GALAGO ENVIRONMENTAL

Fauna and Flora Specialists
PO Box 886
Irene, 0062
Tel: 012-345 4891
Fax: 086 675 6136
Email: Vanessam@lantic.net

Avifauna
Habitat Assessment

of

MOKOLO AND CROCODILE WATER AUGMENTATION PROJECT (MCWAP): PHASE 1

May 2010

Report edited by: Ms. Vanessa Marais of Galago Environmental
Report author: Mr. R.F. Geyser
Report verified/reviewed by: Dr. A.C. Kemp (Ph.D., Pr.Sci. Nat. (Zoology))

VERIFICATION STATEMENT

Mr R. Geyser is not registered as a Professional Natural Scientist with the S.A. Council for Natural Scientific Professions. This statement serves to verify that the bird report compiled by Mr R.F. Geyser has been prepared under my supervision, and I have verified the contents thereof.

Declaration of Independence: I, Alan Charles Kemp (4405075033081), declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions
- act as an independent specialist consultant in the field of zoology
- am subcontracted as specialist consultant by Galago Environmental CC for the proposed MCWAP Phase 1 described in this report
- have no financial interest in the proposed development other than remuneration for work performed
- neither have nor will have any vested or conflicting interests in the proposed development
- undertake to disclose to Galago Environmental CC and its client, and the competent authority, any material information that has or may have the potential to influence decisions by the competent authority as required in terms of the Environmental Impact Assessment Regulations 2006

A.C. Kemp

TABLE OF CONTENTS

FIGURE:

TABLES:

1. INTRODUCTION

Galago Environmental CC was appointed to undertake a bird habitat survey of the Phase 1 Mokolo and Crocodile Water Augmentation Project and its alternative pipeline routes, located mostly along an existing pipeline route.

The objective was to determine which species might still reside on the site. Special attention had to be given to the habitat requirements of all the Red Data species, which may occur in the area. This survey focuses on the current status of threatened mammal species occurring, or which are likely to occur on the proposed development site, and a description of the available and sensitive habitats on the site.

2. SCOPE AND OBJECTIVES OF THE STUDY

- To qualitatively and quantitatively assess the significance of the avifaunal habitat components, and current general conservation status of the property;
- To comment on ecologically sensitive areas;
- To comment on connectivity with natural vegetation and habitats on adjacent sites;
- To provide a list of birds that occur or might occur, and to identify species of conservation importance;
- To highlight potential impacts of the proposed development on the avifauna 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 site covers a large area that runs for approximately 80 km through three quarter degree grid cells (q.d.g.c.), 2327CB, 2327DA and 2327DC, from the Steenbokpan to the Mokolo Dam and passing south of Lephalale (Ellisras). The study site is situated within the Limpopo Province.

The study site is dominated by woodland, ranging from Acacia-dominated woodland to Broadleaved woodland, varying in density from place to place. The pipeline will only cross the Rietspruit, underground.

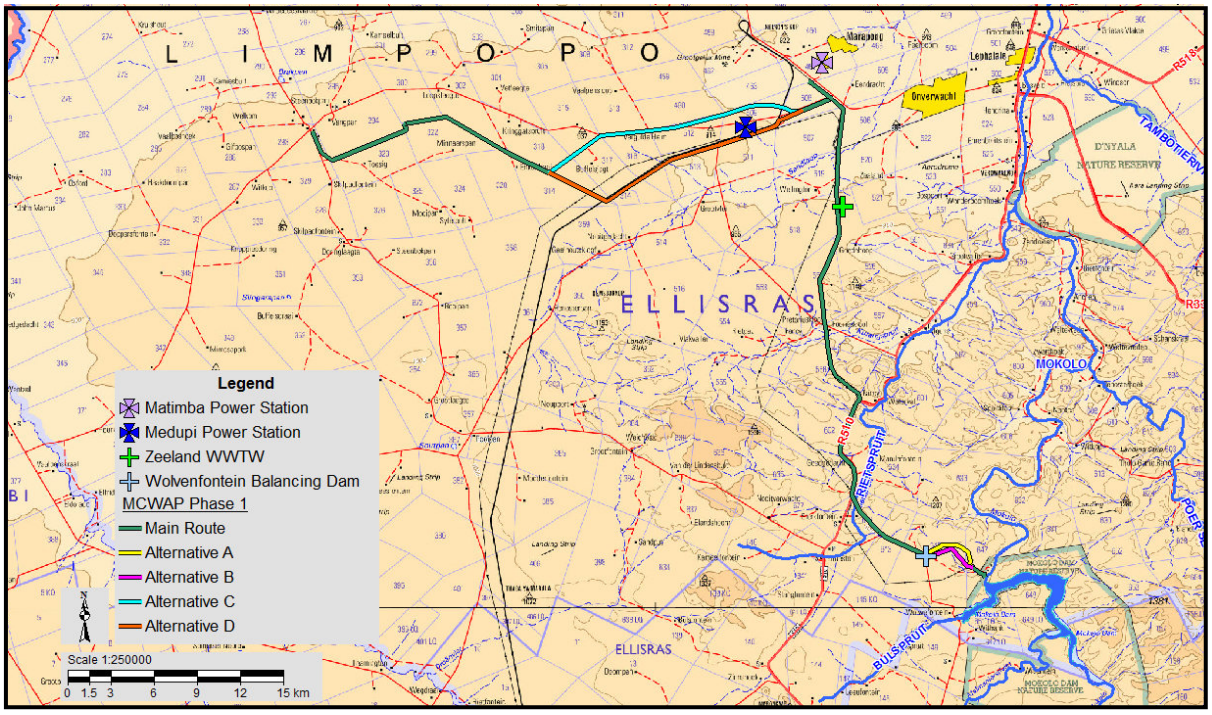

Figure 1: Locality map of the Phase 1 pipeline route

4. METHOD

A seven-day site visit was conducted from 23 to 27 March 2009 and 1 to 2 February 2010 to record the presence of bird species associated with the habitat systems on the study site and to identify possible sensitive areas.

The adjoining properties were scanned for important fauna habitats.

4.1.1 Field Surveys

Birds were identified visually using a 10X42 Bushnell Legend binocular and a 20X-60X Pentax spotting scope and by call and where necessary verified from *Sasol Birds of Southern Africa* (Sinclair *et al*., 2005) and *Southern African Bird Sounds* (Gibbon, 1991).

No trapping or mist netting was conducted, as the terms of reference did not require such intensive work. The property was surveyed both in a vehicle and on foot and in the process sighting were recorded through random transect walks. At suitable situations the vehicle was stopped and local inspections were made on foot.

Three criteria were used to assess the probability of occurrence of Red Data and other bird species on the study site that will most probably make use of the site and surrounding area for breeding or feeding purposes. These include known distribution

range, habitat preference and the presence of suitable habitat on site, including the presence of food.

4.1.2 Desktop Surveys

The presence of suitable habitats was used to deduce the likelihood of presence or absence of species, based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season.

The likely occurrence of key bird species was verified according to distribution records obtained during the Southern African Bird Atlas period from 1981 to 1993 (Harrison *et al.* 1997), and also from earlier records from 1974 to 1987 (Tarboton *et al.* 1987).

The occurrence and historic distribution of likely bird species, including all Red Data species for the q.d.g.c. 2327CB, 2327DA and 2327DC, were verified from Harrison *et al.* (1997) and Tarboton *et al.* (1987). The reporting rate for each species, based on Harrison *et al*. (1997), was scored between 0 – 100% and was calculated as follows: Total number of cards on which a species was reported during the Southern African Bird Atlas SABAP1) period X 100 ÷ total number of cards for a particular q.d.g.c. (Harrison *et al*., 1997). It is important to note that a q.d.g.c. covers a large area: for example, q.d.g.c. 2327CB covers an area of ±27 X 25 km (±693 km²) and it is possible that suitable habitat will exist for a certain Red Data species within this wider area surrounding the study site. However, the specific habitat(s) found on site may not suit the particular Red Data species, even though it has been recorded for the q.d.g.c. For example, the Cape Vulture occurs along the Magaliesberg but will not favour the habitat found within the Pretoria CBD, both of which are both in the same q.d.g.c. Red Data bird species were selected and categorised according to Barnes (2000).

A biodiversity index, which gives an indication of what habitat on site will hold the richest bird diversity, was calculated as the sum of the probability of occurrence of bird species within a specific habitat system on site. For each species and habitat, the probability of occurrence was ranked as: 5 = present on site, 4 = not observed on site but has a high probability of occurring there, 3 = medium probability, 2 = low probability, 1 = very low probability and 0 = not likely to occur,

4.1.3 Specific Requirements

The habitat systems along the proposed pipeline route were all thoroughly investigated for the possible occurrence of Red Data bird species recorded for the 2327CB, 2327DA and 2327DC q.d.g.c. according to Harrison *et al.* (1997).

5. RESULTS

Avifauna Habitat Assessment

Within the vegetation types found along the proposed pipeline route, three major bird habitat systems were identified. A short description of each habitat type is as follows, ranked from most to least important:

River and riparian vegetation:

Only two river systems will be affected by the construction of the proposed pipeline namely the Mokolo River south of Lephalale (Ellisras) (23°58'39.1" S 27°41'52.2" E), where the pipeline is proposed to start and a smaller river, the Rietspruit (23°52'14.7" S 27°38'07.3" E) which is situated more or less in the middle of the proposed Phase 1 pipeline route. The Rietspruit runs into the Mokolo River to the north and the Mokolo River later runs into the Limpopo River further north, close to and west of the town of Tom Burke.

The Mokolo River is a broad river and as such is the largest river of the two that will be affected by the construction and later the water usage out of the river. The banks of the Mokolo River where the proposed pump station will be constructed are mainly steep and situated just below the Mokolo Dam wall. This is a mountainous area, with reeds that grow between exposed rocks on the banks and on islands within the river in certain areas, as well as mainly open riparian vegetation that grows on its banks. It is possible that dense riparian vegetation growth is limited by flooding from the Mokolo Dam (Figure 2).

Figure 2: Riparian Vegetation below the Mokolo Dam Impoundment wall.

The Rietspruit is a smaller river or stream system, largely overgrown by reeds and with dense woodland vegetation that grows on its banks. This small river is narrow and shallow, with a few waterholes in some places where it crisscrosses through a mountainous area.

These rivers are not only sensitive habitats for bird species that depend on them for food, water and breeding purposes, but also for other fauna and people that depend on the river for water, irrigation and other purposes. The Mokolo River is mainly a fast flowing river during the peak rainy season in summer, but will slow down and could even/also become dry during the dry season in winter. The Rietspruit is more a seasonal river that probably only holds water during the summer rainfall season. A fairly large impoundment, the Rietspruit Dam, (Figure 3) has been build within the spruit and the proposed pipeline will run past it by, next to the existing pipe line that is just below the impoundment wall (23°56'09.7" S 27°37'59.2" E). Water extraction for irrigation and other human needs has a large impact on the availability of water downstream in the Mokolo River.

Figure 3: Impoundment built in the Rietspruit

Bird species such as herons, crakes, moorhens, bishops, weavers, cisticolas and warblers will breed in the reeds growing on the banks of the river systems and will also feed on insects that live within the reeds and semi-aquatic vegetation. Fish live in these rivers and will thus attract birds that feed on fish, such as kingfishers, cormorants and darters. Frogs and crabs also occur and will attract bird species that feed on them, such as Hadeda, herons and Hamerkop.

The dominant vegetation within the riparian zone includes/consists of large *Acacia* and broadleaved trees, which grow taller due to the availability of water when compared to trees further away from the river. This riparian vegetation will favour bird species typically associated with a bushveld habitat. These include a great variety of arboreal passerines, such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and

weavers, as well as arboreal non-passerines such as doves, cuckoos and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests. Acacia trees generally attract many insects and in turn attract a good diversity of typical “Bushveld” bird species.

Broodleaved woodland and Rocky ridges

The longest stretch of the proposed pipeline route will run through and along areas with woodland habitat, which varies between broadleaved woodland, mixed *Acacia* and broadleaved woodland, *Acacia*-dominated woodland, and open woodland with small scattered *Acacia* trees. This open woodland is situated on the lower and flatter areas of the study site that used to be cultivated fields and are now overgrown by short grasses and encroached by small scattered *Acacia tortilis* trees. The woodlands described here also include mountain woodland, which mainly consists of mixed broadleaved woodland that grows on the steep slopes of mountains, and within the valleys and gorges between the mountains, in the southern portion of the proposed pipeline route.

Figure 4: Mixed Broadleaved Woodland

The bird species within this habitat generally include a great variety of arboreal passerines, such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers, as well as arboreal non-passerines such as doves, cuckoos and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests. Acacia trees generally attract many insects and in turn attract a good diversity of typical Acacia savanna bird species. The ground cover between the trees consists of mainly short to long grasses interspersed with shrubs.

Figure 5: Mixed Mountain Broadleaved woodland.

Figure 6: Mixed Mountain Broadleaved woodland.

Cultivated fields and pastures

The proposed pipeline route will run past areas that consist of recovering cultivated fields, now overgrown by grasses and encroached by small thorn trees, resembling arid thornveld.

Agriculture is a major environmental problem for threatened bird species as well as species that depend on grassland for survival. The tilling of soil for cultivated fields is one of the most drastic and irrevocable alterations wrought on natural systems destroying the structure and species composition of the natural vegetation (Barnes 1998).

This disturbance is mainly permanent and thereby has a massive impact on the taxa that are dependent on that vegetation. This especially affects the grassland areas in the region. Bird species that are able to exploit monocultures and cultivated crops, or by-products of cultivation such as bare ground, may benefit temporarily.

Observed and Expected Avifauna Species Richness

Of the 337 bird species recorded for the 2327CB, 2327DA and 2327DC q.d.g.c, 314 (93.1%) are likely to occur on the proposed route and 100 (31.8%) of these bird species were actually observed on the study site. In addition, six bird species were observed on site that was not observed within the above-mentioned q.d.g.c.'s during the time of the southern African Bird Atlas Project period. (see pers. obs. in Table 1, of bird species seen on site or that are likely to occur on site).

The biodiversity indices indicates that the largest bird diversity is likely to occur within the River and Riparian vegetation habitat system on site with a biodiversity index (BI) of 898, followed by the woodland habitat (BI 808), and the cultivated fields and fallow lands (BI 540).

The bird species listed in table 1 are in species order according to *Roberts - Birds of Southern Africa* VII th edition (Hockey *et al*, 2005). These comprise the 100 species actually observed on site (**in bold**) or that are likely to occur within the specific habitat(s) found on site. This does not include over flying birds or rare vagrants. Personal observation (pers obs) represented bird species observed on site that were not recorded on the 2327CB, 2327DA and 2327DC q.d.g.c according to Harrison *et al* (1997). Reporting rate (%) is according to Harrison *et al.* (1997). The habitat preference, **RR = River and Riparian vegetation, WD = Woodland, and CF = Cultivated fields and fallow lands** is indicated next to the reporting rate with their possibility of occurrence in these specific habitats on site rated as 5 = present, 4 = High, 3 = Medium, 2 = Low, 1 = very low, and 0 = Not likely to occur.

Table 1: **List of bird species observed on site and that are likely to occur on the study site.**

SCIENTIFIC NAME	ENGLISH NAME	R rate (%)*			HABITAT PREFERENCE		
		2327CB Steenbokpan	2327DA Ellisras	2327DC Afguns	RR	WD	CF
Struthio camelus	Common Ostrich	30	8	2	3	4	4
Peliperdix coqui	Coqui Francolin	40	4	45	2	4	2
Dendroperdix sephaena	**Crested Francolin**	**50**	67	55	5	5	4
Pternistis natalensis	**Natal Spurfowl**		12	**65**	5	5	4
Pternistis swainsonii	Swainson's Spurfowl	60	69	20	3	4	4
Coturnix coturnix	Common Quail		4	4	0	0	1
Coturnix delegorguei	Harlequin Quail		6	14	2	2	1
Numida meleagris	**Helmeted Guineafowl**	70	**80**	**22**	4	5	4
Dendrocygna viduata	White-faced Duck	10	47	14	4	0	0
Alopochen aegyptiaca	Egyptian Goose	10	31	63	4	0	0
Plectropterus gambensis	Spur-winged Goose		20	18	4	0	1
Sarkidiornis melanotos	Comb Duck	10	18	4	4	0	0
Anas capensis	Cape Teal		41		4	0	0
Anas sparsa	African Black Duck		4	53	4	0	0
Anas undulata	Yellow-billed Duck		12	2	4	0	0
Anas smithii	Cape Shoveler		14		3	0	0
Anas erythrorhyncha	Red-billed Teal		43	2	4	0	0
Anas hottentota	Hottentot Teal		4		2	0	0
Netta erythrophthalma	Southern Pochard		45	8	2	0	0
Turnix sylvaticus	Kurrichane Buttonquail			27	2	3	1
Indicator indicator	Greater Honeyguide	10	2	16	4	4	0
Indicator minor	Lesser Honeyguide		8	4	3	3	0
Campethera bennettii	Bennett's Woodpecker		6	10	3	3	1
Campethera abingoni	Golden-tailed Woodpecker	10	33	21	4	4	2
Dendropicos fuscescens	Cardinal Woodpecker	20	25	51	4	4	1
Dendropicos namaquus	**Bearded Woodpecker**		**20**	22	4	5	1
Pogoniulus chrysoconus	**Yellow-fronted Tinkerbird**		2	**18**	3	5	0
Tricholaema leucomelas	**Acacia Pied Barbet**	**50**	49	12	4	5	3
Lybius torquatus	**Black-collared Barbet**	10	2	**35**	5	5	2
Trachyphonus vaillantii	**Crested Barbet**	**20**	76	**73**	4	5	2
Tockus erythrorhynchus	**Red-billed Hornbill**	**50**	**36**	**29**	4	5	4
Tockus leucomelas	**Southern Yellow-billed Hornbill**	**80**	84	**73**	4	5	4
Tockus nasutus	**African Grey Hornbill**	**50**	**82**	82	5	5	2
Upupa africana	African Hoopoe	20	78	73	3	4	3
Phoeniculus purpureus	**Green Wood-Hoopoe**	40	**67**	61	5	4	2
Rhinopomastus cyanomelas	**Common Scimitarbill**	**40**	22	8	4	5	3
Coracias garrulus	European Roller	30	18	8	4	4	4
Coracias caudatus	**Lilac-breasted Roller**	**90**	92	82	4	5	5
Coracias naevius	**Purple Roller**	**50**	**75**	43	4	5	5
Alcedo semitorquata	Half-collared Kingfisher (**NT**)			12	3	0	0
Alcedo cristata	Malachite Kingfisher		4	49	4	0	0
Ispidina picta	African Pygmy-Kingfisher		2	4	3	3	1
Halcyon leucocephala	Grey-headed Kingfisher			4	2	3	0
Halcyon senegalensis	**Woodland Kingfisher**		12	**31**	5	5	2

SCIENTIFIC NAME	ENGLISH NAME	R rate (%)*			HABITAT PREFERENCE		
		2327CB Steenbokpan	2327DA Ellisras	2327DC Afguns	RR	WD	CF
Halcyon albiventris	**Brown-hooded Kingfisher**	20	78	**73**	5	5	3
Halcyon chelicuti	Striped Kingfisher			18	4	4	1
Megaceryle maximus	Giant Kingfisher		6	63	4	0	0
Ceryle rudis	**Pied Kingfisher**		33	**71**	5	0	0
Merops bullockoides	White-fronted Bee-eater	10	24	2	3	2	2
Merops pusillus	Little Bee-eater	30	41	53	4	4	3
Merops hirundineus	**Swallow-tailed Bee-eater**	50	**2**	2	3	5	2
Merops persicus	Blue-cheeked Bee-eater		18	4	3	1	1
Merops apiaster	**European Bee-eater**	**30**	**37**	**49**	5	5	5
Merops nubicoides	Southern Carmine Bee-eater	20	12	22	2	3	1
Colius striatus	Speckled Mousebird	10	14	22	3	3	1
Urocolius indicus	**Red-faced Mousebird**	**50**	**73**	**45**	4	5	5
Clamator jacobinus	Jacobin Cuckoo	10	22	43	4	4	2
Clamator levaillantii	**Levaillant's Cuckoo**	**pers obs**	16	2	4	5	1
Clamator glandarius	Great Spotted Cuckoo		2		1	1	0
Cuculus solitarius	Red-chested Cuckoo	10	8	31	4	4	0
Cuculus clamosus	Black Cuckoo	20	6	27	4	4	0
Cuculus gularis	African Cuckoo	20	16		4	4	1
Chrysococcyx klaas	Klaas's Cuckoo	10	4	24	4	4	2
Chrysococcyx caprius	Diderick Cuckoo	40	35	41	4	4	4
Centropus burchellii	**Burchell's Coucal**		27	**65**	5	3	0
Poicephalus meyeri	Meyer's Parrot		71	16	3	3	0
Cypsiurus parvus	African Palm-Swift		35	6	4	4	4
Tachymarptis melba	Alpine Swift		4	10	2	3	1
Apus apus	Common Swift	10	2		1	5	1
Apus barbatus	**African Black Swift**		8	**6**	2	3	2
Apus affinis	**Little Swift**	10	25	**27**	5	4	4
Apus horus	Horus Swift			2	1	0	1
Apus caffer	White-rumped Swift		20	59	4	4	4
Corythaixoides concolor	**Grey Go-away-bird**	**70**	**96**	**88**	5	5	4
Tyto alba	Barn Owl		6	41	4	4	3
Otus senegalensis	African Scops-Owl		4	20	3	3	0
Ptilopsis granti	Southern White-faced Scops-Owl	10			3	3	0
Bubo africanus	Spotted Eagle-Owl	10	20	61	4	4	1
Bubo lacteus	Verreaux's Eagle-Owl			4	0	3	0
Glaucidium perlatum	**Pearl-spotted Owlet**	**60**	61	**61**	5	5	3
Caprimulgus pectoralis	Fiery-necked Nightjar		2	37	3	4	1
Caprimulgus tristigma	Freckled Nightjar			33	2	4	0
Caprimulgus rufigena	Rufous-cheeked Nightjar	10		4	3	4	3
Columba guinea	Speckled Pigeon	30	55	53	3	3	4
Streptopelia senegalensis	**Laughing Dove**	70	**94**	96	5	5	4
Streptopelia capicola	**Cape Turtle-Dove**	**70**	**86**	**90**	5	5	4
Streptopelia semitorquata	**Red-eyed Dove**	30	71	**53**	4	5	3
Turtur chalcospilos	**Emerald-spotted Wood-Dove**	10	**39**	**78**	5	5	4
Oena capensis	Namaqua Dove	60	75	51	3	3	4

SCIENTIFIC NAME	ENGLISH NAME	R rate (%)*			HABITAT PREFERENCE		
		2327CB Steenbokpan	2327DA Ellisras	2327DC Afguns	RR	WD	CF
Treron calvus	African Green-Pigeon		67	39	4	3	2
Lophotis ruficrista	Red-crested Korhaan	60	43	16	3	4	2
Podica senegalensis	African Finfoot (VU)			12	1	0	0
Crecopsis egregia	African Crake			2	3	0	0
Amaurornis flavirostris	**Black Crake**		6	**47**	5	0	0
Gallinula chloropus	Common Moorhen		12	4	4	0	0
Fulica cristata	Red-knobbed Coot		55		4	0	0
Pterocles bicinctus	Double-banded Sandgrouse		12	41	3	4	2
Pterocles burchelli	Burchell's Sandgrouse	30	2		2	3	1
Tringa stagnatilis	Marsh Sandpiper		18		3	0	0
Tringa nebularia	Common Greenshank		10	33	2	0	0
Tringa glareola	Wood Sandpiper	10	20	4	3	0	0
Actitis hypoleucos	Common Sandpiper		18	4	4	0	0
Actophilornis africanus	**African Jacana**		20	**16**	5	0	0
Burhinus vermiculatus	Water Thick-knee		8	47	4	0	0
Burhinus capensis	Spotted Thick-knee	30	47	22	3	3	4
Himantopus himantopus	Black-winged Stilt		67	2	4	0	0
Recurvirostra avosetta	Pied Avocet		4		1	0	0
Charadrius pecuarius	Kittlitz's Plover		8	22	2	0	0
Charadrius tricollaris	Three-banded Plover		37	57	4	0	0
Vanellus armatus	**Blacksmith Lapwing**	50	86	**61**	5	0	1
Vanellus senegallus	African Wattled Lapwing		16	61	4	0	0
Vanellus coronatus	**Crowned Lapwing**	80	88	**63**	3	4	5
Rhinoptilus chalcopterus	Bronze-winged Courser	10	6		3	4	4
Cursorius temminckii	Temminck's Courser		14	6	0	1	3
Glareola nordmanni	Black-winged Pratincole (NT)	10	2		0	2	2
Larus cirrocephalus	Grey-headed Gull		6	6	1	0	0
Chlidonias leucopterus	White-winged Tern		33	14	2	0	0
Pandion haliaetus	Osprey			20	1	0	0
Elanus caeruleus	Black-shouldered Kite	10	67	20	2	3	4
Milvus migrans	**Black Kite**		**20**	31	3	5	3
Haliaeetus vocifer	**African Fish-Eagle**		**20**	61	5	0	0
Gyps africanus	White-backed Vulture (VU)	30	2		1	1	0
Gyps coprotheres	Cape Vulture (VU)	30			1	1	0
Aegypius tracheliotus	Lappet-faced Vulture (VU)	10			1	1	0
Circaetus pectoralis	Black-chested Snake-Eagle	40	12	37	4	4	3
Circaetus cinereus	**Brown Snake-Eagle**	30	**22**	12	3	5	2
Terathopius ecaudatus	Bateleur (VU)	20	4		1	1	0
Polyboroides typus	African Harrier-Hawk		2	43	4	4	1
Kaupifalco monogrammicus	Lizard Buzzard		8		4	4	1
Melierax canorus	Southern Pale Chanting Goshawk	70	6		4	4	3
Melierax gabar	Gabar Goshawk	30	41		4	4	3
Accipiter badius	Shikra	30		20	4	4	4
Accipiter minullus	Little Sparrowhawk		29	14	4	4	1
Accipiter ovampensis	Ovambo Sparrowhawk		4	2	2	1	0

SCIENTIFIC NAME	ENGLISH NAME	R rate (%)*			HABITAT PREFERENCE		
		2327CB Steenbokpan	2327DA Ellisras	2327DC Afguns	RR	WD	CF
Buteo vulpinus	Steppe Buzzard	20	12	2	4	4	4
Buteo rufofuscus	Jackal Buzzard			20	0	2	0
Aquila nipalensis	Steppe Eagle	10			1	1	0
Aquila rapax	Tawny Eagle (VU)	30		12	2	3	1
Aquila verreauxii	Verreauxs' Eagle		2	65	0	4	0
Aquila spilogaster	**African Hawk-Eagle**		2	**41**	2	5	2
Aquila pennatus	Booted Eagle	10			1	1	0
Aquila wahlbergi	Wahlberg's Eagle	30	14	47	4	4	3
Polemaetus bellicosus	Martial Eagle (VU)		6	18	1	1	1
Sagittarius serpentarius	Secretarybird (NT)	20	12	4	0	0	1
Falco rupicolus	Rock Kestrel	10	4	45	2	3	1
Falco rupicoloides	Greater Kestrel			2	0	0	1
Falco amurensis	Amur Falcon		2		0	0	1
Tachybaptus ruficollis	Little Grebe		69	49	4	0	0
Anhinga rufa	**African Darter**		37	**61**	5	0	0
Phalacrocorax africanus	**Reed Cormorant**		53	**71**	5	0	0
Phalacrocorax lucidus	White-breasted Cormorant		65	61	3	0	0
Egretta ardesiaca	Black Heron			6	3	0	0
Egretta garzetta	**Little Egret**		8	**35**	5	0	0
Egretta intermedia	Yellow-billed Egret		20	8	2	0	0
Egretta alba	Great Egret		2	37	3	0	0
Ardea cinerea	Grey Heron		57	71	4	0	0
Ardea melanocephala	Black-headed Heron		27	65	4	0	1
Ardea goliath	Goliath Heron		2	18	2	0	0
Ardea purpurea	Purple Heron		6	4	4	0	0
Bubulcus ibis	Cattle Egret	30	75	67	4	4	4
Ardeola ralloides	Squacco Heron		4	65	4	0	0
Butorides striata	**Green-backed Heron**		12	**65**	5	0	0
Nycticorax nycticorax	Black-crowned Night-Heron			4	4	0	0
Ixobrychus minutus	Little Bittern			4	3	0	0
Scopus umbretta	**Hamerkop**		**22**	73	5	2	1
Bostrychia hagedash	**Hadeda Ibis**		29	**41**	5	3	2
Threskiornis aethiopicus	African Sacred Ibis		24	6	4	0	0
Platalea alba	African Spoonbill		10	10	3	0	0
Mycteria ibis	Yellow-billed Stork (NT)		4	10	2	0	0
Ciconia nigra	Black Stork (NT)		4	4	1	1	0
Ciconia abdimii	Abdim's Stork		1	4	0	0	1
Ciconia ciconia	White Stork	10	12	8	2	1	2
Oriolus oriolus	Eurasian Golden Oriole	10	4	2	1	1	0
Oriolus larvatus	**Black-headed Oriole**	30	73	**73**	5	5	1
Dicrurus adsimilis	**Fork-tailed Drongo**	80	94	**94**	5	5	5
Terpsiphone viridis	**African Paradise-Flycatcher**	10	41	**51**	5	5	1
Nilaus afer	**Brubru**	**40**	12	**41**	4	5	2
Dryoscopus cubla	**Black-backed Puffback**		69	**78**	5	5	4
Tchagra senegalus	**Black-crowned Tchagra**	40	4	**59**	4	5	3
Tchagra australis	**Brown-crowned Tchagra**	40	22	**49**	4	**4**	3
Laniarius ferrugineus	Southern Boubou			67	4	3	1

SCIENTIFIC NAME	ENGLISH NAME	R rate (%)*			HABITAT PREFERENCE		
		2327CB Steenbokpan	2327DA Ellisras	2327DC Afguns	RR	WD	CF
Laniarius atrococcineus	**Crimson-breasted Shrike**	40	**35**	6	3	5	4
Telophorus sulfureopectus	Orange-breasted Bush-Shrike		14	39	4	4	1
Malaconotus blanchoti	**Grey-headed Bush-Shrike**	20	75	**51**	4	5	1
Prionops plumatus	**White-crested Helmet-Shrike**	**pers obs**	20	53	4	5	3
Batis molitor	**Chinspot Batis**	**40**	**65**	**59**	5	5	5
Corvus albus	Pied Crow		39	10	3	2	3
Lanius collurio	**Red-backed Shrike**	**50**	**25**	**24**	4	5	5
Lanius minor	Lesser Grey Shrike	40	6	18	4	4	4
Lanius collaris	Common Fiscal	10	37	33	3	2	4
Corvinella melanoleuca	**Magpie Shrike**	**70**	80	55	3	5	4
Eurocephalus anguitimens	Southern White-crowned Shrike	50	67	18	3	4	4
Campephaga flava	**Black Cuckooshrike**			**6**	4	5	1
Anthoscopus minutus	Cape Penduline-Tit	20	2	2	2	3	1
Anthoscopus caroli	Grey Penduline-Tit			6	1	2	1
Parus niger	**Southern Black Tit**	**30**	**67**	65	4	5	3
Parus cinerascens	**Ashy Tit**	**20**			4	5	3
Riparia paludicola	Brown-throated Martin		6	2	3	0	1
Hirundo rustica	**Barn Swallow**	**40**	25	29	5	5	5
Hirundo albigularis	White-throated Swallow		2	8	4	3	2
Hirundo dimidiata	Pearl-breasted Swallow		2	4	4	4	2
Hirundo cucullata	Greater Striped Swallow		8	6	3	3	3
Hirundo abyssinica	**Lesser Striped Swallow**		31	**67**	5	4	4
Hirundo semirufa	Red-breasted Swallow	30	53	47	4	4	4
Hirundo fuligula	Rock Martin		6	33	2	3	1
Delichon urbicum	Common House-Martin		6	14	2	3	2
Pycnonotus tricolor	**Dark-capped Bulbul**	**20**	55	**78**	4	5	4
Pycnonotus nigricans	African Red-eyed Bulbul	20	55	2	1	1	0
Chlorocichla flaviventris	**Yellow-bellied Greenbul**			**6**	5	5	0
Sylvietta rufescens	**Long-billed Crombec**	**40**	67	**39**	5	5	3
Eremomela icteropygialis	Yellow-bellied Eremomela	30	8	10	3	4	4
Eremomela usticollis	**Burnt-necked Eremomela**	30	**pers obs**	4	3	5	4
Acrocephalus palustris	Marsh Warbler			2	4	4	1
Acrocephalus gracilirostris	Lesser Swamp-Warbler		2	10	4	0	0
Phylloscopus trochilus	**Willow Warbler**	**20**	8	**4**	5	5	4
Turdoides bicolor	Southern Pied Babbler	60	76		4	4	3
Turdoides jardineii	Arrow-marked Babbler	20	73	69	4	4	3
Parisoma subcaeruleum	**Chestnut-vented Tit-Babbler**	**30**	10	4	4	5	4
Zosterops virens	**Cape White-eye**		51	**63**	5	5	3
Cisticola aberrans	Lazy Cisticola			4	0	1	0
Cisticola chiniana	**Rattling Cisticola**	**50**	**20**	18	5	5	4
Cisticola rufilatus	Tinkling Cisticola	20			1	1	0
Cisticola tinniens	Levaillant's Cisticola		2	2	4	0	0
Cisticola fulvicapilla	**Neddicky**	20	**2**	**33**	5	5	5
Cisticola juncidis	Zitting Cisticola	20	14	10	3	0	4
Cisticola aridulus	Desert Cisticola	20	4	2	0	0	3

SCIENTIFIC NAME	ENGLISH NAME	R rate (%)*			HABITAT PREFERENCE		
		2327CB Steenbokpan	2327DA Ellisras	2327DC Afguns	RR	WD	CF
Prinia subflava	**Tawny-flanked Prinia**	**30**	18	57	5	2	0
Prinia flavicans	Black-chested Prinia	40	4	8	3	3	4
Apalis thoracica	**Bar-throated Apalis**			**24**	3	5	0
Camaroptera brevicaudata	**Grey-backed Camaroptera**	**10**	**2**	**8**	5	5	3
Calamonastes fasciolatus	**Barred Wren-Warbler**	**20**	**2**		4	5	4
Mirafra passerina	Monotonous Lark		8		2	3	3
Mirafra africana	Rufous-naped Lark	30	12	20	0	2	4
Mirafra rufocinnamomea	**Flappet Lark**			**2**	2	5	4
Calendulauda sabota	Sabota Lark	50	6	6	4	4	4
Calendulauda africanoides	Fawn-coloured Lark	10			0	1	1
Pinarocorys nigricans	Dusky Lark	10			0	1	1
Eremopterix leucotis	Chestnut-backed Sparrowlark	20	6		0	0	3
Eremopterix verticalis	Grey-backed Sparrowlark		2		0	0	1
Calandrella cinerea	Red-capped Lark	10	2		0	0	1
Psophocichla litsitsirupa	**Groundscraper Thrush**	30	75	**73**	3	5	3
Turdus libonyanus	Kurrichane Thrush		69	71	4	4	1
Bradornis mariquensis	Marico Flycatcher	60	57	35	2	3	4
Melaenornis pammelaina	Southern Black Flycatcher		10	35	4	4	3
Sigelus silens	Fiscal Flycatcher		12		2	2	1
Muscicapa striata	**Spotted Flycatcher**	**40**	18	**12**	5	5	2
Myioparus plumbeus	Grey Tit-Flycatcher		2	4	4	4	2
Cossypha caffra	Cape Robin-Chat		2	16	2	2	0
Cossypha humeralis	**White-throated Robin-Chat**		14	**37**	3	5	1
Cercotrichas leucophrys	**White-browed Scrub-Robin**	**40**	**22**	**24**	4	5	3
Cercotrichas paena	Kalahari Scrub-Robin	40	4		1	1	3
Saxicola torquatus	African Stonechat		14	2	2	0	1
Oenanthe pileata	Capped Wheatear	20	2		0	0	1
Cercomela familiaris	**Familiar Chat**		**12**	**53**	2	5	1
Myrmecocichla formicivora	Ant-eating Chat	50	33	6	0	1	1
Thamnolaea cinnamomeiventris	Mocking Cliff-Chat		6	27	0	2	0
Onychognathus morio	Red-winged Starling		41	67	1	3	0
Lamprotornis nitens	**Cape Glossy Starling**	**70**	84	**82**	5	5	4
Lamprotornis chalybaeus	Greater Blue-eared Starling	10	4	8	1	1	1
Lamprotornis australis	**Burchell's Starling**	**10**	59	4	3	5	5
Cinnyricinclus leucogaster	Violet-backed Starling	20	10	35	4	4	1
Creatophora cinerea	Wattled Starling	30	29	2	4	4	0
Buphagus erythrorhynchus	**Red-billed Oxpecker (NT)**		2	**1**	4	5	1
Chalcomitra amethystina	Amethyst Sunbird		8	45	3	3	0
Cinnyris talatala	**White-bellied Sunbird**	20	76	**71**	4	5	0
Cinnyris mariquensis	Marico Sunbird	30	65	45	3	4	4
Bubalornis niger	Red-billed Buffalo-Weaver	10	75	2	3	4	1
Sporopipes squamifrons	**Scaly-feathered Finch**	**50**	71	8	3	4	5
Plocepasser mahali	**White-browed Sparrow-Weaver**	**40**	43	24	2	5	4
Ploceus intermedius	Lesser Masked-Weaver		6	4	2	2	1

SCIENTIFIC NAME	ENGLISH NAME	R rate (%)*			HABITAT PREFERENCE		
		2327CB Steenbokpan	2327DA Ellisras	2327DC Afguns	RR	WD	CF
Ploceus velatus	**Southern Masked-Weaver**	20	**65**	67	4	5	4
Ploceus cucullatus	Village Weaver	10	2	41	4	4	2
Anaplectes melanotis	Red-headed Weaver			12	3	3	2
Quelea quelea	**Red-billed Quelea**	**30**	**22**	**16**	4	5	5
Euplectes afer	Yellow-crowned Bishop	10			1	0	0
Euplectes orix	Southern Red Bishop		27	18	3	2	2
Euplectes albonotatus	White-winged Widowbird		22	16	4	1	3
Euplectes ardens	Red-collared Widowbird		6		2	0	1
Sporaeginthus subflavus	Orange-breasted Waxbill		6	2	2	0	0
Ortygospiza atricollis	African Quailfinch	10	16	2	3	0	1
Amadina erythrocephala	Red-headed Finch	10	31		4	4	3
Amadina fasciata	Cut-throat Finch	10	51	2	4	4	4
Coccopygia melanotis	Swee Waxbill			4	0	1	0
Estrilda erythronotos	Black-faced Waxbill	40	10	2	3	4	4
Estrilda astrild	Common Waxbill		25	65	4	2	2
Granatina granatina	**Violet-eared Waxbill**	**50**	25	2	4	5	4
Uraeginthus angolensis	**Blue Waxbill**	**80**	**86**	**76**	5	5	5
Pytilia melba	**Green-winged Pytilia**	**50**	**33**	**8**	5	5	4
Lagonosticta senegala	**Red-billed Firefinch**	10	45	**24**	5	5	4
Lagonosticta rhodopareia	**Jameson's Firefinch**	**pers obs**	12	63	5	4	2
Spermestes cucullatus	Bronze Mannikin		35	16	3	3	2
Vidua macroura	Pin-tailed Whydah		10	31	4	4	4
Vidua paradisaea	**Long-tailed Paradise-Whydah**	**30**	**37**	**14**	4	5	5
Vidua regia	**Shaft-tailed Whydah**	**40**	20	4	4	5	5
Vidua chalybeata	**Village Indigobird**	**pers obs**	12		2	5	4
Anomalospiza imberbis	Cuckoo Finch		2		1	0	0
Passer motitensis	Great Sparrow	10	4		3	3	1
Passer melanurus	Cape Sparrow	10	22	10	2	2	2
Passer diffusus	**Southern Grey-headed Sparrow**	50	**67**	**33**	4	5	5
Petronia superciliaris	**Yellow-throated Petronia**	10	**pers obs**	2	3	5	1
Motacilla aguimp	African Pied Wagtail		24	61	4	0	0
Motacilla capensis	Cape Wagtail		16	43	4	0	0
Anthus lineiventris	Striped Pipit			2	0	1	0
Anthus cinnamomeus	African Pipit	40	6	14	2	2	3
Anthus leucophrys	Plain-backed Pipit	10			0	1	1
Anthus vaalensis	Buffy Pipit			4	1	0	1
Anthus similis	Long-billed Pipit		2		0	0	1
Anthus caffer	Bushveld Pipit		2	4	3	4	1
Crithagra mozambicus	**Yellow-fronted Canary**		**51**	**80**	5	5	4
Crithagra atrogularis	Black-throated Canary	50	69	8	4	4	4
Crithagra flaviventris	Yellow Canary	10	2		3	3	1
Crithagra gularis	Streaky-headed Seedeater			2	1	1	0
Emberiza tahapisi	**Cinnamon-breasted Bunting**	10	**41**	**43**	4	5	4
Emberiza flaviventris	**Golden-breasted Bunting**	**50**	31	**71**	5	5	4
	Species for q.d.g.c:	*164*	*289*	*286*			

SCIENTIFIC NAME	ENGLISH NAME	R rate (%)*			HABITAT PREFERENCE		
		2327CB Steenbokpan	2327DA Ellisras	2327DC Afguns	RR	WD	CF
				Biodiversity Index:	898	808	540

*****The reporting rate is calculated as follows: Total number of cards on which a species was reported X 100 ÷ total number of cards for a particular quarter degree grid cell. **INT** = Introduced or alien birds species to Southern Africa.

Red Data Species Categories for the birds (Barnes, 2000)
RE = Regionally extinct, **CR** = Critically Endangered **EN** = Endangered, **VU =** Vulnerable, **NT =** Near-threatened.

The biodiversity index gives an indication of which habitat will hold the richest bird diversity on site. The colour codes for each species are represented as follows: The colour codes for each species are represented as follows: Yellow = Very Low, Light Orange = Low, Dark Orange = Medium and Red = High. The likelihood of occurrence of each species on site are on the specific habitat systems on site are as follow: 5 = present, 4 = High, 3 = Medium, 2 = Low, 1 = very low, and 0 = Not likely to occur.

Threatened and Red Listed Bird Species

The following Red Data bird species were recorded for the 2327CB, 2327DA and 2327DC quarter degree grid cell (q.d.g.c) according to Harrison *et al.* (1997)(Table 2).

Table 2: Red Data bird species recorded for the 2327CB, 2327DA and 2327DC q.d.g.c.

SCIENTIFIC NAME	ENGLISH NAME	Reporting rate (%)*		
		2327CB Steenbokpan	2327DA Ellisras	2327DC Afguns
Alcedo semitorquata	Half-collared Kingfisher (**NT**)			12
Ardeotis kori	Kori Bustard (**VU**)	30	4	2
Podica senegalensis	African Finfoot (**VU**)			12
Glareola nordmanni	Black-winged Pratincole (**NT**)	10	2	
Gyps africanus	White-backed Vulture (**VU**)	30	2	
Gyps coprotheres	Cape Vulture (**VU**)	30		
Aegypius tracheliotus	Lappet-faced Vulture (**VU**)	10		
Terathopius ecaudatus	Bateleur (**VU**)	20	4	
Aquila rapax	Tawny Eagle (**VU**)	30		12
Polemaetus bellicosus	Martial Eagle (**VU**)		6	18
Sagittarius serpentarius	Secretarybird (**NT**)	20	12	4
Gorsachius leuconotus	White-backed Night-Heron (**VU**)			14
Phoenicopterus ruber	Greater Flamingo (**NT**)		4	
Phoenicopterus minor	Lesser Flamingo (**NT**)		6	
Mycteria ibis	Yellow-billed Stork (**NT**)		4	10
Ciconia nigra	Black Stork (**NT**)		4	4
Leptoptilos crumeniferus	Marabou Stork (**NT**)		2	
Buphagus erythrorhynchus	Red-billed Oxpecker (**NT**)		2	1
	Red Data Species for q.d.g.c:	*8*	*12*	*10*

*****The reporting rate is calculated as follows: Total number of cards on which a species was reported X 100 ÷ total number of cards for a particular quarter degree grid cell. Bird species recorded for the q.d.g.c. according to both Harrison *et al.* (1997). The colour codes for each species are represented as follows: yellow = very low, light orange = low, dark orange = medium and red = high with reference to the specific habitat systems found on site.

Red Data Species Categories for the birds (Barnes, 2000)
RE = Regionally extinct, **CR** = Critically Endangered **EN** = Endangered, **VU =** Vulnerable, **NT =** Near-threatened.

A total of 18 Red Data bird species have been recorded within the 2327CB, 2327DA and 2327DC q.d.g.c. (Table 2). One, the Red-billed Oxpecker, was observed on and surrounding the study site during the time of the survey. The Half-collared Kingfisher, Kori Bustard, African Finfoot, Black-winged Pratincole, Cape Vulture, Tawny Eagle and Martial Eagle indicate a high reporting rate for one or more of the q.d.g.c, White-backed Vulture, Secretarybird, Lesser Flamingo and Yellow-billed Stork indicate a medium reporting rate, Lappet-faced Vulture, Bateleur, White-backed Night Heron, Greater Flamingo and Black Stork a low reporting rate and Marabou Stork and Red-billed Oxpecker a very low reporting rate.

6. FINDINGS AND POTENTIAL IMPLICATIONS

Five Red Data species will be affected directly by the availability of water downstream from the Mokolo dam. These species are the Half-collared Kingfisher, African Finfoot, White-backed Night-Heron**,** Yellow-billed Stork and Black Stork.

Half-collared Kingfisher (*Alcedo semitorquata*)

Criteria for IUCN threatened category: A1c, A2c; B1+2b,c,d,e; C1 Status: Near-Threatened
Habitat: Requires fast-flowing streams, rivers and estuaries, usually with dense marginal vegetation (Maclean, 1993), especially perennial streams and smaller rivers with overhanging riparian vegetation on their banks. Nests in sand/earth banks (Tarboton *et al*. 1987) and requires riverbanks in which to excavate nest tunnels (Harrison *et al.* 1997a). Most typically occurs along fast-flowing streams with clear water and well-wooded riparian growth, often near rapids. It most frequently favours broken escarpment terrain and requires at least 1 km up and down stream of undisturbed river and riparian vegetation while breeding. It occurs from sea-level to 2000 m.a.s.l. in southern Africa. Usually perches low down on the banks of rivers and streams, often on exposed roots, as well as exposed rock and low overhanging tree branches.
Threat: Widespread degradation of its habitat by siltation, erosion, pollution, water extraction and clearing of riparian vegetation (Barnes, 2000), together with disturbance.
On site conclusion: Some areas along the Rietspruit could favour this species although it is doubtful if they will occur along this small river. The Mokolo River downstream from the Mokolo Dam wall also offers ideal habitat for this species. The construction of the pump station will have a minimum impact on this species and will be limited to the construction phase. The habitat where the pump station is to be constructed is suboptimal for this species. Water extraction will however have a negative impact on the water availability downstream.

African Finfoot (*Podica senegalensis*)

Criteria for IUCN threatened category: A2c; C1 Status: Vulnerable
Habitat: Occurs mostly along quiet, wooded streams and rivers flanked by thick riparian vegetation and overhanging trees. Also, dam verges, especially where there is sufficient overhanging vegetation and reed cover. Avoids both stagnant and very fast-flowing watercourses, with a preference for clear, rather than silted water (Hockey *et al*., 2005).
Threat: Reduction of water flow through commercial afforestation of catchment areas. Degradation of its habitat by siltation, erosion, pollution, water extraction, clearing of riparian vegetation (Barnes, 2000).

On site conclusion: The Rietspruit will not favour this species. The Mokolo River downstream from the Mokolo Dam wall could offer ideal habitat for this species. The construction of the pump station will have a minimum disturbance to this species and will be limited to the construction phase. The habitat where the pump station is to be constructed is suboptimal for this species. Water extraction will however have a negative affect on the water availability downstream.

White-backed Night-Heron (*Gorsachius leuconotus)*

Criteria for IUCN threatened category: A1a; A2b,c; C1 Status: Vulnerable
Habitat: Slow-moving streams and rivers overhung with thick tangles of reeds and trees.
Threat: Clearance of vegetation along riverbanks for agriculture occurs in densely populated rural areas. Overgrazing, increased water offtake, soil erosion and poor river management cause reduced flow, increased turbidity and siltation of rivers. The rapid development of South African coastline, particularly coastal rivers, for recreation and vacation development, may further impact this species (Barnes 2000).
On site conclusion: Some areas along the Rietspruit could favour this species. The Mokolo River downstream from the Mokolo Dam wall could also offer ideal habitat for this species. The construction of the pump station will have a minimum disturbance to this species and will be limited to the construction phase. The habitat where the pump station is to be constructed is suboptimal for this species. Water abstraction will however have a negative affect on the water availability downstream.

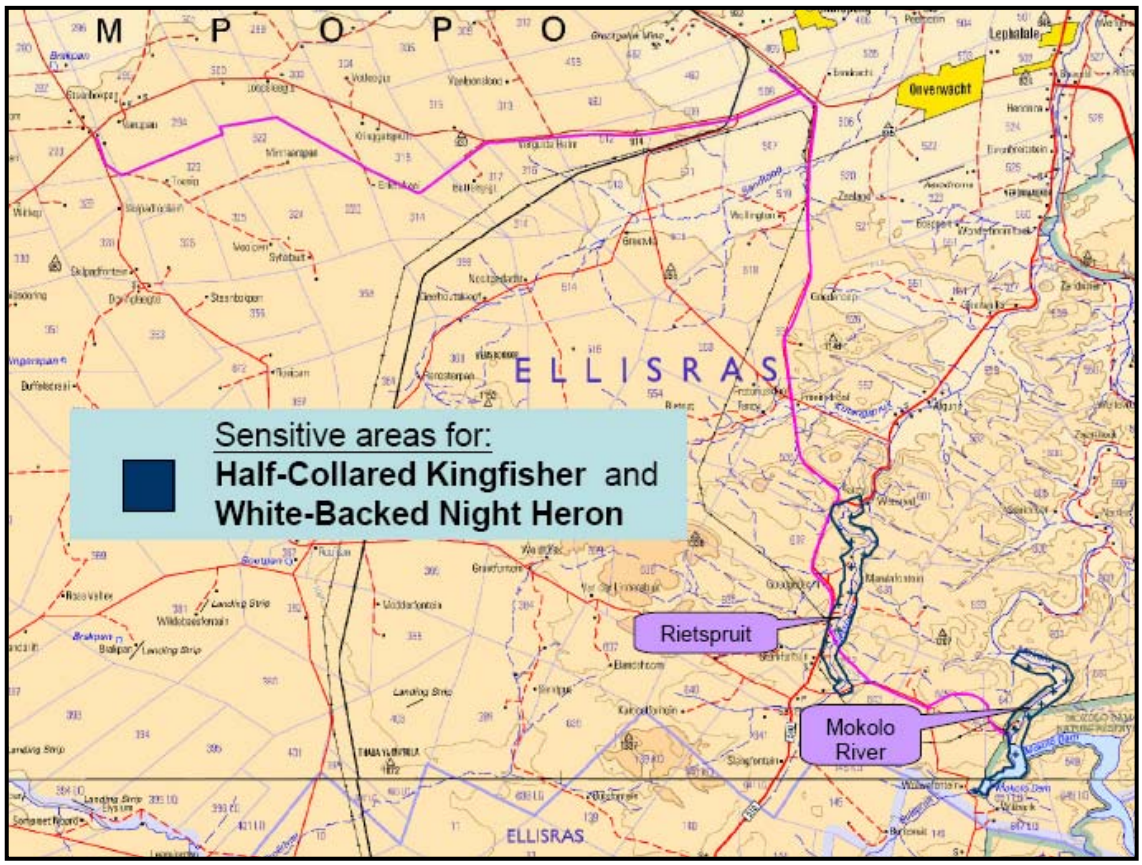

Figure 7: Map of sensitive areas for the Half-Collared Kingfisher and White-Backed Night Heron.

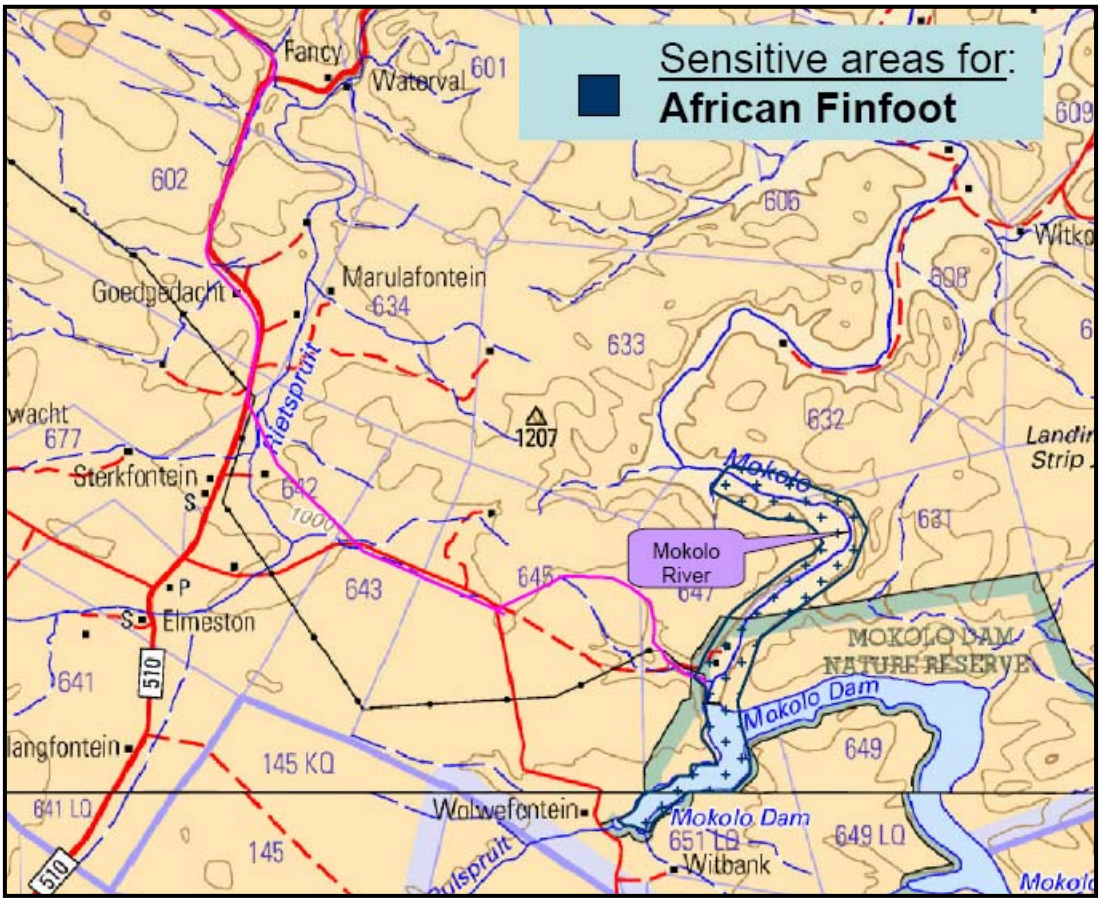

Figure 8: Map of sensitive areas for the African Finfoot.

Yellow-billed Stork (*Mycteria ibis)*

Criteria for IUCN threatened category: C1 Status: Near-Threatened
Habitat: Utilises diverse wetlands and permanent and seasonal habitats, including alkaline and freshwater lakes, rivers, dams, pans, flood plains, large marshes, swamps, estuaries, margins of lakes or rivers, flooded grassland and small pools or streams where there are areas of shallow water free of emergent vegetation (Tarboton *et al.,* 1987); less often marine mudflats and estuaries (Hockey *et al*., 2005). Nests colonially on large trees adjacent to productive wetlands, but only locally and erratically during ideal conditions.
Threat: Destruction of extensive systems of wetlands, notably pans, marches, lakes and floodplains all, which are threatened habitats.
On site conclusion: No suitable habitat was observed in the direct vicinity of the study site but suitable habitat might exist for this species further downsteam along the Mokolo River and water abstraction could have a negative effect on the water availability downstream.

Black Stork (*Ciconia nigra)*

Criteria for IUCN threatened category: A2c Status: Near-Threatened
Habitat: Dams, pans, flood plains, shallows of rivers, pools in dry riverbeds, estuaries and sometimes on marshland and flooded grassland; uncommon at seasonal pans lacking fish. Associated with mountainous regions (Hockey *et al*., 2005) where they nest (Maclean, 1993) on cliffs (Harrison *et al*. 1997a). Feeds in shallow water, but occasionally on dry land, in streams and rivers, marshes, floodplains, coastal estuaries and large and small dams; it is typically seen at pools in large rivers.
Threat: The Black Stork mountain breeding habitat is not threatened due to it inaccessibility. It is reliant on shallow waterbodies such as rivers where they forage for fish, amphibians and a range of aquatic invertebrates.
On site conclusion: No suitable habitat was observed in the direct vicinity of the study site but suitable habitat might exist for this species further downsteam along the Mokolo River.

Red-billed Oxpeckers will occur in any area where there are game and cattle from which they can feed on acaricide-free ticks found on these animals and are very unlikely to be affected by the construction of the pipeline. Several observations were made of this species on cattle and game along the path that the pipeline will follow and well as other areas further away from the pipeline. It appears this species' numbers are increasing within this region.

Kori Bustard prefers dry thornveld, grassland and semi-desert habitat, usually near the cover of trees. Within the area of the study site, they will require open savanna woodland. The woodland along the route of the pipeline is mainly dense and unsuitable for this species and will not cross any areas with large areas of suitable habitat.

Black-winged Pratincole prefers open grassland, fallow lands and edges of wetlands. This migratory species might forage over the areas that used to be cultivated fields but these areas along the path of the proposed pipeline are small and more suitable habitat exists for this species in areas surrounding the study site.

Large Red Data bird species, such as the **White-backed Vulture, Cape Vulture**, **Lappet-faced Vulture**, **Bateleur**, **Tawny Eagle** and **Martial Eagle**, will only be affected by large-scale development in the entire area of the study site. These species require large foraging ranges and are only likely to move over the areas on occasions. The **White-backed Vulture**, **Cape Vulture, Lappet-faced Vulture** are dependent on the availability of food and will only occur if it is available. No suitable cliffs where **Cape Vultures** and **Black Storks** could breed were identified on the route that the proposed pipeline will follow. The construction of the pipeline will only have an impact on these species during the construction phases and since these species forages over large ranges the small total footprint of the construction of the pipeline will have little affect on these species.

Secretarybirds are restricted to large conservation areas and avoid densely wooded areas and hilly and mountainous areas. The study area mainly consists of densely wooded areas, which this species avoids and will not cross-areas with suitable foraging habitat for this species. They are only likely to move over the area in search of suitable foraging and breeding habitat and will forage on fallow field spread over the area.

Greater and **Lesser Flamingo** prefers extensive systems of wetlands, notably pans, marshes, lakes and floodplains. There is no suitable habitat for this species along the entire stretch of the proposed pipeline route.

Marabou Storks are depended on the availability of food. They might move through the area on rare occasions in search of food. It is unlikely that the construction of the pipeline will have a negative affect on this species.

Recommended pipeline alternatives:
The Alternative C route around Madupi, south of the new road is recommended. However, both alternatives will not have a negative affect on any Red Data bird species since the areas within and surrounding the mine has already been disturbed by human activities and high human presence. The Alternative B Environmental Corridor on the farm Wolvenfontein is recommended northwest of the Mokolo Dam. The rest of the alternatives will not have a negative affect on Red Data bird species.

7. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

The general assessment of species rests mainly on the 1987 atlas for birds of the then-Transvaal (Tarboton *et al*. 1987) and comparison with the 1997 SABAP atlas (Harrison et al. 1997), so any limitations in either of those studies will by implication also affect this survey and conclusions.

8. RECOMMENDED MITIGATION MEASURES

The following recommended mitigation measures are proposed by the specialist:

- A thorough water study should be done to establish if enough water will be available downstream of the Mokolo Dam impoundment. Large amounts of water are being extracted legally and illegally out of this river for irrigation, sand mining and other purposes and further extraction of water for the pipeline will decrease the availability of water downstream. This will have a negative affect on Red Data and many other bird species that depend on water for foraging, roosting and breeding purposes.
- Where the pipeline will cross the Rietspruit and other drainage lines, the pipeline should be built over these wetland systems, high enough to allow for free movement of birds underneath the pipeline. The construction of the pipeline underneath the Rietspruit could affect the natural hydrology of the river system.
- The proposed route should preferably follow existing roads and railways, and any existing pipeline or servitude trenches. This will have a minimal effect on the natural vegetation on the route of the proposed pipeline.
- The area where the construction of the pipeline has been completed must be rehabilitated to its natural state as far as possible to provide foodsources (seeds and insects) for birds.
- Measures should be taken to prevent erosion in areas where the pipeline will cross hilly areas.
- Where possible **work should be restricted to one area at a time**. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.

- **No vehicles must be allowed to move in or across the wet areas or drainage lines and possibly get stuck.** This leaves visible scars and destroys habitat. It is important to conserve areas where there are tall reeds or grass and areas were there are short grass and mud.
- The contractor must ensure that no fauna species are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- It is suggested that where work is to be done close to the drainage lines, these areas **be fenced off during construction** to prevent heavy machines and trucks from trampling the plants, compacting the soil and dumping in the system.
- During the construction phase noise must be kept to a minimum to reduce the impact of the development on the fauna residing on the site.
- Alien and invasive plants must be removed during the construction and operation phase of the project.

9. CONCLUSION

Three Red Data bird species will be impacted directly by the availability and water quality of water downstream from the Mokolo River pump station. These species are the Half-collared Kingfisher, African Finfoot and White-backed Night-Heron. The habitat in the Mokolo River is ideal for these species (See Figure 7 and 8 above). The reserve determination (in terms of the National Water Act, No. 36 of 1998) for the Mokolo River has however taken this issue into consideration and has determined that monitoring of the River will be an important measure to determine the impacts on the health of the river. Monitoring in the future must therefore take the following terrestrial features into account:

- Riverine and riverbank deterioration
- Water quality deterioration
- Decreasing biodiversity within the River that could cause a decrease in food that would have a negative impact on mammal species.

At other places the proposed pipeline route will only have a negative impact during the construction phase where is will cut through the woodland habitat system areas and, in many sections, follow an existing pipeline. After the pipeline is closed and rehabilitated correctly (topsoil replacement and grass seeding), the bird species depending on grassland habitat will return to the area and the woodland species will overfly the area.

The other Red Data avifauna species are only likely to move through the area and should not be affected by the pipeline, except during the construction phase, provided that large areas with natural woodland areas are not disturbed.

10. LITERATURE SOURCES

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

Barnes, K.N. (ed.). 2000. *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Johannesburg.

Chittenden, H. 2007. *Roberts Bird Guide*. John Voelcker Bird Book Fund, Cape Town.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds.). 1997. *The Atlas of Southern African Birds.* Vol. 1 & 2. BirdLife South Africa, Johannesburg.

Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. 2005. *Roberts Birds of Southern Africa VII th Edition*, The Trustees of the John Voelcker Bird Book Fund, Cape Town.

Keith, S., Urban, E.K. & Fry, C.H. 1992. *The Birds of Africa.* Vol. 4. Academic Press, London.

Kemp, A.C. & Calburn, S. 1987. The owls of southern Africa. Cape Town: Struik Winchester.

Maclean, G.L., 1990. *Ornithology for Africa*. University of Natal Press, Pietermaritzburg.

Maclean, G.L., 1993. *Roberts' Birds of Southern Africa*. John Voelcker Bird Book Fund, Cape Town.

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

Sinclair, I., Hockey, P. & Tarboton W. 2002. *Sasol Birds of Southern Africa*. Struik, Cape Town

Sinclair I., & Hockey P. 2005. *The Larger Illustrated Guide to Birds of Southern Africa*. Struik, Cape Town

Steyn, P. 1982. *Birds of prey of southern Africa*. Claremont, Cape Town: David Philip.

Tarboton, W.R., Kemp, M.I., & Kemp, A.C. 1987. *Birds of the Transvaal*. Transvaal Museum, Pretoria.

Tarboton, W., 2001. *A Guide to the Nests and Eggs of Southern African Birds*. Struik, Cape Town.

Urban, E.K., Fry, C.H., & Keith, S., 1986. *Birds of Africa*. Vol. 2. Academic Press, London