

# Information Sheet on Ramsar Wetlands (RIS)

*Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.*

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
  2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Bureau. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.
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## 1. Name and address of the compiler of this form:

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**KENYA**

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Designation date

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Site Reference Number

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## 2. Date this sheet was completed/updated:

5<sup>th</sup> September 2005

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## 3. Country:

Republic of Kenya

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## 4. Name of the Ramsar site:

Lake Nakuru

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## 5. Map of site included:

Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps.

a) **Hard copy** (required for inclusion of site in the Ramsar List): *yes*  -or- *no*

b) **Digital (electronic) format** (optional): *yes*  -or- *no*

Attached Annex 1 & 2 (Ramsar site area same as the park area and is marked in light green)

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## 6. Geographical coordinates (latitude/longitude):

Longitude 36°05' E

Latitude 00°24' S

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## 7. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Lake Nakuru in Nakuru District, Rift Valley Province of Kenya, is located about 2 km South of Nakuru Town and about 160km North of Nairobi, Kenya.

**8. Elevation:** (average and/or max. & min.)

Altitude: 1750-2070 m

**9. Area:** (in hectares)

Approximate size of the Lake and boundaries  
18,800 ha; (Lake 3,300 ha)

**10. Overview:**

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland. Lake Nakuru is a very shallow, strongly alkaline lake, with surrounding woodland and grassland set in a picturesque landscape within the Lake Nakuru National Park that abuts Nakuru town. The lake is located in a closed basin of about 1800 km<sup>2</sup> of which 3,300 ha forms the main lake waterbody. The lake's high alkalinity, conductivity and other physical-chemical parameters makes it uninhabitable to many aquatic species; however the few that have adapted to these harsh conditions have made the lake to have one of the highest producer biomass among Kenya's southern Rift Valley alkaline lakes. The foundation of the lake's simple food chains is the cyanophyte *Spirulina platensis*, which often occurs as unialgal bloom. At such times, it can support huge numbers of Lesser Flamingo *Phoeniconaias minor*. The introduction of fish species *Oreochromis alcalicus grahami* in 1960s has attracted a number of other secondary consumers including several piscivorous bird species. The lake's catchments has experienced expansion in agriculture and urban developments.

**11. Ramsar Criteria:**

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1 • 2 • 3 • 4 • 5 • 6 • 7 • 8

**12. Justification for the application of each Criterion listed in 11. above:**

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

**Criteria 2:** *A wetland is considered internationally important if it supports vulnerable, endangered or critically endangered species or threatened ecological communities*

The Flamingo community: Lesser Flamingo *Phoeniconaias minor* (CITES Appendix II) and Greater Flamingo *Phoenicopterus ruber roseus* (CITES Appendix II) are becoming regionally and globally threatened due to loss of their habitats as a result of unsustainable land use activities around Lake Nakuru National Park. The Lake offers refuge for these two species including other regionally threatened bird species such as Great Crested Grebe *Podiceps cristatus*, African Darter *Anhinga rufa*, Great Egret *Casmerodius albus melanorhynchus* and the range-restricted Grey-crested Helmet-shrike *Prionops poliophus* (probably resident in the surrounding acacia woodland) among others. The Lake is a staging site for endangered migrant bird species including Madagascar Squacco Heron *Ardeola idea* (proposed for CMS Appendix I listing) and the Vulnerable Lesser Kestrel *Falco naumanni*. The Lake also supports large populations of wildlife species including hippos *Hippopotamus amphibious* (CITES Appendix II) and the globally endangered Black Rhino *Diceros bicornis* (CR).

**Criteria 3:** *A wetland is considered internationally importance if it supports populations of plant and/ or animal species important for maintaining the biological diversity of a particular biogeographic region*

Lake Nakuru supports over 450 avian species and about 70 waterbird species, including 1 million flamingos. The lake also supports large densities of cynophytes *Spirulina platensis*, characteristic of the Rift Valley saline lakes. The spirulina in turn supports sodic fish *Tilapia grahami* (*Oreochromis alcalicus grahami*) introduced into the lake from Lake Magadi in the 1960s. Introduction of this fish has enriched waterbird diversity by supporting hundreds of fish eating water birds like Pelicans and Cormorants

**Criteria 4:** *A wetland is considered internationally important if it supports plant and /or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions*

Lake Nakuru offers display and refuge site to the threatened Lesser Flamingo (*Phoeniconaias minor*) and Greater

Flamingo (*Phoenicopterus ruber roseus*). During water bird counts conducted at the Lake since 1990s, a significant percentage of juvenile flamingos have been counted at the lake. Breeding attempts for Lesser Flamingo has also been reported from the Lake. The Lake is a pathway and staging site for several Palearctic migrants during migration seasons. The springs and their associated wetlands found at the Lake is a source of drinking water for birds and mammals during critical breeding stages.

**Criteria 5:** *A wetland should be considered internationally important if it regularly supports 20,000 or more water birds.*

Over 450 species of birds have been identified at Lake Nakuru including over 70 species of waterbirds counted during the early and mid-year water bird counts. The Lake supports over 20,000 waterbirds for different species of waterbirds. For the last five year of counts (1999-2003) the average number of birds counted has been of over 535,655 (See Appendix 1).

**Criteria 6:** *A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of water bird.*

For the most recent five-year period of bird counts (1999-2003) Lake Nakuru has supported over 1% of the East African Flamingo populations of Lesser Flamingo (*Phoeniconaias minor*) (average of 488,908 birds; 24.4%) and Greater Flamingos (*Phoenicopterus ruber roseus*) (average of 3,519 birds; 10.05%) (See Appendix 1).

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**13. Biogeography** (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

**a) Biogeographic region:**

The lake is representative of a natural saline wetland type found within the rift valley region of Kenya.

**b) Biogeographic regionalisation scheme** (include reference citation):

Its representative of the dispersal lakes for the flamingos and other waterbird species in Kenya.

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**14. Physical features of the site:**

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

At 1,750 m above sea level, Lake Nakuru is one of the highest points in central Kenya dome of the Rift Valley. This high elevation has hydrological implications on the water balance in the lake. Unlike other low lying rift valley lakes like Bogoria and Magadi, which have copious water supply through a series of hot and freshwater springs; underground inflows into Lake Nakuru through the axial fault line system is minimal. Baharini springs to the north and freshwater springs from Lion hill contribute negligible amounts that cannot sustain the lake during drought periods, but are an important source of fresh water.

Four seasonal rivers Makalia, Nderit, Naishi, Njoro and Larmudiac; and treated wastewater from Nakuru Town drain into the lake. The Baharini Springs and other springs along the eastern shoreline are perennial. Some surface streams such as the Ngosur and Naishi become influent, disappearing along the fault lines as re-charge to deep aquifers.

There is a clear stream flow in response to precipitation occurring in the catchments. The first peak flow occurs in May, a month after peak rainfall, while the second peak coincides with that of rain in the month of August. Nakuru is an enclosed Lake and only evaporation accounts for water loss. The long drought periods of 1993-96 have resulted into particularly poor hydrological conditions as exhibited by excessive lake level decline at that time.

**Vegetation:** The general vegetation comprises of grasslands and scrublands at the lower parts of the basin with Yellow acacia along the lakeshore and flood plains, riverine vegetation along the river courses, which gives way to dry upland forest in the slopes of the highlands. The lake, *sp* shore is characterized by a swamp to the east

dominated by *Cyperus laevigatus*, *Sporobolus spicatus*, *Pluchea bequaertii* and a small strand of *Typha*. The other shore is sandy with infringing sporobolus grasslands.

**Evaporation, Radiation and Temperature:** Evaporation, radiation and temperature have annual means of 1,800 mm, 490 Langlays and 27°C respectively. The three parameters have their peaks centred around January and September and minimum around April and August. Wind speeds are high especially in dry seasons in March and August causing whirlwinds in the low-lying areas.

**Water quality:** Water quality conditions of Lake Nakuru are not favorable to most aquatic biota, with high conductivity and relatively low chloride content characterizing the lake as “an alkaline-saline class III lake”, or a “concentrated sodium hydro-carbonate low chloride lake”. The water chemistry makes the Lake habitable to very few organisms. pH remains constant at 10.4 due to the buffering effect of Sodium Carbonate (NaCO<sub>3</sub>) and Sodium hydrocarbonate (NaHCO<sub>3</sub>). The conductivity range is optimum for algal primary productivity and a consumer-producer biomass of ~500gm<sup>-2</sup>. The low diurnal winds cause mixing of the water body almost on a daily basis.

Parameter	Value
pH	10.4
Temperature	8°C-32°C
Conductivity at 20°C	6,500 – 165,000 $\mu$ scm <sup>-1</sup>
Secchi depth	0.4m
Dissolved Oxygen	5-28mg l <sup>-1</sup>
Alkalinity	5,000 – 90,000 mg l <sup>-1</sup> CaCO <sub>3</sub>
Ionic composition	96.4%Na <sup>+</sup> , 84% HCO <sub>3</sub> <sup>-</sup> and CO <sub>3</sub> <sup>-</sup>
Water permanency & depth	Permanent, with varying water depth depending on season, Maximum depth 4m

### 15. Physical features of the catchments area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

Lake Nakuru catchments in Nakuru District, Rift Valley province is a closed basin located in the spectacular and picturesque Gregorian portion of the Eastern Rift Valley in Kenya. It covers an area of approximately 1800 km<sup>2</sup>. The catchments is delineated to the north by Menengai crater, to the south by Eburru mountain ridges, to the east by Dondori and Bahati uplands, to the southeast by the grassland plains between Lakes Nakuru and Elmenteita and to the west by Mau escarpment.

The geological evolution of the Great Rift Valley in Kenya created a series of inland drainage basins that contain endorheic lakes with no outlets. The catchments and its landforms i.e. volcanoes, lakes, mountains and rifts within the Great Rift Valley, forms one of the world’s most marvelous geological formations, dating from more than 12 million years ago. This catchment ranges from Mau escarpment to Bahati highlands, with Lake Nakuru at the lowest point creating a closed basin, fed with run-off from the surrounding slopes by a few seasonal rivers namely Makalia, Enderit, Njoro, Naishi, Larmudiac and Ngosur and treated waste water from Nakuru Town. Siltation and sedimentation from the catchment accounts for the lakes shallow depth, and has been recorded to have almost completely dried up in 1933, 1939, 1947, 1961, 1968, 1996.

**Climate:** There is considerable variation in climate within the Lake Nakuru catchment basin depending on altitude and topography. The climate ranges from cold, hot and humid to arid and semi-arid, characteristic of areas within the Rift Valley. Maximum and minimum recorded temperatures are 33°C and 12°C respectively.

**Rainfall:** The Mean annual rainfall averages about 750 mm, falling within the periods of November to December and April to May. The total annual rainfall increases and becomes more certain and dependable with increasing altitude. Rainfall has a tri-modal distribution with peaks centered around April, August and November; April peak being highest followed by August and November. Isohyet analysis shows a general decrease in rainfall from the highlands to the center of the lake.

**Geology:** The area surrounding Lake Nakuru catchment belongs to Tertiary-Quaternary volcanic materials associated with alkaline sediments. The main geological features found around this wetland include:

- (i) The Rift Valley bottom or lowland, in which the Lake Nakuru lies,
- (ii) The escarpments including the foot-slopes and cliffs on the western side of the lake, Mau and Eburru
- (iii) The uplifted lion hill range on the eastern side and other hills,
- (iv) Menengai crater on the northern side of the lake and
- (v) Fault lines that run in a North -South direction.

Geography, climate and evolutionary history have played a deterministic role in the evolution of the features and characteristics that define Lake Nakuru catchment. These features drive the lake's water chemistry, dictating the species that can successfully establish themselves and the levels of productivity. The alkaline water chemistry makes the lake a unique ecosystem, functionally independent of its immediate environs but dependent on its larger catchment for sustenance.

The lake is highly alkaline as the catchment rocks contain a high proportion of alkaline minerals that are leached into the lake. The word "Nakuru" is actually derived from a Maasai word "en-akuro", which means, "swirling dust". Variations in lake size sometimes reduce the water body enormously, creating white salt fillets swirling with dust devils. The prevailing climate induces an evaporation-precipitation deficit that through evaporative concentration has turned the lake alkaline and naturally hyper-eutrophic.

**Soils:** Soils are primarily of volcanic origin and tend to be friable, well drained and in some instances shallow. Those on central plains are mainly derived from lacustrine deposits and volcanic ashes. Having developed on sediments, the soils are gray, deep and poorly drained and slightly calcareous to saline. On the more open grassland plains are soils derived from pumice beds and ashes from recent volcanoes and appear to be well drained friable loams to sandy clay loam that support the bulk of grazing land in the park. Rocks that compose the cliffs and rock outcrops are of basaltic formation. The lake bottom has been filled with weathered material from the catchment area. The soil type is mainly sandy alluvial, of volcanic origin indicated by soda ash and fine sandy/loam soils on the lake bottom and its immediate surrounding areas. The soil in most areas is highly permeable and very little surface water is noticeable after the rains.

## 16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

The hydrological conditions in Lake Nakuru dictate that water levels are dependent on catchment supply through rivers and therefore the integrity of this catchment. The shallow depth, the high evaporation rates and seasonal rivers make the lake a hydrologically impacted ecosystem. Therefore, the lake does not have any buffering capacities to withstand hydrological impacts driven by catchment processes. Nearly half the catchment is now under cultivation, and rivers' flow have been reduced markedly.

The Lake basin does not have considerable underground water recharge; however, sediments from the catchment accumulate in the lake.

## 17. Wetland Types

### a) Presence:

Circle or underline the applicable codes for the wetland types of the Ramsar "Classification System for Wetland Type" present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

**Marine/coastal:** A • B • C • D • E • F • G • H • I • J • K • Zk(a)

**Inland:** L • M • N • O • P • Q • R • Sp • Ss • Tp • Ts • U • Va •

**Vt** • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

**b) Dominance:**

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

1. Q; 2. Tp; 3. Sp; 4. Y; 5. N; 6. 8; 7. Ts; 8.Ss

**18. General ecological features:**

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

Three major Rivers, the Njoro, Makalia and Nderit drain into the Lake, together with treated water from the town's sewage works and the outflows from several springs along the shore. Generally these flows cause nutrient cycling, which is of great benefit to the aquatic organisms. Diatoms and other algae that bloom occasionally form substantial amount of total biomass. The main primary producer of the open water zone is the blue-green algae *Spirulina platensis* that constitutes 95% of the algal population. Primary consumers vary from microscopic zooplanktons to the flamingo. The most important zooplankton is the copepod *Lavenula africana* though rotifers such as *Brachionous dimidiatus* and *B. plicatilis* occasionally become dominant. The lesser flamingo is the major primary consumer of *Spirulina platensis* while *Oreochromis alcalicus grahami* also grazes on it. Other important primary consumers include Hippopotamus *Hippopotamus amphibius*, which feed on the shoreline vegetation at night and import nutrient when they return to the open water zone.

The lake shores are mainly open alkaline mud with areas of sedge *Cyperus laevigatus* and *Typha* marsh around the River inflows and springs, giving way to grassland and a belt of *Acacia xanthophloea* woodland. The Eastern and Northern shores are characterized by a swamp of deep, soft mud kept moist by springs and seepage along the lakeside. Sedges and rushes grow here and provide shelter for a variety of animals and birds. The rushes are mostly confined to areas of relatively fresh water while the sedges tolerate more soda. Many waders especially the migrants sift through the mud for small insects. The Western and Southern shores are sandy, and are habitat for sand pipers and other water birds.

**19. Noteworthy flora:**

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

**Woodlands** - These comprise of:

- *Acacia woodlands:* The Park has several stands of scattered acacia woodlands associated with areas of low water table, and prominent on the plains
- *Bushed woodlands:* This is the second largest habitat in the park, and it alternates with acacia woodlands. Common plant species here is *Tachonanthus camphronatus*

**Open Grassland** - This comprises of:

- Alkaline tolerant species mainly found along the lakeshores and include *Cyperus laevigatus*, *Sporobolus spicatus*, *Pluchea bequaertii* and *Typha sp.*, all in various associations.
- Plain grassland communities occur mainly on sedimentary /lacustrine plains to the south and north of the lake, and common species include *Chloris gayana*, *Digitaria abyssinica*, Boma Rhode grass. *Themeda triandra* and *Cynodon digitaria* forming various associations.

**Forests** - Major forest habitats in the park include:

- *Euphorbia forest:* The common species here is *Euphorbia candelabra*, which grows to 15 metres high

- *Olea forest*: Commonly known as “Olive forest” is found to the southwest of the Park. It is a habitat for Black Rhino and Eland. The common species here are *Olea africana*, *Teclea simplicifolia*, and *Juniperus sp.* The forest is a small remnant of a larger forest, which extended to the higher reaches of the Mau escarpment, the main catchment of Lake Nakuru.
  - *Acacia forest*: Dominant species is the *Acacia xanthophlea* associated with areas of high water table. These are prominent along the river courses and shoreline.
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## 20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Lake Nakuru is rich in biodiversity, key faunal species being:-

Unique – Lesser Flamingo *Phoeniconaias minor* and Greater Flamingo *Phoenicopterus ruber roseus*

Endangered – Black Rhino *Diceros bicornis*

For other species See Appendix 1

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## 21. Social and cultural values:

e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Lake Nakuru is known worldwide for tourism and recreation, the main social activity in this site. Over 300,000 visitors (Tourists) visit the site annually from all parts of the world, including local visitors and school education groups.

Cultural values are associated with the archeological caves found near Lanet Gate and Hyrax Hill, which were used by the early man. No religious activities take place at the site at the moment. Water catchment forests are found in the catchments of this site.

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## 22. Land tenure/ownership:

(a) Within the Ramsar site:

Lake Nakuru is state land gazetted vide legal notice number 137 of 12/6/86 as a protected conservation area (National Park); and the boundaries are delineated in boundary plan 204/57, which delineates a total protected area of 18,800 ha.

(b) In the surrounding area:

Individual farmers privately own the area surrounding the park to the South, West and East. To the North of the Lake is The Nakuru Municipal Town with an estimated area of 124km<sup>2</sup> and a population of approximately 360,000 people. Also in the catchment are protected forests that are owned by the state.

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## 23. Current land (including water) use:

(a) Within the Ramsar site:

The Ramsar site is a protected area (National Park) used for biodiversity conservation, Tourism and recreation, Research and education.

(b) In the surroundings/catchments:

The township of Nakuru, 2km North of the site has grown from a small railway station to a large industrial, commercial and administrative Center with a growth rate of about 10%. There are several land use types in the catchment that have had diverse impacts on the lake ecosystem. They range from urban and rural settlements, small and large-scale cultivation, pastoralism, ranching to forestry.

Agriculture is the largest land use activity, and ranges from small to large-scale farms and ranches. Important crops grown include Wheat, Barley, Pyrethrum, Maize, Coffee and Potatoes. There is also beef and dairy farming in the area, some of which is for commercial production

Apart from Lake Nakuru National Park, which is a gazetted National Park, other conservation areas include various forests found in Bahati, Menengai, Ndudori, Eburru and Mau escarpment. The area of the catchment under forest has progressively declined from 47% in 1970 to about 15% in 1998. The forest excision continues to date and un-quantified forest cover has been lost to other land uses, in particular small-scale farming.

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**24. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:**

(a) Within the Ramsar site:

**Ecological Changes-**

(i) The site is completely insularised by electric fence, thereby affecting wildlife migrations patterns leading to over stocking and grazing in the Park. Coupled with inadequate application of management interventions this has brought about invasion by terrestrial plant species like *Datura stramonium* and *Ocimum suave* in the Park. These plants are not used by wildlife in the Park, making them flourish well at the expense of palatable/edible plant species utilized by wildlife. The invader species are causing ecological change in the ecosystem and are a major challenge to the protected area management. Likewise, there has been observed wildlife interspecies competition, whereby the general mixed feeders like Zebra and buffalo are increasing in numbers while the specialized feeders (strictly browsers or grazers) like Bush bucks and Reed bucks are declining in numbers. This is leading to an imbalanced species composition and dynamics in the Park, which has impacts on the ecological stability of the system.

(ii) Siltation and eutrophication arising from inappropriate land use systems in the catchment, agrochemical runoffs from unsustainable agricultural practices and effluents and solid wastes from Nakuru Town are contributing to ecological changes in the lake.

(iii) Lake level fluctuations arising from irregular recharge by the Inlet Rivers and declining ground water systems being caused by inadequate water conservation measures in the catchment.

(iv) Changes in water Quality- As a result of excess nutrients in the lake there has been frequent algal crashing and occurrence of *Anabaena flos-aquae*. Heavy metals originating from local industries and farming practices have also been detected in the lake.

(b) In the surrounding area:

(i) **Forestry:** - In the past various types of forests covered by Nakuru catchment ranging from lowland savannah woodlands and forests to dry upland forests to moist highland forests. These forests have undergone various modifications and changes to accommodate various land use systems and development needs and policies. These changes have altered the landscape especially the extent, coverage and distribution of forests. The continued forest disruption and alteration through development has precipitated serious adverse environmental impacts especially water resources and hydrological functions in the catchment. The clear felling of vast tracts of forested land in the Lake Nakuru catchment has had immediate effect of causing a major loss of nutrients in the catchment and eutrophication in the lake. Exposure of the ground surface and changes in surface runoff, have continued the export of nutrients and soil from the deforested areas for several years.

(ii) **Agriculture & settlement:** - Agricultural activities in the Nakuru catchment have undergone various changes from pastoralism through large scale farming to current day intensive small-scale agriculture. The soils of the catchment are quite varied, and environmental consequences of this land use vary with soil type, topography and land treatment. Overall, agricultural practices have had serious negative implications on the environment, such as soil erosion, stability of water resources and flow regimes. There is evidence of serious gully and sheet erosion at several sites in the catchment. Rivers Nderit and Makalia traverse regions of steep



slopes in their upper reaches and flow through areas dominated by small-scale farms. Both rivers carry high sediment loads. The extensive use of agrochemicals in the catchment has significantly affected water quality in the form of agrochemical pollution, eutrophication and siltation, although the range of agro-chemicals used on small-scale farms is minimal and confined to fertilizers, insecticide and acaricides. Banned chemicals such as DDT, Aldrin and Dieldrin have been detected in the biota. Agro-chemicals used include 4 varieties of fertilizers, 5 brands of herbicides, 7 brands of pesticides, 5 brands of acaricides and 3 brands of fungicides.

**(iii) Water resources:** - Nakuru is a water deficient zone and the situation has been aggravated by inappropriate land use practices. Cultivation on riverbanks and clearing of forests has affected water percolation, springs and river flow regimes resulting in reduced water storage capacities to meet needs during critical dry periods of the year. This has led to increased abstraction from underground aquifers affecting borehole depths, density and yields. Likewise, various human activities have led to deterioration of water quality consequently increasing incidences of water borne diseases. To alleviate water shortages in the catchment there has been an inter-basin water transfer from the Malewa basin in Naivasha to Nakuru Town. Such inter-basin transfer has the potential to cause hydrological instability in both basins.

**(iv) Land Tenure and Land use dynamics:** -Land tenure and land use systems in the Nakuru catchment have undergone extensive changes in historical and recent times. The land has changed from pastoralism through large scale farming to extensive small-scale farming. These changes in land use patterns have had severe effects on the environment, productivity and socio-economics. There has been policy shifts affecting appropriate land use systems with de-gazettement of forests into rural and urban settlement. Such habitat fragmentation has the potential to disrupt the ecological character of the catchment area including the lake.

**(v) Urban development:** -The growth of Nakuru town from a small railway station to a medium sized urban and industrial center is concomitant with infrastructure growth and provision of services and facilities such as roads, hospitals, schools, sewerage, drainage and waste management systems. Like most cities and urban centres, the city is a prodigious producer of human, domestic and industrial waste, but waste handling and treatment facilities have not kept pace with the rate of production thereby posing environmental pollution from solid waste. In this catchment, there are other satellite settlements and towns with inadequate facilities and services. The spread of impervious surfaces due to the built environment has reduced infiltration rates leading to higher runoff volumes, which produces a pollution peak in the early part of the wet seasons. This makes storm water from the first flush of rains, the single most important source of pollution into Lake Nakuru. Thus, unplanned urban development has the potential to affect the natural landscape and ecological stability of the region including the lake.

**(vi) Sewerage and Sanitation:** There are two sewerage treatment plants in Nakuru Town with a total design capacity of 16,200 m<sup>3</sup> per day. The sewerage area of the town is only 13 km<sup>2</sup> or 19% of the built-up area. The low-density areas and Public institutions rely on cesspools and septic tanks, while high-density (peri-urban settlements) use pit latrines with only a few households using septic tanks. Use of pit latrines and cesspools has the potential of contaminating ground water systems with adverse impacts on water quality and biodiversity resources both within the town and the adjacent Ramsar site.

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## 25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

The site is a protected wildlife conservation area, with legal status of a National Park. A 10 year integrated ecosystem management plan is available.

Designated bird sanctuary 1960

Designated National Park 1968

Designated Ramsar site 1990

Designated Important Bird Area (IBA) 1999

Gazettement of several forest reserves as forestry conservation areas

Protection of wetlands, riverbanks and water catchment areas through the new national environment management and coordination act, 2000.

Nakuru Municipal Strategic Structure Plan that prescribes urban development including waste and effluent management strategies within the Municipality.

A Proposed Nakuru Region environmental strategic plan

Formation and Gazettement of District Environment Committee.

Mobilization of environmental NGOs and CBOs in the region.

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## 26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

- (i) Implementation of some actions recommended in the ecosystem integrated management plan like Park Zonation based on habitat types and wise use of natural resources found in the site and the catchment.
  - (ii) Implementation of Rift Valley Lakes GEF proposal.
  - (iii) WWF/KWS/BCP community based conservation proposal.
  - (iv) Water and sanitation improvement proposal to be funded by JIBC/World Bank.
  - (v) Promoting use of integrated pest management systems.
  - (vi) Encouraging community participation in forestry management and water conservation.
  - (vii) Train on appropriate land use practices.
  - (viii) Adopting the ecosystem integrated management plan as an annex of the District environment action plan.
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## 27. Current scientific research and facilities:

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

The ecosystem integrated management plan encourages management-oriented research. Some of the on-going research activities include: -

### 1. Monitoring by KWS/WWF/Universities of Nairobi and Egerton/ MCN

(a) Ecological/ Environmental Monitoring: The monitoring of both ecological and environmental attributes including the following: -

- (i) **Meteorology:** Meteorological variables currently being monitored are rainfall, temperature, relative humidity, evaporation, radiation and wind speed.
- (ii) **River and lake levels:** All the rivers flowing into the lake have automatic flow recorders. The Lake, Baharini springs and the two sewage outflows have staff gauges.
- (iii) **Water quality monitoring:** Water quality monitoring programme for the lake and Feeder Rivers and effluents is in place. Sampling points have been identified and geo-referenced.

(b) Ecological Monitoring

- (i) **Animal Counts:** This is done quarterly and includes all large animals in the Park. Main parameters include species identification, composition, and distribution, feeding patterns, social structure and behavior, habitat conditions that include forage, water and security.
- (ii) **Rhino:** Rhino surveillance done on a 24-hour basis. Sighting and data on habitat utilization, social characteristics and feeding patterns are recorded. Individual Animal location and movement patterns are mapped using GIS.
- (iii) **Waterfowl counts:** Waterfowl counts are biannual in January and July. The count includes species identification, estimates of flock sizes, mortalities, age groups, indicator species, rare and threatened species, and training of counters.
- (iv) **Habitat Monitoring:** Vegetation monitoring transects and enclosures have been identified and geo-referenced in the Park. Main parameters include species composition and identification, biomass estimation, grazing and browsing pressure, Densities and cover, and species seasonality.

### Recent and on going Research projects

- (i) Nutrient cycles in saline-alkaline lakes
- (ii) Flamingo mortalities
- (iii) Hydrological studies
- (iv) Environmental conditions in respect to heavy metal contamination

- (v) Participatory Rural Appraisal Studies in the catchment
- (vi) Flamingo movements tracking by satellite
- (vii) Effects of disturbance on breeding biology of Kittlitz's Plover *Charadrius pecuarius*

#### Research facilities

- (i) **Research Station-** Lake Nakuru National Park has a full fledged research station.
- (ii) **Water Quality Monitoring Laboratory-** A modern laboratory is in place that can monitor potable water, effluents; sewage works efficiency, lake and river waters.

#### 28. Current conservation education:

e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

The Park has two education centers for school visits and tailor-made training, which offer

- (i) Environmental Education and Awareness
- (ii) Environmental conservation education

The two education centers are managed by Kenya Wildlife Service and Wildlife Clubs of Kenya respectively, though other stakeholders participate in the process. The centers are particularly used by school groups and record more than 100,000 students per year.

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#### 29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

- (i) **Tourism:** The site and its catchment have a high tourism potential with high visitation. Tourist attractions include animals like black and white rhinos, leopard, tree-climbing lions, the Rothschild's giraffe, bird viewing and other species. A concentration of over 1 million Flamingos is a particularly unique attraction to visitors in the Park. Geomorphological features like Baboon Cliff, Honeymoon Hill, Lion Hill, Hyrax Hill, Makalia Falls, Menengai Crater and pre-historic sites and caves are of great tourist attraction. Over 300,000 visitors visit the site annually. Whereas, tourism amenities in the park are well developed, the same does not apply in the rest of the catchment areas, though the potential for tourism in those areas is quite high.
- (ii) **Visitor facilities:** Visitor facilities in the site – 2 Lodges with a total occupancy capacity of 240 beds, picnic sites, special and public campsites and view points
- (iii) **Visitor activities:** Visitor activities in the site – game drives and bird watching

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#### 30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

Ramsar Site – State owned, gazetted National Park under the Wildlife Conservation and Management Act.

Functional – Managed by Kenya Wildlife Service, a Government parastatal body responsible for Wildlife Conservation and Management in Kenya.

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#### 31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Kenya Wildlife Service  
P.O. Box 40241, 00100, Nairobi  
Kenya

Tel 254-20-501081/2/602345;  
E-mail [kws@kws.org](mailto:kws@kws.org)  
Web site [www/kws@kws.org](http://www/kws@kws.org)

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scientific/technical references only. If biogeographic regionalisation scheme applied (see 13 above), list full reference citation for the scheme.

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