

Kenya Lake System in the Great Rift Valley

2020 Conservation Outlook Assessment

SITE INFORMATION

Country: Kenya
Inscribed in: 2011
Criteria: (vii) (ix) (x)



The Kenya Lake System in the Great Rift Valley, a natural property of outstanding beauty, comprises three inter-linked relatively shallow lakes (Lake Bogoria, Lake Nakuru and Lake Elementaita) in the Rift Valley Province of Kenya and covers a total area of 32,034 hectares. The property is home to 13 globally threatened bird species and some of the highest bird diversities in the world. It is the single most important foraging site for the lesser flamingo anywhere, and a major nesting and breeding ground for great white pelicans. The property features sizeable mammal populations, including black rhino, Rothschild's giraffe, greater kudu, lion, cheetah and wild dogs and is valuable for the study of ecological processes of major importance. © UNESCO

SUMMARY

2020 Conservation Outlook

Finalised on 01 Dec 2020

SIGNIFICANT CONCERN

The three lakes which make up the Kenya Lake System World Heritage site are subject to pronounced and unpredictable fluctuations in rainfall, water levels and alkalinity – factors which determine the movements of flamingoes and other birds between these lakes, and others beyond. Waterbird counts over the past 20 years suggest that bird populations are stable, but their distribution has changed, with uncertainties over the future of the lakes as the catchment areas come under progressively more intensive land use, with the loss of wetlands through livestock grazing, with increasingly large volumes of water abstracted upstream for agriculture, whilst floods are becoming more severe, with the associated sediments carried into and accumulating within the lakes.

Lake Elmenteita and Lake Nakuru are very close to Kenya's major transport corridor from the Indian Ocean to Central Africa, and hence are exposed to the many associated development pressures, whilst at the same time being very accessible to visitors. Lake Bogoria is remote from the development corridor pressures and is very accessible too. Lake Nakuru is impacted by poorly managed waste discharges from a rapidly growing nearby township, both solid and liquid wastes, and the OUVs of Lake Elmenteita are being compromised by uncontrolled development of its surrounding area, and by the loss of conservation status of part of its

Ramsar site area, and hence the loss of that natural habitat.

The mammal population numbers in Lake Nakuru National Park are increasing, with no room for expansion, and habitat is being overloaded and in parts inundated by rising lake water level. The Soysambu conservancy portion of Elmenteita faces the challenges of surrounding area developments. Like Lake Nakuru National Park, it is enclosed, but with quality livestock production alongside wildlife. The zebra population is burgeoning beyond desirable levels, and regrettably the lion population that might help control this has been progressively decimated by poisoning. Human wildlife conflicts are an ongoing challenge in all such areas. In Bogoria, the challenge is with livestock competing with wildlife within the same habitat, but there are no apex predators.

Management within the three reserves is planned and resourced, except that Elmenteita is remote controlled. In terms of management, there is uncertainty over the extent to which land degradation, deforestation and upstream water use are being addressed in all the lake catchment areas (which are experiencing high rates of population growth and development pressure), as these catchment areas are beyond the direct jurisdiction of the reserve managers.

Of the three sites, Nakuru and Elmenteita are at the forefront in bordering development pressures, but all three lakes are vulnerable to catchment degradation pressures and changes to the hydrological cycles that drive the lake ecologies.

FULL ASSESSMENT

Description of values

Values

World Heritage values

► **Outstanding natural beauty**

Criterion:(vii)

The three lakes, each with its own characteristic features, are areas of outstanding natural beauty. Flanked by the towering walls of the Great Rift escarpments, they nestle in the valley floor, their open waters set against the thorn-tree savannas, forests and marshes that surround them. The landscape is punctuated by volcanic cones, hot springs and gushing geysers. Massive congregations of flamingos and other birds and a diverse array of large mammals inhabit the area, creating an unmatched experience of raw nature, truly one of the great wonders of the natural world (World Heritage Committee, 2011).

► **Exceptionally diverse bird fauna, including rare and endangered species**

Criterion:(vii)

All three lakes are recognized as Important Bird Areas (Birdlife, 2017a,b,c) and listed as Ramsar Sites, on account of the numbers and diversity of birds, including many rare and endangered species. Many diverse bird species have been recorded in these lakes, with about 480 species recorded at Lake Nakuru, 450 species at Lake Elementeita and 370 species at Lake Bogoria (IUCN, 2011). Survival of some of these birds are threatened both globally (13 species) and regionally (8 species) (UNEP-WCMC, 2012). Lake Elementeita supports the region's main breeding colony of Great White Pelicans (8,000 pairs) and there are globally important populations of Black-necked Grebe, African Spoonbill, Avocet, Little Grebe, Yellow-billed Stork, Black-winged Stilt, Grey-headed Gull and Gull-billed Tern (IUCN, 2011)

► **Extraordinary soda lake ecosystem processes and trophic dynamics**

Criterion:(ix)

The three lakes are generally shallow, alkaline lakes with relatively small catchments and no surface outlets. Straddling the equator at altitudes of around 1,500m they are subject to high rates of evaporation and marked fluctuations in water levels. The alkaline lake waters support a prolific growth of green algae (*Spirulina platensis*), the main food of the itinerant Rift Valley population of lesser flamingoes (IUCN, 2011). The alkaline Rift Valley lakes are among the world's most productive ecosystems and, although these harsh environments are relatively species-poor, they feed extraordinary numbers of birds. They provide important insights into our understanding of trophic dynamics and ecosystem processes.

► **World's largest congregations of lesser flamingoes**

Criterion:(x)

Congregations of more than 1.5 million Lesser Flamingoes have been counted at Lakes Nakuru and Bogoria, as they move between the ten 'Flamingo Lakes' of East Africa. Such congregations are globally unique and constitute one of the world's most spectacular wildlife phenomena (World Heritage Committee, 2011).

► **Crucial flyway for bird migration**

Criterion:(x)

The Great Rift Valley is of global significance as a migratory corridor for 500 million birds of 350 species which pass through the area en route between their summer breeding grounds in Eurasia and over-wintering sites in southern Africa (IUCN, 2011). The lakes serve as over-wintering sites for large numbers of Palearctic waders as well as being an important stop-over for birds on passage (BirdLife, 2017a)

► **Diverse assemblage of mammals, including rare and endangered species**

Criterion:(x)

The lake shore habitats, particularly those of Lake Nakuru National Park, support a diverse assemblage of large mammals, including important populations of endangered species such as black (and southern white) rhino, Rothschild's giraffe, lion, cheetah and leopard (KWS, 2003)

Assessment information

Threats

Current Threats

Very High Threat

The most significant current threats are related to developments outside the property affecting the reliable river inflow patterns to the lakes. All three lake basins have witnessed massive deforestation (Mau Forest, especially), settlement of people in the catchments and thus intensification of land use over the past few decades. Upstream abstraction of water for irrigation as well as deforestation and over-grazing are affecting the quality and quantity of the inflowing waters and is affecting the ecology of the lakes and threatening the survival of the flamingoes especially. Agricultural chemicals will increasingly be washed into the lakes altering the nutrient balances, potentially leading to eutrophication and potential lethal cyanotoxin production. In the case of Nakuru, the increasing population and urbanization will increase pollution risks. The sediment runoff through the rivers is accumulating in the lakes and will thus be permanently raising bed and lake levels. The higher lake levels will lead to increasing inundation of the terrestrial habitats surrounding the lakes, thereby reducing grazing / forage areas, and increasing pressure on the terrestrial ecology and wildlife. Lake Elmenteita is in dire straits, now being impacted by a host of developments along its eastern shores, with a high-voltage powerline having been constructed close to the southern shore, in spite of objections, and with the previously contiguous Ututu conservation area to the south of Elmenteita now sub-divided into plots and sold off and no longer a conservation area. The buffer zones are not big enough to accommodate encroachments, let alone assure the protection of the OUV.

► **Dams/ Water Management or Use**

Very High Threat

(Use of water from upstream catchment areas and groundwater aquifers)

Inside site, throughout(>50%)
Outside site

Small irrigation dams have been constructed on rivers flowing into the lakes and river flows have reduced markedly (IUCN, 2012). At Lake Elmenteita in recent years there has been little water flowing into the lake because 'farmers use most of the water for irrigation upstream' (GLECA, 2010). This is a common occurrence throughout the region, often due to illegal abstractions, and the Water Resources Authority lacks capacity to effectively manage abstraction licensing and compliance in order to ensure downstream users are not affected.

Lake Elmenteita has geothermal activity and receives baseline water underground from Lake Naivasha, a fresh water lake fed mainly by the Aberdare Mountain ecosystem. Naivasha's own water level has been critically lowered in recent years due to abstractions of water for agriculture, a situation likely to be exacerbated by the construction of a dam on the Malewa River, some of whose water may be transferred out of the basin (LNRA, 2019).

Given the rate of population increase and intensification of land use in the Rift Valley catchments, the trend of increasing water abstraction will accelerate and continue to impact medium and low flows. The Rift Valley Basin population is forecast to increase 53% by 2030 (WRA, 2020). On the other hand changing land usage coupled with unusually high rainfall is leading to unprecedented flooding. The Rift Valley lakes of Kenya have filled to unprecedented levels. There are local concerns that Lake Bogoria's saline waters will spill overland and contaminate Lake Baringo's fresh water. Lake Nakuru's limnological conditions have altered, and this has caused flamingoes to desert the lake, which in turn reduces tourism numbers (RVWSB, 2018). All the lakes are currently impacted by high water levels with access

roads, buildings and terrestrial ecological habitat inundated. These changes are affecting the OUV under which the site was listed as a World Heritage site.

The Lake Nakuru hydrology is complicated and it is believed that there has been increased seepage from the lake underground to recharge aquifers to compensate water pumped from boreholes near the lake, and also to compensate decreased groundwater recharge arising from deforestation (RVWSB, 2018).

The challenges are exacerbated by the collapse of tourism revenue due to the Covid-19 pandemic (since March 2020).

► **Other Ecosystem Modifications**

Very High Threat

(Ecological isolation)

Inside site, widespread(15-50%)
Outside site

The three lakes are quite small (40 km², 38 km² and 25km² for Lakes Nakuru, Bogoria and Elmenteita respectively) and although the property includes surrounding lakeshore habitats (totaling 217km²), the three areas are isolated from one another. The primary functional linkages between them are associated with their shared role in supporting the lesser flamingo and other bird populations.

The terrestrial components of the three lakes are not large enough to support viable populations of the many species that would naturally occur in the area. In the case of Lake Elmenteita, parts of the terrestrial buffer on the eastern and southern shores are being developed. This in stark contrast to the other sides which are a national wildlife sanctuary. And Lake Elmenteita's Ramsar site area to the south has ceased to be a conservation zone having been sold off for development. And with recent rises in lake water levels in all lakes, the terrestrial space is being further diminished. Also in the case of Elmenteita, a new HV powerline with 50m high pylons has been constructed right through the Elmenteita Ramsar site, and this is crossing bird flight paths. This construction is in spite of a NEMA moratorium on such developments, and in spite of objections, and presumably contrary to applicable agreements in regard to Ramsar sites.

In the case of Lake Nakuru, there had been the opportunity to open up an overflow corridor for wildlife through Soysambu Conservancy and beyond to Naivasha, but the discussions have stalled. A recent study had recommended this process be resuscitated through the Nakuru County Wildlife Conservation Committee (RVWSB, 2018, Biodiversity Component). But the Ututu conservation area, previously contiguous with Elmenteita that would have served as part of the planned corridor is no longer available (GLECA, 2017) as it has been sub-divided and sold off.

► **Invasive Non-Native/ Alien Species**

High Threat

(Invasive alien species)

Inside site, scattered(5-15%)
Outside site

There has been concern about the growth of *Solanum incanum* in the grazing areas for the large mammals within Lake Nakuru National Park (LBNR Committee, 2007). The presence of this plant is often associated with degradation. A recent KWS workshop presentation added *Datura stramonium* and *Lantana camara* amongst invasive plants that are reducing grazing / browsing areas for wildlife (KWS/NMK, 2020).

A notable invasive plant that invades grasslands is *Prosopis juliflora*, seen throughout Kenya's Rift Valley, and proliferating in the region of Lake Bogoria (LBNR, 2019). The plant is robust and thorny and invades grasslands and wetlands and displaces the indigenous vegetation.

Though invasive plants may affect the integrity of the sites, it is noteworthy that new species may in some cases be beneficial as observed with the introduction of the cichlid *tilapia grahami* in Lake Nakuru in about 1960, that changed the ecology and trophic dynamics of the lake (Vareshi, 1979). Prior to this introduction there were no fish in Lake Nakuru, and its introduction extended the food chain, and has since supported a diversity of piscivorous birds, the dominant fish-eating bird being Great White Pelicans that breed at nearby Lake Elmenteita (Vareshi, 1979; KWS, 2003). A recent media post has reported a study citing a total of four tilapia species now present in Lake Nakuru (The County Look,

2020).

► **Housing/ Urban Areas**

(Urban development)

High Threat

Inside site, localised(<5%)
Outside site

There are increased housing developments both in part of the former Ututu conservation area to the south of Lake Elmentaita, as well as in the eastern side pressurising the critical buffer zone. The previously contiguous Ututu conservation area no longer exists as it has been sub-divided into small plots and sold off (State Party of Kenya, 2019), thereby totally altering the land usage within the designated Ramsar site, and reducing the area available for conservation.

► **Other**

(Ecological change in other Rift Valley lakes)

High Threat

Outside site

The lesser flamingoes and other birds move great distances between the ten 'flamingo lakes' of the Rift Valley, and beyond, so are vulnerable to ecological changes or pollution of any of the other lakes within the food chain. There has long been trona mining and a major soda factory on Lake Magadi, and a similar development has been mooted for Lake Natron, which serves, critically, as the main breeding site for lesser flamingoes. There are also plans for a cascade of three hydropower dams and associated irrigation developments on the Ewaso Ngiro South river in Kenya, this being the main freshwater feed to Lake Natron and its associated Shompole swamp. There are important susceptible wetland habitats elsewhere within the Rift Valley that are utilized by migrating birds, including a small flamingo lake within the endangered Lake Turkana National Park World Heritage site. Riparian swamps on the rivers flowing into the Soysambu conservancy have also been illegally destroyed for agriculture in recent years (IUCN Consultation, 2020), thereby exacerbating the sediment runoff into the lake. Typha swamps in the vicinity and north of Lake Bogoria have similarly been reduced to dry bare areas in recent years through persistent grazing and browsing by livestock (IUCN Consultation, 2020).

► **Livestock Farming / Grazing**

(Livestock grazing pressure)

High Threat

Inside site, localised(<5%)
Outside site

Repeated concerns have been expressed about livestock grazing at Lakes Bogoria and Elementeita, where cattle and goats graze along the lakeshore habitats, causing increased rates of erosion, run-off and siltation (BirdLife, 2017c; LBNR Committee, 2007; LBNR, 2019). Those areas are currently inundated with water due to the exceptional high lake water levels, and the grazing pressure will now be concentrated further away, but with the same detrimental effects if not controlled. Livestock numbers exceeding the carrying capacity of rangelands and leading to degradation is a challenge throughout the Rift Valley basin (WRA, 2020).

► **Erosion and Siltation/ Deposition**

(Degradation of lake catchment areas, soil erosion and siltation)

Very High Threat

Inside site, widespread(15-50%)
Outside site

The catchment areas of the three lakes are relatively small (930 km², 1,800 km² and 630 km² for Lakes Bogoria, Nakuru and Elementeita respectively), and subject to rapid deforestation, over-grazing and expansion of agriculture (IUCN, 2011; WRA, 2020). Forest cover in Lake Nakuru's catchment was reduced from 47% in 1970 to just 26% in 1986 (IUCN, 2011), and reportedly to only 7% in 2005 (FlamingoNet, 2005), and nearly half the catchment is now under cultivation (BirdLife, 2017a). These land-use changes and encroachments into riparian zones are resulting in increased soil erosion, run-off and siltation. This is affecting all Rift Valley lakes as these lakes are the terminus of these catchments. These sediments that are accumulating within the lakes are raising bed levels and this in turn raises lake water levels and areas of inundation thereby encroaching into the restricted terrestrial buffers around the lakes. In the case of Lake Bogoria, the current water level has flooded the designated buffer zone and has reached the reserve headquarters at Lobo.

The Rift Valley Basin as a whole is recognized to be in need of soil and water conservation measures, with most of the county integrated plans promoting mitigation plans (WRA, 2020). But these are not new challenges, and past measures have had little effect, being rapidly overridden by the demographic

challenges that include increasing population, inadequate education, and the level of poverty (WRA, 2020). Land management is critical, with degradation leading to chronic poverty for those that are closely linked to natural resource use (WRA, 2020).

► **Problematic Native Species**

High Threat

(Habitat change induced by over-abundant animal populations)

Inside site, scattered(5-15%)

Lake Nakuru National Park is surrounded by a 74-km electric fence that prevents animal dispersal, and has allowed large mammal populations to increase to a level where serious ecological imbalances are becoming apparent. The park is reported to be over-stocked, leading to changes in mammal species, and thereby impacting diversity (RVWSB, 2018). Options to reduce buffalo and zebra numbers have been suggested (RVWSB, 2018). It has been reported that the buffalo population is over 6-times the sustainable number of 1000 animals (KWS/NMK, 2020). The number of giraffe had increased to the extent that they were beginning to destroy the Acacia woodland by debarking the trees excessively (BirdLife, 2017a). Rising lake levels in all lakes are inundating terrestrial zones and reducing grazing areas thereby intensifying forage competition between large-bodied grazers.

► **Tourism/ Recreation Areas**

Low Threat

(Tourism pressure)

Inside site, localised(<5%)

Outside site

Lake Nakuru National Park has attracted up to 340,000 visitors annually, albeit with reductions in recent years, and this has been creating some pressures related to off-road driving, over-crowding, littering and waste management challenges for the park authorities. Lake Nakuru has been one of Kenya's most popular tourist destinations, and management of tourism impacts has however generally been reported to be good (IUCN, 2011). At present, tourism exerts little pressure on either of the other two lakes and is a force for their conservation (BirdLife, 2017c). However, littering of the hot springs and campsites in Lake Bogoria has been a problem that significantly detracts the tourism experience, as well as being a hazard to wildlife. Off-road driving is not allowed in national parks. Kenya has commendably taken stern measures to limit plastic usage, and plastic water bottles are no longer allowed in national parks.

► **Mining/ Quarrying**

Very Low Threat

(Mineral exploitation)

Inside site, extent of threat not known

Outside site

Small-scale extraction of soda and sand on the eastern shores of Lake Elmenteita is not a major threat, but any expansion of these operations could have a significant impact on the site (BirdLife, 2017c)

► **Water Pollution**

Very High Threat

(Water pollution and eutrophication)

Inside site, throughout(>50%)

Outside site

Pollution of the lakes' waters is a problem, especially affecting inflows from the growing agricultural and industrial town of Nakuru (population of 390,000 in 2020, predicted to increase to over 800,000 by 2045 (at medium growth rate) (RVWSB, 2018). Though the town has existing wastewater treatment facilities, these are near the lake shore, and the treatment of wastewater entering the lake has been inadequate (BirdLife, 2017a). In the wider catchments, intensification of agriculture and increased use of fertilizers may be increasing the nutrient load of inflowing waters and could lead to eutrophication. A further challenge is the siltation arising from the soil being washed into the lake from the deforested catchment areas.

Lake Nakuru has long been impacted by poorly treated wastewater runoff into the lake, a situation that will soon be exacerbated by the increase in water supply brought into the town from Itare dam, with the wastewater volumes doubling by the year 2045. In addition to increased pollution risks, if the increased volumes of wastewater are discharged to the lake, lake levels would rise appreciably (RVWSB, 2018).

Increasing urbanisation is increasing the stormwater runoff into the lake, and this is compounding the impacts of increasing wastewater discharges. In addition, due to poor waste management within the town (RVWSB, 2018), the stormwater drains are often used to dump a range of wastes including garbage, plastics, sullage and oils, which are then carried by stormwater untreated to the lake, to the

detriment of the lake ecology and wildlife (RVWSB, 2018).

Plans are being implemented in Nakuru town to improve both stormwater management, sewerage reticulation, sewage treatment and final disposal of effluent (RVWSB, 2018). After treatment of raw sewage at the treatment works located near Lake Nakuru, the final effluent disposal is planned to be transferred through pumping to an oxidation pond system to be located east of the Lanet airstrip. This final effluent disposal site is well away from Lake Nakuru, but is within the Lake Elmenteita catchment. Thus, in the event of poor treatment or malfunctioning equipment, effluents would potentially discharge towards Lake Elmenteita.

Only 21% of water consumers within the former Nakuru municipality are currently connected to sewers (RVWSB, 2018). The performance in maintaining the sewage pumping and treatment facilities is not encouraging, and a recent study noted biochemical oxygen demand (BOD; or simply the 'food' for the biomass) loadings in the final sewage treatment ponds that were almost 10-times the allowable limit for safe release to Lake Nakuru (RVWSB, 2018). Recent water quality sampling in the Lake Nakuru sewage treatment ponds identified the presence of cyanotoxins, which if ingested by wildlife through drinking can be fatal (LNRA, 2019).

► **Utility / Service Lines, Flight Paths**

Very High Threat

(High-voltage power transmission line)

Outside site

The Kisumu-Lessos-Olkaria high-voltage power transmission line has been built on the southern edge of Lake Elmenteita. The proponent is KETRACO (Kenya Electricity Transmission Company). The alignment passes very close to the southern lake shore and thereafter west through the Soysambu Conservancy. The structures are unsightly, and they create a physical barrier spanning across bird flight paths, in this case within 500 metres of the southern shore of Lake Elmenteita. The pylons are 50 metres tall, and the physical hazard to birds in flight will be considerable. Not surprisingly, there was a media outcry (Mangat, 2019a; 2019b), including reference to a letter from WHC to Kenya's permanent delegate to UNESCO whose contents were published by the media and online (WHC, 2019, cited by Mangat, 2019b).

There are a number conflicting information that require clarification as follows:

1. In Kenya's most recent state of conservation report (Kenya, 2020), it states that an EIA license for the transmission line had been issued to KPLC (Kenya Power & Lighting Co.) on 6th Sept 2019, whereas the license attached by the State Party was actually issued nine years earlier on 6th Sept 2010, and was only valid for 24 months. Compounding matters, that license was transferred to KETRACO by NEMA with effect from 24th Aug 2015, although its validity had already expired three years earlier, which means the EIA exercise needed revision in order to capture changed circumstances.
2. The Executive Summary of Kenya's report (Kenya, 2020) states that a joint KETRACO/KWS assessment was undertaken in June 2019 to ascertain impacts and include mitigation measures to guard the OUV of the lake, and that these have been factored into re-designing the powerline routing. However, there has been no re-routing. The transmission line has been built following the same alignment (through the Ramsar site) to which stakeholders had objected.
3. The same Executive Summary of Kenya's report (Kenya, 2020) uses the explanation that "flamingo / pelican migration is between Lakes Elmenteita and Nakuru and not any other route" to justify the alignment between Lakes Naivasha and Elmenteita. This is factually incorrect, as flamingos and pelicans and other birds fly both up and down the Rift Valley including south to Lake Naivasha and beyond to Lakes Magadi, Natron, and Manyara in Tanzania. The joint KETRACO-KWS rapid assessment dated June 2019, which is annexed to the State Party report even states that "the line will pass across bird migratory routes or paths" (KWS/KETRACO, 2019). The joint assessment concluded that "the proposed transmission line should avoid bird migratory routes or paths" and further stated "There is need to engage bird experts (ornithologists eg from Nature Kenya[...])" (KWS/KETRACO, 2019).
4. Kenya's state of conservation report does not mention that Nature Kenya was thereafter consulted as recommended by the joint assessment, and that in their letter dated 5th August 2019, Nature Kenya urged NEMA to "please stop the transmission line through Lake Elmenteita and Soysambu" as the line "is a huge danger to birds and fails to meet avian safety standards" (Nature Kenya, 2019a). Meetings were then convened between Nature Kenya and KETRACO at which the unacceptability of the

transmission line alignment was repeated, and it was resolved that a joint team Nature Kenya / KETRACO would undertake a study, the results and recommendations of which would inform subsequent decision making. These resolutions were confirmed by letter to KETRACO copied to a long list of leading government officials and JICA, UNESCO, and KWS (Nature Kenya, 2019b). The outcome has never been reported, and should be requested, as the precedent to disregard the due process is disturbing.

The alignment is clearly inappropriate as it is contrary to guidelines that sensibly state that "powerline routing should avoid large wetlands and other sensitive bird habitats, important migratory routes or protected areas designated for species of conservation concern" (Bernadino, 2018).

► **Other**

(Covid-19)

High Threat

Outside site

The Covid pandemic of 2020 has impacted institutional will, tourism revenue generation, and economic capacity in Kenya, thereby affecting the capacity of custodians to adequately protect the site.

Potential Threats

High Threat

There are several potential threats: (1) climate change; (2) geothermal energy development; (3) the close proximity to a major transport corridor to Uganda and associated developments, (4) infrastructure development around the lakes including a high-voltage powerline and an airport expansion close to bird flight corridors; (5) oil and gas exploration activities; (6) a new industrial city near Naivasha exerting a large water demand that will require trans-basin water transfer; (7) hydropower and irrigation developments on the principal river feed to Lake Natron.

The ongoing developments of the geothermal plants within the region of the Kenya Lake Systems may affect associated springs and wetlands. The associated towering high voltage transmission power lines are dangerous for the migratory birds. Poor land use practices leading to changes in rainfall runoff characteristics, consequent flooding, and increasing sediment runoff into the lakes, are already being manifested through extreme hydrological events such as the high water levels in the lakes, and in turn, the changed ecology of the lakes. This is especially true in Lake Nakuru that already lost its flamingo population, and with the dilution of Bogoria's waters, that lake's alkaline ecology is at risk too.

There are lots of infrastructure developments in the region, including major roads whose potential impact is unknown and therefore deserve recognition. Nakuru town is growing and this will present ever more wastewater and stormwater disposal challenges, and Lake Elmentaita's catchment may also be affected by Nakuru's wastewater disposal plans.

► **Temperature extremes, Storms/Flooding**

(Climate change)

High Threat

Inside site, extent of threat not known

Outside site

Whilst the property has demonstrated extreme resilience to fluctuations in climate and water levels, the possible future impacts of climate change are unpredictable (IUCN, 2012). The risks are especially evident with the massive flooding in Lake Nakuru in the last four years that has resulted in changes in its ecology with the emigration of flamingos from the lake to other water bodies. The flooding has also reduced the grazing area for the mammals. Flooding has also occurred in the other two lakes in the site in the last four years, as well as affecting lakes throughout Kenya's Rift Valley basin.

With the land use changes associated with the forecast human population increase, rainfall / runoff patterns will continue to change, and the flood risks are not likely to diminish. It is fairly certain that rainfall is following an increasing trend. It is also debatable whether changes to the lake inflow hydrology should be attributable solely to "climate change", as is often claimed. The major factors governing increasing flood severity are deforestation, urbanization, and agricultural activities causing the destruction of flood attenuating wetlands, and destroying the natural protective vegetation cover within the vital riparian zones (The Conversation, 2018).

► **Commercial/ Industrial Areas**

(Infrastructure development)

Low Threat

Outside site

The lakes lie along the main 'transport and infrastructure corridor' between the capital city Nairobi and countries to the north-west (Uganda, Rwanda, Sudan and DRC). As this corridor develops further, and branches to the north and south are developed, it is likely to further disrupt landscape connectivity, particularly for large mammals. Major road and rail developments are planned. Further, there has been massive development of geothermal power generation within the Rift Valley lakes region at Menengai (5 km to the north of Lake Nakuru, lying between Lake Bogoria and Nakuru) with the construction of high voltage transmission powerlines with tall pylons. These are likely to kill large number of birds migrating along this corridor, especially the nomadic flamingos that do move in large numbers at night between the lakes.

► **Oil/ Gas exploration/development**

(Oil and gas exploration and development)

Low Threat

Outside site

There has been major interest in oil and gas exploration especially around Lake Bogoria region, but this has not been formally sanctioned. The discovery of oil in the Lokichar basin within Turkana County had stimulated the need for further exploration of this resource along the Rift Valley (Tullow Oil Concession Map, 2011), but with the fall in oil prices, intrusive exploration activities have largely ceased for the time being, the focus instead being to develop the commercial oil extraction and transport infrastructure needed for the Lokichar oilfield far north of the World Heritage site.

► **Renewable Energy**

(Geothermal energy development)

High Threat

Inside site, scattered(5-15%)

Outside site

Kenya has an impressive portfolio of geothermal potential extending throughout the Rift Valley from Lake Magadi to the Barrier Volcanic complex at the south end of Lake Turkana, with geothermal fields in Magadi, Suswa, Longonot, Olkaria, Eburru, Menengai, Bogoria, Baringo, Koroso, Paka, Silali, Emurangogolak, Namurunu and the Barrier (Kengen, 2018). And these geothermal fields are often manifested by hot alkaline springs feeding ponds and lakes favoured by flamingos (both Lesser and Greater Flamingos).

The birds migrate along the Rift Valley from alkaline lakes in northern Tanzania through Kenya and into the Ethiopia. The important lakes in Kenya include the northern end of Natron, Magadi, Oloidien, Elmenteita, Nakuru, Bogoria, wetlands within the Suguta valley ending with Lake Logipi at the base of the Barrier. There are small lakes beyond and north of the Barrier favoured by migrating flamingoes, notably green ponds at the south end of the lake near the Nabuyatom volcanic cone and crater, and Flamingo Lake on Central Island (within the Lake Turkana NPs World Heritage site). Flamingoes will often be seen on the shores of the main lake too, and within Ferguson's Gulf.

Though outside the boundaries of the World Heritage site, the geothermal fields are on the flight path of the migratory birds, and if poorly planned these developments may therefore affect the migration of these birds. The development of these geothermal abstractions may dry up surface ponds used by flamingoes, and the high-voltage powerlines will pose a hazard to birds passing between the World Heritage sites.

► **Mining/ Quarrying**

(Proposed Soda Ash plant in Lake Natron)

High Threat

Outside site

Lake Natron is the main breeding site for the Lesser Flamingoes found in all the ten African Rift Valley lakes. The Government of Tanzania had proposed to put up Soda Ash plant, an activity that has high potential of destroying the breeding sites for these birds. Though the plan has been shelved and reported to be safe (Birdlife, 2018), there are no guarantees, and the plans may be revisited again in the future.

- **Flight Paths** **High Threat**
(Lanet military airstrip expansion for civilian aircraft) Outside site
- A so-called ESIA for a Lanet military airstrip expansion exists but could not be accessed. However the title "Project Report" as seen on the cover page suggests this is not a full ESIA, and may thus not include any public consultations. The title of the Project Report indicates that the current Lanet military airstrip in Nakuru plans to expand to encompass civilian aircraft use. This will increase air traffic. This may well require runway extensions to cater for jet aircraft as the altitude is high. The possible flight paths will potentially and very likely clash with the existing bird flight corridor between the Rift Valley lakes. This is not advisable either for aircraft safety, nor for the integrity of the bird flight corridor between the lakes. The ESIA document was requested by Soysambu Conservancy in June 2020 (IUCN Consultation, 2020).
- **Water Pollution, Household Sewage/ Urban Waste Water, Industrial/ Military Effluents, Agricultural effluents, Solid Waste, Air Pollution** **High Threat**
(Nakuru town's proposed sewerage, sewage treatment, solid waste management, and stormwater drainage expansions) Inside site, widespread(15-50%)
Outside site
- With increasing population in Nakuru town and associated urbanisation, more water will be supplied from outside the catchment, and there will thus be increasing wastewater, solid waste and stormwater production within Nakuru's drainage catchment area, that would lead to potential increased pollution of the lake, and resultant rising lake levels, and associated inundation of terrestrial grazing zones, further increasing pressure on the dependent herbivores. Rehabilitation and new expanded wastewater handling facilities are being implemented (RVWSB, 2018). Those plans envisage new oxidation ponds for final effluent treatment to the east of Nakuru near Lanet, and within the Lake Elmenteita catchment, thereby increasing the pollution risk to that lake too.
- Increasingly in urban areas of Kenya where solid waste collection facilities are non-existent, solid wastes are often being disposed illegally through burning, thereby causing gross air pollution. This burning occurs widely at the landfill sites, and is common-place alongside road verges during litter collection campaigns.
- Air pollution sources within the sites are mainly tourist vehicles, either fumes due to poor maintenance, or dust caused by speeding along tracks. It is important that tourism establishments dispose of wastes responsibly.
- **Other** **Low Threat**
(Fire risks) Inside site, throughout(>50%)
Outside site
- Fire risk is ever-present within the site. Fire-breaks should be maintained along the boundaries and tourism establishments should ensure that wastes are disposed responsibly. Wood burning within the sites should be banned, not only because of fire risk and air pollution, but because this is in keeping with Kenya's energy policy to transition towards clean energy sources. To stem forest decimation, the transport of wood is banned in Kenya, as otherwise it was impossible to manage abuse. And no wood collection should be allowed within the site as decaying wood is an important part of the food cycle upon which insects and birds depend.
- **Dams/ Water Management or Use** **High Threat**
(Proposed hydropower schemes in Natron catchment) Outside site
- The Kenya government has long harboured plans to build a cascade of three hydropower dams within the Ewaso Ngiro South basin, which is the major water catchment for Lake Natron. The possibility of this happening is now very real (LNRA, 2019; AWSB, 2018). The dams would be located where the river drops into the Rift Valley before flowing south to Natron, and the plans downstream of the dams include irrigation developments within the Rift Valley. The recent interest is triggered by the need for significant amount of water at the new industrial city near Naivasha, planned as an inland container port on the

new Standard Gauge Railway from Mombasa (LNRA, 2019; AWSB, 2018). As there is insufficient water in the Ewaso Ngiro River, the plans include transfer of water into the basin from the Mara basin by what is called the Amala transfer (AWSB, 2018). The Industrial City's major water supply needs would be served through a long pipeline from one of the Ewaso Ngiro dams (AWSB, 2018; LNRA, 2019). The impacts of the altered river Ewaso Ngiro South hydrology and irrigation abstractions on Lake Natron have not been discussed.

It was reported earlier by the last assessment of the site that the States Parties of Kenya and Tanzania are in agreement on the need to protect and conserve the Lake Natron flamingo breeding site, with even a committee proposed to be formed to coordinate the protection of the site. It was also reported that there was no evidence that the committee was formed nor that it is working. The State Party of Kenya might be asked to include reference to progress on this in the annual State Party report.

Overall assessment of threats

Very High Threat

The most important threats relate to the reliable natural hydrological cycles that sustain the diverse lake ecological systems, which are threatened by deforestation and degradation of the catchment areas, changes to the hydrological cycle with increasing flood risks, and by upstream water abstractions diminishing medium to low river flows. The massive population of lesser flamingoes and other birds depend on a network of at least ten 'flamingo lakes', so any significant ecological change in any of the other lakes (in Kenya, Tanzania and Ethiopia) could have a devastating knock-on impact on the entire system. Water pollution is a significant threat, and there are minor issues related to tourism pressures, small-scale mineral extraction and invasive alien species. Potential future threats may arise from geothermal and hydropower energy development, additional high voltage transmission lines, climate change, infrastructure development projects and oil exploration and implementation activities.

Protection and management

Assessing Protection and Management

► Management system

Some Concern

Each component site has a management plan which describes the management and monitoring procedures to be carried out on a catchment-wide basis by a wide range of stakeholders. In each case, there is a multi-stakeholder committee which meets on a regular basis to co-ordinate management. The management plans for all three lakes are reported to be undergoing processes of review (State Party of Kenya, 2020). Three separate plans have so far been prepared for Lake Nakuru National Park (LNNP). These cover the periods 2002-12, 2007-12 and 2010-20, and a new plan is under preparation (State Party of Kenya, 2020). Two plans have been prepared for Lake Bogoria National Reserve (LBNR Committee, 2007), the latest covering the period 2019-29 (LBNR, 2019). The latest draft applicable from 2019 is awaiting endorsement by the Baringo County Governor. Two plans have been prepared for the Greater Lake Elmenteita Conservation Area (GLECA), covering the periods 2010-20 and 2017-27 respectively (GLECA, 2010; GLECA, 2017). In each case the plan area is zoned for particular uses and management interventions, with the GLECA area (for example), zoned in three portions, 'core', 'buffer' and 'transition' zones. The GLECA 2017-27 plan has however not yet been endorsed. The GLECA zoning and boundaries are currently being reviewed and surveyed (State Party of Kenya, 2020). The Ututu Conservation Area has regrettably ceased to exist. Although within the Elmenteita Ramsar site and although its development was included within the GLECA Management Plan 2010-20, the Ututu Conservation Area has been sub-divided into plots and sold off for development.

Several clarifications are being sought by the major GLECA stakeholder prior to endorsement of the new management plan (Soysambu, 2018). These include clarification of the legal status of the Lake Elmenteita Wildlife Sanctuary and the important role of the Nakuru County Wildlife Conservation and

Compensation Committee.

At Lake Bogoria, the terrestrial part of the national reserve was initially divided between designated zones for 'grazing', 'wilderness' and 'natural preservation areas' (LBNR Committee, 2007). The proposed new plan applicable from 2019-29 has described seven zones, 'high use', 'low use', 'wilderness', 'restricted', 'livestock grazing', 'utility', 'influence' zones (LBNR, 2019). This latest plan awaits endorsement by the Baringo County Governor.

► **Effectiveness of management system**

Serious Concern

Management of the site is generally effective, especially for Lake Nakuru National Park (NP) and Lake Bogoria National Reserve (NR). Management within the boundaries of the World Heritage site is well-resourced and sufficient to satisfy the requirements set out in the Operational Guidelines (IUCN, 2011). The exact boundary of the Elmenteita portion is under review (State Party of Kenya, 2020). There are qualified staff employed to manage both Lake Nakuru NP and Lake Bogoria NR, while Lake Elmenteita is managed by the staff from Lake Nakuru NP and the Soysambu Conservancy. The staff have the necessary management infrastructure, vehicles and equipment. Lake Elmenteita management is however rather weak since the KWS staff in Nakuru are far away from the lake (50 km) hence the lake depends to a large extent on the involvement of conservation-oriented landowners from the surrounding 'buffer zone' (IUCN, 2011). The current management status for Lake Elmenteita is uncertain as the draft management plan supposed to be effective from 2017 has been awaiting clarifications sought by the major stakeholder in 2018 (Soysambu, 2018). Effective management is severely constrained by the apparent lack of will by the authorities to support through respecting the NEMA Moratorium on development in the close vicinity of Lake Elmenteita. The OUV of the Elmenteita portion of the site are being compromised in the face of mounting seemingly poorly regulated development pressures.

► **Boundaries**

Some Concern

Two of the three lakes lie within protected areas that include significant areas of terrestrial habitats, serving as 'buffer zones' for the water bodies they surround. The third (Lake Elmenteita) borders onto the privately-owned Soysambu Wildlife Conservancy, which has been designated as a Buffer Zone (outside the World Heritage site). Each site is demarcated on the ground with concrete beacons or fences, and Lake Nakuru is completely enclosed by a 74-km electric game-proof fence (Birdlife, 2012a). The proposal to restore landscape connectivity and ecological resilience by establishing a wildlife corridor between Lake Elmenteita and Lake Nakuru National Park though agreed on in principle (IUCN, 2011) has not been implemented however. Such a connectivity would be very helpful to the Lake Nakuru National Park since it would help relieve overgrazing due to the large number of large mammals in the park.

► **Integration into regional and national planning systems**

Some Concern

Though there are no formal mechanisms for regional co-ordination between the Kenyan, Tanzanian and Ethiopian authorities, the nomadic and migratory life of the lesser flamingoes, and the location of their breeding ground in Lake Natron in Tanzania, creates a strong need for cooperation between these state parties (Tanzania National Single Species Action Plan 2010-2020 for the Lesser Flamingo). The Kenya and Tanzania governments have shown desire to form a joint committee for the protection of Lake Natron and management of the migratory route of these birds. However, this idea has not been brought to fruition (State Party of Kenya, 2015). In Kenya, there is a National Steering Committee for the Kenya Lakes System, chaired by the Director of KWS that supervises the three site management committees. It is expected to be meeting three times a year (State Party of Kenya, 2010). However, there was no evidence of these meetings taking place as proposed.

► **Relationships with local people**

Mostly Effective

Local stakeholders are involved at a number of levels, with broad representation on the management committees of each site (State Party of Kenya, 2010). The stakeholders for Lakes Bogoria and Elmenteita are identified, however their involvement in site management is minimal. For Lake Bogoria,

the Endorois who are the indigenous people there have their rights to the lake recognized and their views are to be communicated to the management through the Endorois Bio-Cultural Protocol (BCP) that they have developed (LBNR, 2019). They are allowed to graze livestock within the reserve, especially during droughts (LBNR, 2019). The latest management plan includes provisions on access to cultural and sacred sites, access to genetic resources and benefit sharing, controlling access to extractive resources (oil, gas, minerals) and benefit sharing, regulating filming and photography, building of community capacity to participate in the reserve's resource management, and to share 10% of reserve gate money, generate community livelihood projects to promote a positive view towards conservation, and to lobby for enhancement of the County Government of Baringo community grant (LBNR, 2019). Further, there is fostering of local self-employment, especially for Lake Bogoria through making of handicrafts sold to the tourists and bee-keeping and sales of honey. Generally, the impacts of site management on the community are reported to be positive (State Party of Kenya, 2015).

Lake Nakuru is managed by the Kenya Wildlife Service who have also been given mandate to take care of Lake Elmenteita (World Heritage Committee, 2015). Wildlife-human conflict around Lake Nakuru National Park has been minimized through the erection of a game-proof electric fence, which has gone a long way towards resolving past conflicts and improving relationships with local people. To further enhance support for the park, Lake Nakuru National Park has supported social and enterprise projects in neighbouring communities (KWS, 2002) through the initiative called cooperate social responsibility. This support, though started over fifteen years back was still being given to the communities around the park. However, it is to be noted that with devolution to county governments, the KWS community budgets have been axed, that money instead in future being channeled through the Counties. This will restrict the KWS role with communities to wildlife conflict issues, and in future the County wildlife conservation departments need to be actively engaged as they are best equipped to build conservation-sympathetic relationships with their people. This will only affect the Nakuru and Elmenteita portions of the site.

► Legal framework

Some Concern

Lake Nakuru is a National Park managed by Kenya Wildlife Service (KWS), while Lake Bogoria is designated as a National Reserve managed by the County Government of Baringo (CGB). Lake Elmenteita was gazetted in 2010 as a National Wildlife Sanctuary, and is managed by KWS, with its surrounding lands (outside the site) either under private ownership or managed as a Wildlife Conservancy. The site also benefits from other pieces of legislation that serve to strengthen the provisions for catchment protection, including the Environmental Management and Co-ordination Act (1999), the Water Act (2002) and the Forest Act (2005). There is however conflict between different Acts in regard to riparian zones.

The legal framework for the site is generally effective in maintaining its values, although there are concerns in the case of Elmenteita where legislated mechanisms are not effectively controlling activities that are damaging to the OUV. There are no land tenure issues that could be an impediment to management for Lake Nakuru, but for Lake Bogoria, the Endorois community was given rights to the land around the lake even though the lake is controlled by the Baringo County Government (State Party of Kenya, 2016). In Lake Elmenteita, surrounding land is owned by communities and Delamere Estates which established the Soysambu Conservancy.

Lake Nakuru National Park is safely protected through national legislation, but some former responsibilities of the custodian KWS have been devolved to the County, and these should be clarified. Lake Elmenteita Wildlife Sanctuary was legally placed under the management of the Kenya Wildlife Services for its protection (World Heritage Committee 2014), but in this regard, clarifications have been raised concerning the revised management plan 2017-27. These clarifications include omission of the Lake Elmenteita Wildlife Sanctuary from Schedule 11 of the Wildlife (Conservation and Management) Act of 2013, in which National Wildlife Sanctuaries are listed (Soysambu, 2018). The situation should hopefully be secure and legal from the Gazette Notice No. 8077, although the Schedule number "11" was omitted (Kenya Gazette, 2010).

Each of the three component sites had previously been stated wholly owned by the Government of Kenya and managed according to different legal and institutional arrangements (State Party of Kenya, 2010). This is because all water bodies are riparian bodies, and there is a terrestrial area surrounding

each body which is also riparian, although rarely demarcated on the ground, and hence liable to be encroached upon (The Conversation, 2018).

► **Law enforcement**

Some Concern

There is good enforcement of the management protocol in Lakes Bogoria and Nakuru by the respective enforcement authorities. In Lake Elmentaita, the enforcement is not strong enough, and this has resulted in uncontrolled activities around some parts of the lake that are upsetting the OUV of this portion of the site.

► **Implementation of Committee decisions and recommendations**

Some Concern

The site was given World Heritage status in 2011 at which time the State Party was encouraged to (1) strengthen the legal status and on-the-ground management of Lake Elmenteita, (2) enhance the functional linkages between the three components of the site through the establishment of wildlife corridors and (3) curb deforestation in the catchment areas especially the Mau escarpment that serves Lake Nakuru (UNESCO, 2011). Though a number of meetings have been held by the management and stakeholders focussed on deliberating on the best ways to conserve the site with a number of recommendations made, it was earlier reported that there is not much information to show the extent of implementation of those original recommendations (State Party of Kenya, 2015). There are mounting concerns that the site's OUV is being compromised in the face of development and other pressures. The boundaries of Lake Elmenteita are still confused. The management plan supposed to be effective three years ago from 2017 is not in place with clarifications not yet resolved. In the latest WH Committee Decision for this site, the Committee regretted that the State Party of Kenya only provided limited information on the implementation of past decisions (WH Committee, 2019). It is therefore difficult to ascertain to what extent the WH Committee's requests have been addressed by the State Party.

► **Sustainable use**

Serious Concern

The principal forms of consumptive resource use within the site are livestock grazing and firewood collection, which affects the shores of Lakes Elmenteita and Bogoria. These areas cannot support both wildlife and livestock, a situation exacerbated by the recent rising lake levels that have reduced the grazing areas through inundation. There had been no clearly defined strategies to regulate grazing within the reserves, although this has been practiced since before these two areas became protected areas (LBNR Committee, 2007; GLECA, 2010). Even though there is no consumptive use allowed in Lake Nakuru NP, the terrestrial areas of that park are under huge pressure from within (RVWSB, 2018).

► **Sustainable finance**

Serious Concern

Management of Lake Nakuru and Lake Elmentaita is financed through budget allocations made by KWS while for Lake Bogoria this is done through the County Government of Baringo. In all cases, funds are generated from gate entry fees and other tourism-related revenues (lodge concession fees, camping and guide fees etc) that are routinely generated across national parks and reserves. In the case of KWS, these funds are pooled and allocated according to perceived needs and priorities (KWS, 2002). Lake Nakuru National Park is top amongst KWS's two premium national parks, and is a prime destination for tourists. The advent of the Covid-19 pandemic has been disastrous for the tourism-based revenue streams, with international travel and tourism collapsing. Even domestic tourism is impacted with lockdown and travel restrictions. With the closure of schools, popular educational visits by schools have ceased until early 2021 at the earliest.

► **Staff capacity, training, and development**

Mostly Effective

The staff manning these facilities are generally well trained. Kenya Wildlife Service which is managing the Lake Nakuru National Park and Lake Elmentaita routinely hires well-educated staff from the universities and colleges, also further offering them training at their staff training colleges in Naivasha, and at a Law Enforcement Academy located in Tsavo West National Park at Manyani (UNEP-WCMC, 2012). The staff manning Lake Bogoria are also generally well-trained, and now have the role to capacity-build members the community in these roles (LBNR, 2019). The number of staff manning these

facilities is generally adequate with over 100 being located in Lake Nakuru, and they are also in-charge of Lake Elmentaita, while Lake Bogoria has a staff of about 30 people (IUCN, 2011). It is a concern however that the management plans are not in place.

► **Education and interpretation programs**

Mostly Effective

There are environmental education centres, used extensively by local schools, at Lake Nakuru and Bogoria (UNEP-WCMC, 2012). Lake Nakuru operates an ambitious schools outreach programme which involves hosting school parties at the park and disseminating environmental education materials (KWS, 2002). Enthusiastic school parties visiting the hot springs of Lake Bogoria have been a regular sight (IUCN Consultation, 2020).

► **Tourism and visitation management**

Mostly Effective

Kenya is traditionally a popular destination for a large number of national and international visitors, but numbers have dipped in recent years, due to global financial crises, insecurity fears arising from terrorist attacks within Kenya, fears of Ebola, and now the Covid-19 pandemic with its global impacts. Lake Nakuru is one of KWS's two 'premium' parks, the other being Amboseli. Visitor numbers into Lake Nakuru ranged between 327,000 and 197,000 annually between 2006 and 2011 (KWS, 2011), the trend being downwards. Recent KWS annual reports don't provide visitor statistics, but visitor numbers have been cited as 200,000 in 2018 (Business Daily, 2019).

Lake Nakuru is the most popular of KWS's two premium national parks, and is served by three high-end tourist lodges, nine campsites, two hostels, an education centre, and other tourist facilities (UNEP-WCMC, 2012). There are also accommodation and entertainment facilities in nearby Nakuru town. However Lake Nakuru receives bad press due to persistent pollution affecting the park from the nearby town. This is beyond KWS direct control, but steps have been taken by KWS to mitigate this, with funding assistance of the German Government (RVWSB, 2018).

The World Heritage site is easy to access, with Lakes Nakuru and Elmenteita close to the Mombasa to Uganda highway, whilst Lake Bogoria is accessed by a good tarmac road off the Nakuru to Lake Baringo tarmac road. There is an airstrip in Nakuru, but air access within Baringo needs improvement. Tourist accommodation facilities for Lakes Elmenteita and Bogoria are located outside the site, but are very close by.

► **Monitoring**

Some Concern

Waterbird counts have been conducted at all three sites (and other Kenyan wetlands) twice each year since 1991 (UNEP-WCMC, 2012). There is reported to be a wide-ranging monitoring programme at Lake Nakuru National Park which includes automatic flow detectors on all the inflowing rivers, as well as regular monitoring of water quality and weather. These data and findings would be useful to share in the State Party's annual report. Mammal counts and vegetation transects are also reported to be conducted on a regular basis to determine whether carrying capacity limits are being reached (KWS, 2002). The findings could similarly be reported annually by the State Party. Recent independent studies note that Lake Nakuru is over-stocked, especially zebra and buffalo, with no obvious action being taken (RVWSB, 2018). It has recently been reported that buffalo numbers are 6-times the sustainable number (KWS/NMK, 2020).

► **Research**

Some Concern

The Lake Nakuru management plan had proposed the establishment of a research committee to co-ordinate research programmes throughout the park's catchment area (KWS, 2002). Nine broad research topics had been identified for priority attention including important issues such as hydrology, park carrying capacity, flamingo mortality etc (KWS, 2002). The Soysambu Wildlife Conservancy (part of the buffer zone around Lake Elmenteita) did establish a research centre within the conservancy (UNEP-WCMC, 2012), but this was shut down in 2015. None of the current management plans have been finalised, so the current situation on research has not been assessed.

Overall assessment of protection and management

Some Concern

There is little information on the effectiveness of current management in addressing threats to the World Heritage site, but it was considered adequate at the time the nomination was evaluated in 2010 (IUCN, 2011). Management within the three reserves was considered well-planned and adequately resourced, but there was considerable uncertainty over the extent to which land degradation, deforestation and upstream water use are being curbed in the lake catchment areas (which are experiencing high rates of population growth and development pressures). The consequences are being seen today through changes in rainfall / runoff patterns, with increasing flood severity, that in turn leads to increasing sediment runoff. The sediment is conveyed into the lakes, where it settles, causing lake beds to rise, and this in turn is affecting water levels in the lakes. Management plans are being prepared, albeit delayed.

► Assessment of the effectiveness of protection and management in addressing threats outside the site

Serious Concern

The management plans for each component site provide for integrated catchment-wide strategies for dealing with issues that affect the quality and quantity of water flowing into the lakes, but there are no data output shared in the latest State Party report, and hence little information on the effectiveness of implementing these strategies. While there had earlier been reported improvements in the management of sewage and reduction of pollution from Nakuru municipality (IUCN, 2011), recent media coverage on pollution of the lake is discouraging (Business Daily, 2019). Recent studies into waste disposal funded by the German Government are however a positive step (RVWSB, 2018), but the town's waste disposal challenges are increasing with rising population, as are the pollution risks to the lake, and there is urgency to deal with these. And once built, management of the facilities will need to be much more effective than has been achieved in the past, as sustainability is a question.

There is reported to be little water flowing into Lake Elmenteita from its three main rivers 'because farmers use most of the water for irrigation upstream' (GLECA, 2010). Elmenteita's underground water is also dependant on Lake Naivasha whose water levels have been reaching critical low levels in recent years, and that situation is likely to be made worse by government water abstraction intentions to serve the new industrial city (LNRA, 2019). The above issues have been masked in the recent period during which lake levels have risen with shoreline infrastructure within the riparian zones inundated. Lake Bogoria is also reporting incoming water quality concerns, and buildings erected within the riparian zones have been inundated by the recent rise in water levels. The high lake waters levels are also not conducive to the feeding regime favoured by the flamingoes (LBNR, 2019).

► Best practice examples

Involvement of all stakeholders in the management decisions is important for sustainable management of the site. The process of governmental devolution means that county conservation and wildlife departments need to be engaged.

State and trend of values

Assessing the current state and trend of values

World Heritage values

► Outstanding natural beauty

High Concern
Trend:Deteriorating

The natural beauty of the lakes is protected within the context of the surrounding shoreline habitats by

national park and reserve status at Lakes Nakuru and Bogoria. The shoreline habitats around Lake Elmenteita are less secure, as they lie within private property on one side (designated as a National Wildlife Conservancy and recognized as a Buffer Zone outside the World Heritage site; IUCN, 2011), and numerous private properties along the east and southern shores. There is a major highway corridor close to the eastern boundary. The Elmenteita boundaries are confusing, as the Ramsar site and World Heritage boundaries differ, and there are fresh surveys being done.

The riparian area to the south and east of Lake Elmenteita has already been impacted by uncontrolled urban development and a recent major development includes the construction of huge unsightly pylons built for the Kisumu-Lessos-Olkaria high-voltage powerline passing right through the Ramsar site (closely following the World Heritage site's boundary). Any developments are contrary to the NEMA development moratorium issued in 2015. The Ututu conservation area previously contiguous with the south of Lake Elmenteita no longer exists, having been sub-divided into small plots and sold off. Regrettably this development has upset plans for a protected wildlife corridor from Soysambu to Marula on the shores of Lake Naivasha. Lake Nakuru is very close to an expanding town, which will increase pressure on the national park. Lake Bogoria is more remote from such pressures, being within a rural area, but is also an area of expanding human population with associated land use changes, and with wetlands being reduced to dry bare areas by livestock grazing.

The aesthetic qualities of the lake landscapes vary according to natural fluctuations in the lake levels (which can leave vast expanses of exposed mudflats during drier periods), which may be exacerbated by deforestation and degradation of the catchment areas. In addition, the resultant sedimentation is raising lake bed levels which means an increasing tendency to inundate the terrestrial buffer zones of the Site during flood periods. These buffers thus need to be reviewed and extended to cater for these changes, something that will not be easy to achieve in the case of Lake Elmenteita and Lake Nakuru.

► **Exceptionally diverse bird fauna, including rare and endangered species**

High Concern
Trend:Data Deficient

Though records show an overall trend of the waterbirds having increased considerably in numbers and diversity since the introduction of fish to Lake Nakuru in about 1960, the population of the flamingoes have been fluctuating strongly in the site (Birdlife, 2012a). Subsequently there was a trough in waterbird numbers (other than flamingoes) in the mid-90s attributed to major changes in the food chain associated with a period of low lake levels (Birdlife, 2012a), but they subsequently recovered when the lake level rose again.

The ongoing situation is unclear. It seems likely that future demands for water abstraction from rivers will cause water levels to drop more generally during dry rainfall periods, thereby affecting waterbird populations. On the other hand recent high rainfall periods have resulted in lake levels reaching unprecedented levels that may seem to favour water birds, but which inundates important shoreline and terrestrial habitats, deltas and associated reed beds. Hydrological diversity stimulates ecological diversity, but the extremes of recent years are extreme and rapid. Environmental changes and extreme hydrological cycles in the lakes are a concern for the numbers and diversity birds, especially long drought periods that follow extreme El Niño events.

It is also a concern that public perception views water birds such as cormorants as unwelcome visitors competing with fishermen in lakes like Baringo, in which there are commercial fish stocking programs. These lakes are within a chain and are inter-dependent.

► **Extraordinary soda lake ecosystem processes and trophic dynamics**

High Concern
Trend:Deteriorating

The ecological processes characteristic of the alkaline lakes are likely to be responding to changes in the quality and quantity of the inflowing waters, and with increasing flood volumes, dilution of saline waters. Deforestation, agricultural development, over-grazing by livestock, soil erosion, and water abstraction in the catchment areas are probably having an impact, the increasing flood runoff severity

being perhaps the best indicator of this. Riparian zones throughout Kenya are at constant risk.

The trophic dynamics at Lake Nakuru have been significantly altered following the introduction of a unique cichlid fish from Lake Magadi (another of the alkaline 'flamingo lakes' of Kenya), and reportedly there are now three new cyclid species in Lake Nakuru.

The variability in the water level in the last four years will have affected the salinity and alkalinity and therefore the ecology of the lakes. The reduction in low and medium fresh water inflows causes the lakes to concentrate chemically, whereas the recent extreme high inflows dilute the lake waters and introduce different nutrients scoured from the catchments. The impact of these changes in surface water influx patterns on alkaline lakes characterized by geothermal springs is uncertain.

► **World's largest congregations of lesser flamingoes**

High Concern
Trend:Deteriorating

Lesser flamingo numbers on each of the lakes fluctuate dramatically and unpredictably. January waterfowl counts conducted annually since 1991 indicate that the Kenyan population of lesser flamingoes has fluctuated between 280,000 and 1,450,000 birds between 1992 and 2007 (UNEP-WCMC, 2012), and 162,000 in 2018 (most being on Bogoria, NMK, 2018), but no clear trend in population. Since 2014, the high water level in Lake Nakuru has changed the ecology of this lake through dilution and flamingoes flew away due to lack of *Arthrospira fusiformis* (*Spirulina platensis*), their main food which could no longer thrive. The lake has not recovered up to now. Also, Lake Elmentaita and Lake Bogoria have had low counts of the lesser flamingoes around this time.

Though the changes in water level had been suggested to follow a ten-year cycle, it may be hard to predict the direction which the water level fluctuations may take in future. The recent high water levels have been unprecedented, and the inundation of Natron's flamingo breeding areas is always a concern, as is the timing of these flood influx occurrences. Ironically, the future presence of hydropower reservoirs on the main river that feeds Lake Natron could provide the opportunity to regulate the extreme and unpredictable flood events caused by deforestation and rangeland degradation.

► **Crucial flyway for bird migration**

Low Concern
Trend:Deteriorating

The status and trends in waterbird numbers at key wetlands in Kenya have been monitored since 1991 and indicate stable overall numbers of birds recorded (UNEP-WCMC, 2012), with seasonal peaks during March and September (while birds are on passage). However, the construction of a number of high voltage power line transmissions in this region, especially between Lakes Nakuru and Bogoria is likely affect migratory birds since these lines cut across the flyway for these birds. The knowledge base on the impact of these powerlines is growing, but there is need to support concerted study along the Rift Valley.

► **Diverse assemblage of mammals, including rare and endangered species**

High Concern
Trend:Deteriorating

Previous assessments reported that the population of mammals, especially in Lake Nakuru National Park has always been periodically estimated by the KWS scientists, but that this had not been done effectively for the areas surrounding Lake Elmenteita and Lake Bogoria (UNEP-WCMC, 2012). In Lake Nakuru National Park, there has been a steady increase in numbers of most prominent species (IUCN, 2011) with some species populations even exceeding the area's carrying capacity and therefore they had to be transferred to other parks since the high number may cause habitat damage (Birdlife, 2012a). However, translocation is clearly not working as KWS recently reported buffalo numbering over 6-times the carrying capacity of the park (KWS/NMK, 2020). The number of zebra in the Soysambu conservancy has long been a challenge. The problems facing KWS are the restrictions on "utilisation" of wildlife.

The last 40 years have seen a consistent decline in wildlife numbers in Kenya as well as diversity, with the large animals having declined 68%, a trend that is continuing for a range of factors including habitat loss, inadequate institutional and technical capacities, and insufficient regulations to devolve user rights to landowners with wildlife (CWU, 2019). The concept of consumptive wildlife utilization (CWU) is poorly

understood in Kenya, and often presumed to be trophy hunting or bush meat poaching. But the role that consumptive and non-consumptive wildlife uses play in the national wildlife strategy in Kenya will be expanded and bird shooting will be re-introduced, and devolved wildlife conservation and CWU are envisaged on private lands and community conservancies (CWU, 2019).

Summary of the Values

► Assessment of the current state and trend of World Heritage values

High Concern
Trend: Deteriorating

The values of the World Heritage sites are facing increasing threats. Urban development and electricity line construction are visually intruding on the aesthetics of site as well threatening the migration flyway for birds. Likely increases in water demands will cause water levels to drop in the lakes during dry periods but on the other hand, recent high rainfalls have resulted in unprecedented lake levels that creates extreme environmental conditions and the impacts on the lesser flamingos and other birds need further research. Variability in water levels affect the salinity and alkalinity of the lakes. Whilst some mammal species are far exceeding the carrying capacity of the site, many other species have seen a consistent decline.

Additional information

Benefits

Understanding Benefits

► History and tradition, Wilderness and iconic features, Sacred natural sites or landscapes, Cultural identity and sense of belonging

Lake Bogoria is culturally connected to the Endorois community who associate it with their origin.

Hot springs in Lake Bogoria are believed to have healing value and the Endorois and other communities are known to visit these 'spa-like' springs.

Factors negatively affecting provision of this benefit :

- Climate change : Impact level - Low, Trend - Continuing
- Pollution : Impact level - Low, Trend - Continuing
- Overexploitation : Impact level - Low, Trend - Continuing
- Invasive species : Impact level - Low, Trend - Continuing
- Habitat change : Impact level - Low, Trend - Continuing

Due to increase in water level in the last four years, the hot springs have been inundated and are no longer accessible or visible, hence affecting this important cultural value.

Visitors to the sites have tended to litter the site with plastic bottles and bags thus polluting the habitat.

The "climate change" impact is unpredictable, but the effect of the high water level in the last four years has caused tremendous changes in the lake, especially by flooding the hot spring sites and affecting the water quality and the ecology of the lake, with few lesser flamingoes being seen in the lake.

► Carbon sequestration, Water provision (importance for water quantity and quality), Pollination

The site shows very high primary productivity through the dominant blue-green algae *Arthrospira*

fusiformis through which carbon is withdrawn from the atmosphere/water.

Through the springs, water is made available, especially in Lake Bogoria that is used by livestock.

In Lake Bogoria, bee-keeping is another major activity and the vegetation in the protected area, especially the Acacia trees aid in keeping the bees and contributing to the beekeeping venture.

Factors negatively affecting provision of this benefit :

- Climate change : Impact level - Moderate, Trend - Continuing
- Pollution : Impact level - Low, Trend - Continuing
- Overexploitation : Impact level - Low, Trend - Continuing
- Invasive species : Impact level - Moderate, Trend - Decreasing
- Habitat change : Impact level - Moderate, Trend - Continuing

The environmental services offered are threatened by the changing hydrological patterns epitomised by the rising lake levels

► **Tourism-related income, Provision of jobs**

Tourism opportunities offer income through the neighbouring communities selling their merchandise to the tourists. It also assists in provision of jobs such as tour guides to the community as well as in the management of the parks. This is especially so for Lake Bogoria where the people manning the park are generally drawn from the local community.

Factors negatively affecting provision of this benefit :

- Climate change : Impact level - Low, Trend - Continuing
- Pollution : Impact level - Low, Trend - Continuing
- Overexploitation : Impact level - Low, Trend - Continuing
- Invasive species : Impact level - Low, Trend - Continuing
- Habitat change : Impact level - Low, Trend - Continuing

The factors have minimal effect to the benefit type associated with the site.

► **Collection of medicinal resources for local use, Outdoor recreation and tourism, Natural beauty and scenery**

In Lake Bogoria, the Endorois community collect herbal medicine from the vegetation within the Reserve. The hot springs and the mud from the lake are also used for medicinal purposes especially in the treatment of skin diseases.

Hot springs are especially used for outdoor recreation and are one of the major tourist attractions in the lake.

Factors negatively affecting provision of this benefit :

- Climate change : Impact level - Moderate, Trend - Increasing
- Pollution : Impact level - Low, Trend - Continuing
- Overexploitation : Impact level - Low, Trend - Decreasing
- Invasive species : Impact level - Low, Trend - Continuing
- Habitat change : Impact level - Low, Trend - Continuing

There are no significant data to establish how these factors may be affecting the stated benefit type.

Summary of benefits

The site has a lot of benefits that both the local and international communities derive. This therefore calls for proper management so that humanity may sustainably benefit even in the future.

Projects

Compilation of active conservation projects

No	Organization	Project duration	Brief description of Active Projects
1	National Museums of Kenya/Kenya Wildlife Service/Nature Kenya		Annual Water fowl count - every January and July
2	Kenya Forest Service		Rehabilitation of Mau Forest
3	Water Resources Authority		Monitoring lake levels and river discharges
4	Soysambu Conservancy		Major stakeholder in GLECA; Managing the major part of the Elmenteita buffer zone; Engaged in ecological monitoring, wildlife counts, bird counts, habitat conservation, community engagement

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