Pollution Prevention Act (45 of 1965) and various other laws dealing with air pollution and it provides a more comprehensive framework within which the critical question of air quality can be addressed.

The purpose of the Act is to set norms and standards that relate to:

- Institutional frameworks, roles and responsibilities
- Air quality management planning
- Air quality monitoring and information management
- Air quality management measures
- General compliance and enforcement

Amongst other things, it is intended that the setting of norms and standards will achieve the following:

- The protection, restoration and enhancement of air quality in South Africa
- Increased public participation in the protection of air quality and improved public access to relevant and meaningful information about air quality
- The reduction of risks to human health and the prevention of the degradation of air quality.

The Act describes various regulatory tools that should be developed to ensure the implementation and enforcement of air quality management plans. These include:

- Priority Areas, which are air pollution 'hot spots'
- Listed Activities, which are 'problem' processes that require an Atmospheric Emission License
- Controlled Emitters, which includes the setting of emission standards for 'classes' of emitters, such as motor vehicles, incinerators, etc.
- Control of Noise
- Control of Odours.

#### **Impact on proposed Development:**

Not significant - The Act has relevance to the proposed development during the construction phase. Dust pollution could be a concern primarily during the construction phase of the proposed project. Dust control would be adequately minimised during this phase by way of water spraying and possible dust-nets, when working close to existing residential dwellings or roads/highways. It is not foreseen that the proposed development would contribute significantly to pollution in terms of emissions and noise during its operational phase.

#### **3.8.3 National Environmental Management Act (Act 107 of 1998)**

The NEMA is primarily an enabling Act in that it provides for the development of environmental implementation plans and environmental management plans. The principles listed in the act serve as a general framework within which environmental management and implementation plans must be formulated.

The principles in essence state that environmental management must place people and their needs at the forefront of its concern and that development must be socially, environmentally and economically sustainable.

**Impact on proposed Development:**

Significant - Section 28 (1) of NEMA stated that every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

The EMPr is compiled in terms of Section 28 of NEMA.

**3.8.4 The National Environmental Management: Waste Act (Act 59 of 2008)**

This Act came into effect on 11 June 2009. It aims to consolidate waste management in South Africa, and contains a number of commendable provisions, including:

- The establishment of a national waste management strategy, and national and provincial norms and standards for, amongst others, the classification of waste, waste service delivery, and tariffs for such waste services;
- Addressing reduction, reuse, recycling and recovery of waste;
- The requirement for industry and local government to prepare integrated waste management plans;
- The establishment of control over contaminated land;
- Identifying waste management activities that requires a licence, which currently include facilities for the storage, transfer, recycling, recovery, treatment and disposal of waste on land;
- Co-operative governance in issuing licenses for waste management facilities, by means of which a licensing authority can issue an integrated or consolidated license jointly with other organs of state that has legislative control over the activity; and
- The establishment of a national waste information system.

On 3 July 2009 the Minister of Environmental Affairs and Tourism promulgated a list of waste management activities that might have a detrimental effect on the environment. These listed activities provide the activities that require a Waste Management License. Two

Categories is specified: Category A and Category B. As part of Category A Waste Management License application a Basic Assessment in terms of Section 24(5) of the National Environmental Management Act (Act 107 of 1998) must be submitted to the relevant Authority. As part of a Category B Waste Management License a Scoping and EIA process in terms of Section 24(5) of the National Environmental Management Act (Act 107 of 1998) must be followed and submitted to the relevant Authority. On 29 November 2013 the Minister of Environmental Affairs and Tourism amended the list of waste activities that might be detrimental to the environment.

**Impact on proposed Development:**

This impact is not considered significant. No Waste Management License is expected to be required during the construction or operational phase of the proposed development.

### **3.8.5 The Municipal Systems Act (Act 32 of 2000)**

This Act was introduced to provide for the core principles, mechanisms and processes that are necessary to enable municipalities to move progressively towards the social and economic upliftment of local communities, and ensure universal access to essential services that are affordable to all.

The proposed development will support the local authority in complying with the principles of the Municipal Systems Act, by assisting in providing the community with essential services, such as water and sewage infrastructure.

**Impact on proposed Development:**

Significant - The proposed development will contribute to the municipal services in the area.

### **3.8.6 National Veld and Forest Fire Act, 1998 (Act No. 101, 1998)**

The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic. Furthermore, the Act provides for a variety of institutions, methods and practices for achieving the prevention of fires.

**Impact on proposed Development:**

Significant - Fires of construction workers may only be lit in the designated site camp as indicated in assistance with the ECO. It is important that a site development camp be located on a part of the application site that is already disturbed.

### **3.8.7 Conservation of Agricultural Resources Act (Act No. 43 of 1983)**

This Act provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.

#### **Impact on proposed Development:**

This impact is not considered significant. According to the Gauteng Agriculture Potential Atlas (GAPA 3) the study area has a very low agricultural potential.

### **3.8.8 National Environmental Management Act: Biodiversity Act (Act No. 10 of 2004)**

The purpose of the Biodiversity Act is to provide for the management of South Africa's biodiversity within the Framework of the NEMA and the protection of species and ecosystems that warrant National protection. As part of the implementation strategy, the National Spatial Biodiversity Assessment was developed.

#### **Impact on proposed Development:**

This impact is not considered significant. Majority of the study area is regarded as degraded with some illegal dumping taking place in the Jukskeiriver. Some areas along the N4 highway is regarded as sensitive such as rocky outcrops and in addition to this area, the drainage line/watercourse should be regarded as sensitive.

### **3.8.9 National Spatial Biodiversity assessment**

The National Spatial Biodiversity Assessment (NSBA) classifies areas as worthy of protection based on its biophysical characteristics, which are ranked according to priority levels.

#### **Impact on proposed Development:**

Not Significant – Even though the proposed development is situated within the Endangered Egoli Granite Grassland vegetation type according to Mucina and Rutherford (2006) the natural vegetation of the study area is almost completely transformed.

### **3.8.10 Protected Species – Provincial Ordinances**

Provincial ordinances were developed to protect particular plant species within specific provinces. The protection of these species is enforced through permitting requirements associated with provincial lists of protected species. Permits are administered by the Provincial Departments of Environmental Affairs.

#### **Impact on proposed Development:**

Not significant – No Red List species were recorded on the study site. However, the wetland/watercourse and the perennial river towards the south of the study area should be regarded as sensitive.

### **3.8.11 National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)**

The purpose of this Act is to provide for the protection, conservation and management of ecologically viable areas representative of South Africa's biological biodiversity and its natural landscapes.

#### **Impact on proposed Development:**

Not significant - The Application site is not located within any conservancy or protected area.

### **3.8.12 Heritage Act**

The National Heritage Resources Act legislates the necessity and heritage impact assessment in areas earmarked for development, which exceed 0.5ha. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).



**Impact on proposed Development:**

Not significant- No cultural/historical significant areas were identified with in the application site and thus no areas of historical or cultural value will be affected.

**3.8.13 Gauteng Province Environmental Management Framework (GPEMF)**

The newly enacted GPEMF replaces all other Environmental Management Frameworks in the Gauteng Province, in terms of Regulation 5(4) of the Environmental Management Framework Regulations, 2010, published under Government Notice R547 in *Gazette* 33306 on 18 June 2010.

**Impact on proposed Development:**

From an institutional point of view, this site is also regarded as strategically located for urban development. The newly enacted Gauteng Provincial Environmental Management Framework (GPEMF) placed the study area in Zone 1, which is an area in which development infill, densification and the concentration of urban development within the urban development zones will be supported and promoted. In this zone applicants are exempted from certain EIA Related listed activities, but the listed activities associated with a watercourse/ wetland will however still remain applicable.

**3.8.14 Gauteng Conservation Plan (C-Plan)**

A systematic conservation plan for the Gauteng Province was undertaken by Gauteng Nature Conservation, a division within the Gauteng department of Agriculture and Rural Development (GDARD). The Gauteng Conservation Plan version 3.3 (Gauteng C-Plan v3.3) was released in February 2012, and a technical report was made available in March 2014.

**Impact on proposed Development:**

Not significant – In the C-Plan, the study site is located in an important area. This is based on suitable habitat for Red and Orange List plant species and is considered as primary vegetation. However, only one Orange List species (*Hypoxis hemerocallidea*) was recorded during the plant species survey.

## 4. Project activities

### 4.1 Construction Phase

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
Contractors Camp	Vegetation and topsoil	To minimize damage to and loss of vegetation and retain quality of topsoil	<p>1) Site to be established under supervision of ECO.</p> <p>2) Clearing and relocation of plants to be undertaken in accordance with site specific requirements.</p>	Minimal vegetation removed/ damaged during site activities.	Contractor	As and when required
	Surface and ground water pollution	To minimize pollution of surface and Groundwater resources.	<p>1) Sufficient and temporary facilities including ablution facilities must be provided for construction workers operating on the site.</p> <p>2) A minimum of one chemical toilet shall be provided per 10 persons.</p> <p>The contractor shall keep the toilets in a clean, neat and hygienic condition.</p> <p>Toilets provided by the contractor must be easily accessible and a maximum of 50m</p>	<ul style="list-style-type: none"> <li>• Effluents managed effectively.</li> <li>• No pollution of water resources from site.</li> <li>• Workforce use toilets provided.</li> </ul>	Contractor; ESO	As and when required

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>from the works area to ensure they are utilized. The contractor (who must use reputable toilet-servicing company) shall be responsible for the cleaning, maintenance and servicing of the toilets. The contractor (using reputable toilet-servicing company) shall ensure that all toilets are cleaned and emptied before the builders' or other public holidays.</p> <p>3) No person is allowed to use any other area than chemical toilets.</p> <p>4) No French drain systems may be installed.</p> <p>5) No chemical or waste water must be allowed to contaminate the run-off on site.</p> <p>6) Avoid the clearing of the site camp (of specific phase) or paved surfaces with soap.</p>			
		To minimize pollution of surface and Groundwater	1) Drip trays and/ or lined earth bunds must be provided under vehicles and equipment, to contain spills of hazardous materials such as fuel, oil and cement.	No pollution of the environment	Contractor; ESO	Daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
		resources due to spilling of materials.	<p>2) Repair and storage of vehicles only within the demarcated site area.</p> <p>3) Spill kits must be available on site.</p> <p>4) Oils and chemicals must be confined to specific secured areas within the site camp. These areas must be bunded with adequate containment (at least 1.5 times the volume of the fuel) for potential spills or leaks.</p> <p>5) All spilled hazardous substances must be contained in impermeable containers for removal to a licensed hazardous waste site.</p> <p>6) No leaking vehicle shall be allowed on site. The mechanic/ the mechanic of the appointed contractor must supply the environmental officer with a letter of confirmation that the vehicles and equipment are leak proof.</p> <p>7) No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site.</p>			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
		To minimize pollution of surface and groundwater resources by cement	The mixing of concrete shall only be done at specifically selected sites, as close as possible to the entrance, on mortar boards or similar structures to prevent run-off into drainage lines, streams and natural vegetation.	No evidence of contaminated soil on the construction site.	Contractor; ESO	Daily
		To minimize pollution of surface and Groundwater resources due to effluent.	No effluent (including effluent from any storage areas) may be discharged into any water surface or ground water resource.	No evidence of contaminated water resources.	Contractor; ESO	Daily
	<b>Pollution of the environment</b>	To prevent unhygienic usage on the site and pollution of the natural assets.	1) Weather proof waste bins must be provided and emptied regularly. 2) The contractor shall provide laborers to clean up the contractor’s camp and construction site on a daily basis. 3) Temporary waste storage points on the site should be determined. THESE AREAS SHALL BE PREDETERMINED AND LOCATED IN AREAS THAT IS ALREADY DISTURBED. These storage points should be accessible	No waste bins overflowing  No litter or building waste lying in or around the site	Contractor; ESO	Daily  Weekly

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>by waste removal trucks and these points should be located in already disturbed areas /areas not highly visible from the properties of the surrounding land-owners/ in areas where the wind direction will not carry bad odours across the properties of adjacent landowners. This site should comply with the following:</p> <ul style="list-style-type: none"> <li>• Skips for the containment and disposal of waste that could cause soil and water pollution, i.e. paint, lubricants, etc.;</li> <li>• Small lightweight waste items should be contained in skips with lids to prevent wind littering;</li> <li>• Bunded areas for containment and holding of dry building waste.</li> </ul> <p>4) No solid waste may be disposed of on the site.</p> <p>5) No waste materials shall at any stage be disposed of in the open veld of adjacent properties.</p> <p>6) The storage of solid waste on the site, until such time as it may be disposed of,</p>			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>must be in a manner acceptable to the local authority and DWS.</p> <p>7) Cover any wastes that are likely to wash away or contaminate storm water.</p>			
		Recycle material where possible and correctly dispose of unusable wastes	<p>1) Waste shall be separated into recyclable and non-recyclable waste, and shall be separated as follows:</p> <ul style="list-style-type: none"> <li>• General waste: including (but not limited to) construction rubble,</li> <li>• Reusable construction material.</li> </ul> <p>2) Recyclable waste shall preferably be deposited in separate bins.</p> <p>3) All solid waste including excess spoil (soil, rock, rubble etc) must be removed to a permitted waste disposal site on a weekly basis.</p> <p>4) No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site.</p>	<p>Sufficient containers available on site</p> <p>No visible signs of pollution</p>	Contractor; ESO	<p>Daily</p> <p>Weekly</p>



TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			5) Keep records of waste reuse, recycling and disposal for future reference. Provide information to ECO.			
	<b>Waste</b>	To keep the site clean and tidy.  To ensure waste enters the appropriate waste stream in order to optimize recycling opportunities.	1) Rubble must be removed from the construction site frequently and be disposed of at an approved dumping site.  2) Sufficient and covered containers must be available on the construction site.  3) Such containers are to be emptied frequently.  4) All liquid effluent is to be disposed of in a manner approved of by the Local Authority.  5) Material to be used as backfill during a later stage of the building construction must be covered with a layer of soil to prevent litter from being blown over the site and to prevent unhygienic conditions.  6) Chemical containers and packaging brought onto the site must be removed for disposal at a suitable site.		Contractor	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>7) The burning of waste is prohibited.</p> <p>8) Where possible, waste must be separated into clearly marked containers and subsequent recycling thereof must be a priority.</p>			
	<b>Increased fire risk to site and surrounding areas</b>	To decrease fire risk.	<p>1) Fires shall only be permitted in specifically designated areas and under controlled circumstances.</p> <p>2) Food vendors shall be allowed within specified areas.</p> <p>3) No wood may be collected from the site for fires.</p> <p>4) Fire extinguishers to be provided in all vehicles and fire beaters must be available on site.</p> <p>5) Emergency numbers/ contact details must be available on site, where applicable.</p>	No open fires on site that have been left unattended	Contractor	Monitor daily
<b>Construction site</b>	<b>Geology and soils</b>	To protect underground services from	Underground services should be treated appropriately prior to installation.	Underground services are not	Contractor	Monitor regularly/

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
		alkaline or corrosive attack.		being corroded		as required
		To prevent the damage of the existing soils and geology.	<p>1) The top layer of all areas to be excavated for the purposes of construction shall be stripped and stockpiled in areas where this material will not be damaged, removed or compacted.</p> <p>2) All surfaces that are susceptible to erosion, shall be protected either by cladding with biodegradable material or with the top layer of soil being seeded with grass seed/planted with a suitable groundcover.</p>	<p>Excavated materials correctly stockpiled</p> <p>No signs of erosion</p>	Contractor	Monitor daily
		<p>To prevent the loss of topsoil</p> <p>To prevent siltation &amp; water pollution.</p>	<p>1) Stockpiling will only be done in designated places where it will not interfere with the natural drainage paths of the environment.</p> <p>2) In order to minimize erosion and siltation and disturbance to existing vegetation, it is recommended that stockpiling be done/ equipment is stored in already disturbed/</p>	<p>Excavated materials correctly stockpiled</p> <p>No visible signs of erosion and sedimentation</p>	Contractor of the Individual Developer	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>exposed areas.</p> <p>3) Cover stockpiles and surround downhill sides with a sediment fence to stop materials washing away.</p> <p>4) Remove vegetation only in areas designated during the planning stage.</p> <p>5) Rehabilitation/ landscaping are to be done immediately after the involved works are completed.</p> <p>6) All compacted areas should be ripped prior to them being rehabilitated/ landscaped by the contractor as appointed by the developer/ individual erf owner.</p> <p>7) The top layer of all areas to be excavated must be stripped and stockpiled in areas where this material will not be damaged, removed or compacted. This stockpiled material should be used for the rehabilitation of the site and for landscaping purposes.</p> <p>8) Strip topsoil at start of works and store in</p>	<p>Minimal invasive weed growth</p> <p>Vegetation only removed in designated areas</p>		

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>stockpiles no more than 1,5 m high in designated materials storage area.</p> <p>9) During the laying of any cables, pipelines or infrastructure (on or adjacent to the site) topsoil shall be kept aside to cover the disturbed areas immediately after such activities are completed.</p>			
	<b>Erosion and siltation</b>	To prevent erosion and siltation	<p>1) It is recommended that the construction of the development be done in phases.</p> <p>2) Each phase should be rehabilitated immediately after the construction for that phase has been completed. The rehabilitated areas should be maintained by the appointed rehabilitation contractor until a vegetative coverage of at least 80% has been achieved as appointed by the developer/ individual erf owner.</p> <p>3) Mark out the areas to be excavated.</p> <p>4) Large exposed areas during the construction phases should be limited. Where possible areas earmarked for construction during later phases should remain covered with vegetation coverage until the actual construction phase. This will prevent unnecessary erosion and siltation in these areas.</p>	<p>No erosion scars</p> <p>No loss of topsoil</p> <p>All damaged areas successfully rehabilitated</p>	Contractor ESO	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>5) Unnecessary clearing of vegetation resulting in exposed soil prone to erosive conditions should be avoided.</p> <p>6) All embankments must be adequately compacted and planted with indigenous grass and trees to stop any excessive soils erosion and scouring of the landscape if required.</p> <p>7) The eradication of alien vegetation should be followed up as soon as possible by replacement with indigenous vegetation to ensure quick and sufficient coverage of exposed areas by the individual erf owner.</p> <p>8) Storm water outlets shall be correctly designed to prevent any possible soil erosion.</p> <p>9) All surface run-offs shall be managed in such a way so as to ensure erosion of soil does not occur.</p> <p>10) Implementation of temporary storm water management measures that will help to reduce the speed of surface water by the individual erf owner / developer.</p> <p>11) All surfaces that are susceptible to erosion shall be covered with a suitable vegetative cover as soon as construction is completed by the individual erf owner /</p>			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			developer.			
	<b>Stability of structures due to geology</b>	To ensure stability of structures	Preventative foundation designs shall be done. Detailed foundation inspections should be carried out at the time of construction to identify any variances and adjust foundation designs accordingly if need be. The foundation recommendations from the geotechnical engineers must be adhered to.		Engineers; Contractor; Individual Developer	When required
	<b>Seepage of groundwater into excavations</b>	To ensure that excavations do not become flooded	Provision should be made for the removal of groundwater from excavations.		Contractor	Monitor daily
	<b>Cracking of structures</b>	To ensure that built structures do not crack due to collapsible soils and settlement	1)The floors of foundation excavations should be compacted by a hand-operated vibratory roller or else by a machine equivalent to a Wacker Rammer (a mechanised tamping device); a test section should firstly be compacted under supervision of the Engineer in order to determine the number of roller passes. The structures may then be constructed by conventional means.	Built structures show no sign of cracks	Engineer; Contractor	As required



TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>Additional precautionary measures that can be employed are:</p> <p>2) The provision of expansion joints in the walls of structures;</p> <p>3) A concrete walkway of 1,0m in width around the perimeter of each structure; and</p> <p>4) The shaping of the walkway and the ground surface in the vicinity of the structures so as to drain water away from each structure so that no ponding of surface water can take place in the vicinity of the structures.</p>			
	<b>Hydrology</b>	To minimise pollution of soil, surface and groundwater	<p>1) Increased run-off during construction must be managed using berms and other suitable structures as required to ensure flow velocities are reduced.</p> <p>2) The contractor shall ensure that excessive quantities of sand, silt and silted water do not enter the storm water system.</p>	<p>No visible signs of erosion.</p> <p>No visible signs of pollution</p>	Contractor	Monitor daily
	<b>Wetland</b>	Preserving River and Wetland areas.	1) The rehabilitated wetland area should be clearly marked prior to construction. This area is strictly excluded from development	No visible signs of pollution	Contractor	

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>and should remain open space during the proposed development activities.</p> <p>2) Construction of water control structures to prevent and control any erosion on the site.</p> <p>3) Prevent contamination of wetland areas from polluted runoff/ seepage/ drainage water by utilizing relevant control measures.</p> <p>4) During the construction phase, no dumping and no stockpiling of materials within the wetland areas and associated buffers should take place.</p> <p>5) No construction or dumping of activities should take place within the 1:50 year or 1:100 year floodline or a horizontal distance of 100m from a water resource unless authorized by DWA.</p> <p>6) No vehicles should be allowed to indiscriminately drive through the wetland areas. Fence-off sensitive areas prior to construction and apply temporary storm water management measures outside the watercourse and watercourse buffer zones</p>			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			to prevent entry into the wetland areas and drainage line by construction vehicles and prevent storing or dumping of topsoil, construction material and other waste in the wetland/drainage line. 7) The area should be prepared with sandbags or other applicable measures to avoid siltation into the wetland area.			
	<b>Fauna and flora</b>	To protect the existing fauna and flora.	1) All alien invaders and weeds must be eradicated on a continuous basis. 2) Alien invaders must be included in an alien management program for the site. Eradication must occur every 3 months. 3) Alien plants, especially lawn grasses and other ground-covering plants, should not be introduced in the communal landscaping of the proposed site, as they will drastically interfere with the nature of the area. 4) Where possible, trees naturally growing on the site should be retained as part of the landscaping.	No exotic plants used for landscaping	Contractor ESO / Home Owners Association / Design Review Committee	As and when required  Every 6 months
		To protect the existing fauna and flora.	1) Trees that are intended to be retained shall be clearly marked on site. 2) Snaring and hunting of fauna by construction workers on or adjacent to the	No measurable signs of habitat destruction	Contractor ESO	As and when required

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>study area are strictly prohibited and the Council shall prosecute offenders.</p> <p>3) All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss as far as possible and maintain and improve available habitat, in order to maintain and possibly increase numbers and species of indigenous fauna.</p> <p>4) Wood harvesting of any trees or shrubs on the study area or adjacent areas shall be prohibited.</p> <p>5) Where possible, work should be restricted to one area at a time.</p> <p>6) Noise should be kept to a minimum and the development should be done in phases to allow faunal species to temporarily migrate into the conservation areas in the vicinity.</p> <p>7) The integrity of remaining wildlife should be upheld, and no trapping or hunting by construction personnel should be allowed. Caught animals should be relocated to the conservation areas in the vicinity.</p> <p>8) Entrance by vehicles, especially off-road</p>			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			cars and bakkies, off-road bicycles and quad bikes and construction staff into the application site should be prohibited, both during the construction phase and during the lifespan of the project.			
		To protect the existing fauna and flora.	<p>1) Retain natural habitat elements such as tree stumps, termite mounds, etc. where possible.</p> <p>2) Preserve, maintain and construct biological corridors where possible, as well as retaining green belts interconnected with these corridors.</p>	No measurable signs of habitat destruction	Contractor ESO	As and when required
<b>Social</b>	<b>Noise impact</b>	To maintain noise levels below "disturbing" as defined in the national Noise Regulations.	<p>1) Site workers must comply with the Provincial noise requirements as outlined in Provincial Notice No. 5479 of 1999: Gauteng Noise Control Regulations.</p> <p>2) Noise activities shall only take place during working hours.</p>	No complaints from surrounding residents and I & APs	Contractor	Monitored daily
	<b>Dust impact</b>	Minimise dust from the site	1) Dust pollution could occur during the construction works, especially during the dry months. Regular and effective damping down of working areas (especially during	No visible signs of dust pollution	Contractor	Monitored daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>the dry and windy periods) must be carried out to avoid dust pollution that will have a negative impact on the surrounding environment.</p> <p>2) When necessary, these working areas should be damped down in the mornings and afternoons.</p>	No complaints from surrounding residents and I & APs		
	<b>Safety and security</b>	To ensure the safety and security of the public.	<p>1) Although regarded as a normal practice, it is important to erect proper signs indicating the operations of heavy vehicles in the vicinity of dangerous crossings and access roads or even in the development site if necessary.</p> <p>2) With the exception of the appointed security personnel, no other workers, friend or relatives will be allowed to sleep on the construction site (weekends included)</p> <p>3) Construction vehicles and activities to avoid peak hour traffic times</p> <p>4) Presence of law enforcement officials at strategic places must be ensured</p> <p>5) Following actions would assist in management of safety along the road</p> <ul style="list-style-type: none"> <li>▪ Adequate road marking</li> </ul>	No incidences reported	Contractor ESO	Monitored daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<ul style="list-style-type: none"> <li>▪ Adequate roadside recovery areas</li> <li>▪ Allowance for pedestrians and cyclists where necessary</li> <li>▪ Although regarded as a normal practice, it is important to erect proper signs indicating the danger of the excavation in and around the development site. Putting temporary fencing around excavations where possible.</li> </ul>			
	<b>Infrastructure and services</b>	Installation of services	<p>Determine areas where services will be upgraded and relocated well in advance.</p> <p>Discuss possible disruptions with affected parties to determine most convenient times for service disruptions and warn affected parties well in advance of dates that service disruptions will take place</p>	No complaints from I & AP	Contractor ESO	When required
	<b>Visual impact</b>	In order to minimise the visual impact.	<p>1) The disturbed areas shall be rehabilitated immediately after the involved construction works are completed.</p> <p>2) Shade cloth must be used to conceal and minimise the visual impact of the site camps and storage areas</p>	Visual impacts minimized	Contractor; ESO	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
	<b>Vegetation</b>	Landscaping	<p>1) When planting trees, care should be taken to avoid the incorrect positioning of trees and other plants, to prevent the roots of trees planted in close proximity to the line of water-bearing services from causing leaking in, or malfunctioning of the services.</p> <p>2) The proposed planting materials for the areas to be landscaped should preferably be endemic and indigenous.</p> <p>3) All new trees and shrubs to be planted on the study area shall be inspected for pests and diseases prior to them being planted.</p> <p>4) The inspection shall be carried out by the maintenance contractor at the property of the supplier and not on the study area.</p> <p>5) All trees to be planted shall be in minimum 100L containers with a height of approximately 3 metres and a main stem diameter of approximately 80 mm.</p>	Landscaping done according to landscape development plan	Landscape architect  Contractor / Individual Developer	When required
		Loss of plants	<p>1) Aerate compacted soil and check and correct pH for soils affected by construction activities.</p> <p>2) Make sure plant material will be matured enough and hardened off ready for planting. Water in plants immediately as</p>	Landscaping done according to landscape development plan	Landscape architect  Contractor / Individual	When required



TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			planting proceeds. 3) Apply mulch to conserve moisture. Plant according to the layout and planting techniques specified by the Landscape Architect in the Landscape Development plans for the site.		Developer	
		Spread of weeds	Ensure that materials used for mulching and topsoil/ fertilisers are certified weed free. Collect certifications where available.  Control weeds growth that appears during construction.	Weed growth controlled	Landscape architect  Contractor	When required
		To ensure rehabilitation of the site	1) Compacted soils shall be ripped at least 200mm. 2) All clumps and rocks larger than 30mm diameter shall be removed from the soil to be rehabilitated. 3) The soil shall be leveled before seeding 4) Hydroseed the soil with Potch mixture 5) Watering shall take place at least once per day for the first 14 days until	Grass have hardened off	Landscape architect  Contractor	Once a day  Then every 4 days

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			germination of seeds have taken place  6) Thereafter watering should take place at least for 20 minutes every 4 days until grass have hardened off.			
		Rehabilitation of area directly surrounding stream	1) Vehicles and workers associated with construction should not have free access to the stream and unnecessary disturbance to the stream should be avoided.  2) No vegetation may be removed from the stream area or buffer zone unless stipulated in a Water Use License granted to the owner of the site.  3) Erosion control measures should be implemented on all open soils and steep slopes.  4) Upon completion of the construction in the area, the area should be rehabilitated to a level that will ensure that wetland vegetation can become re-established. In this regard special mention of the following is made:	No erosion surrounding new river area	Landscape architect  Contractor	Immediately after construction

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<ul style="list-style-type: none"> <li>All areas of disturbed and compacted soils need to be compacted and reprofiled.</li> <li>Ongoing removal of alien vegetation from the area must take place after the completion of the structure to prevent the uncontrollable recruitment of these species.</li> </ul>			

## 4.2 Operational Phase

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Responsibility	Frequency of Action
Site clean-up and preparation for use	Storm water pollution	Do not allow any materials to wash into the storm water system.	Remove erosion and sediment controls only if all bare soil is sealed, covered or re-vegetate.  Sweep roadways clean and remove all debris from kerb and gutter areas. Do not wash into drains.	Contractor	-
		Minimise waste	Decontaminate and collect waste in storage	Contractor	-

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Responsibility	Frequency of Action
			area ready for off-site recycling or disposal Arrange for final collection and removal of excess and waste materials.		
<b>Establishing plants</b>	<b>Slow or no re-vegetation to stabilise soil; loss or degradation of habitat</b>	To ensure re-vegetation to stabilize soil	Agreed schedule for regular follow-up watering, weed control, mulch supplements and amenity pruning, if needed. Replace all plant failures within three month period after planting.	Contractor	To be agreed
<b>Geology</b>	<b>Erosion of topsoil</b>	Prevent topsoil erosion	Due to loose topsoil, the soil must be covered by means of re-seeding and vegetation with suitable ground covering.	Engineer; Contractor	Once off
		<b>To ensure effective stormwater management</b>	1) Stormwater throughout the site should be managed to accommodate the higher quantities of run off;  2) Sheet flow should be encouraged as far as possible, and channels should be designed to sufficiently address the problem of erosion; and  3) Bio-swale system could be implemented to filter water from paved areas and especially	Section 21 Company; HOA	

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Responsibility	Frequency of Action
			from roads and parking areas to sufficiently clean water of heavy metals and other hazardous materials in stormwater in a natural manner. This will further provide an opportunity for water to infiltrate the soil, break the energy of stormwater and keep the water on site for longer.		
<b>Materials failure</b>	<b>Structural damage. Loss of site materials.</b>		Inspect all structures monthly to detect any cracking or structural problems. Confirm with designer if there are design problems. Rectify with materials to match, or other agreed solution.	Contractor	-
<b>Water management and Wetland features</b>	<b>Work being done in Wetland Areas &amp; Storm Water Management</b>		1) Continued implementation of an approved Stormwater Management Plan must take place. Siltation, prevention of obstruction at culverts and prevention of erosion must take place on an ongoing basis.  2) Success of rehabilitation works is to be monitored on a continuous basis. At least 80% coverage from veldgrass seeding should be achieved.	Developer	

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Responsibility	Frequency of Action
<b>Drainage failure</b>	<b>On-site and downstream drainage pollution or flooding</b>	Storm water management plan	Inspect all site drainage works and repair any failures. Confer with design engineer and to correct site problems.	Contractor	-
<b>Site audit</b>	<b>Eventual project failure</b>	Successful project establishment	Routinely audit the works and adjust maintenance schedule accordingly.	Contractor	-
<b>General</b>	<b>Mismanagement</b>	Maintenance team in place	A maintenance team as well as a landscaping team is needed to ensure that the development is well maintained.	Developer	-
			Open fires and smoking during maintenance works are strictly prohibited.	Contractor	-

## **5. Procedures for environmental incidents**

### **5.1 Leakages and spills**

- Identify source of problem.
- Stop goods leaking, if safe to do so.
- Contain spilt material, using spills kit or sand.
- Notify Environmental Control Officer
- Remove spilt material and place in sealed container for disposal (if possible).
- Environmental Control Officer to follow Incident Management Plan.

### **5.2 Failure of erosion/sediment control devices**

- Prevent further escape of sediment.
- Contain escaped material using silt fence, hay bales, pipes, etc.
- Notify ECO.
- Repair or replace failed device as appropriate.
- Dig/scrape up escaped material; take care not to damage vegetation.
- Remove escaped material from site.
- ECO to follow Incident Management plan.
- Monitor for effectiveness until re-establishment.

### **5.3 Bank/slope failure**

- Stabilize toe of slope to prevent sediment escape using aggregate bags, silt fence, logs, hay bales, pipes, etc.
- Notify ECO.
- ECO to follow Incident Management plan.
- Divert water upslope from failed fence.
- Protect area from further collapse as appropriate.
- Restore as advised by ECO.
- Monitor for effectiveness until stabilized.

### **5.4 Discovery of rare or endangered species**

- Stop work.
- Notify ECO.
- If a plant is found, mark location of plants.
- If an animal, mark location where sighted.
- ECO to identify or arrange for identification of species and or the relocation of the species if possible.
- If confirmed significant, ECO to liaise with Endangered Wildlife Trust.
- Recommence work when cleared by ECO.

## 6. EMPr review

1. The Site Supervisor is responsible for ensuring the work crew is complying with procedures, and for informing the work crew of any changes. The site supervisor is responsible for ensuring the work crew is aware of changes that may have been implemented by GDARD before starting any works.
2. If the contractor cannot comply with any of the activities as described above, they should inform the ECO with reasons within 7 working days.



# Annexure O

## Rehabilitation and Wetland Management Plan



# DRAFT Amended Rehabilitation and Wetland Management Plan For Portions of the Remainder of Portion 1 of the Farm Waterval 5IR



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**May 2016**

**Ref No: 006/16-17/E0010**

## Figures

**Figure 1:** Map indicating the locality of the study site.

**Figure 2:** Aerial map of the study area.

## Tables

**Table 1:** Measures for determining the extent of the impacts on the Water Resources and Water Users.

**Table 2:** Adverse Impacts and Mitigation Measures.

**Table 3:** Wetland Rehabilitation Measures.

**Table 4:** Control methods for alien invasive species.

## List of Abbreviations

**DWA:** Department of Water Affairs

**EMPr:** Environmental Management Programme

**GDARD:** Gauteng Department of Agriculture and Rural Development

**NEMA:** National Environmental Management Act

**SWMP:** Storm Water Management Plan

## Glossary of Terms

**Alien species:** A plant or animal species introduced from elsewhere: neither endemic nor indigenous.

**Biodiversity:** The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are apart.

**Contractor:** The contractors shall be responsible for ensuring that all activities on site are undertaken in accordance with the environmental provisions detailed in the Environmental Management Programme and that the sub-contractors and laborers are duly informed of their roles and responsibilities in this regard. The contractors will be responsible for the cost of rehabilitation of any environmental damage that may result from non-compliance with the environmental regulations.

**Developer:** ATTACQ WATERFALL INVESTMENT COMPANY (Pty) Ltd (AWIC)

**Ecology:** The study of the inter relationships between organisms and their environments.

**Environment:** All physical, chemical and biological factors and conditions that influence an object and/or organism. Also defined as the surroundings within which humans exist and are made up of the land, water, atmosphere, plant and animal life (micro and macro), interrelationship between the factors and the physical or chemical conditions that influence human health and well-being.

**Environmental Management Plan:** A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.

**Home Owners Association:**

**Study Area:** Refers to the entire study area compassing the total area of the land parcels as indicated on the study area map.

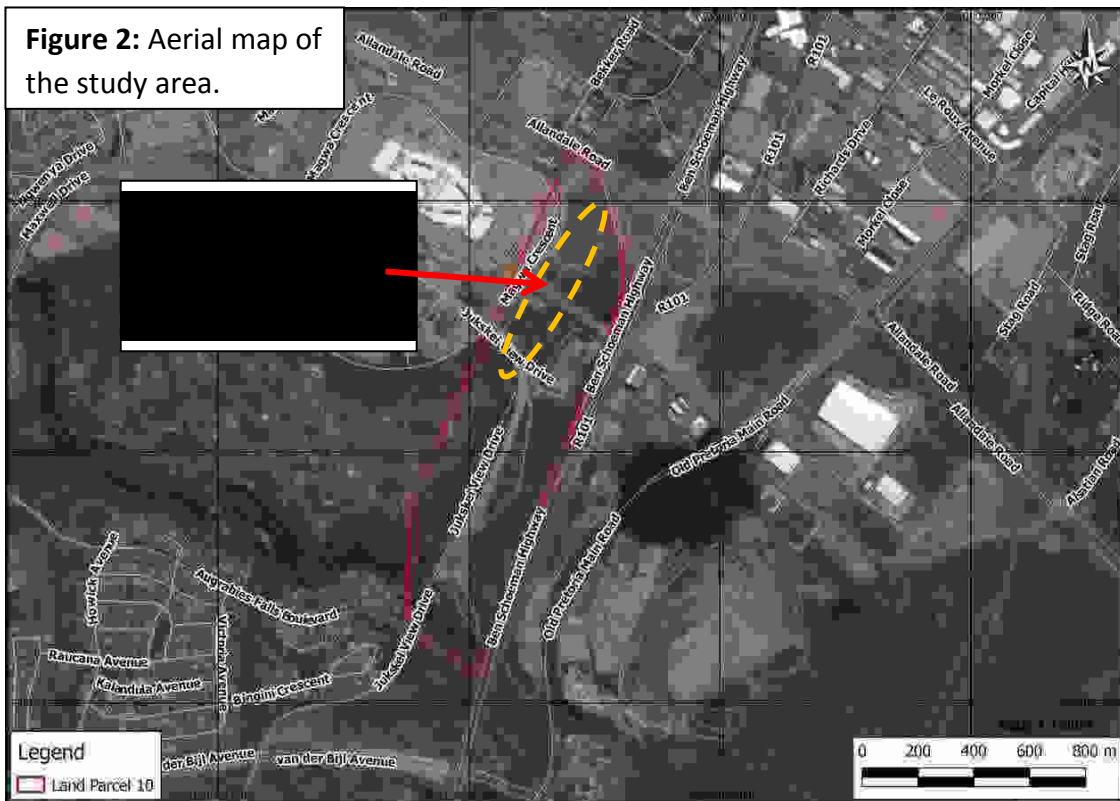
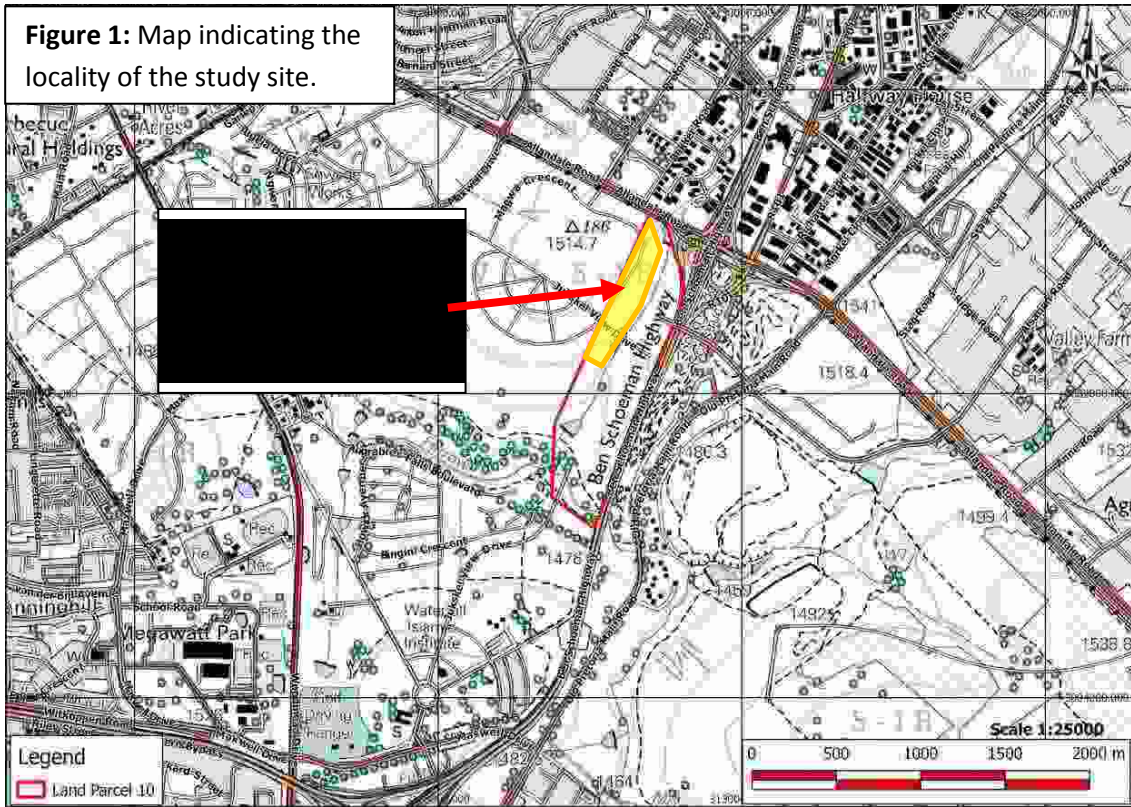
## 1. Introduction

**Bokamoso Landscape Architects & Environmental Consultants** has been appointed by **Atterbury Waterfall Investment Company (PTY) LTD** as independent Environmental Consultants/ Environmental Assessment Practitioner (EAP) to compile a Wetland Rehabilitation Plan for the Proposed Mixed-use Development, known as Northern Residential Estate. A RoD (Environmental Authorisation) was granted under Reference Number GAUT 002/05-06/1476. The application site is situated on portions of the Remainder of Portion 1 of the Farm Waterval 51R in Midrand, Gauteng, just south of Allendale Road and west of the N1 freeway (**Figure 1 and 2**). The study site falls in the jurisdiction of the City of Johannesburg Metropolitan Municipality. An updated Rehabilitation Plan is required as the additional stormwater from the Proposed Development will be directed towards the wetland area which will have additional impacts on the system.

An updated “**Open Space and Wetland Management Plan**” was prepared by Dr. Gwen Theron in August 2012 in response to the ROD from the GDARD.

The purpose of the Amended Rehabilitation and Wetland Management Plan is to guide the additional rehabilitation work downstream of the existing rehabilitated wetland upstream to compensate for the additional stormwater run-off from the proposed development. This plan is flexible to be adapted where necessary and to address issues that may arise during the construction phase.

**Take note:** There is already an approved Rehabilitation Plan and EMPr for the study area and no amendments to these plans will be required. However, a new Rehabilitation Plan and EMPr which will specifically be applicable to the relaxation of the 30m buffer area and proposed mitigation measures will be submitted as part of this application and must be regarded as supplementary documentation to the existing Rehabilitation Plan and EMPr which have already been approved and implemented in the former authorisations.



## 2. Rationale and Objectives

The purpose of this document is to:

- Provide suitable rehabilitation measures in order to facilitate the ongoing ecological functioning of the wetland and associated areas;
- Incorporate the storm water management plan obtained from the engineer to reduce erosion and siltation;
- Provide recommendations and mitigation measures for adverse impacts caused during the construction phase;
- Guide the management of the ecological attributes of the wetland;
- Provide guidance as to the strategic decision making by the DWA and GDARD; and
- Inform the relevant stakeholders/role players, such as the Contractor, Developer and Home Owners Association of their responsibilities during and after the construction process.

The intention to rehabilitate the wetland area and riparian zone include:

- The stabilisation and rehabilitation of the wetland habitat area;
- The stabilisation and rehabilitation of the riverine zone;
- Rehabilitation of construction activities adjacent to the wetland area;
- Biodiversity conservation to maintain habitat for flora and fauna species associated with wetland areas;
- Reduction and management of soil erosion and siltation from storm water run-off;
- Maximise the service provision from the wetland and surrounding affected areas;
- Maximise the ecological functioning of the wetland and surrounding affected areas;
- Minimise impacts on the receiving environment; and
- Monitor the impact of the proposed development on the receiving environment.

## 3. Documentation consulted

The following reference material was consulted during the Amended Rehabilitation and Wetland Management Plan:

- Hydropedology Based Wetland Buffer Assessment and Management Report dated 3 September 2015 compiled by Dr. Johan H. van der Waals from TerraSoil Science (*Refer to Annexure H of EA*).
- Waterfall Open Space and Wetland Management Plan dated August 2012 compiled by Dr. Gwen Theron (*Refer to Annexure G of EA*).
- ROD for Northern Residential Estate – GAUT 002/05-06/1476



- A Preliminary Wetland Delineation and Functional Assessment dated March 2006 compiled by Strategic Environmental Focus (PTY) LTD
- Wetland Buffer Zone Reduction Report dated September 2010 compiled by Antoinette Bootsma (Wetland Ecologist Specialist)
- The ecological assessments undertaken by Bokamoso Environmental: Specialist Division as part of the Amened Environmental Authorization Report dated May 2016.
- National Environmental Management Act (1998), including amendments to the Act;
- National Water Act (Act 36 of 1998);
- National Environmental Management: Biodiversity Act (2004);
- Conservation of Agricultural Resources Act (CARA; Act 43 of 1983)

### **3.1. The National Water Act, 1998 (Act No: 36 of 1998)**

#### **CHAPTER 6 Section 65**

##### ***Expropriation for rehabilitation and other remedial work***

*(1) If a person who is required under this Act to undertake rehabilitation or other remedial work on the land of another, reasonably requires access to that land in order to effect the rehabilitation or remedial work, but is unable to acquire access on reasonable terms, the Minister may -*

*(a) expropriate the necessary rights in respect of that land for the benefit of the person undertaking the rehabilitation or remedial work, who will then be vested with the expropriated rights; and*

*(b) recover all costs incurred in connection with the expropriation, including any compensation payable, from the person for whose benefit the expropriation was effected.*

*(2) Where a servitude of abutment, aqueduct or submersion is expropriated under this section, the Minister or water management institution responsible for the expropriation has the same rights as those vesting in the holder of a servitude under section 128.*

#### **CHAPTER 14 Section 137**

*(1) The Minister must establish national monitoring systems on water resources as soon as reasonably practicable.*

*(2) The systems must provide for the collection of appropriate data and information necessary to assess, among other matters -*

*(a) the quantity of water in the various water resources;*



- (b) the quality of water resources;*
- (c) the use of water resources;*
- (d) the rehabilitation of water resources;*
- (e) compliance with resource quality objectives;*
- (f) the health of aquatic ecosystems; and*
- (g) atmospheric conditions which may influence water resources.*

#### 4. Limitations and Potential Problems

The success of the rehabilitation measures will only be evident after a certain time period has elapsed; therefore monitoring and record keeping is critical to ensure hydrological and ecological functioning. Vegetation used for the rehabilitation and stabilisation of the wetland habitat should be done according to this report based on the documentation consulted and the EMPr. If such measures are not implemented correctly the risk of storm water erosion and siltation in the wetland could cause water and soil pollution and further degradation of the entire system.

#### 5. Potential Impacts and Threats

The significance of Adverse Environmental Impacts on the water resources and other water users were assessed according to the criteria of Table 1. The adverse impacts and mitigation measures are discussed in Table 2.

**Table 1: Measures for determining the extent of the impacts on the Water Resources and Water Users**

<b>Improbable</b>	- Low possibility of impact to occur either because of design or historic experience.
<b>Probable</b>	- Distinct possibility that impact will occur.
<b>Highly probable</b>	- Most likely that impact will occur.
<b>Definite</b>	- Impact will occur, in the case of adverse impacts regardless of any prevention measures.

Table 2: Adverse Impacts and Mitigation Measures

POTENTIAL IMPACTS	DESCRIPTION	SIGNIFICANT RATING OF THE IMPACT	PROPOSED MITIGATION	SIGNIFICANT RATING OF THE IMPACT AFTER MITIGATION
Altered Storm Water Flow due to Altered Surfaces and Gradients	The proposed development will create relatively large impervious areas that will substantially increase the storm water runoff from the site. These areas should be mitigated, in order to ensure that the storm water be released into the shallow valley along the southern boundary of the site.	Highly Probable	<ul style="list-style-type: none"> <li>• Storm water run-off from the developed areas must be routed via the route channels and proposed storm water pipe-and-culvert network;</li> <li>• Spillways must be designed and implemented to assist with the flow of storm water;</li> <li>• The drainage system must be gravity operated to ensure that the capacity of the system is not affected;</li> <li>• The storm water management plan should be designed as to ensure the post-development run-off does not exceed pre-development values in: <ul style="list-style-type: none"> <li>○ Peak discharge for any given storm</li> <li>○ Total volume of runoff for any given storm</li> </ul> </li> </ul>	Probable

			<ul style="list-style-type: none"> <li>○ Frequency of run-off</li> <li>○ Pollutant and debris concentrations reaching water courses;</li> <li>● The storm water management plan must ensure that all culverts and storm water discharge outlets promote diffuse flow and should be fitted with energy dissipaters;</li> <li>● The concentration and size of the storm water outlets must be considered;</li> <li>● Run-off from paved surfaces should be slowed down by the strategic placement of berms;</li> <li>● Flows should be dispersed before reaching the culverted road crossing below and energy dissipating structures must be constructed above the culvert inlet. Measures to prevent erosion should be implemented and an energy dissipating structure should be constructed below the culvert outlet;</li> <li>● A piped culvert is recommended at all road crossings or any place where infrastructure will</li> </ul>	
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			<p>cross or infringe on the main storm water channel. All point source discharges and culverts should be fitted with energy dissipating structures at the outlets/outfall, which is where the storm water is received into the rehabilitated environment. Energy dissipaters are structures designed to reduce runoff velocity below an outfall;</p> <ul style="list-style-type: none"> <li>• The use of permeable paving is advised for the parking lot to delay the speed of the water into the storm water drains. This will serve a localised flood attenuation function over a larger area.</li> </ul>	
Erosion and siltation	If not planned and managed correctly, construction and other activities could cause soil erosion. Mitigation measures must be taken into account to prevent erosion and the possible	Highly Probable	<ul style="list-style-type: none"> <li>• The manner and volume of discharge of storm- and treated water must be addressed in the SWMP and accordingly be managed correctly and effectively to prevent erosion and siltation from occurring to ensure the sustainability of the drainage system especially lower down in the catchment;</li> <li>• Mitigation measures to prevent erosion, siltation</li> </ul>	Improbable

	<p>impact on the wetlands and water quality.</p> <p>Erosion may occur due to surface runoff and the water discharged at the discharge points eroding the soil through occasional or permanent discharge and runoff. This is also dependant on the volumes of discharge.</p>		<p>and water pollution at the storm water discharge points should be provided by the involved storm water engineer;</p> <ul style="list-style-type: none"> <li>• The SWMP should be designed inherent to the following principles;             <ul style="list-style-type: none"> <li>○ Alter the natural flow regime of water course on site as little as possible</li> <li>○ Retain inherent drainage systems in natural areas</li> <li>○ Simulate natural runoff and convergence of storm water</li> <li>○ Minimise unnatural drainage diversions</li> <li>○ Promote sheet flow of storm water runoff on open areas</li> <li>○ Conserve the in situ soil mantle as far as possible by ensuring that accelerated erosion caused by human activities are addressed and attended to</li> <li>○ Make use of energy dissipation solutions to storm water systems where necessary</li> </ul> </li> </ul>	
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			<ul style="list-style-type: none"> <li>○ Minimise and avoid structures across drainage channels</li> <li>○ Protect and line open storm water drainage channels as an aid and secondary assistance to storm water management</li> <li>○ Maintain quality or even improve quality of water bodies</li> <li>● The SWMP plan should be signed and implemented in a way that aims to ensure that post development runoff does not exceed predevelopment values in:             <ul style="list-style-type: none"> <li>○ Peak discharge for any given storm</li> <li>○ Total volume of runoff for any given storm</li> <li>○ Frequency of runoff</li> <li>○ Pollutant and debris concentrations reaching water courses</li> </ul> </li> <li>● Exposed areas at runoff and discharge should be covered with vegetation to prevent unnecessary erosion and siltation in these areas.</li> </ul>	
Contamination	Seepage of waste water or	Highly	<ul style="list-style-type: none"> <li>● Sufficient and temporary facilities including</li> </ul>	Probable

<p>of surface and groundwater resources</p>	<p>storm water combined with process water can seep through to groundwater resources and contaminate it.</p>	<p>probable</p>	<p>ablution facilities must be provided for construction workers operating on the site;</p> <ul style="list-style-type: none"> <li>• A minimum of one chemical toilet shall be provided per 10 persons. The contractor shall keep the toilets in a clean, neat and hygienic condition. Toilets provided by the contractor must be easily accessible and a maximum of 50m from the works area to ensure they are utilized. The contractor (who must use reputable toilet-servicing company) shall be responsible for the cleaning, maintenance and servicing of the toilets. The contractor (using reputable toilet-servicing company) shall ensure that all toilets are cleaned and emptied before the builders or other public holidays;</li> <li>• The toilets must be placed outside the 1:100 year flood line and as far away as feasible from any water courses;</li> <li>• No person is allowed to use any other area than chemical toilets;</li> </ul>	
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			<ul style="list-style-type: none"> <li>• No French drain systems may be installed;</li> <li>• No chemical or waste water must be allowed to contaminate the run-off on site;</li> <li>• Avoid the clearing of the site camp or paved surfaces with soap;</li> <li>• Drip trays and/ or lined earth bunds must be provided under vehicles and equipment, to contain spills of hazardous materials such as fuel, oil and cement;</li> <li>• The repair and storage of vehicles only within the demarcated site area;</li> <li>• Spill kits must be available on site. In case of accidental spills of oil, petroleum products, etc., good oil absorbent materials must be on hand to allow for the quick remediation of the spill. The kit should also be well marked and all personnel should be educated to deal with the spill. Vehicles must be kept in good working order and leaks must be fixed immediately on an oil absorbent mat. The use of a product such as Sunorb is</li> </ul>	
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			<p>advised;</p> <ul style="list-style-type: none"> <li>• Oils and chemicals must be confined to specific secured areas within the site camp. These areas must be bunded with adequate containment (at least 1.5 times the volume of the fuel) for potential spills or leaks;</li> <li>• All spilled hazardous substances must be contained in impermeable containers for removal to a licensed hazardous waste site;</li> <li>• No leaking vehicle shall be allowed on site. The appointed contractor must supply the environmental officer with a letter of confirmation that the vehicles and equipment are leak proof;</li> <li>• No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site;</li> <li>• No effluent (including effluent from any storage areas) may be discharged into any water surface</li> </ul>	
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			<p>or ground water resource;</p> <ul style="list-style-type: none"> <li>• The contractor shall ensure that excessive quantities of sand, silt and silted water do not enter the storm water system;</li> <li>• Ensure safe storage conditions so that there are no losses or leaks;</li> <li>• An area must be allocated for stockpiling of topsoil;</li> <li>• The area must be allocated before the construction takes place on the application site and must be situated away from any water source or drainage channel;</li> <li>• A sediment fence or temporary barrier must be constructed around the stockpile to prevent the soil from washing away by rain or any water; and</li> <li>• Water quality must be monitored from the commencement of construction.</li> </ul>	
Protection of the Existing and Planned	To ensure that the existing and planned rehabilitated wetland areas on the	Probable	<ul style="list-style-type: none"> <li>• The existing rehabilitated wetland area should be clearly marked prior to construction. This area is strictly excluded from development, and should</li> </ul>	Improbable

<p>Rehabilitated Wetland Areas</p>	<p>study area is adequately protected prior and during construction</p>		<p>remain open space during the proposed development activities.</p> <ul style="list-style-type: none"> <li>• Changing the amount of water in the wetlands and riparian area                             <ul style="list-style-type: none"> <li>➤ The groundwater reserves must be protected;</li> <li>➤ Monitor quality of water;</li> <li>➤ Control the activities directly impacting on the water resource;</li> <li>➤ Rehabilitation/restoration of indigenous vegetative cover;</li> <li>➤ Management of onsite water use;</li> <li>➤ Management of point discharges;</li> <li>➤ Alien plant control activities;</li> <li>➤ Storm water detention and treatment;</li> <li>➤ Establishment of a swale downstream to counter the additional runoff.</li> </ul> </li> <li>• Changing the amount of sediment entering the wetland which will result in altered hydrology and associated change in turbidity (increasing or</li> </ul>	
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			<p>decreasing the amount);</p> <ul style="list-style-type: none"> <li>• Implementation of best management practices (Roads and associated drainage and also earthwork activities) <ul style="list-style-type: none"> <li>➤ Source directed controls</li> <li>➤ Buffer zones to trap sediments</li> <li>➤ Active rehabilitation;</li> </ul> </li> <li>• Alteration of water quality - increasing the amount of nutrients (phosphates, nitrite, nitrate) <ul style="list-style-type: none"> <li>➤ Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone</li> <li>➤ Implementation of appropriate storm water management</li> </ul> </li> <li>• Utilize slow-release organic fertilizers.</li> </ul>	
Fauna and Flora	Alien plant species (not indigenous to the area) should be discouraged and restricted as far as possible. Alien species	Definite	<ul style="list-style-type: none"> <li>• A list of invader plant species is made available (<b>Annexure A</b>) which occurs on site which should be eradicated and not be used for rehabilitation purposes;</li> <li>• Only indigenous plant species, preferably those</li> </ul>	Improbable

	<p>depletes surface and ground water resources. They have a significant impact on ecological integrity of natural systems, flooding, erosion, and also water quality and quantity.</p>		<p>that are endemic to the natural vegetation of the area are to be used for rehabilitation purposes;</p> <ul style="list-style-type: none"> <li>• As far as possible plants and trees growing naturally on the study area must be retained as part of the landscaping;</li> <li>• Measures must be developed to protect and conserve the water resources by removing existing alien plants and to discourage recruitment and recolonisation of the alien plants on the study area according to the measures indicated by a qualified wetland/botany specialist;</li> <li>• <i>Hypoxis hemerocallidea</i> was identified during the flora assessment. <i>H. hemerocallidea</i> species should be clearly marked on site prior to construction, and should be relocated to areas with high sensitivity such as wetland boundaries, before any site clearance takes place.</li> <li>• If during the construction phase any species of fauna is found, it is advised that the species be</li> </ul>	
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			<p>removed to a safe place to ensure the species is not damaged by the construction activities according to the measures indicated by a qualified fauna specialist;</p> <ul style="list-style-type: none"><li>• There must be ensured that no fauna species are unnecessarily disturbed, trapped, hunted or killed during the construction phase</li></ul>	
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## 6. Wetland Rehabilitation Measures

### 6.1. Storm Water Management Plan (SWMP)

#### Construction Phase

- Energy dissipation structures and stilling basins must be installed at each storm water outlet structure. Stilling basins will help to reduce the amount of suspended solids in the storm water run-off and to act as sand traps.
- The internal storm water system must consist of an underground gravity pipe and culvert network, roadside channels and inlet structures that will drain the roads and other impermeable and semi-impermeable surface areas. It must be designed to have sufficient capacity to convey a 1:5 and 1:25 year rainfall event. It must thus be aimed to concentrate storm water runoff in certain areas, for example at low points in the parking areas and in the roadside channels.
- Storm water runoff from the developed areas will be routed via the road side channels and storm water pipe and culvert network. It must eventually be released into the shallow valley along the southern boundary of the site.
- Should the 30m buffer zone be relaxed as proposed, an additional swale should be implemented downstream of the existing rehabilitated wetland to counter the additional storm water run-off. The swale is not fixed in its position and can move up or down the stream with  $\pm 35\text{m}$  to suit existing site conditions. The catchment area affected is 4.2 ha, thus the catchment area requires an attenuation pond of  $1470\text{m}^3$ .
- Frequent inspection of the wetland site must be done to ensure that no harmful practices/detrimental impacts (erosion, siltation etc.) occur on site. In the event that such practices/impacts are noted, it must be rectified and remediated immediately.
- Another aim is that the roads, walkways, parking areas and channels can act as overland flow routes which will channel, attenuate and ultimately discharge the surface runoff via predetermined escape routes into the shallow valley along the southern boundary of the site. The design will have to allow for adequate management of the 1:50 year rainfall event.
- Culvert outlet structures and overland chutes must be installed to convey storm water runoff from the development into the valley. Each outlet structure must have an energy dissipation structure and stilling basin to protect the river banks and riparian vegetation from erosion while also reducing the amount of suspended solids in the runoff released back into the river.
- The floor of each catch pit must have a sump 150mm lower than the invert of the outgoing pipe/culvert to act as sand traps all over the development.
- It is advised that for purposes of improved storm water quality, shallow overland storm water channels must be shaped from two major storm water outlets and stilling basins. The open channels must be planted with wetland vegetation such as reed beds to ensure that the levels of phosphorous in the storm water runoff are reduced.
- Other measures that are advised are:

- Identification and protection of potential routes for major floods;
- Minimising the concentration of storm water runoff;
- Promotion of onsite filtration; and
- Adequate drainage of all temporary/artificial low points;
- Spillways must be implemented to assist with the flow of storm water.
- The drainage system must be gravity operated to ensure that the capacity of the system is not affected.
- The storm water management must ensure that all culverts and storm water discharge outlets promote diffuse flow and should be fitted with energy dissipaters.
- Flows should be dispersed before reaching the wetland and energy dissipating structures such as gabions or Armorflex lining should be installed to aerate the water.
- The use of permeable paving is advised for the parking lots to delay the speed of the water into the storm water outlets.
- Shaping of the parking areas to allow water to drain into separate field drains and not collect into a single high flow system.

### Operational Phase

- Storm water runoff from the developed areas will be routed via the road side channels and storm water pipe and culvert network. It must eventually be released into the exiting rehabilitated wetland area.
- Frequent inspection of the wetland site must be done to ensure that no harmful practices/detrimental impacts (erosion, siltation etc.) occur on site. In the event that such practices/impacts are noted, it must be rectified and remediated immediately.
- Regular inspection of dissipation and erosion devices is needed.
- Removal of debris and other obstructing materials from the site and erosion prevention structures must be done regularly to prevent damming of water and increasing flooding danger.
- It is of utmost importance that storm water must be managed in an effective manner to ensure the following, especially in terms of the water resources:
  - Preserve and protect aquatic resources – Existing, relatively intact ecosystems are the keystone for conserving biodiversity and provide the biota and other natural materials needed for the recovery of impaired systems.
  - Maintain and/or improve ecological integrity – The ecologic integrity of the natural systems must be maintained to ensure that the aquatic ecosystems don't degrade.
  - Maintain and/or improve natural structure – Stream channelization, ditching in wetlands, disconnection from adjacent ecosystems and other modifications are examples of structural arrangements which need to be avoided as far as possible.
  - Maintain and/or improve natural function – Structure and function are closely linked in river corridors, lakes, wetlands, estuaries and other aquatic resources.



- Maintain and/or improve the natural potential of the watershed – A watershed has the capacity to become only what its physical and biological setting – its Ecoregion, climate, geology, hydrology and biological characteristics will support.
- Prevent degradation – When degradation is noted, restoration/rehabilitation must be implemented according to this rehabilitation plan.
- Develop clear, achievable and measurable goals for the resources – Environmental degradation may occur without clear goals which direct implementation measures such as storm water management and provide the standards for measuring success.
- Focus on feasibility – It is critical to focus on whether the activities related to the resources are feasible (taking into account scientific, financial, social and other considerations).
- To serve as a reference site – Reference sites are areas that are comparable in structure and function of water resources
- Manage/anticipate the current/future changes – The environment and our communities are both dynamic. Although it is impossible to plan for the future precisely or always effectively manage planned changes, many foreseeable ecological and societal changes can and should be factored into the changes/designs. It is important to take into account changes in runoff resulting from projected increases in upstream impervious surface areas due to development. In addition to impacts from changes in watershed land use, natural changes such as plant community succession can also play an important role.
- Involve skills and insights of a multi-disciplinary team - Management of water resources and/or rehabilitation can be a complex under taking that integrates a wide range of disciplines including ecology, aquatic biology, hydrology and hydraulics, geomorphology, engineering, planning, communications and social science.

## 6.2. Erosion, Siltation and Sedimentation

### Construction Phase

- Large exposed areas during the construction phase should be limited.
- Where possible, areas earmarked for construction during later phases should remain covered with vegetation coverage until the actual construction phase. This will prevent unnecessary erosion and siltation in these areas.
- Unnecessary clearing of vegetation resulting in exposed soil prone to erosive conditions should be avoided.
- All embankments must be adequately compacted and planted with indigenous grass (such as *Eragrostis* spp., *Imperata cylindrica*, *Leersia hexandra* and *Sporobolus* spp.) and tree species (such as *Celtis africana*, *Combretum erythrophyllum*, *Olea europaea* subsp. *africana*, *Searsia lancea* and *Vachellia karroo*) to stop any excessive soil erosion.

- The removal of any alien plant species (**Annexure A**) should be followed up as soon as possible by replacement with indigenous vegetation to ensure quick and sufficient coverage of exposed areas.
- Storm water outlets must be correctly designed to prevent any possible soil erosion.
- All surface runoff must be managed in such a way as to ensure erosion of soil does not occur.
- Temporary storm water management measures that will help to reduce the speed of surface water must be implemented.
- An area (away from the wetland and drainage line) must be allocated for stockpiling of topsoil. The area must be allocated before the construction takes place on the application site and must be situated away from any water source.

### Operational Phase

- The groundwater reserves must be protected.
- Monitoring of water quality must take place regularly.
- Replanting and rehabilitation of indigenous vegetative cover such as indigenous grasses (such as *Eragrostis* spp., *Imperata cylindrica*, *Leersia hexandra* and *Sporobolus* spp.) and tree species (such as *Celtis africana*, *Combretum erythrophyllum*, *Olea europaea* subsp. *africana*, *Searsia lancea* and *Vachellia karroo*).
- Management of onsite water use.
- Management of point discharges.
- Alien plant control activities (**Annexure A**).

## 6.3. Surface and groundwater pollution

### Construction Phase

- Sufficient temporary facilities including ablution must be provided for construction workers.
- A minimum of one chemical toilet must be provided per 10 persons. The contractor must keep the toilets clean, neat and in a hygienic condition. Toilets provided by the contractor must be easily accessible and a maximum of 50m from the works area to ensure they are utilised. The contractor (who must use a reputable toilet servicing company) shall be responsible for the cleaning, maintenance and servicing of the toilets. The contractor is responsible for the cleaning, maintenance and servicing of the toilets. The contractor must ensure that all toilets are cleaned and emptied before the builder's or other public holidays.
- No person is allowed to use any other area than the chemical toilets.
- No chemical or waste water must be allowed to contaminate the runoff on site.
- Avoid the clearing of the site camp or paved surfaces with soap.
- Repair and storage vehicles only allowed within the demarcated site area.
- No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site.
- No effluent may be discharged into any water surface or ground water resource.

- The contractor shall ensure that excessive quantities of sand, silt and silted water do not enter the storm water system.
- Ensure safe storage conditions so that there are no losses or leaks
- An area must be allocated for stockpiling of topsoil
- The area must be allocated before the construction takes place on the application site and must be situated away from any water resource

### Operational Phase

## 6.4. Fauna and flora

### Construction Phase

- Propagation of plants should be encouraged. The growth of endangered and important indigenous plants must be encouraged
- If during the construction phase any species of fauna is found, it is advised that the species be removed to a safe place to ensure the species is not damaged by the construction activities
- It must be ensured that no fauna species are unnecessarily disturbed, trapped, hunted or killed during the construction phase.

### Operational Phase

- Replanting and rehabilitation of indigenous vegetative cover in wetland areas such as:
  - Sedges (*Cyperus* spp., *Fuirena* spp. and *Schoenoplectus* spp.)
  - Rushes (*Juncus* spp.)
  - Bull rushes (*Typha capensis*)
  - Reeds (*Phragmites australis*)
  - Grasses (*Imperata cylindrica*)
  - Bulbs (such as *Crinum* spp., *Trachyandra* spp., *Kniphofia ensifolia*) could also be used in non-permanent wetland zones.

Installation of the plants should reflect their natural position in a wetland area.

## 6.5. Wetland Management Plan

**Refer to Table 3.**

Table 3: Wetland Rehabilitation Measures

Rehabilitation action	Method	Responsible person
1. Removing alien invasive species	Section 7 describes a recommended alien invasive monitoring program. Next to the existing wetland areas, any alien invasive species that are present should be removed. Locations where large individuals/groups are removed it will later in the rehabilitation program be replaced by indigenous species. ( <i>Refer to Annexure A for list of known alien plant species on site</i> ).	Landscape contractor
2. Additional swale downstream of existing rehabilitated wetland	<ul style="list-style-type: none"> <li>• An additional swale is recommended by the civil engineer to counter the additional storm water runoff from the extended infrastructure development. The swale will include two attenuation ponds of approx. 750 m<sup>3</sup>.</li> <li>• Soil erosion structures such as berms/water offshoots should be constructed at drainage outlets.</li> <li>• Indigenous hydrophyte vegetation should be used, such as: <ul style="list-style-type: none"> <li>○ Sedges (<i>Cyperus</i> spp., <i>Fuirena</i> spp. and <i>Schoenoplectus</i> spp.)</li> <li>○ Rushes (<i>Juncus</i> spp.)</li> <li>○ Bull rushes (<i>Typha capensis</i>)</li> <li>○ Reeds (<i>Phragmites australis</i>)</li> <li>○ Grasses (<i>Imperata cylindrica</i>)</li> <li>○ Bulbs (such as <i>Crinum</i> spp., <i>Trachyandra</i> spp., <i>Kniphofia ensifolia</i>) could also be used in non-permanent wetland zones.</li> </ul> </li> <li>• Siltation prevention measures such as hay bales and indigenous vegetation should be installed at the outflows from all storm water outlets to catch any sediment still in suspension.</li> <li>• Energy dissipation measures such as gabions, straw bales and other dissipation devices must be installed at storm water inlets and outlets to decrease the speed and energy of water and to minimise the potential for downstream erosion.</li> </ul>	Engineer; Contractor; Landscape contractor; Hydro-seeding contractor

<p>3. Stabilization of watercourse where erosion occur</p>	<p>Levelling of the existing watercourses will be done where it has eroded to form gullies or deep (steep) river banks. This will make the stream shallower by increasing the width of the stream, resulting in a decreased velocity of the stream and reducing the erosion ability. Hyson cells or Eco mats can be considered if the stability of the sloped area is in question. Levelling of the watercourse will be done in conjunction with action no. 5 (construction of small structures).</p>	<p>Contractor Engineer</p>
<p>4. Sloping</p>	<p>If the embankments of the wetland is too steep (this is unlikely), it will be sloped to an acceptable gradient (decided upon by engineers) and be vegetated to ensure stability.</p>	<p>Contractor Engineer</p>
<p>5. Regulate flow through the construction of small structures</p>	<p>Construct boulder weirs at allocated points (indicated on the rehabilitation plan), where storm water enter the wetland stream, in order to decrease the water flow. The weir will allow the water table to rise a little and break the energy flow which will decrease the risk of erosion. The weir will include a Reno mattress which will assist with silt trapping and thus releasing cleaner water. Effective levelling should be conducted before the implementation of any rehabilitation structure. A geotextile lining may be incorporated between the boulders to act as a silt trap and ensure that the soil do not move downwards through the boulders.</p> <p>Below are illustrations of the recommended structures to be used for the rehabilitation of the wetland where storm water outlets will be directed towards the stream.</p> <p>The size and position of all weir structures need to be assigned by engineers after the necessary calculations and analysis have been conducted. The contractor on site will be responsible to ensure temporary measures to prevent siltation, gully formation and water pollution during the rehabilitation process. These measures need to be approved by the Environmental Consultant or Landscape Architect before it is implemented.</p>	<p>Engineer Contractor</p>

<p>6. Installation of silt traps</p>	<p>Water will be cleaned before it is transported to the wetland area through the installation of silt traps. A silt trap will be constructed at all boulder weirs within the watercourse. The silt trap will include indigenous vegetation, boulders (Reno mattress), as well as a geotextile lining.</p>	<p>Contractor</p>
<p>7. Re-vegetation of the rehabilitated watercourse</p>	<p>Re-vegetation is a very important part of sloping as it will make the soil more stable and create roughness. A groundcover should be established on the sloped areas (where work was done for the storm water channels) to avoid sedimentation in the wetland downstream. Groundcover will also be necessary as the rehabilitated area need to have a vegetation cover of at least 75%.</p> <p><i>It should be noted that re-vegetation is only necessary if the natural vegetation was disturb or removed. In order to maintain a natural system, as little as possible work should be done within the wetland as well as the minimum alterations should be executed.</i></p> <p>Indigenous tree species such as <i>Celtis africana</i>, <i>Combretum erythrophyllum</i>, <i>Searsia lancea</i> and <i>Vachellia karroo</i>, and grasses such as <i>Eragrostis</i> spp., <i>Sporobulus</i> spp. and <i>Cynodon dactylon</i> are recommended for the sloped areas. <i>C. dactylon</i> is an adaptable grass that forms a thick mat and is able to grow in wet and dry land conditions. Planting method suggested for this project is hydro-seeding or even sowing by hand as the area is not that big. Hydro-seeding is the establishment of vegetation using a slurry water and seed mixture which is sprayed over a prepared surface. This is the most cost effective method for rehabilitation of large areas as all surfaces are covered and vegetation quality is high.</p> <p>Aquatic vegetation may also be incorporated in the re-vegetation plan. These will include sedges (<i>Cyperus</i> spp., <i>Fuirena</i> spp. and <i>Schoenoplectus</i> spp.), rushes (<i>Juncus</i> spp.), bull rushes (<i>Typha</i></p>	<p>Landscape contractor Hydro-seeding contractor</p>

	<p><i>capensis</i>), reeds (<i>Phragmites australis</i>), and grasses (<i>Imperata cylindrica</i>). Alongside the water channel, <i>Typha capensis</i> should be planted to add roughness to the stream. This aquatic plant provides nesting opportunities and shelter for various bird species as well as habitat for frogs, toads and other aquatic organisms. On the areas cleared of vegetation along the watercourse, a seed mix suitable for moist conditions can be seeded.</p>	
<p>8. Clean up litter</p>	<p>For the health of the wetland, a program is suggested to clean up the litter especially near the streams. Litter, sewage and the bathing of humans in the streams allows chemicals into the wetland, decreasing the health in the wetland which will lead to lower biodiversity. The program may include the occasional day job for previously disadvantaged individuals.</p>	<p>Owner</p>

## 7. Alien Invasive Programme

An alien invasive eradication and monitoring program is recommended for the study area as well as the adjacent wetland areas that will form part of the SWMP, as this will promote biodiversity in the area and limit the distribution of alien invasive species via water and humans. (*Refer to Annexure A for a list of alien species known to occur on site*).

**Table 4: Control methods for alien invasive species**

Method	Description
Mechanical	The removal of species by hand or with appropriate tools, instruments and machines
Chemical	The optimal use of herbicides to control target species
Biological	This involves the intentional use of populations of natural enemies of the target alien or invasive species or other methods that adversely affect the biological integrity of the target species
Habitat management	This control methods uses measures such as prescribed burning, grazing and other activities
Integrated pest management (IPM)	This involves a combination of methods above based on ecological research regular monitoring and careful co-ordination

A recommended eradication program includes:

- The areas to be disturbed during construction should be limited.
- Careful removal of indigenous plants before construction commences. Plants should be replanted on the study site (as suggested by the landscape architect) as soon as construction is completed.

The best mitigation measure for alien and invasive species is the early detection and eradication of these species.

A suggested method of establishing a continual eradication program is:

1. The scope of the problem should be assessed and a clearing plan should be established. Funding should be included in the budget to rehabilitate the areas in which alien and invasive species have been removed in order to prevent further destruction to the ecosystem.



2. Decide where control should start and how much can be coped with. Remove weeds in the least affected areas and work outwards to the heavier weed infestations thus rapidly safeguarding relatively large areas.
3. Identify areas where vigorous indigenous bush meets weedy areas and carefully work outwards from the indigenous area to the weedy area. If possible always start at the peak and work downwards.
4. Remove weeds carefully and try to cover exposed soil with cut vegetation or leaf litter that is free of weeds, seeds which will not regrow if in contact with the soil.
5. Press any loosened soil down lightly taking care not to damage native plants and mulch with plant material where possible. This will help prevent alien weeds from filling gaps left by weeding.
6. Wherever possible try to prevent weeds from producing seeds or fruit by controlling them before they flower. Do not transport seeds, fruits, bulbs, tuber or stems that root easily away from the areas. It is advisable to burn the pieces "on site" if at all possible.

Often the most time/cost effective way of dealing with heavy infestations is to arrange for the correct use of herbicides e.g. use a spot spray or foliar spray correctly applied to the target plants, thus ensuring minimum soil disturbance and so reducing the chance of invader seeds germinating in the "seed bed" created by "weeding". In other instances, slash the plant down and return in a few months to foliar spray the re-growth e.g. reeds. Paint or spray the cut stumps of the larger and more difficult plants. Paint the lower stem.

Follow up control is essential and it requires a regular monitoring program done on a regular basis to ensure early detection and removal of alien seedlings until the viable invasive seed bank is exhausted and indigenous plants once again are naturally re-established. The ultimate goal in the control and eradication of alien invasive plants must be the restoration and rehabilitation of the land.

## **8. Monitoring**

### **8.1. Construction Phase**

#### **Water quality**

#### **Other aspects**

- Soil and water contamination must be avoided. In the event that it does occur, the impacts of such pollution must be mitigated and remediated immediately.
- A competent person must be appointed to assess and ensure the quality of the water during all phases of the construction period.

- Removed soil and stockpiling of soil must occur outside the extent of the watercourse to prevent siltation and increased runoff during construction.
- Utilisation and servicing of chemical toilets must be monitored to ensure that possible soil and water pollution are prevented.
- No chemical or waste water must be allowed to contaminate the runoff on site.
- The utilisation of drip trays, lined earth bunds and cement trays must be monitored to ensure prevention of spill of hazardous materials such as fuel, oil and cement.
- Ensure that a spill kit is always available on site.
- Oils and chemicals must be confined to specific secured bunded/containment areas within the site camp to prevent potential spills or leaks.
- All spilled hazardous substances must be contained in impermeable containers for removal to a licensed hazardous waste site and the area where the spill occurred is rehabilitated.
- No leaking vehicles must be allowed on site.
- No bins containing organic solvents such as paints and thinners may be cleaned on site, unless containers for liquid waste disposal are placed on site for such purposes.
- No effluent (including effluent from any storage areas) may be discharged into any water surface or groundwater resources.
- An area must be allocated for stockpiling of topsoil
- A sediment fence or temporary barrier must be constructed around the stockpile to prevent the soil from washing away by rain or any other water.
- Water quality must be monitored from commencement to completion of construction.

## 8.2. Operational Phase

### Water quality

- Bi-annual water quality monitoring should be undertaken by a competent person to ensure that no detrimental impacts occur on the wetland, surface or groundwater resources.

### Other aspects

- On-going monitoring of water quality on a monthly basis is essential to ensure the functionality of the wetland and Jukskeiriver.
- No effluent (including effluent from any storage areas) may be discharged into any surface or groundwater resources.
- Repair and storage of vehicles only allowed within the demarcated site area.
- Spill kits must be available on site and inspected and monitored regularly to ensure that it complies with the minimum safety requirements.

**All spilled hazardous substances must be contained in impermeable containers for removal to a licensed hazardous waste site.**

## 9. Conclusion

It is believed that the rehabilitation measures offer a viable solution to lessen the impact on the environment and for the conservation of ecological processes. The new proposed swale downstream of the existing rehabilitated wetland should counter the additional storm water runoff should the buffer zone be removed. The rehabilitation plan further provides a tool for managing the current state of the wetland area and should act as a guideline for future monitoring. Since the success of the rehabilitation measures will only be evident after a certain time period has elapsed, this document serves as a dynamic document and should preferably be updated on a yearly basis.

This document should be read in conjunction with the draft EMPr attached as **Addendum A**.

**Annexure A: Alien plant species occurring in the study area which should be eradicated. (Species list extracted from Flora assessment and used with permission from specialist).**

<b>Species</b>	<b>Invasive Category</b>
<i>Acacia dealbata</i> *	2
<i>Acacia mearnsii</i> *	2
<i>Alternanthera pungens</i>	
<i>Amaranthus hybridus</i> subsp. <i>hybridus</i> var. <i>hybridus</i> *	
<i>Arundo donax</i> *	1b
<i>Bidens bipinnata</i>	
<i>Bidens pilosa</i>	
<i>Campuloclinium macrocephalum</i>	1b
<i>Celtis australis</i> *	3
<i>Conyza bonariensis</i>	
<i>Cortaderia selloana</i>	1b
<i>Datura ferox</i>	1b
<i>Datura stramonium</i> *	1b
<i>Flaveria bidentis</i> *	1b
<i>Gomphrena celosioides</i>	
<i>Hibiscus trionum</i>	
<b><i>Ipomoea purpurea</i>*</b>	<b>1b</b>
<i>Lantana camara</i>	1b
<i>Melia azedarach</i>	3
<i>Mirabilis jalapa</i> *	1b
<i>Morus alba</i> *	3
<i>Opuntia cf. stricta</i>	1b
<b><i>Paspalum dilatatum</i>*</b>	
<b><i>Paspalum urvillei</i></b>	
<i>Pennisetum clandestinum</i> *	
<b><i>Persicaria lapathifolia</i>*</b>	
<i>Pinus</i> sp.	
<i>Platanus wrightii</i> *	
<i>Populus alba</i> *	2
<i>Populus x canescens</i> *	2
<i>Ricinus communis</i> var. <i>communis</i> *	2
<i>Richardia brasiliensis</i>	
<i>Salix babylonica</i> *	2
<i>Solanum mauritianum</i> *	1b
<b><i>Tagetes minuta</i>*</b>	
<i>Verbena aristigera</i>	
<b><i>Verbena bonariensis</i>*</b>	<b>1b</b>
<b><i>Verbena brasiliensis</i></b>	<b>1b</b>
<b><i>Xanthium spinosum</i>*</b>	<b>1b</b>
<i>Zinnia peruviana</i>	

Species in **Bold** occur in the wetland area; Species with \* occur in riverine area.

# **Annexure P**

Former Wetland Reports



**A PRELIMINARY WETLAND DELINEATION AND FUNCTIONAL  
ASSESSMENT FOR THE PROPOSED NORTHERN GOLF  
COURSE DEVELOPMENT ON THE REMAINDER OF FARM  
WATERVAL 5 IR, WOODMEAD EXTENSION 24, GAUTENG**

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March 2006

## Executive Summary


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A preliminary wetland delineation and functional assessment was conducted in order to determine the wetland boundaries and functions provided by wetlands for a proposed public golf course and private golf estate to be established on Portion 1 of the Farm Waterval 5 – IR, Woodmead Extension 24, Gauteng. The site's wetland units are in a good functioning condition with their hydrological integrity still well intact. The wetlands support a high natural Egoli Granite Grassland (Mucina & Rutherford, in press) biodiversity, including populations of the vulnerable Marsh Sylph (*Metisella meninx*). The only exceptions are the Modderfonteinspruit and the Jukskei River Riparian Wetlands (Valley bottom with a channel hydro-geomorphic units 5 & 6), which both possess a low water quality and poor aquatic species diversity.

The outer wetland boundary was partly determined by the methodology described in the Department of Water Affairs and Forest's (DWAF) delineation guide document entitled, *A practical field procedure for identification and delineation of wetlands and riparian areas* (DWAF, 2005). Hydrophytic plants and especially hydromorphic soils were the two main indices relied on in this specific delineation process, but only covered a small portion of the site, due to restricted fieldwork. In addition the geotechnical site investigation, soil investigation report, and interpretations from 1:50 000 cadastral maps and 1: 10 000 ortho rectified aerial photographs with 5 m contour lines were made to determine wetland boundaries as part of the desktop study. Desktop delineated wetlands did correlate well with the soil core derived data.

A total of 229.13 ha of wetlands have been delineated, with 84.48 % (193.57 ha) wetland area located on the proposed private golf estate and 15.52 % (35.56 ha) on the public golf course. The wetlands form 1.03 % of the collective wetland catchment (22 293.20 ha).

A Level 1 wetlands function assessment was conducted according to the "Wet-EcoServices" document (Kotze *et al.*, 2005). The result was 15 hydro-geomorphic (HGM) units consisting of three different categories:

- Valley bottom with a channel 6
  - Valley bottom with a channel 5
  - Valley bottom with a channel 4
  - Valley bottom with a channel 3
  - Valley bottom with a channel 2
  - Valley bottom with a channel 1
  - Valley bottom without a channel 5
  - Valley bottom without a channel 4
- 

- Valley bottom without a channel 3
- Valley bottom without a channel 2
- Valley bottom without a channel 1
- Hillslope seepage feeding a watercourse 4
- Hillslope seepage feeding a watercourse 3
- Hillslope seepage feeding a watercourse 2
- Hillslope seepage feeding a watercourse 1

The wetland units perform vital functions in terms of improving water quality, regulating stream flow, assisting flood attenuation, help control erosion and facilitate sedimentation. A minimum buffer zone of 35 m is recommended around each wetland unit to help keep existing hydrological functioning intact, while a 200 m buffer zone is recommended around Valley bottom with a channel 1 HGM unit to conserve viable populations of the endangered Marsh Sylph (*Metisella meninx*).

Hardened surface structures and golf course holes should be kept outside of all buffered wetland units and several mitigation measures, including a well designed wetland sensitive stormwater management plan need to be put in place.



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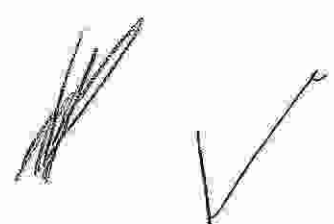
# 1 Introduction: Background and description of the scope of the study

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As South Africa is a contracting party to the Ramsar Convention on Wetlands, the South African government has taken a keen interest in the conservation, sustainable utilisation and rehabilitation of wetlands in South Africa. This aspect is also reflected in various pieces of legislation controlling development in and around wetlands and other water resources, of which the most prominent may be the National Water Act, Act 36 of 1998. As South Africa is an arid country, with a mean annual rainfall of only 450mm in relation to the world average of 860mm (DWAF:2003), water resources and the protection thereof becomes critical to ensure their sustainable utilisation. Wetlands perform various important functions related to water quality, flood attenuation, stream flow augmentation, erosion control, biodiversity, harvesting of natural resources, and others, highlighting their importance as an irreplaceable habitat type. Determining the location and extend of existing wetlands, as well as evaluating the full scope of their ecosystem services, form an essential part in the strive towards sustainable development and protection of water resources.

## *1.1 Site and project description*

The site is situated on the farm remainder of Portion 1 of the Farm Waterval 5 – IR, adjacent to the Ben Schoeman Highway on the east, Allandale Road to the northeast and Witkoppen road to the south (Figure 1). The Jukskei River runs through the site in a general north-western direction, with several tributaries flowing into it, especially from the north-eastern side and the main tributary, the Modderfontein spruit, from the south-eastern side (see Fig. 1). Strategic Environmental Focus, as independent environmental consultants and impact assessors, have been appointed by Waterval Islamic Institute to undertake a wetland delineation and assessment for the proposed development of a public and private golf course on the remainder of Portion 1 of the farm Waterval 5 IR. The Waterval Islamic Institute is proposing to develop both a public and a private golf course, with the required ancillary features. The proposal is to develop the courses as single 18-hole courses with the private golf course consisting of residential erven, situated between the fairways.

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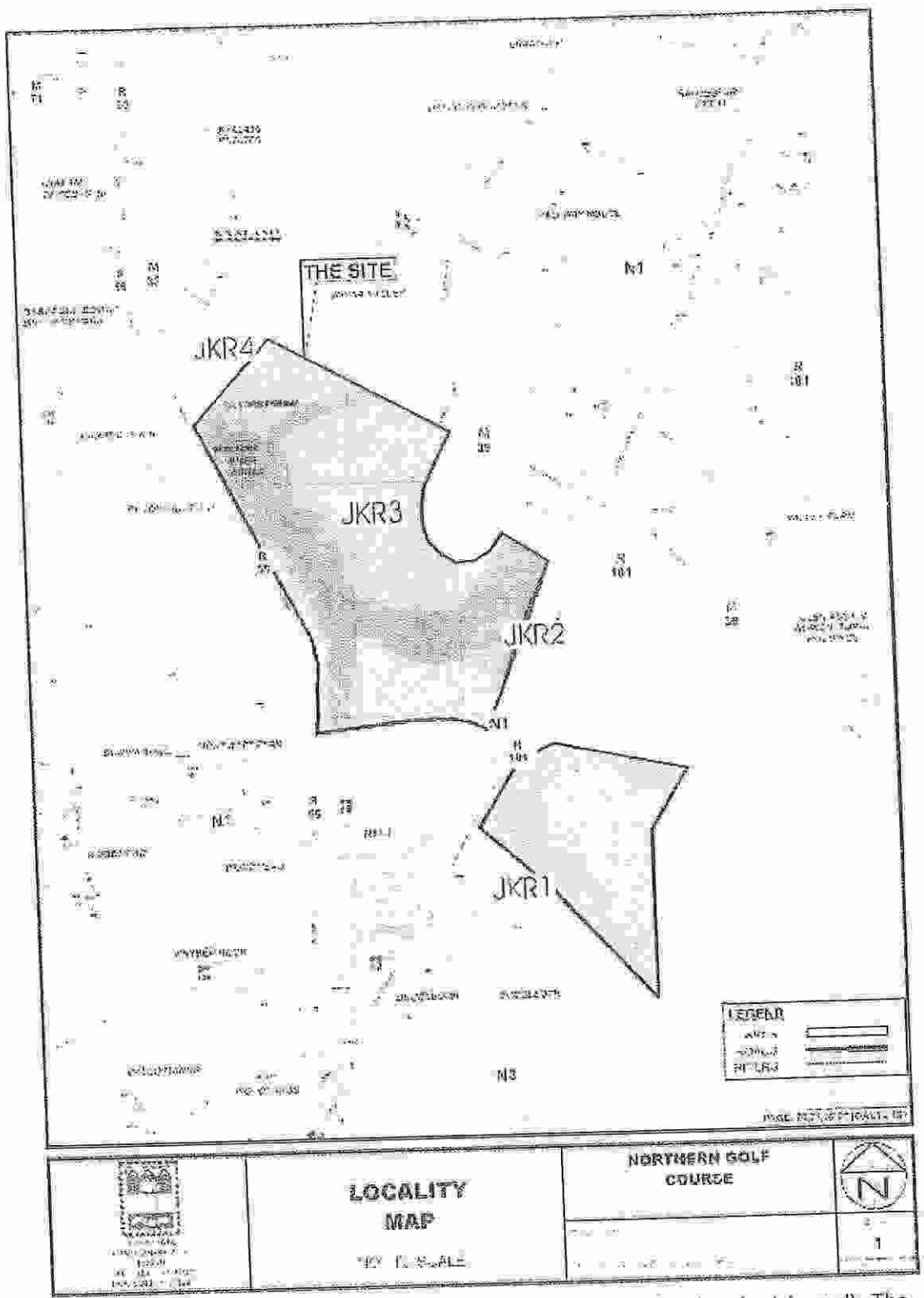


Figure 1. The locality map of the Northern Golf Course site (marked in red). The private golf estate is located on the north-western side of the N1 and the public golf course on the south-eastern side.

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## ***1.2 Terms of reference***

- To delineate the wetlands found within the Northern Golf Course study site.
- To indicate the relative functional importance of the wetlands.
- To make recommendations and an assessment of the proposed development's impacts on the site's wetlands.

## ***1.3 Limitations of the study***

The following assumptions were made:

- No plant studies and surveys are required.
- No animal studies and surveys are required.
- No archaeology studies and surveys are required.
- No geological and pedological studies and surveys are required.

Due to significant time constraints with regards to the fieldwork (only a single field visit on the 2006-03-03) and report compilation, this study is only a preliminary one (an opinion). A more detailed study is required in future to present a more accurate and reliable source of information, with regards to wetland delineation, functional assessment, buffer zones, recommendations and mitigation measures. The results in this report should therefore not be viewed as final and changes should be anticipated. Care was taken to make the most of available means and time.

## ***1.4 Definitions and terms***

A glossary of terms is provided in Section 11 of this document.

## ***1.5 Statutory Requirement related to wetlands***

Prior to 1983 wetlands were poorly protected by law and regarded as "wastelands" that should be drained, filled in or destroyed as pest breeding habitat. From 1983 up to 1997 the Conservation of Agricultural Resources Act (CARA, Act no 43 of 1983) was the deciding statute on wetland utilisation and was only applicable to agricultural land outside official town planning schemes (Lizamore, 2005). Since 1997 onward additional legislation protecting wetlands has been drafted, but no single act exist solely dedicated to wetlands.

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The authoritative legislation, which list impacts and activities on wetlands that requires authorisation, are:

- Conservation of Agriculture Resources Act, Act 43 of 1983.
- Environment Conservation Act, Act 73 of 1989.
- National Water Act, Act 36 of 1998.
- National Environmental Management: Biodiversity Act, Act 10 of 2004.

## 1.6 Wetlands

According to the National Water Act (Act no 54 of 1956) a wetland is defined as, "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

## 2 Methodology

---

The study was conducted as a desktop survey with one day of fieldwork to verify the accuracy of the desktop survey in certain sections of the site. With limited soil coring to be analysed for signs of wetness as wetland indicators, defined by the Department of Water affairs and Forestry in their document "A practical field procedure for identification and delineation of wetlands and riparian areas" (DWAF, 2005), other data sources had to be relied onto. These included:

- The Geotechnical site investigation report (Van Rooy, 2005).
- The Soil information report (Paterson, 2006)
- 1:50 000 cadastral maps
- 1:10 000 ortho rectified aerial photographs with 5 m contour lines

Aerial photographs, 1:50 000 cadastral maps and georeferenced 1:10 000 ortho rectified aerial photos were used as reference material for the mapping of the wetland boundaries. These were converted to digital image backdrops and delineation lines and boundaries were imposed accordingly after the field surveys. These maps are included as part of the project report (see Fig. 2 & 3).

A field survey was undertaken on the property on 3 March 2006. The delineation methodology used was the same as the one set out by the DWAF (2005) document "A Practical field procedure for the identification and delineation of wetlands and riparian areas", but only covered some wetland units located in the north-central section of the site. The "marshy areas prone to flooding" delineated in the geotechnical report (Van Rooy, 2005) correlated well with the soil coring results and a fair degree of accuracy is

therefore assumed. Soil profiles described in the geotechnical were also used to identify potential wetlands in combination with local topography, ortho rectified aerial photo interpretation and the soil information report.

The DWAF field guide makes use of indirect indicators of prolonged saturation by water, namely wetland plants (hydrophytes) and (hydromorphic) soils. The presence of these two indicators is indicative of an area that has sufficient saturation to classify the area as a wetland. Hydrophytes were recorded during the site visit and hydromorphic soils were identified by augering with a bucket soil auger. Wetland boundaries were mapped all throughout the site area.

The methodology "*Wet-EcoServices*" (Kotze *et al.*, 2005) was adapted and used to assess the different benefit values of the wetland units. A Level 1 desktop assessment was performed to determine the wetlands' functional benefits. Other documents and guidelines used are referenced accordingly. Where possible, cross sections were taken to determine the state and boundaries of the wetlands.

### 3 Wetland delineation

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Wetland delineation was based on DWAF's (2005) wetland delineation document, described under the Methodology (see section 2), as well as on topography (5 m contour lines), aerial photo interpretation, and information from the geotechnical site report (Van Rooy, 2005). The result is a series of maps, which indicate the wetlands' boundaries on site, as well as their collective catchment (see Fig. 2 & 3); and a table with wetland specific statistics (Table 1).

#### 3.1 Delineated wetlands on the site area

Total wetland area delineated: 229.13 hectares

Site area: 667.05 hectares

(Private golf estate area = 559.70 ha; Public golf course area = 107.35 ha)

Wetland statistics are listed in Table 1.

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Table 1: Statistics of wetlands situated in the wetlands' direct catchment and quaternary catchment (see Fig. 2 & 3)

	Hectares	Percentage of catchment	Percentage of respective site areas (Private and Public; see Fig. 3)
Site wetlands' direct catchment	22 293.20	100	
Total site area	667.05	2.99	100
Wetlands within the total site boundary	229.13	1.03	34.35
Private golf estate wetland area	193.57	0.87	34.58
Public golf course wetland area	35.56	0.16	33.13
Quaternary	Hectares	Percentage	Not applicable
Other wetlands	Non mapped/ Not available	Non mapped/ Not available	Not applicable

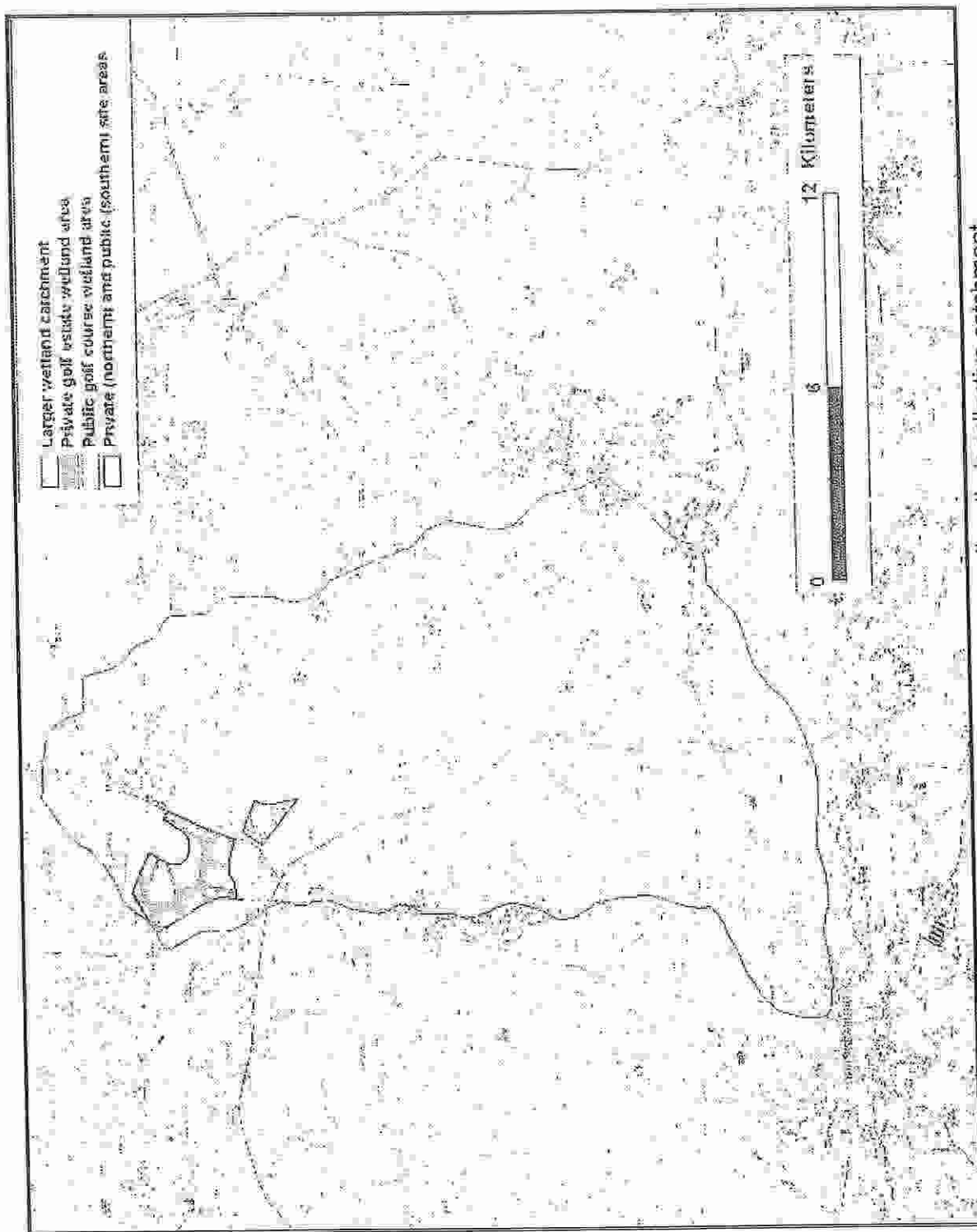


Figure 2. Delineated wetland areas within the site area, as well as their collective catchment.





Figure 3. Wetland area delineated on Private golf estate (northern site) and the Public golf course (southern site)

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### 3.2 Wetland soils

According to the document "A practical field procedure for identification and delineation of wetlands and riparian areas", the permanent zone of the wetland will always have either Champagne, Katspruit, Willowbrook or Rensburg soil forms present, as defined by the Soil Classification Working Group (1991).

The seasonal and temporary zones of the wetlands will have one or more of the following soil forms present (signs of wetness incorporated at the form level): Kroonstad, Longlands, Wasbank, Lamotte, Estcourt, Klapmuts, Vilafontes, Kinkelbos, Cartref, Fernwood, Westleigh, Dresden, Avalon, Glencoe, Pinedene, Bainsvlei, Bloemdal, Witfontein, Sepane, Tukulu, Montagu. Alternatively, the seasonal and temporary zones will have one or more of the following soil forms present (signs of wetness incorporated at the family level): Inhoek, Tsitsikamma, Houwhoek, Molopo, Kimberley, Jonkersberg, Groenkop, Etosha, Addo, Brandvlei, Glenrosa, Dundee (DWAF, 2005).

Signs of wetness were abundant and distinct in several of the soil cores, including the sampled higher lying hillslope seepages, as well as at lower lying sections of valley bottoms (see Fig. 4 & 5). Perched aquifers (Parsons, 2004) and seepages zones are located throughout the site area, typically with hardpan formations (ferricrete) forming an underlying impermeable layer (Van Rooy, 2005). The high degree of seepage is also evident from wet contour drainage lines and furrows collecting seepage and run off water, with a discrete difference in vegetation colouration (see Fig. 6).

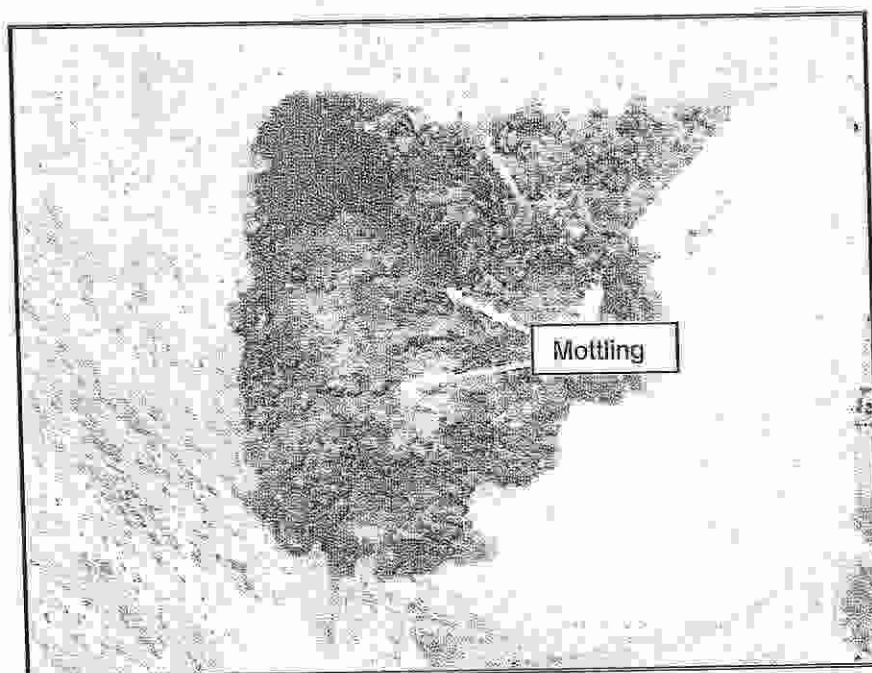


Figure 4. A seasonal wetland soil with distinct mottling.

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Figure 5. Seepage from an excavation site, exposing a wetland soil profile.

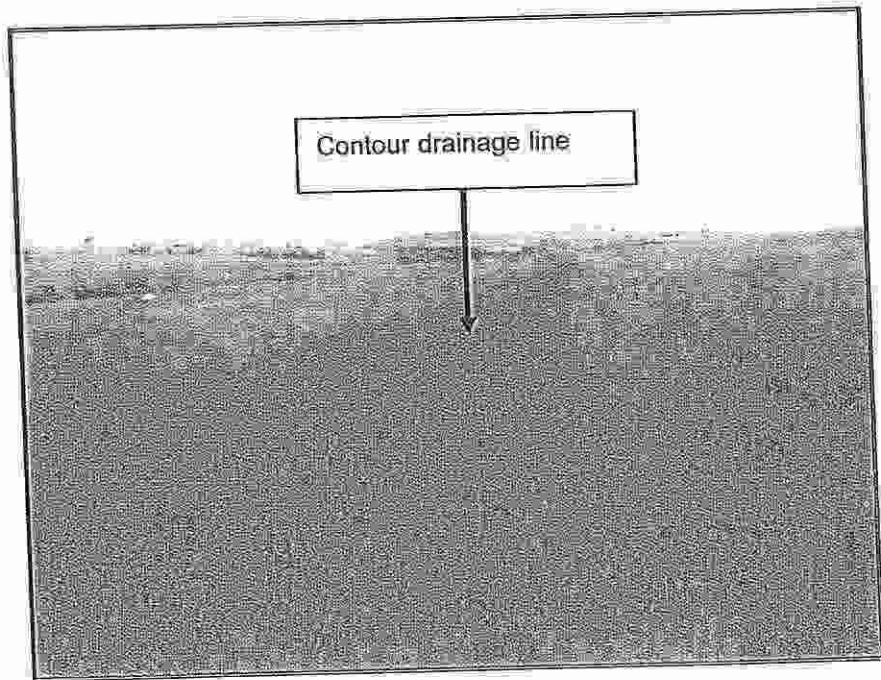


Figure 6. A wet contour drainage line with a different vegetation coloration.

The soil information report (Paterson, 2006) classifies the predominate portion of the site's soils as shallow soils of the *Glenrosa* form (468.6ha), followed by plinthic soils of the *Avalon* and *Longlands* form (81.7 ha & 15.0 ha respectively), and red, structureless soils, mainly of the *Hutton* form, but also of *Avalon* and *Bainsvlei* forms (24 ha). The *Glenrosa*, *Avalon*, *Longlands*, and *Bainsvlei* soil forms are all soil forms described as potential seasonal to temporary wetland soils in the wetland delineation document (DWAF, 2005), which underlines the likelihood and widespread occurrence of wetlands on the site.

### 3.3 Wetland vegetation

The Department of Water Affairs and Forestry's (DWAF) identification and delineation of wetlands and riparian areas document (2005), highlights vegetation as a key component to be used in the delineation procedure. Vegetation also forms a central part of the wetland definition in the National Water Act. Using vegetation as a primary wetland indicator however, requires undisturbed conditions (DWAF, 2005). In general the site's vegetation is in a good condition, with the major disturbance being grazing. Grazing is pronounced especially in the lower lying areas with little sign of erosion or over grazing. Most of the wetland units are dominated by wet grasslands with few sedge species (see Fig. 7). The lack of sedges, especially in the higher lying seepages zones, may give the impression of non-wetland conditions, but signs of wetness from the soils confirm their status. Important wetland associated species include: *Imperata cylindrical*, *Cynodon dactylon*, *Typha capensis*, *Leersia hexandra*, *Phragmites australis*, and *Paspalum* spp.

The lower lying valley bottom wetland zones also contain a high grassland component, but some areas, especially along the Jukskei River, are characterised by riparian trees, such as *Rhus pyroides*, *Celtis Africana*, *Salix babylonica*, *Acacia karoo* and *Combretum erythrophylum* (see Fig. 7 & 8)



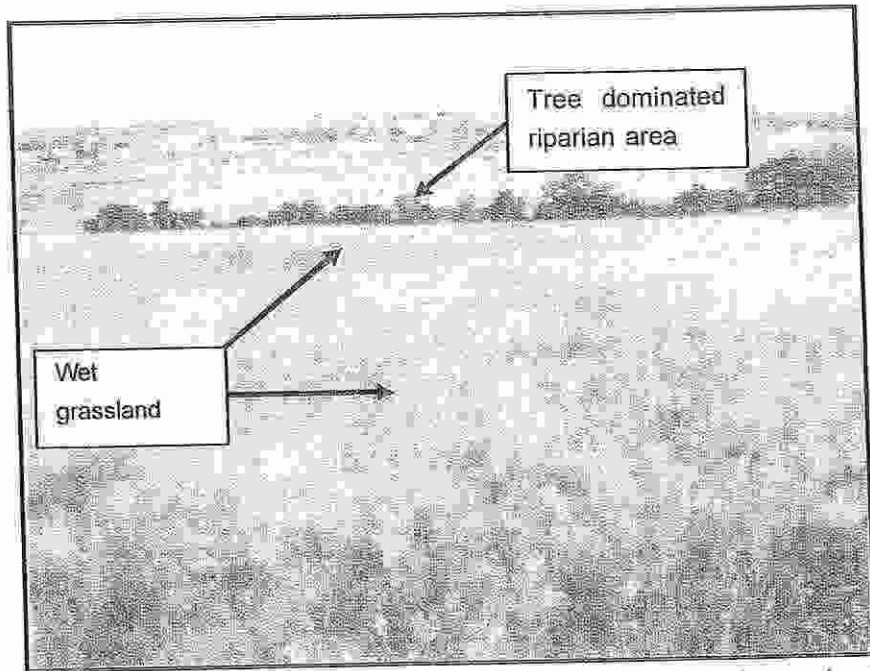


Figure 7. A wetland hillslope seep characterised by a wet grassland with the tree dominated riparian wetland below.

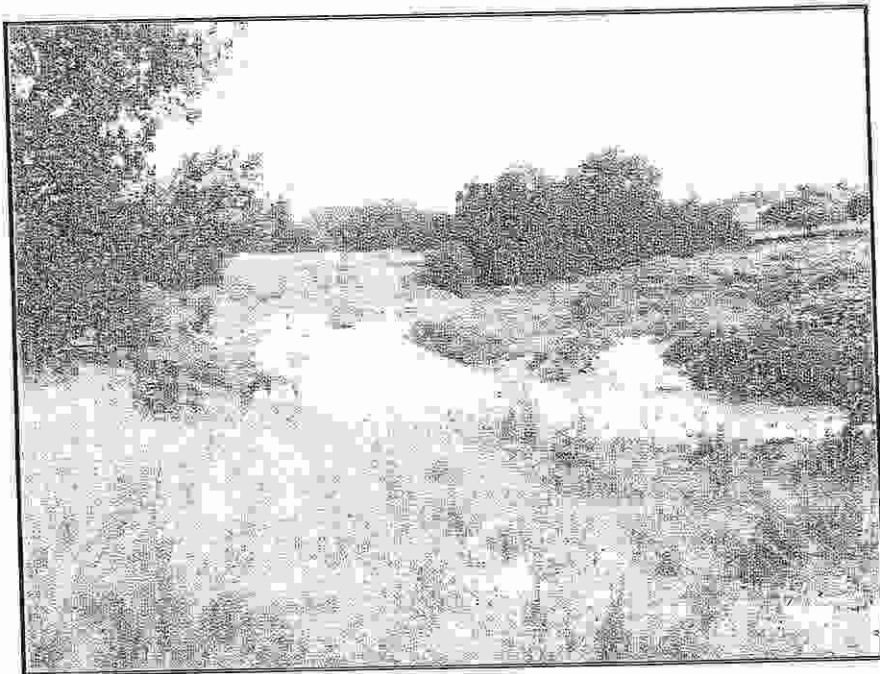


Figure 8. Riparian vegetation along the Jukskei River

The riparian area along the Jukskei River can be classified as a Category C to a Category B wetland from field observations and the geotechnical report (Van Rooy, 2005). This means that it is in almost permanent contact with the zone of saturation and seepage into the system will only cease during periods of drought.

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## 4 Wetland assessment

---

The "*Wet-EcoServices*" (Kotze *et al.*, 2005) methodology was adapted and used to assess the benefit values of the site's wetland units. A level 1 desktop assessment was combined with field observations during the site visit. The technique is however not ideally suited to determine "the specific level of impact of a current or proposed development" and is based more on qualitative data as opposed to quantitative data, which opens it up to subjective misuse (Kotze *et al.*, 2005). The authors do however highlight the system's value to assist in identifying key wetland issues. The technique is used increasingly, due to a lack of existing official wetland assessment techniques in South Africa. It therefore fulfils an important role in assessing wetland functions and value, provided that its limitations are thoroughly taken note of throughout the process.

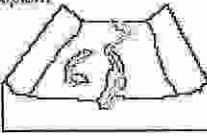

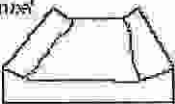
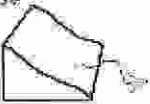


The site's wetlands have been categorised according to different hydro-geomorphic units (HGM units), they are also referred to as wetland units in this report. Hydro-geomorphic units describe how water moves through the landscape. Each time the flow pattern of water changes through the landscape, one HGM unit changes to another type. To keep matters simplified and avoid repetition that might deter comparison, the Valley bottom with a channel HGM units are kept as single HGM entities in spite of the presence of several dams along their length. Each HGM unit on the site area has been mapped as intact systems, even outside the site area's boundaries (see Fig. 9). The only exception are the Modderfonteinspruit Jukskei River Riparian Wetlands (Valley bottom with a channel 5 & 6 HGM units), which stretch beyond the site's boundaries (see Fig. 9).

All the wetland units appear to be in a good functional condition with an intact hydrology. The largest current impacts are overgrazing by livestock and dams within Valley bottom with a channel 6 and Valley bottoms without a channel 3 & 4 HGM units (see Fig. 9). A broad summary of each group of hydro-geomorphic units' hydrological functions and benefits follow below, accompanied by a table illustrating the different types of hydro-geomorphic units (see Table 2 & 3).

### ***4.1 Description and results from the hydrological services provided by the different wetland units***

Three different types of HGM units are described in the study site (see Fig 9 & Table 2). The majority of the wetlands were classified as Valley bottoms with a channel (40 % of all HGM units), followed by Valley bottoms without a channel (33.33 % of all HGM units), and Hillslope seepages feeding a watercourse (26.67 % of all HGM units).

Table 2. Different hydro-geomorphic units typically supporting inland wetlands in South Africa (modified from Brinson, 1993; Kotze, 1999; and Marnewick and Batchelor, 2002).

Hydro-geomorphic types	Description	Sources of water maintaining the wetland	
		Surface	Sub-surface
 <p><i>Floodplain</i></p>	<p>Valley bottom areas with a well-defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the flow of water; transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overtop) and from adjacent slopes.</p>	---	.
 <p><i>Valley bottom with a channel</i></p>	<p>Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overtop) and from adjacent slopes.</p>	---	✓ ---
 <p><i>Valley bottom without a channel</i></p>	<p>Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channels entering the wetland and also from adjacent slopes.</p>	---	✓ ---
 <p><i>Hill slope seepage feeding a watercourse</i></p>	<p>Slopes on hillsides, which are characterized by the vertical (transport) by gravity movement of materials. Water inputs are mainly from subsurface flow and outflow is usually via a well-defined stream channel connecting the area directly to a watercourse.</p>	.	---
 <p><i>Hill slope seepage not feeding a watercourse</i></p>	<p>Slopes on hillsides, which are characterized by the vertical (transport) by gravity movement of materials. Water inputs mainly from subsurface flow and outflow either vertically or through surface flow and outflow is not directly to a surface water connection to a watercourse.</p>	.	---
 <p><i>Depression (includes Pans)</i></p>	<p>A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is a wald basin). It may also receive subsurface water. An outlet is usually absent.</p>	✓ ---	✓ ---

Precipitation is an important water source and evapotranspiration an important output of the above settings

Water sources:

- Contribution only small
- ✓ --- Contribution not very large
- ✓ --- Contribution may be small or important depending on the local circumstances

Wetland:

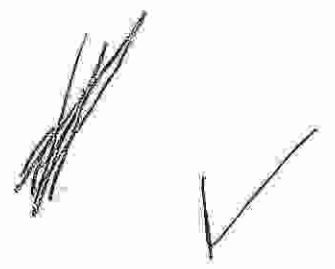




Figure 9. Hydro-geomorphic units in and around the site area.

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Table 3. Preliminary rating of the hydrological functions likely to be performed by a wetland given its particular hydrogeomorphic type (Kotze *et al.*, 2005).

WETLAND HYDRO-GEOMORPHIC TYPE	HYDROLOGICAL FUNCTIONS POTENTIALLY PERFORMED BY THE WETLAND										
	Flood attenuation			Stream flow augmentation			Erosion control	Enhancement of water quality			
	Early wet season	Late wet season	Early wet season	Late wet season	Early wet season	Late wet season		Sediment trapping	Phosphates	Nitrates	Toxicants <sup>1</sup>
1. Floodplain	++	+	0	0	0	0	++	++	++	+	+
2. Valley bottom - channelled	+	0	0	0	0	0	++	+	+	+	+
3. Valley bottom - unchannelled	+	+	+	+?	+	+	++	++	+	+	++
4. Hillslope seepage feeding a stream channel	+	0	+	+	+	+	++	0	0	++	++
5. Hillslope seepage not feeding a stream	+	0	0	0	0	0	++	0	0	++	+
7. Pan/Depression	+	+	0	0	0	0	0	0	0	+	+

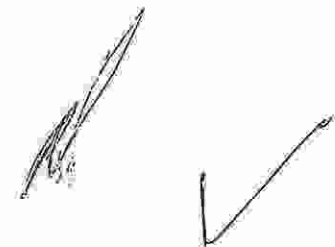
Note: <sup>1</sup>Toxicants are taken to include heavy metals and biocides

Rating: 0 Function unlikely to be performed to any significant extent

+

++ Function likely to be present at least to some degree

+++ Function very likely to be present (and often performed to a high level)



#### 4.1.1 Valley bottom channelled HGM units

There are a total of 6 of these HGM units draining from various directions into the system (see Fig. 9). The source of water is in the form of surface input and a higher than normal subsurface contribution. The main hydrological benefit is erosion control, but additional important benefits are also provided in the form of water supply, early season flood attenuation, sediment trapping, and water quality improvement (see Table 3).

#### 4.1.2 Valley bottom unchannelled HGM units

There are a total of 5 of these HGM units draining predominately from a north-eastern to eastern direction into the Jukskei River. Their source of water is in the form of surface input and a high contribution of subsurface flow. The main hydrological benefits are erosion control, sediment trapping, and water quality improvement. Additional important benefits are also provided in the form of water supply, and early and late season flood attenuation (see Table 3).

#### 4.1.3 Hillslope seepages feeding a watercourse HGM units

There are a total of 4 of these HGM units draining from a north-eastern and south-western direction into the Jukskei River. Their source of water is mainly in the form of subsurface input, with some contribution of surface runoff during the wet season. The main hydrological benefits are erosion control and water quality improvement. Additional important benefits are provided in the form of water supply, early and late season flood attenuation and sediment trapping (see Table 3).

### 4.2 Discussion on the importance of the wetland units and the implications for development

The wetlands are in excellent conditions, with the exception of the Modderfonteinspruit and the Jukskei River (Valley bottom with a channel 5 & 6 respectively), which are highly polluted as a result of various urban related impacts along its length. The site possesses some of the best examples of remaining "near-pristine" wetlands in Midrand, as an ever increasing development pressure has already resulted in a high percentage of wetland loss.

The intact wetland units provide important water quality and quantity benefits to the degraded Jukskei System, which help alleviate negative impacts that have occurred further upstream. The wetlands also help maintain a threatened biodiversity, in the form of confirmed populations of Marsh sylvan (*Metisella meninx*) present in Valley bottom with a channel 1 HGM unit and provide a high degree of connectivity for species, by linking important habitats with one another (see Fig. 9).

The perched aquifers and groundwater seepage in the Valley bottom and Hillslope HGM units are the vital hydrological factors determining the wetlands' functioning. For these subsurface hydrological processes to take place, open areas upslope of the wetland units need to remain free of hardened surfaces in order to facilitate water infiltration, the source of all subsurface flow. Buffering around each wetland unit must therefore not only focus at protecting sensitive habitat for biodiversity, but also take the hydrological processes into consideration (see Section 5). The potential for groundwater pollution and pollution into the Jukskei River is very high, due to shallow perched aquifers and groundwater seepage in the wetland units and the site gradient toward the Jukskei River (Van Rooy, 2005). Accordingly golf course development must be excluded from all buffered wetland area, as fertilisation is likely to lead to groundwater pollution. Draining wetlands in an attempt to prevent or reduce the risk of groundwater contamination and to create conditions conducive for year round golfing is strongly not advised. Wetland draining will undermine their hydrological integrity and result in degraded wetlands with little to no remaining functionality. In conclusion, all wetland areas on the site should be excluded from development and preserved, although delineated wetland boundaries and functions should be redefined with further fieldwork and analysis.

## 6 Buffer zones

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A wetland buffer zone is area of vegetation which usually begins from the boundary of a wetland's temporary zone (wetland edge) and extends outward (Water Notes 4 (WNA4), 2000). The buffer width recommended for a particular wetland depends upon the conservation significance of the wetland and the purpose/function of the buffer (Water Notes 4 (WNA4), 2000). Each wetland should therefore be assessed on its own criteria in order to determine a sufficient buffer zone. A recent literature search indicated that there is no worldwide standard buffer zone width to rely on and that the most common ranges fall between 20 -60 m with some reports indicating even less (Dlamini, 2005).

Defining an adequate buffer zone without a thorough wetland assessment is consequently unreliable and open to significant future change. A preliminary minimum buffer zone of 35 m is however recommended around each wetland unit, in order to ensure continued hydrological functioning (see Fig. 10 & Section 4.2). A 200 m buffer zone has been suggested around Valley bottom with a channel 1 HGM unit, proposed as a guideline by the Gauteng Department of Agriculture, Conservation and Environment (Dlamini, 2005). A 200 m buffer zone around suitable habitat of rice grass (*Leersia hexandra*) at confirmed sightings of the red data Marsh Sylph (*Metisella meninx*), would help conserve viable populations (see Preliminary Avifaunal and Invertebrate Study, 2006).

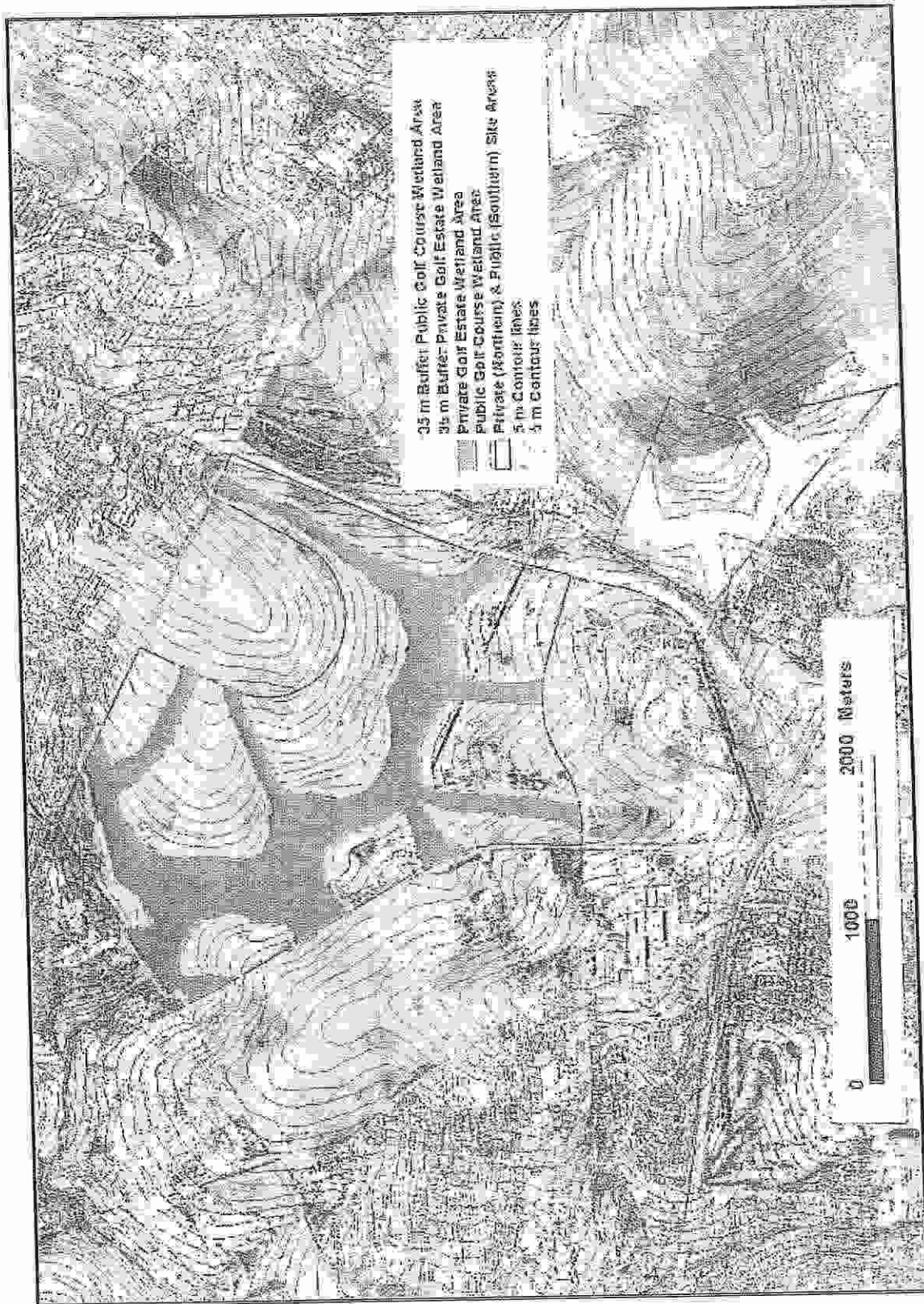


Figure 10. Delineated wetland areas located on the site area with 35 m buffer zones.

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## 7 Recommendations and mitigation

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Meaningful mitigation and appropriate recommendations are dependent on well informed decision making. A preliminary wetland study of this nature has limited scope to successfully attain these ends. Established guidelines and principals can however still be applied to help steer proposed development plans as to help ensure minimal wetland disturbance. It is suggested that the document "*Interim guidelines for development activities that may affect wetlands*" by Kotze *et al* (2002) be utilised in the design, planning and implementation phases to eliminate negative wetland impacts. Section 4.2 also pertains to several of the recommendations and should be incorporated in concordance.

Most of the current impacts on the wetlands, such as contour furrows and dams, are historic and legislation would in all likelihood regard it as such. The planned development does involve hardened surfaces in some of the wetland areas, as well as significant sections of golf course. Hardened surfaces are likely to impact negatively on the wetlands, as most of the wetlands are fed, at least to some extent, by seepage. Constructing impermeable layers on the surface will prevent infiltration and ultimately result in reduced seepage yield. Hardening of surface area will also result in increased run off with an increased erosion potential. The narrow nature of many of the drainage lines/valley bottoms and the steepness of the slopes will further increase run off velocity. An appropriate buffer zone comprised of dense stands of natural vegetation will help slow run off water down and simultaneously filtrate and facilitate pollutant removal.

In addition a well designed storm water management plan will be required to attenuate flood peak events and prevent excessive erosion. It is recommended that the storm-water management systems be designed in such a way that the natural flow regime (velocity of the water) of the wetlands are not exceeded by 50% in the event of 1:10 year flood to prevent the possibility of erosion in the wetland (pers. comm. M Lizamore).

Construction of storm water engineering structures in wetland units will require a Water Use Licence and is only recommended in wetland units that already contain water retention structures, such as existing dams. Ideally these existing structures should be converted into the desired storm water system, which will prevent other wetland areas from being disturbed. In other wetland units, free of hydrological modifications, storm water mitigation measures, such as storm water retention dams, need to be constructed outside of wetland areas. Storm water retention dams adjacent to wetlands can intercept storm flows, store the water for at least 48 hours and release it slowly into the wetland. Storm water outflows should not be allowed to enter into a wetland directly, but must be well buffered by vegetation and accompanied by energy dissipating interventions (Kotze *et al.*, 2002).



Draining wetlands on site to create habitat favourable for year round golfing could only be done on authorisation of NWA, CARA, and ECA. Wetland draining would destroy the wetlands' integrity and result in exacerbating functional loss, wetland functioning may even cease completely.

No roads should be constructed through wetlands, but in areas where this is unavoidable planning should be done to ensure minimum impact. This include among others (Kotze *et al.*, 2002):

- Impacts should as far as possible be focussed on more degraded wetlands as opposed to more intact systems. (The intactness or integrity of each individual wetland unit i.e. its remaining ecological functioning, would be more accurately assessed with more extensive fieldwork.).
- Roads must be constructed in such a way as to have a minimal impact on the flow of water through the wetland (e.g. by using a bridge or box culverts in preference to pipes).
- Where a road runs adjacent to a wetland and impede natural runoff from a hill slope, the road should be separated by an appropriate buffer from the wetland boundary. Feed-off points should be incorporated into the road at regular intervals (at least every 100 m).
- Stormwater originating from the roads should also not be allowed to enter directly into the wetland areas.
- Compaction of soils should be limited as far as possible as it would reduce infiltration and result in increased runoff and erosion.

In wetland systems of this nature, where infiltration rates are high and groundwater inputs are very important, portions of higher lying non-wetland surface areas need to be kept as open areas to allow adequate infiltration. Interventions and mechanisms can also be included into the development to facilitate a higher percentage of infiltration (e.g. porous pavements). The importance of buffer zones cannot be emphasised enough, firstly in order to help maintain hydrological functioning, but also to ensure a high level of connectivity and biological integrity. A minimum buffer zone of 35 m is therefore recommended to be incorporated as natural features into the development around each wetland unit, with an additional 200 m buffer zone around Valley bottom with a channel 1 HGM unit to protect confirmed populations of the Marsh Sylph (*Metisella meninx*).

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## 8 Conclusion

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A cautionary approach, dictated by a wide array of available information, has been taken as the best course of action throughout the wetland delineation and assessment process. The study site contains wetland units of an exceptional quality, which display a well functioning hydrology and maintain an intact biodiversity, including endangered Egoli Granite Grassland habitat. The Jukskei River and Modderfonteinspruit Riparian Wetlands are the main exceptions, with degraded water quality and a consequently low aquatic biodiversity. The wetland units feed water of a significantly higher quality into the river system, and thereby fulfil a crucial role in alleviating and mitigating some of the water quality impacts. If these wetland units were to become degraded and yield low quality water with a high sediment load and several golf course and storm water derived pollutants, the negative impact on the Jukskei River would escalate and have a detrimental effect on down stream users.

The presence of some of the last remaining "near-pristine" wetlands left in Midrand, which apart from their rarity also perform vital ecological and hydrological functions, stresses the need to prevent any further net loss to development in an environment where water quality and quantity continues to grow of concern.

This report is not the final assessment or conclusion to indicate the viability of establishing a golf course and golf estate on the property. Such a conclusion can only be done in accordance with various other reports, which did not form part of this investigation. The need, however to protect the site's existing wetlands are of imperative importance. It is believed that sufficient space will remain for development on this large property without further impacting on the wetland, if the development is redesigned to include appropriate layouts around buffered wetland areas and open space, include wetland compatible engineering designs, as well as taking wetlands into consideration throughout further planning, implementation and monitoring phases.



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## 10 Glossary of terms

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- Aquatic macrophytes:** Obligated wetland plants that have morphological features visible with the naked eye, including emergent aquatic macrophytes (eg. bulrush and reeds), submerged aquatic macrophytes (eg. saw weed and bladderwort), free floating aquatic macrophytes (eg. water hyacinth and duckweed), and attached floating aquatic macrophytes (eg. water lilies and water chestnut).
- Alluvial soil:** can be defined as a deposit of sand, mud, etc. formed by flowing water or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
- Base Flow:** long-term flow in a river that continues after storm flow has passed.
- Biodiversity:** is the number and variety of living organisms on earth, the millions of plants, animals, and micro-organisms, the genes they contain, the evolutionary history and potential they encompass, and the ecosystems, ecological processes, and landscapes of which they are integral parts.
- Buffer:** A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
- CARA:** Conservation of Agricultural Resources Act, Act 43 of 1983.
- Catchment:** the area contributing to runoff at a particular point in a river system.
- Channel Section:** a length of river bounded by the banks and the bed
- DALA:** Mpumalanga Provincial Department of Agriculture and Land Affairs.
- Delineation (of a wetland):** to determine the boundary of a wetland based on soil, vegetation, and/or hydrological indicators (see definition of a wetland)
- DWAF:** Department of Water Affairs and Forestry.
- ECA:** Environment Conservation Act, Act 73 of 1989.
- Emergent aquatic macrophyte:** – A water living plant, easily visible with the eye, which grows in the permanent wetland zone with its roots attached to the substrate and a large part of its vegetative parts are emerged above the water surface.
- Flood Plain:** a relatively level alluvial (sand or gravel) area lying adjacent to the river channel, which has been constructed by the present river in its existing regime.
- Gleying:** a soil process resulting from prolonged soil saturation, which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix
- Groundwater:** subsurface water in the saturated zone below the water table
- Habitat:** the natural home of species of plants or animals
- Hydro-geomorphic (HGM) unit :** - encompasses three key elements: (1) geomorphic setting (i.e. the landform, its position in the landscape and how it evolved (e.g. through the deposition of riverborne sediment); (2) water source (i.e. where does the water come from that is maintaining the wetland?) of which there are usually several sources including precipitation groundwater flow, streamflow, etc. but



their relative contributions will vary amongst wetlands; and (3) hydrodynamics, which refers to how water moves through the wetland.

**Hydromorphic soil:** a soil that, in its undrained condition, is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).

**Hydrology:** the study of the occurrence, distribution and movement of water over, on and under the land surface.

**Hydromorphy:** a process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.

**Intermittent Flow:** flows only for short periods.

**National Water Act:** National Water Act, Act 36 of 1998.

**NBA:** National Biodiversity Act

**NDA:** National Department of Agriculture.

**NEMA:** National Environmental Management Act, Act 107 of 1998.

**NWA:** National Water Act, Act 36 of 1998.

**Peat:** a dark brown or black organic soil layer, composed of partly decomposed plant matter, and formed under permanently saturated conditions.

**Perennial:** flows all year round.

**Permanent Zone of Wetness:** the inner zone of a wetland that is permanently saturated.

**Ramsar convention on wetlands:** South Africa acceded to the International Ramsar Convention on 12 March 1975 as one of the founding members of the wetland conservation movement and currently has 12 designated wetlands on the "Wetlands of International Importance List"

**Riparian area delineation:** the determination and marking of the boundary of a riparian area. In terms of the delineation procedure described in this document, delineation means marking the outer edge of the macro channel bank and associated vegetation.

**Riparian Habitat (as defined by the National Water Act):** includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils (deposited by the current river system), and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas

**Runoff:** stream channel flow.

**Seasonal Zone of Wetness:** the zone of a wetland that lies between the Temporary and Permanent zones and is characterized by saturation for 3 - 10 months of the year within 50cm of the surface.

**Soil Family:** A hierarchical level within the S.A. Soil Classification System, below soil form.

**Soil Form:** a hierarchical level within the S.A. Soil Classification System, above soil family.

**Soil horizons:** layers of soil that have fairly uniform characteristics and have developed through pedogenic processes; they are bounded by air, hard rock or other horizons (i.e. soil material that has different characteristics).

**Soil profile:** the vertically sectioned sample through the soil mantle, usually consisting of two or three horizons.

**Soil survey:** the systematic examination, description, clarification and mapping of soils in an area for a specific purpose.

**Soil wetness factor:** an index indicating the period of wetness of a soil horizon; W1, W2 and W3 being short, long and all year round wetness respectively (correlated to the Forestry Soils Database).

**Temporary zone of wetness:** the outer zone of a wetland characterized by saturation within 50cm of the soil surface for less than 3 months of the year.

**Watercourse (as defined by the National Water Act):**

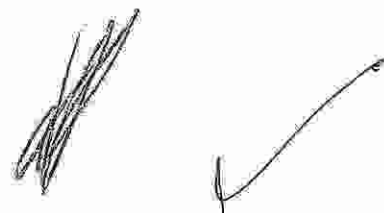
- A river or spring;
- Natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declared to be a watercourse, and a reference to a watercourse includes where relevant, its bed and banks.

**Water table:** The upper surface of groundwater or that level below which the soil is saturated with water. The water table feeds base flow to the river channel network when the channel bed is in contact with the water table.

**Wetland (as defined by the National Water Act):** land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

**Wetland delineation:** the determination and marking of the boundary of a wetland. In terms of the delineation procedure described in this document, delineation means marking the outer edge of the temporary zone of wetness.

**Wetland unit:** - See Hydro-geomorphic unit



337  
Antoinette HOBAN

# Limosella

The Proposed Phasing of a Township known  
as Jukskei View Extension 19 Situated on a part  
of the Remainder of the Farm Waterval 5-IR

Wetland Buffer Zone Reduction Report  
September 2010

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**Declaration of Independence**

I, **Antoinette Bootsma**, in my capacity as a specialist consultant, hereby declare that I -

- o Act as an independent consultant;
- o Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- o Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- o As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member; and
- o Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement.



2010.09.20

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**Antoinette Bootsma (PrSciNat)**

\_\_\_\_\_  
Date

Ecologist/Botanist.

SACNASP Reg. No. 400222-09



EXECUTIVE SUMMARY

Limosella Consulting was appointed by Century Property Developments to provide a report on the proposed buffer zone reduction for three wetland areas situated within the boundaries of the approved township known as Jukskei View Ext 19, on a part of the remainder of the Farm Waterval 5 – IR.

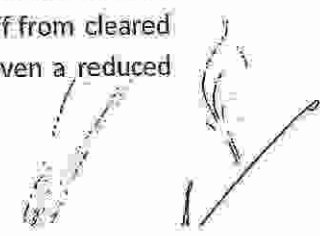
Wetland unit one is currently impacted by drains in the vicinity of the new Netcare Hospital and several path and road crossings. A reduced buffer zone for this wetland should be accompanied by the following mitigation measures can be supported given that the following mitigation measures are effectively implemented:

- o A conveyance system that intercepts water from rooftops, roads, parking lots, sidewalks, compacted sports fields and driveways to prevent the input of high energy stormwater into the wetland area. Stormwater intensity should be dissipated by including vegetated swales, permeable paving and attenuation structures shown to be designed based on the calculations of post-development stormwater volumes and velocities as well as slopes and soil permeability and erodibility properties;
- o Rigorous erosion control implemented throughout each phase of the development, including the post-development phase;
- o Strict landscaping policies regarding the use of indigenous vegetation species;
- o Wetland and buffer zone areas should be fenced as a matter of priority to prevent access to construction crews and vehicles; and
- o Strictly revegetate cleared areas as soon as possible to prevent sediment input into the downstream watercourses. It is evident that this policy is not currently being applied and is therefore considered as a risk to the success for protecting wetland and riparian areas should buffer zones be decreased.

Wetland unit two is currently impacted by invasion of *Pennisetum clandestinum* (Kikuyu Grass), trampling and grazing by cattle. A reduced buffer zone for this wetland should be accompanied by the following mitigation measures can be supported given that the following mitigation measures are effectively implemented:

- o Enhance indigenous biodiversity by implementing a landscape policy that supports the use of indigenous plant species;
- o Place proposed sports fields in areas that are more disturbed than surrounding areas;
- o Ensure that fertilisers not be washed into the wetland or downstream waterbodies; and
- o Monitor potential erosion.

Wetland unit three is in a highly impacted state. Canalisation has resulted from high energy water input from a culvert from Allandale Road, and recently infilling and dumping from the recent upgrade of the Allandale intersection has resulted in loss of wetland area and sedimentation. Further erosion and sedimentation were recorded in the southernmost section of the wetland and appear to be associated with runoff from cleared areas in preparation for construction. The effect of the development on the watercourse given a reduced



buffer zone should be addressed in a detailed rehabilitation and stormwater management report which demonstrate how impacts to the wetland will be contained within the reduced buffer area. The following principles apply in this regard:

- o It should not be the aim to return the wetland to its hypothetical original state. Rather interventions and management should aim to maintain the wetland in the best functional condition that is currently feasible;
- o Ecological principles must hold sway in determining how best to manage the wetland's different zones— including the buffer. Ecological principles include:
  - o Utilising opportunities to enhance current ecological functions of the wetland (described in SEF, 2006);
  - o Maintaining the zonation of wetland areas by avoiding canalization and increased water velocity; and
  - o Making use of soft engineering rather than hard engineering by using natural landscape features and vegetation to direct water flow rather than concrete canals;
- o Engineering interventions must enhance rather than further deteriorate the ecological functions of the wetland and must:
  - o Promote groundwater recharge by avoiding impermeable structures;
  - o Allow for lateral movement of water in the buffer zone;
  - o Focus on storm water management in terms of flow attenuation and reduced velocity;
  - o Avoid stagnant water pools; and
  - o Must be based on calculated volumes from the before and after development scenario, taking cognizance of the area of land required to maintain seasonal wetland conditions, while managing storm water impacts.

Given that the mitigation measures discussed above are stringently implemented and monitored, a reduced buffer zone can be supported. It is important that any mitigation be implemented in the context of an Environmental Management Plan in order to ensure accountability and ultimately the success of the mitigation.





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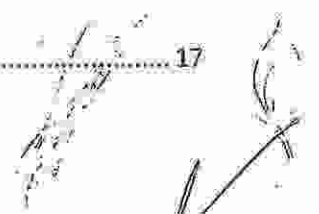
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# 1 INTRODUCTION

Limosella Consulting was appointed by Century Property Developments to provide a report on the proposed buffer zone reduction for three wetland areas situated within the boundaries of the approved township known as Jukskei View Ext 19, on a part of the remainder of the Farm Waterval 5 – IR (Figure 1). A site visit was undertaken on the 15th of September 2010.

## 1.1 Terms of Reference

The terms of reference for the current study were as follows:

- Discuss potential reduction in the generic required wetland buffer zones given site conditions;
- Discuss detailed mitigation measures relevant to the reduction of buffer zones and the potential impact of the proposed development.

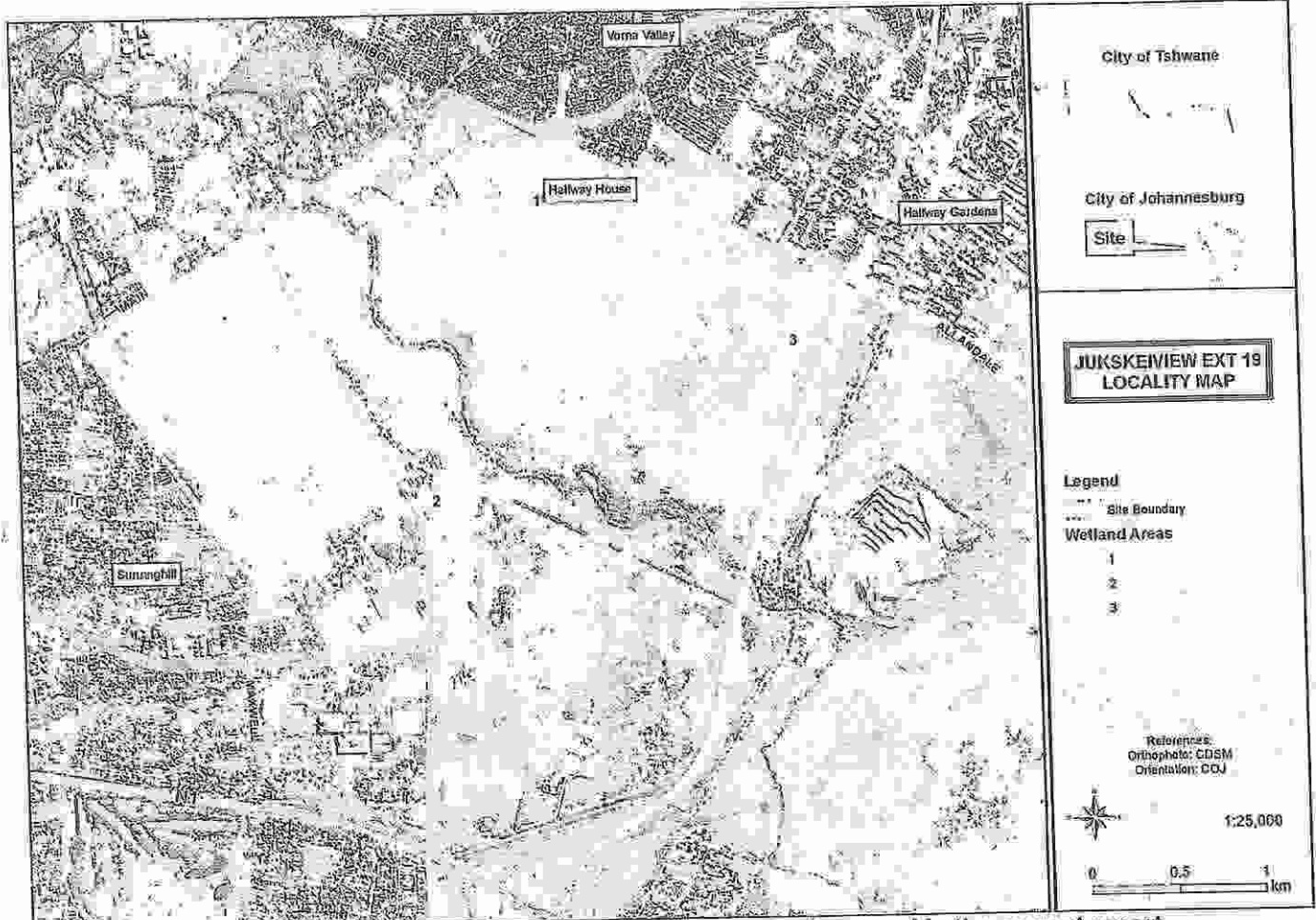


Figure 1: Location of the study site relative to the three wetlands discussed in the current report

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## 1.2 Assumptions and Limitations

The current assessment did not include a fine-scale wetland or riparian delineation nor a detailed faunal or floral survey. The site visit occurred before the onset of the growing season, and therefore a detailed plant species list could not be compiled. It was further assumed that wetland and riparian delineations provided by the client were correct and accurate.

## 1.3 A summary of south African Legislation Relating to Wetlands

In a South African legal context, the term watercourse is often used rather than the terms wetland, or river. The National Water Act, 1998 (Act No. 36 of 1998) includes wetlands and rivers into the definition of the term watercourse in the following definition:

- a) A river or spring;
- b) A natural channel in which water flows regularly or intermittently;
- c) A wetland, lake or dam into which, or from which, water flows, and
- d) Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; and
- e) Reference to a watercourse includes, where relevant, its bed and banks.

Authoritative legislation that lists impacts and activities on wetlands and riparian areas that requires authorisation includes (Armstrong, 2009):

- o Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983);
- o Environment Conservation Act, 1989 (Act 73 of 1989);
- o National Water Act, 1998 (Act 36 of 1998);
- o National Forests Act, 1998 (Act 84 of 1998);
- o National Environmental Management Act, 1998 (Act No. 107 of 1998);
- o National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).
- o GNR 1182 and 1183 of 5 September 1997, as amended (ECA);
- o GNR 385, 386 and 387 of 21 April 2006 (NEMA);
- o GNR 392, 393, 394 and 396 of 4 May 2007 (NEMA);
- o GNR 398 of 24 March 2004 (NEMA); and
- o GNR 544, 545 and 546 of 18 June 2010 (NEMA).

## 1.4 Current Literature Regarding Wetland and Riparian Buffer Zones

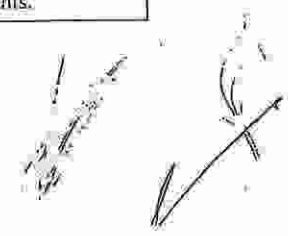
A buffer zone is defined as a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted (DWAf, 2005). A development has several impacts on the surrounding environment and on a wetland or riparian area. The development changes habitats, the ecological environment, infiltration rate, amount of runoff and runoff intensity of the site, and therefore the water regime of the entire site. A hard impervious surface such as parking areas, roads and roofs adjacent to the wetland or riparian area will block normal water flow to the wetland, while increasing storm water flow during a rainfall event. An increased volume of stormwater runoff, peak discharges, and frequency and severity of flooding is therefore often characteristic of transformed catchments.



Buffer zones have been shown to perform a wide range of functions and have therefore been widely proposed as a standard measure to protect water resources and their associated biodiversity. These include (i) maintaining basic aquatic processes; (ii) reducing impacts on water resources from upstream activities and adjoining landuses; (iii) providing habitat for various aspects of biodiversity. A brief description of each of the functions and associated services is outlined in Table 1 below.

Table 1: Functions of buffer zones relevant to the study site (adapted from Macfarlane et al, 2010)

Primary Role	Buffer Functions
<p>Maintaining basic aquatic processes, services and values.</p>	<ul style="list-style-type: none"> <li>• Maintaining channel stability: Vegetation, in particular, root systems, strengthen streambanks while groundcover increases resistance to erosion, improving channel stability and reducing the impacts on aquatic systems and downstream users. Stream bank stability is particularly important during flood events, with the amount of erosion being greatly reduced by good vegetation cover along stream banks.</li> <li>• Groundwater recharge: Seasonal flooding into riparian and wetland areas allows infiltration to the water table and replenishment of groundwater. This groundwater will often discharge during the dry season providing the base flow for streams, rivers, estuaries and wetlands.</li> <li>• Control of microclimate and water temperature: Riparian vegetation may affect the microclimate of the stream area nearest the stream bank and reduce water temperatures. This can have serious consequences for aquatic biota as water temperature plays a key role in the lifecycles of many species. The occurrence of riparian vegetation also has a significant effect on aquatic plant growth, as light incidence is the main variable controlling productivity in shaded streams. Removing stream bank vegetation is likely to increase stream primary productivity, increase the risk of eutrophication and change the species structure and community composition in the water body. The lower temperatures caused by shading, also has important consequences for other water quality variables besides temperature, such as the dissolved oxygen concentration (DO), which increases with lower temperatures. This increases the capacity of the stream to contain life and assimilate organic wastes, further increasing water quality.</li> <li>• Flood attenuation: Riparian and wetland vegetation increases the roughness of stream margins, slowing down flood-flows. This may therefore reduce flood damage in downstream areas. Aquatic buffers have therefore been promoted as providing cost-effective alternatives to highly engineered structures to reduce erosion and control flooding, particularly in urban settings.</li> </ul>
<p>Reducing impacts from upstream activities and adjoining landuses</p>	<ul style="list-style-type: none"> <li>• Storm water attenuation: Flooding into the buffer zone increases the area and reduces the velocity of storm flow. Roots, branches and leaves of plants provide direct resistance to water flowing through the buffer, decreasing its velocity and thereby reducing its erosion potential. More water is exchanged in this area with soil moisture and groundwater, rather than simply transferring out of the area via overland flow.</li> <li>• Sediment removal: Surface roughness provided by vegetation, or litter, reduces the velocity of overland flow, enhancing settling of particles. Buffer zones can therefore act as effective sediment traps, removing sediment from runoff water from adjoining lands thus reducing the sediment load of surface waters.</li> <li>• Removal of toxics: Buffer zones can remove toxic pollutants, such hydrocarbons that would otherwise affect the quality of water resources and thus their suitability for aquatic biota and for human use.</li> <li>• Nutrient removal: Riparian and wetland vegetation and vegetation in terrestrial buffer zones may significantly reduce the amount of nutrients (N &amp; P), entering a water body reducing the potential for excessive outbreaks of microalgae that can have an adverse effect on both freshwater and estuarine environments.</li> <li>• Removal of pathogens: By slowing water contaminated with faecal material, buffer zones encourage deposition of pathogens, which soon die when exposed to the elements.</li> </ul>



Despite limitations, buffer zones are well suited to perform functions such as sediment trapping, erosion control and nutrient retention which can significantly reduce the impact of activities taking place adjacent to water resources. Buffer zones are therefore proposed as a standard mitigation measure to reduce impacts of landuses / activities planned adjacent to water resources. These must however be considered in conjunction with other mitigation measures.

Local government policies require that protective wetland buffer zones be calculated from the outer edge of the temporary zone of a wetland and river buffer zones be calculated from the outer edge of the riparian zone (KZN DAFA, 2002; CoCT, 2008; GDACE, 2009). Although research is underway to provide further guidance on appropriate defensible buffer zones, there is no current standard other than the generic recommendation of 32m for rivers, and 30m for wetlands inside the urban edge.

Changes to recommended buffer zones to accommodate proposed development layouts may be considered by the authorities if supporting documentation is provided to indicate that the integrity of the wetland or riparian areas will not be compromised by a reduced buffer zone.

The section below discusses each of the three wetlands for which buffer zone reductions are proposed in terms of their current functionality and the mitigation measures deemed appropriate for replacing the function of the original buffer zones to ensure their protection should such a scenario be approved by the authorities.

## 2 RESULTS

Appendix A provides a table of survey data (Table 2) and visually displays the location of survey points relative to the wetlands on the study site (Figure 6).

### 2.1 Wetland Unit 1

This wetland unit is classified in SEF (2006) [attached as Annexure A] as an un-channelled valley bottom wetland. The 2006 report described the wetland as relatively unmodified with little evidence of disturbance. The recent site visit, conducted in September 2010 indicated some impact in the form of stormwater drains associated with the new Netcare Hospital although the main body of the wetland appears to be undisturbed (Figure 2). Three pathways cross the wetland at several points and a new road has been cleared to join Kyalami Road opposite Harry Galaun Drive (Figure 3). No current evidence of erosion or sedimentation was found to be associated with these wetland crossings. Potential future impacts of the development approved for the area immediately adjacent to the wetland include increased stormwater flows, erosion and sedimentation which will negatively impact on the wetland area downstream and consequently add to the impacts to the Jukskei River.



Figure 2: Wetland Unit 1

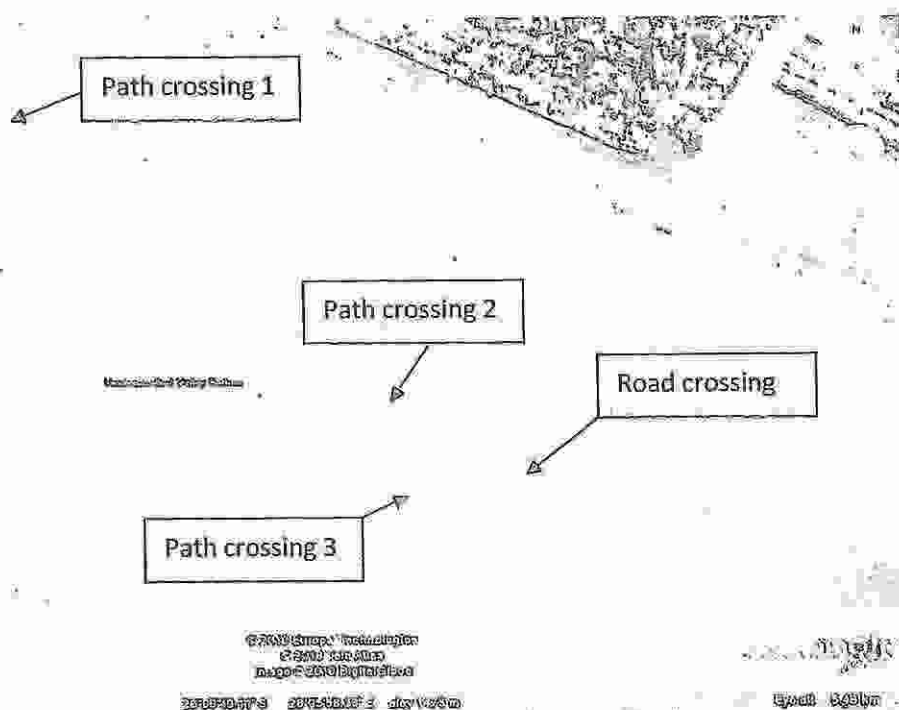
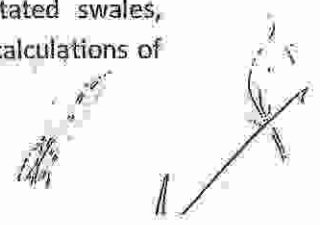


Figure 3: Location of pathways and road crossing wetland unit 1

The proposed reduction of the generic 30m buffer zone to 15m could potentially increase the risk of degradation unless strict mitigation measures are put into place. These include partially replacing the functionality of the buffer zone by:

- A conveyance system that intercepts water from rooftops, roads, parking lots, sidewalks, compacted sports fields and driveways to prevent the input of high energy stormwater into the wetland area. High energy stormwater should be dissipated by including vegetated swales, permeable paving and attenuation structures shown to be designed based on the calculations of



- post-development stormwater volumes and velocities as well as slopes and soil permeability and erodibility properties;
- o Rigorous erosion control implemented throughout each phase of the development, including the post-development phase;
  - o Strict landscaping policies regarding the use of indigenous vegetation species;
  - o Wetland and buffer zone areas should be fenced as a matter of priority to prevent access to construction crews and vehicles; and
  - o Strictly revegetate cleared areas as soon as possible to prevent sediment input into the downstream watercourses. It is evident that this policy is not currently being applied and is therefore considered as a risk to the success for protecting wetland and riparian areas should buffer zones be decreased.

## 2.2 Wetland Unit 2

This wetland unit is classified in SEF (2006) [attached as Annexure A] as an un-channelled valley bottom wetland impacted by invasion of *Pennisetum clandestinum* (Kikuyu Grass), trampling and grazing by cattle. The recent site visit, conducted in September 2010 highlighted landscaping of the areas downstream from the wetland, particularly associated with the dams, and clearing of the riparian zone adjacent to the Jukskei River in this area. Based on the functionality of the wetland and the downstream conditions, the current study suggests that a reduction of the buffer zone of this wetland unit from 30m to 15m should not impact on the downstream water resources as they are sufficiently buffered by dams that will attenuate increased stormwater flows and sedimentation (Figure 4). The following mitigation measures are relevant:

- o Enhance indigenous biodiversity by implementing a landscape policy that supports the use of indigenous plant species;
- o Placement of the proposed sports fields should be prioritised for the areas where disturbance is more pronounced than surrounding areas;
- o Ensure that fertilisers not be washed into the wetland or downstream waterbodies; and
- o Monitor potential erosion.



Figure 4: Dams downstream from Wetland Unit 2

2.3 Wetland Unit 3

This wetland unit runs parallel to the N1 and is classified in SEF (2006) [attached as Annexure A] as a channelled Valley Bottom wetland. SEF (2006) describes the wetland as impacted by channel incision (erosion) resulting from concentrated flows from the culvert that delivers water to the wetland from Allandale Road as well as dams in the northern and southern sections of the wetland. The recent site visit (conducted in September 2010) indicated further degradation of the wetland. The upgrading of the Allandale Road intersection has resulted in the loss of a section of wetland area at approximately S 26° 0'59.20" and E 28° 6'47.31" by large scale dumping and infilling. Sediment input in this area was also recorded (Figure 5). Although water quality was not assessed, a white precipitate as well as algal blooms were recorded in this section of the wetland and are expected to indicate a compromised condition regarding water quality. Erosion and sedimentation resulting from land clearing in preparation for construction were recorded at approximately S 26° 1'33.50" and E 28° 6'22.30" (Figure 6). This area is below the southernmost dam and marks the delineated boundary between the Jukskei River and the wetland unit discussed. The current study concludes that this wetland unit is in a highly impacted state and currently contributes to the cumulative degradation of the Jukskei River. Potential impacts associated with development adjacent to this wetland include further sediment input and erosion resulting from increased stormwater flows, increased degradation in water quality resulting from the input of hydrocarbons from roads and parking areas and invasion of alien invasive plant species.

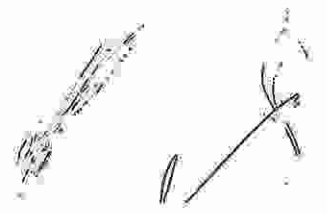






Figure 5: Degradation to Wetland Unit 3 resulting from construction activities at Allendale Road



Figure 6: Sedimentation and erosion in Wetland Unit 3 resulting from adjacent land clearing

In order to prevent potential degradation whilst reducing the wetland buffer zone to 15m, a team of engineers and landscape architects should design a rehabilitation and stormwater management plan which applies the following principles:





- o It should not be the aim to return the wetland to its hypothetical original state. Rather interventions and management should aim to maintain the wetland in the best functional condition that is currently feasible;
- o Take into consideration the slope and soil erodibility properties of the study site;
- o Ecological principles must hold sway in determining how best to manage the wetland's different zones – including the buffer. Ecological principles include:
  - o Utilising opportunities to enhance current ecological functions of the wetland (described in SEF, 2006);
  - o Maintaining the zonation of wetland areas by avoiding canalization and increased water velocity; and
  - o Making use of soft engineering rather than hard engineering by using natural landscape features and vegetation to direct water flow rather than concrete canals;
- o Engineering interventions must enhance rather than further deteriorate the ecological functions of the wetland and must:
  - o Promote groundwater recharge by avoiding impermeable structures;
  - o Allow for lateral movement of water in the buffer zone;
  - o Focus on storm water management in terms of flow attenuation and reduced velocity;
  - o Avoid stagnant water pools; and
  - o Must be based on calculated volumes from the before and after development scenario, taking cognizance of the area of land required to maintain seasonal wetland conditions, while managing storm water impacts.

## 2.4 Conclusion

Wetland unit one is currently impacted by drains in the vicinity of the new Netcare Hospital and several path and road crossings. A reduced buffer zone for this wetland can be supported if the following mitigation measures are effectively implemented:

- o A conveyance system that intercepts water from rooftops, roads, parking lots, sidewalks, compacted sports fields and driveways to prevent the input of high energy stormwater into the wetland area. Stormwater intensity should be dissipated by including vegetated swales, permeable paving and attenuation structures shown to be designed based on the calculations of post-development stormwater volumes and velocities as well as slopes and soil permeability and erodibility properties;
- o Rigorous erosion control implemented throughout each phase of the development, including the post-development phase;
- o Strict landscaping policies regarding the use of indigenous vegetation species;
- o Wetland and buffer zone areas should be fenced as a matter of priority to prevent access to construction crews and vehicles; and
- o Strictly revegetate cleared areas as soon as possible to prevent sediment input into the downstream watercourses. It is evident that this policy is not currently being applied and is



therefore considered as a risk to the success for protecting wetland and riparian areas should buffer zones be decreased.

Wetland unit two is currently impacted by invasion of *Pennisetum clandestinum* (Kikuyu Grass), trampling and grazing by cattle. A reduced buffer zone for this wetland can be supported if the following mitigation measures are effectively implemented:

- Enhance indigenous biodiversity by implementing a landscape policy that supports the use of indigenous plant species;
- Place proposed sports fields in areas that are more disturbed than surrounding areas;
- Ensure that fertilisers not be washed into the wetland or downstream waterbodies; and
- Monitor potential erosion.

Wetland unit three is in a highly impacted state. Canalisation has resulted from high energy water input from a culvert from Allandale Road, and recently infilling and dumping from the recent upgrade of the Allandale Intersection has resulted in loss of wetland area and sedimentation. Further erosion and sedimentation were recorded in the southernmost section of the wetland and appear to be associated with runoff from cleared areas in preparation for construction. The effect of the development on the watercourse given a reduced buffer zone should be addressed in a detailed rehabilitation and stormwater management report which demonstrate how impacts to the wetland will be contained within the reduced buffer area. The following principles apply in this regard:

- It should not be the aim to return the wetland to its hypothetical original state. Rather interventions and management should aim to maintain the wetland in the best functional condition that is currently feasible;
- Take into consideration the slope and soil erodibility properties of the study site;
- Ecological principles must hold sway in determining how best to manage the wetland's different zones – including the buffer. Ecological principles include:
  - Utilising opportunities to enhance current ecological functions of the wetland (described in SEF, 2006);
  - Maintaining the zonation of wetland areas by avoiding canalization and increased water velocity; and
  - Making use of soft engineering rather than hard engineering by using natural landscape features and vegetation to direct water flow rather than concrete canals;
- Engineering interventions must enhance rather than further deteriorate the ecological functions of the wetland and must:
  - Promote groundwater recharge by avoiding impermeable structures;
  - Allow for lateral movement of water in the buffer zone;
  - Focus on storm water management in terms of flow attenuation and reduced velocity;
  - Avoid stagnant water pools; and
  - Must be based on calculated volumes from the before and after development scenario, taking cognizance of the area of land required to maintain seasonal wetland conditions, while managing storm water impacts.



If the above measures are stringently implemented and monitored, a reduced buffer zone can be supported. It is important that any mitigation be implemented in the context of an Environmental Management Plan to in order to ensure accountability and ultimately the success of the mitigation.

### 3 METHODOLOGY

The delineation method documented by the Department of Water affairs and Forestry in their document "A practical field procedure for identification and delineation of wetlands and riparian areas" (DWAF, 2005) was followed throughout the field survey. This guideline describes the use of indicators to determine the outer edge of the wetland such as soil and vegetation forms as well as the terrain unit indicator.

A hand held GPSmap 76CSx was used to capture GPS co-ordinates in the field. 1:50 000 cadastral maps and available GIS data were used as reference material for the mapping of the preliminary wetland boundaries. These were converted to digital image backdrops and delineation lines and boundaries were imposed accordingly after the field survey.

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Armstrong A. (2009). WET-Legal: Wetland rehabilitation and the Law in South Africa. WRC Report No. TT 338/09. Water Research Commission, Pretoria

City of Cape Town (2008). Floodplain Management Policy, version 2.0 (draft for comment) City of Cape Town

Department of Water Affairs and Forestry (2005). A practical field procedure for identification and delineation of wetlands and riparian areas. Department of Water affairs and Forestry. Pretoria. South Africa

Gauteng Department of Agriculture, Conservation & Environment (2009) GDACE Minimum Requirements for Biodiversity Assessments Version 2. Directorate Nature Conservation, Johannesburg.

KwaZulu Natal Department of Agriculture and Environmental Affairs: Chief Directorate Environmental Management (2002). Interim Guidelines for Development Activities that may Affect Wetlands.

Macfarlane D.M., Teixeira-Leite A., Goodman P., Bate G and Colvin C. (2010) Draft Report on the Development of a Method and Model for Buffer Zone Determination. Water Research Commission project K5/1789. The Institute of Natural Resources and its Associates



Strategic Environmental Focus (2006). Wetland Delineation and Functional Assessment for the Proposed Northern Golf Course Development on the Remainder of Farm Waterval 51R, Woodmead Extention 24, Gauteng. Strategic Environmental Focus

Appendix A: Survey Data

Table 2: Soil and vegetation data recorded during the site visit

Waypoint	Coordinates		Description
	South	East	
1	26° 01' 01.1"	28° 06' 45.9"	Large scale dumping and infilling, eroded gullies of about 3-4m deep, compromised water quality evident in algal blooms and white precipitate, sedimentation visible, sewer outfall in wetland area
2	26° 01' 01.7"	28° 06' 46.4"	Some invasion of pioneer and invasive species, for example, <i>Datura sp.</i> , <i>Salix Babylonica</i> , <i>Verbena bonariense</i> ,
3	26° 01' 01.9"	28° 06' 47.3"	Stand of <i>Imperata cylindrica</i> , distinct mottling and gleying within 15cm of the soil surface, soil dark, coarse grained with high clay component
4	26° 01' 02.8"	28° 06' 48.4"	Culverts release water from the N1, some invasive and pioneer species
5	26° 01' 18.6"	28° 06' 33.2"	Steep slopes, canalisation of the watercourse, overgrazing, loss of vegetation from cleared areas leads to sediment input.
6	26° 01' 33.5"	28° 06' 22.3"	Erosion and sediment input from cleared land
7	26° 00' 36.1"	28° 05' 47.9"	Sandy soil with fine particles and concretions at about 20cm. High abundance of <i>Seriphium plumosum</i> indicating overgrazing.
	26° 00' 35.3"	28° 05' 48.7"	Soil shallow, sandy, various forb species present, no evident disturbance
9	26° 01' 31.2"	28° 05' 42.9"	Dams downstream from wetland will attenuate sediments and nutrients and therefore protect the Jukskei River. Dominance of <i>Pennisetum clandestinum</i> , trampling and overgrazing



## Appendix B: Glossary of Terms

Anaerobic	not having molecular oxygen (O <sub>2</sub> ) present
Buffer	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area
Gley	soil material that has developed under anaerobic conditions as a result of prolonged saturation with water. Grey and sometimes blue or green colours predominate but mottles (yellow, red, brown and black) may be present and indicate localised areas of better aeration.
Hydrophyte	any plant that grows in water or on a substratum that is at least periodically deficient in oxygen as a result of soil saturation or flooding; plants typically found in wet habitats
Hydromorphic soil	soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils)
Mottles	soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles
Seepage	A type of wetland occurring on slopes, usually characterised by diffuse (i.e. unchannelled, and often subsurface) flows
Perched water table	the upper limit of a zone of saturation in soil, separated by a relatively impermeable unsaturated zone from the main body of groundwater
Permanently wet soil	soil which is flooded or waterlogged to the soil surface throughout the year, in most years
Sedges	Grass-like plants belonging to the family Cyperaceae, sometimes referred to as nutgrasses. Papyrus is a member of this family.
Soil horizons	layers of soil that have fairly uniform characteristics and have developed through pedogenic processes; they are bound by air, hard rock or other horizons (i.e. soil material that has different characteristics).
Soil profile	the vertically sectioned sample through the soil mantle, usually consisting of two or three horizons (Soil Classification Working Group, 1991)
Soil saturation	the soil is considered saturated if the water table or capillary fringe reaches the soil surface

Temporarily wet soil The soil close to the soil surface (i.e. within 50 cm) is wet for periods > 2 weeks during the wet season in most years. However, it is seldom flooded or saturated at the surface for longer than a month.

Temporary zone of wetness the outer zone of a wetland characterised by saturation within 50cm of the soil surface for less than three months in a year

Wetland: "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil." (National Water Act; Act 36 of 1998).

Wetland delineation the determination and marking of the boundary of a wetland on a map using the DWAF (2005) methodology. This assessment includes identification of suggested buffer zones and is usually done in conjunction with a wetland functional assessment. The impact of the proposed development, together with appropriate mitigation measures are included in impact assessment tables

Appendix C: Abridged Curriculum Vitae of the Specialist

Name: ANTOINETTE BOOTSMA nee van Wyl

Name of Company: Limosella Consulting

Position: Wetland Specialist

SACNASP Status: Professional Natural Scientist # 400222-09

EDUCATIONAL QUALIFICATIONS

- B. Sc (Botany & Zoology), University of South Africa (1997 - 2001)
- B. Sc (Hons) Botany, University of Pretoria (2003-2005)
- Short course in wetland delineation, legislation and rehabilitation, University of Pretoria (2007)
- Short course in Wetland Soils, Terrasoil Science, (2009)

KEY QUALIFICATIONS

Principal Specialist

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This entailed the management of wetland vegetation and rehabilitation related projects in terms of developing proposals, project management, technical investigation (delineation and functional assessment of wetlands and riparian areas in order to advise proposed development layouts) and quality control through the following:

- More than 60 fine scale wetland and ecological assessments in Gauteng, Mpumalanga, KwaZulu Natal, Limpopo and the Western Cape. Liaison with clients, and all facets of project management. April 2007, ongoing.
- Reviewing of specialist reports, including faunal and floral assessments, aquatic, wetland and rehabilitation reports;
- An assessment of wetlands in Tatu, Kenya in order to inform the proposed development of a residential estate. August 2009
- Riparian Management Plan for Mixed-Use developments in Kagiso, Gauteng. August 2009;
- Rehabilitation Plan for the wetland associated with Heroes Bridge in Soweto. Technical investigation as well as management of a team of specialist, integration of information into a final report. The technical investigation for this project also included an investigation into the occurrence of Red Data vegetation. June 2009;
- Input into the wetland component of the Green Star SA rating system. April 2009;
- Strategic analysis of wetlands in Thohoyandou in conjunction with a strategic vegetation assessment of the area, March 2009;
- Strategic analysis of wetlands in Gauteng for the GDACE Regional Management Framework, August 2008;
- Successful completion of an audit of the wetlands in the City of Johannesburg. Specialist studies as well as project management and integration of independent datasets into a final report. July 2008.
- An assessment of wetlands in southern Mozambique. This involved a detailed analysis of the vegetation composition and sensitivity associated with wetlands and swamp forest in order to inform the development layout of a proposed resort, May 2008.
- An assessment of three wetlands in the Highlands of Lesotho. This involved a detailed assessment of the value of the study sites in terms of functionality and rehabilitation opportunities. Integration of the specialist reports socio economic, aquatic, terrestrial and wetland ecology studies into a final synthesis. May 2007.
- Ecological investigation on a strategic scale to inform an Environmental Management Framework for the Emakazeni Municipality and an Integrated Environmental Management Program for the Emalahleni Municipality. May and June 2007

#### Conservation ecology

The implementation and management of projects related to long and short term studies on impacts and rehabilitation in a mining environment.

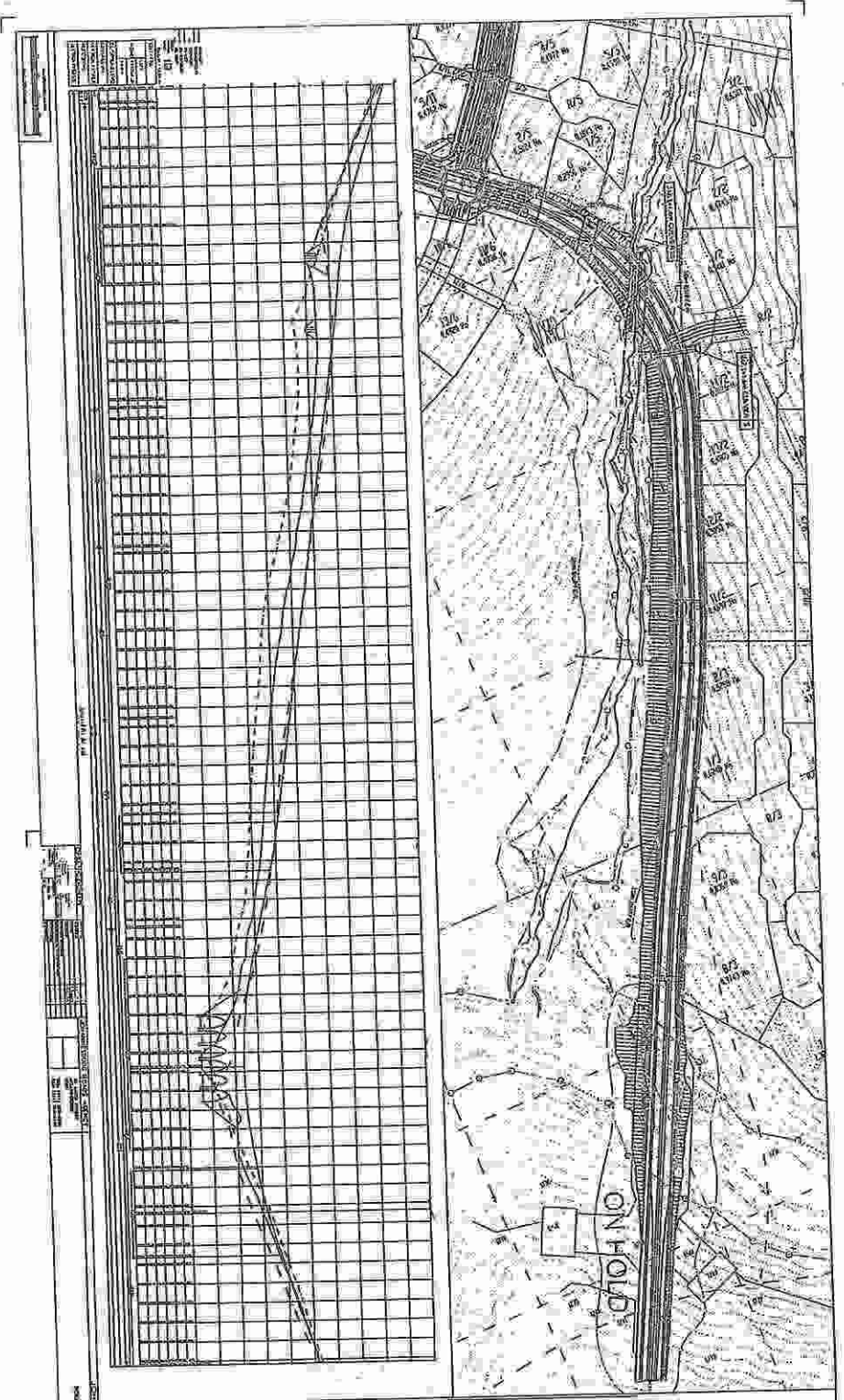


- Principal investigator. Species assemblages in the woody vegetation communities of coastal dune forests between the Umfolozi and Umlalazi rivers. This relates to colonisation trends across disturbance and rehabilitation age gradients, including aspects such as seed ecology and phenology. 2006/7
- Principal investigator. Biodiversity of the coastal dune forests and associated habitats in Richards Bay, particularly on the epiphytic orchids and ferns found on the mineral lease area of Richards Bay Minerals. 2006
- Technical assistant. Biodiversity of the coastal dune forests and associated habitats in Richards Bay, particularly on the herpetofauna found on the mineral lease area of Richards Bay Minerals. 2006
- Principal investigator. Baseline vegetation, and topsoil maps for Richards Bay Minerals' Zulti South lease area. 2005/6
- Technical assistant. A species list of woody and herbaceous plants of the Sekhukhune area. 2005

#### ▶ Phytosociology

A technical investigation as part of academic research

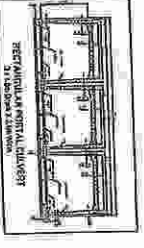
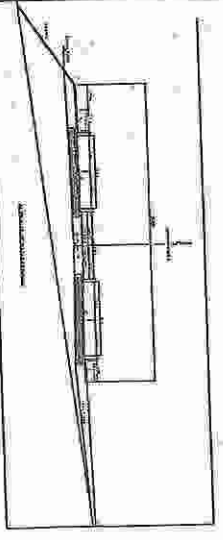
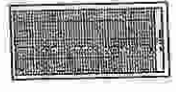
- Principal investigator. A phytosociological study of vegetation associated with the wetlands of Lake Chrissie, Mpumalanga. 2004



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# Annexure HCR 21

## Limosella

+27 83 454 5454  
+27 12 543 9982  
antoinette@limosella.co.za

14 May, 2013

### RE: REDUCTION OF BUFFER ZONES FOR THE WETLAND ON THE NORTHERN RESIDENTIAL ESTATE (WATERFALL)

To Whom It May Concern,

This document serves to provide a specialist opinion on the buffer zone reduction application for the wetland that lies along the N1, south of Allandale Road (Figure 1).

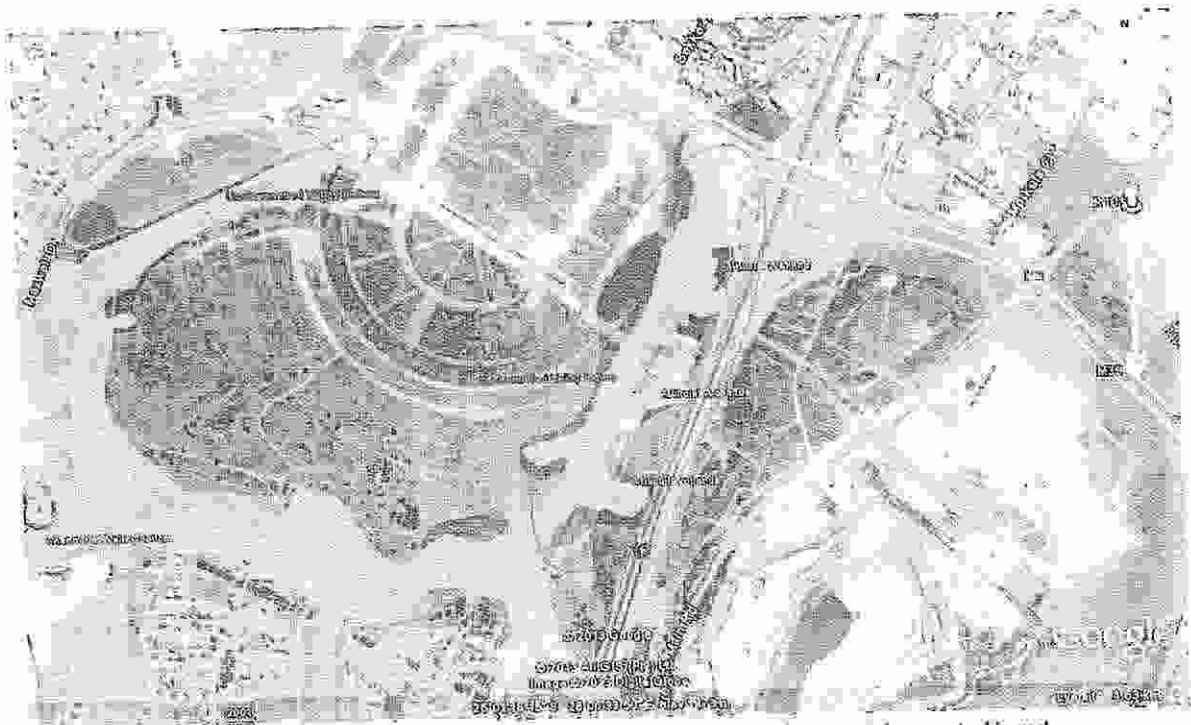


Figure 1: Position of the wetland area discussed in the current document demarcated in red

Handwritten signature and date:

14 May 2013

*[Signature]*

The integrity of this wetland has deteriorated drastically in the past few years. It is currently severely incised, colonised by alien plants, and subject to large inputs of sediment and stormwater which are further decreasing its functionality. The largest current impact is severe erosion caused by stormwater input from the N1 (Figure 2). Downstream from this point the wetland has become incised to such a degree as to no longer display saturation of soils characteristic of wetland conditions. In this area in particular the buffer zone no longer functions to protect the wetland. Upstream from this point, erosion is not as pronounced yet and the buffer zone helps to maintain groundwater processes that are lost in the southern section. This was seen in the presence of the grass *Imperata cylindrica* which still grows along the northern section of the wetland but which has been lost from the southern section.



Figure 2: The northern section of the wetland marked in yellow and the southern section of wetland downstream of the stormwater input resulting in severe erosion in blue



In conclusion, national and regional policies and legislation have failed to protect this wetland and the sensitive ecological elements associated with it. Although the generic 30m buffer zone on the northern section of the wetland is in a better condition than the southern section, it is unfortunately not likely to ensure the persistence of this wetland. It is our opinion that the only way to ensure the persistence of this wetland is to include it into a managed open space system in which impacts (including those emanating from the N1) are carefully monitored and mitigated. Should such a system be implemented, the reduction of the generic 30m buffer zone to the 2006 floodline would not result in the further deterioration of the wetland.

Should the need for further details arise, please don't hesitate to contact us.

Yours sincerely,



Antoinette Bootsma  
Wetland Ecologist Pr Sci Nat # 400222-09



# Annexure Q

## Public Participation



# Annexure Q1

Site notice



**INTERESTED AND AFFECTED PARTY NOTIFICATION: APPLICATION FOR AMENDMENT OF AUTHORIZATION FOR THE PROPOSED NORTHERN RESIDENTIAL ESTATE MIXED-USE TOWNSHIP ON PORTIONS OF THE REMAINDER OF PORTION 1 OF THE FARM WATERVAL 5 IR**

In terms of Regulation 32(1) (a) of the 2014 Amended National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations the EAP **must** notify all registered interested and affected parties of an application for Amendment of an Authorization. This correspondence represents the formal notification of Interested and Affected Parties.

**DATE OF NOTICE:** 26 April – 30 May 2016

**PROJECT NAME:** The authorization applies in respect of establishment of the Northern Residential Estate mixed-use township within the development area indicated on the layout submitted (Drawing Number 050-S-018,0) including associated structures and infrastructure.

**PROPERTY DESCRIPTION:** On Portions of the Remainder of Portion 1 of the Farm Waterval 5 IR situated to the west of the N1 freeway. The study area falls within the area of jurisdiction of the City of Johannesburg Metropolitan Municipality.

**APPLICANT:** ATTACQ WATERFALL INVESTMENT COMPANY (PTY) LTD (AWIC)

An application for the amendment of the Environmental Authorisation is made in terms of Section 31 of the 2014 NEMA EIA Regulations which sets out the requirements for amendments where a change in scope occurs

The Applicant applied for the following Amendments to the Environmental Authorisation granted on **20 October 2007. GDARD Reference Number: Gaut: 002/05-06/1476.**

<b>Amendment 1:</b>		
<b>From:</b>	<b>To:</b>	<b>Reason:</b>
Current Holder of Authorization: Waterval Islamic Institute <b>Contact Person:</b> Mr. Hercules Coenraad Bezuidenhout (authorized representative of the Land-Owner.	<b>Postal Address:</b> ATTACQ WATERFALL INVESTMENT COMPANY (PTY) LTD (AWIC) P.O. Box 2527 Sunninghill 2157 <b>Physical Address:</b> Building 2 Maxwell Office Park Maxwell Crescent West Waterval City Jukskei View 2090	The name and contact details of the applicant changed and the Decision require that the Department be informed of a name change and transfer of responsibilities.
<b>Amendment 2:</b>		
<b>From:</b>	<b>To:</b>	<b>Reason:</b>
Wetland buffer.	No wetland buffer.	The Applicant already completed a significant amount of rehabilitation works in this very disturbed and artificial watercourse and according to the appointed specialists no wetland/riparian buffer is required around the modified watercourse.

**\*Please note: The EIA Report for the proposed amendments w**  
In order to ensure that you are identified as an Interested and  
and interest in the matter, in writing, to the contact person gi

**Bokamoso Landscape Architects and Environmental Consult**  
**Contact Person: Juanita De Beer**  
P.O. Box 11375  
Maroelana  
0161  
Tel: 012 346 3810  
Fax: 086 570 5659  
E-Mail: [reception@bokamoso.net](mailto:reception@bokamoso.net)





**INTERESTED AND AFFECTED PARTY NOTIFICATION: APPLICATION FOR AMENDMENT OF  
AUTHORIZATION FOR THE PROPOSED BUSINESS TOWNSHIP ON PORTIONS OF THE REMAINING  
EXTENT OF PORTION 1 OF THE FARM WATERVAL 5 IR (SECTION 10), JOHANNESBURG  
METROPOLITAN MUNICIPALITY**

In terms of Regulation 32(1) (a) of the 2014 Amended National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations the EAP **must** notify all registered interested and affected parties of an application for Amendment of an Authorization. This correspondence represents the formal notification of interested and affected parties.

**DATE OF NOTICE:** 26 April – 30 May 2016

**PROJECT NAME:** The authorisation applies in respect of establishment of a business township on site, comprising of 33 erven zoned as follows: "Special" permitting offices, shops, restaurants, business buildings, dwelling units, residential buildings including hotels, public garage, places of public worship, places of instruction, transport nodes, social halls, commercial purposes, institution, places of amusement, private open space, public open space, parking garage structures.

**PROPERTY DESCRIPTION:** On Portions of the Remaining extent of Portion 1 of the Farm Waterval 5 IR (Section 10), Johannesburg Metropolitan Municipality.

**APPLICANT:** ATTACQ WATERFALL INVESTMENT COMPANY (PTY) LTD (AWIC)

An application for the amendment of the Environmental Authorisation is made in terms of Section 31 of the 2014 NEMA EIA Regulations which sets out the requirements for amendments where a change in scope occurs.

The Applicant applied for the following Amendments to the Environmental Authorisation granted on **29 April 2010**.  
**GDARD Reference Number:** Gaut: 002/08-09/N0993.

Amendment 1:		
From:	To:	Reason:
Current Holder of Authorization: Afterbury Investments Holdings Morne Wilken  Meritech Building Glenfield Office Park Oberon Street Faerie Glen 0100	<b>Postal Address:</b> ATTACQ WATERFALL INVESTMENT COMPANY (PTY) LTD (AWIC) P.O. Box 2527 Sunninghill 2157 <b>Physical Address:</b> Building 2 Maxwell Office Park Maxwell Crescent West Waterval City Jukka View 2090	The name and contact details of the applicant changed and the Decision require that the Department be informed of a name change and transfer of responsibilities.
Amendment 2:		
From:	To:	Reason:
Wetland buffer.	No wetland buffer.	The Applicant already completed a significant amount of rehabilitation works in this very disturbed and artificial watercourse and according to the appointed specialists no wetland/riparian buffer is required around the modified watercourse.

**\*Please note: The EIA Report for the proposed amendments will be made available to all registered I&APs.**  
In order to ensure that you are identified as an interested and/or affected party (I&AP) please submit your comment and information to me or, in writing, to the contact person given below **within 30 days of this Notice.**

Bokamoso Landscape Architects and Environmental Consultants  
Contact Person: Juchika De Beer  
P.O. Box 11375  
Morningside  
0141  
Tel: 011 341 3810  
Fax: 011 570 9459  
E-Mail: [info@bokamoso.co.za](mailto:info@bokamoso.co.za)



26.04.2016 13:40

# Annexure Q2

Public notice



**INTERESTED AND AFFECTED PARTY NOTIFICATION: APPLICATION FOR AMENDMENT OF AUTHORIZATION FOR THE PROPOSED NORTHERN RESIDENTIAL ESTATE MIXED-USE TOWNSHIP ON PORTIONS OF THE REMAINDER OF PORTION 1 OF THE FARM WATERVAL 5 IR**

In terms of Regulation 32(1) (a) of the 2014 Amended National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations the EAP **must** notify all registered interested and affected parties of an application for Amendment of an Authorization. This correspondence represents the formal notification of Interested and Affected Parties.

**DATE OF NOTICE:** 26 April – 30 May 2016

**PROJECT NAME:** The authorization applies in respect of establishment of the Northern Residential Estate mixed-use township within the development area indicated on the layout submitted (Drawing Number 050-S-018,0) including associated structures and infrastructure.

**PROPERTY DESCRIPTION:** On Portions of the Remainder of Portion 1 of the Farm Waterval 5 IR situated to the west of the N1 freeway. The study area falls within the area of jurisdiction of the City of Johannesburg Metropolitan Municipality.

**APPLICANT:** ATTACQ WATERFALL INVESTMENT COMPANY (PTY) LTD (AWIC)

An application for the amendment of the Environmental Authorisation is made in terms of Section 31 of the 2014 NEMA EIA Regulations which sets out the requirements for amendments where a change in scope occurs

The Applicant applied for the following Amendments to the Environmental Authorisation granted on **20 October 2007. GDARD Reference Number: Gaut: 002/05-06/1476.**

<b>Amendment 1:</b>		
<b>From:</b>	<b>To:</b>	<b>Reason:</b>
Current Holder of Authorization: Waterval Islamic Institute <b>Contact Person:</b> Mr. Hercules Coenraad Bezuidenhout (authorized representative of the Land-Owner.	<b>Postal Address:</b> ATTACQ WATERFALL INVESTMENT COMPANY (PTY) LTD (AWIC) P.O. Box 2527 Sunninghill 2157 <b>Physical Address:</b> Building 2 Maxwell Office Park Maxwell Crescent West Waterval City Jukskei View 2090	The name and contact details of the applicant changed and the Decision require that the Department be informed of a name change and transfer of responsibilities.
<b>Amendment 2:</b>		
<b>From:</b>	<b>To:</b>	<b>Reason:</b>
Wetland buffer.	No wetland buffer.	The Applicant already completed a significant amount of rehabilitation works in this very disturbed and artificial watercourse and according to the appointed specialists no wetland/riparian buffer is required around the modified watercourse.

**\*Please note: The EIA Report for the proposed amendments w**  
In order to ensure that you are identified as an Interested and  
and interest in the matter, in writing, to the contact person gi

**Bokamoso Landscape Architects and Environmental Consult**  
**Contact Person: Juanita De Beer**  
P.O. Box 11375  
Maroelana  
0161  
Tel: 012 346 3810  
Fax: 086 570 5659  
E-Mail: [reception@bokamoso.net](mailto:reception@bokamoso.net)



# Annexure Q3

E-mailed



**From:** juanita@bokamoso.net  
**Sent:** 26 April 2016 02:50 PM  
**To:** 'jgrobler@geoscience.org.za'; msebesho; 'asalomon@sahra.org.za'; 'maphata.ramphele@gauteng.gov.za'; 'mhingav@dws.gov.za'; 'central@eskom.co.za'; 'paia@eskom.co.za'; schmidk; kumen govender; 'mmpshe@randwater.co.za'; 'nkoneigh@randwater.co.za'; 'Noziphom@joburg.org.za'; 'lebom@joburg.org.za'; 'loveous.tampane@transnet.net'; CLCC@drdlr.gov.za; 'magezi.mhlanga@drdlr.gov.za'; 'Naomi.Baatjes@gauteng.gov.za'; 'albert.marumo@gauteng.gov.za'; 'Kaye.petersen@gauteng.gov.za'; 'Rethabile.Nkosi@gauteng.gov.za'; 'andre.vanderwalt@gauteng.gov.za'; 'Nmahlo@jra.org.za'; 'steve@moores.co.za'; 'cameron@sentinel360.co.za'  
**Subject:** LP 10 - Public Participation Process  
**Attachments:** Public Notice - LP10 No 1.pdf, Public Notice - LP10 - No 2.pdf

Dear Interested and/or Affected Parties,

Please refer to the attached Public Notices regarding the *Application for Amendment of Authorisation for the proposed Northern Residential Estate Mixed-Use Township on Portions of the Remainder of Portion 1 of the Farm Waterval 5* Project and also for the *Application for Amendment of Authorisation for the proposed Business Township of Portions of the Remaining extent of Portion 1 of the Farm Waterval IR (Section 10), Johannesburg Metropolitan* Project.

Kind Regards/Vriendelike Groete

Juanita De Beer

Senior Public Participation Consultant & EAP in training



**Landscape Architects &  
Environmental Consultants**

T: (+27)12 346 3810 | F: (+27) 86 570 5659 | E: [juanita@bokamoso.net](mailto:juanita@bokamoso.net) | [www.bokamoso.net](http://www.bokamoso.net)  
38 Lebombo Street, Ashlea Gardens, Pretoria | P.O. Box 11376 Maroelana 0161

[corne@bokamoso.net](mailto:corne@bokamoso.net)

---

**From:** juanita@bokamoso.net  
**Sent:** 28 April 2016 08:21 AM  
**To:** Shari de Nobrega  
**Subject:** RE: LP 10 - Public Participation Process  
**Attachments:** Aerial Street.jpeg; Windeed.jpeg

Dear Shari de Nobrega,

Thank you for your response, we have registered you as an Interested and/or Affected Party for the proposed LP10 Project.

Please refer to the attached Map.

We will keep you updated regarding the process in the future.

*Kind Regards/Vriendelike Groete*

**Juanita De Beer**

**Senior Public Participation Consultant & EAP in training**



**Landscape Architects &  
Environmental Consultants**

T: (+27)12 346 3810 | F: (+27) 86 570 5859 | E: [juanita@bokamoso.net](mailto:juanita@bokamoso.net) | [www.bokamoso.net](http://www.bokamoso.net)  
36 Lebombo Street, Ashlea Gardens, Pretoria | P.O. Box 11375 Maroelana 0181

---

**From:** Shari de Nobrega [<mailto:shari@denobrega.net>]  
**Sent:** 27 April 2016 11:37 AM  
**To:** [juanita@bokamoso.net](mailto:juanita@bokamoso.net)  
**Cc:** Kevin Gow  
**Subject:** Fwd: LP 10 - Public Participation Process

Dear Juanita,

Your attached application refers.

Please provide a detailed map of the stated wetland area and buffer  
Please advise whether your client has any intentions for the area in question that necessitates removal of the boundary, and if so what are those intentions?

Regards  
Shari de Nobrega  
082 850 4158  
[shari@denobrega.net](mailto:shari@denobrega.net)  
[www.pilatesroom.co.za](http://www.pilatesroom.co.za)



---

**From:** <juanita@bokamoso.net>

**Date:** Tuesday 26 April 2016 at 2:49 PM

**To:** <erobler@geoscience.org.za>, msebesho <msebesho@geosciences.org.za>, <asalomon@sahra.org.za>, <maohlata.ramphela@eauteng.gov.za>, <mhinstav@dws.gov.za>, <central@eskom.co.za>, <pala@eskom.co.za>, schmidk <schmidk@nra.co.za>, kumen govender <kumen.govender@eauteng.gov.za>, <mmoshe@randwater.co.za>, <nkonelehi@randwater.co.za>, <Noziphem@joburg.org.za>, <leboni@lobur.org.za>, <loveous.tampone@transnet.net>, <CLCC@drdlr.gov.za>, <magezi.mhlanga@drdlr.gov.za>, <Nazmi.Baatias@eauteng.gov.za>, <albert.marimbo@eauteng.gov.za>, <Kave.petersen@eauteng.gov.za>, <Rethabile.Nkosi@eauteng.gov.za>, <andre.vanderwalt@eauteng.gov.za>, <Nmahlö@jra.org.za>, Stephen Moore <steve@moores.co.za>, Cameron MacKenzie Cameron <cameron@sentine1360.co.za>

**Subject:** LP 10 - Public Participation Process

Dear Interested and/or Affected Parties,

Please refer to the attached Public Notices regarding the *Application for Amendment of Authorisation for the proposed Northern Residential Estate Mixed-Use Township on Portions of the Remainder of Portion 1 of the Farm Waterval 5 Project* and also for the *Application for Amendment of Authorisation for the proposed Business Township of Portions of the Remaining extent of Portion 1 of the Farm Waterval IR (Section 10), Johannesburg Metropolitan Project*.

Kind Regards/Vriendelike Groete

**Juanita De Beer**

**Senior Public Participation Consultant & EAP in training**

[corne@bokamoso.net](mailto:corne@bokamoso.net)

---

**From:** [juanita@bokamoso.net](mailto:juanita@bokamoso.net)  
**Sent:** 17 May 2016 09:04 AM  
**To:** Administration - Pravin Amar Development Planners  
**Subject:** RE: Registering as an I&AP for the Development on Portion 1 of the Farm Waterval 5 IR

Dear Pravin,

Thank you for your response, we have registered Pravin Amar Development Planners as an Interested and/or Affected Party for the proposed LP1&6 and LP10 Projects.

We will keep you updated regarding the process in the future.

Kind Regards/Vriendelike Groete

**Juanita De Beer**

**Senior Public Participation Consultant & EAP in training**



**Landscape Architects &  
Environmental Consultants**

T: (+27)12 346 3810 | F: (+27) 86 570 5659 | E: [juanita@bokamoso.net](mailto:juanita@bokamoso.net) | [www.bokamoso.net](http://www.bokamoso.net)  
36 Lebombo Street, Ashlea Gardens, Pretoria | P.O. Box 11375 Marolana 0161

**From:** Administration - Pravin Amar Development Planners [<mailto:admin@pravinamar.com>]

**Sent:** 17 May 2016 08:54 AM

**To:** [juanita@bokamoso.net](mailto:juanita@bokamoso.net)

**Subject:** Re: Registering as an I&AP for the Development on Portion 1 of the Farm Waterval 5 IR

Dear Juanita,

As per our telephonic conversation;

Please register us as an I&AP for both the projects, as the landfill site we working on is located close to them.

Regards,  
Pravin

On Thu, May 5, 2016 at 8:15 AM, <[juanita@bokamoso.net](mailto:juanita@bokamoso.net)> wrote:

Dear Pravin Amar Singh,

Thank you for your response, can you please refer to the Project Name?



Please find the attached Notices, which one do you refer to?

Kind Regards/  
Vriendelike Groete

Juanita De Beer

Senior Public Participation Consultant & EAP in training



Landscape Architects &

Environmental Consultants

T: (+27)12 346 3810 | F: (+27) 86 570 5659 | E: [juanita@bokamoso.net](mailto:juanita@bokamoso.net) | [www.bokamoso.net](http://www.bokamoso.net)

36 Lebombo Street, Ashlea Gardens, Pretoria, P.O. Box 11375 Maroelana 0161

**From:** Administration - Pravin Amar Development Planners [<mailto:admin@pravinamar.com>]

**Sent:** 04 May 2016 10:19 AM

**To:** [reception@bokamoso.net](mailto:reception@bokamoso.net)

**Cc:** Managing Director - Pravin Amar Professional Services; Pravin Amar

**Subject:** Re: Registering as an I&AP for the Development on Portion 1 of the Farm Waterval 5 IR

Dear Juanita De Beers,

Please note that we act on behalf of EnviroServ Waste Management. We undertake land use and environmental audits on a monthly basis for the Chloorkop Landfill Site situated approximately 2km from your study area.

Please kindly register us as I&APs. Our details are as follows;

**Name of Company:** Pravin Amar Development Planners

**Contact Person:** Pravin Amar Singh

**Tel No.:** 031 201 7510

**Fax No.:** 031 201 8939

**Email:** [admin@pravinamar.com](mailto:admin@pravinamar.com)

Regards,

Pravin Amar Singh

**corne@bokamoso.net**

---

**From:** juanita@bokamoso.net  
**Sent:** 28 April 2016 04:04 PM  
**To:** Kevin Gow  
**Subject:** RE: LP 10 - Public Participation Process

Dear Kevin,

We are currently in the Public Participation Process, we will notify all the registered Interested and/or Affected Parties when there will be documents available for review.

Kind Regards/Vriendelike Groete

**Juanita De Beer**

**Senior Public Participation Consultant & EAP in training**



**Landscape Architects &  
Environmental Consultants**

T: (+27)12 346 3810 | F: (+27) 86 570 5859 | E: [juanita@bokamoso.net](mailto:juanita@bokamoso.net) | [www.bokamoso.net](http://www.bokamoso.net)  
36 Lebombo Street, Ashlea Gardens, Pretoria | P.O. Box 11375 Maroelana 0161

---

**From:** Kevin Gow [<mailto:kevin@bmpro.co.za>]  
**Sent:** 28 April 2016 03:39 PM  
**To:** [juanita@bokamoso.net](mailto:juanita@bokamoso.net)  
**Subject:** RE: LP 10 - Public Participation Process

Thanks, is the EIA report available?

---

**From:** [juanita@bokamoso.net](mailto:juanita@bokamoso.net) [<mailto:juanita@bokamoso.net>]  
**Sent:** 28 April 2016 15:29  
**To:** Kevin Gow  
**Subject:** RE: LP 10 - Public Participation Process

Dear Kevin Gow,

Thank you for your response, we have registered you as an Interested and/or Affected Party for the proposed LP10 Project.

We will keep you updated regarding the process in the future.

Kind Regards/Vriendelike Groete

**Juanita De Beer**

**Senior Public Participation Consultant & EAP in training**



**Landscape Architects &  
Environmental Consultants**

T: (+27)12 346 3810 | F: (+27) 86 570 5659 | E: [juanita@bokamoso.net](mailto:juanita@bokamoso.net) | [www.bokamoso.net](http://www.bokamoso.net)  
36 Lebombo Street, Ashlea Gardens, Pretoria | P.O. Box 11375 Maroelana 0161

**From:** [juanita@bokamoso.net](mailto:juanita@bokamoso.net) [<mailto:juanita@bokamoso.net>]

**Sent:** 28 April 2016 03:26 PM

**To:** Kevin Gow

**Subject:** RE: LP 10 - Public Participation Process

Dear Kevin Gow,

Please refer to the attached Map.

Kind Regards/Vriendelike Groete

**Juanita De Beer**

**Senior Public Participation Consultant & EAP in training**



**Landscape Architects &  
Environmental Consultants**

T: (+27)12 346 3810 | F: (+27) 86 570 5659 | E: [juanita@bokamoso.net](mailto:juanita@bokamoso.net) | [www.bokamoso.net](http://www.bokamoso.net)  
36 Lebombo Street, Ashlea Gardens, Pretoria | P.O. Box 11375 Maroelana 0161

**From:** Kevin Gow [<mailto:kevin@bmpro.co.za>]

**Sent:** 28 April 2016 03:11 PM

**To:** [juanita@bokamoso.net](mailto:juanita@bokamoso.net)

**Subject:** LP 10 - Public Participation Process

Hi Juanita

Please send drawings or link for attached public notice so we can see what you are referring to.

Kind Regards

Kevin Gow  
082 852 5440

corne@bokamoso.net

---

**From:** juanita@bokamoso.net  
**Sent:** 28 April 2016 03:29 PM  
**To:** Kevin Gow  
**Subject:** RE: LP 10 - Public Participation Process

Dear Kevin Gow,

Thank you for your response, we have registered you as an Interested and/or Affected Party for the proposed LP10 Project.

We will keep you updated regarding the process in the future.

Kind Regards/Vriendelike Groete

**Juanita De Beer**

Senior Public Participation Consultant & EAP in training



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**From:** [juanita@bokamoso.net](mailto:juanita@bokamoso.net) [<mailto:juanita@bokamoso.net>]

**Sent:** 28 April 2016 03:26 PM

**To:** Kevin Gow

**Subject:** RE: LP 10 - Public Participation Process

Dear Kevin Gow,

Please refer to the attached Map.

Kind Regards/Vriendelike Groete

**Juanita De Beer**

Senior Public Participation Consultant & EAP in training



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**From:** Kevin Gow [<mailto:kevin@bmpro.co.za>]

**Sent:** 28 April 2016 03:11 PM

**To:** [juanita@bokamoso.net](mailto:juanita@bokamoso.net)

**Subject:** LP 10 - Public Participation Process

Hi Juanita

Please send drawings or link for attached public notice so we can see what you are referring to.

Kind Regards,

Kevin Gow

082 852 6440



corne@bokamoso.net

---

**From:** juanita@bokamoso.net  
**Sent:** 28 April 2016 03:26 PM  
**To:** Kevin Gow  
**Subject:** RE: LP 10 - Public Participation Process  
**Attachments:** Aerial Street.jpeg

Dear Kevin Gow,

Please refer to the attached Map.

Kind Regards/*Vriendelike Groete*

**Juanita De Beer**

Senior Public Participation Consultant & EAP in training



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**Subject:** LP 10 - Public Participation Process

Hi Juanita

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Kind Regards

Kevin Gow  
082 852 6440

# **Annexure Q4**

Advertisement placed in the  
Star Newspaper









# Annexure Q5

Interested and affected  
parties



<b>Nr</b>	<b>Registered Parties</b>	<b>Contact details</b>	<b>Address</b>
<b>Stakeholders</b>			
1	Council Geo-Science	<a href="mailto:igrobler@geoscience.org.za">igrobler@geoscience.org.za</a> <a href="mailto:msebesho@geoscience.org.za">msebesho@geoscience.org.za</a>	
2	SAHRA Gauteng	<a href="mailto:asalomon@sahra.org.za">asalomon@sahra.org.za</a> <a href="mailto:nndobochani@sahra.org.za">nndobochani@sahra.org.za</a>	
3	PHRAG	<a href="mailto:maphata.ramphele@gauteng.gov.za">maphata.ramphele@gauteng.gov.za</a>	
4	DWA	<a href="mailto:mhingav@dws.gov.za">mhingav@dws.gov.za</a>	
5	Eskom	<a href="mailto:central@eskom.co.za">central@eskom.co.za</a> <a href="mailto:paia@eskom.co.za">paia@eskom.co.za</a>	
6	SANRAL	<a href="mailto:schmidk@nra.co.za">schmidk@nra.co.za</a>	
7	Gautrans	<a href="mailto:kumen.govender@gauteng.gov.za">kumen.govender@gauteng.gov.za</a>	
8	Randwater	<a href="mailto:mmpshe@randwater.co.za">mmpshe@randwater.co.za</a> <a href="mailto:nkoneigh@randwater.co.za">nkoneigh@randwater.co.za</a>	
9	<b>City of Johannesburg</b>		
	Nozipho Maduse	<a href="mailto:Noziphom@joburg.org.za">Noziphom@joburg.org.za</a> Tel: 011 587 4225	
	Lebo Molefe	<a href="mailto:lebom@joburg.org.za">lebom@joburg.org.za</a>	
10	Spoornet	<a href="mailto:loveous.tampane@transnet.net">loveous.tampane@transnet.net</a>	
11	<b>Department of Land Claims</b>	<a href="mailto:CLCC@drdlr.gov.za">CLCC@drdlr.gov.za</a> <a href="mailto:magezi.mhlanga@drdlr.gov.za">magezi.mhlanga@drdlr.gov.za</a>	
	Ms Nomfundo Gobodo	Tel: 012 312 8883	
12	<b>Ward Councillor - Ward 106</b>		
	Stephen James Moore	<a href="mailto:steve@moores.co.za">steve@moores.co.za</a> Cell: 084 332 4413	
13	<b>Constituency head Fourways</b>		
	Cameron Mackenzie	<a href="mailto:cameron@sentinel360.co.za">cameron@sentinel360.co.za</a> Cell: 083 694 4510	

