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SWP SUSTAINABLE WATER PARTNERSHIP

WATER RESOURCES PROFILE SERIES

The Water Resources Profile Series synthesizes information on water resources, water quality, the water-related dimensions of climate change, and water governance and provides an overview of the most critical water resources challenges and stress factors within USAID Water for the World Act High Priority Countries. The profile includes: a summary of available surface and groundwater resources; analysis of surface and groundwater availability and quality challenges related to water and land use practices; discussion of climate change risks; and synthesis of governance issues affecting water resources management institutions and service providers.

Kenya Water Resources Profile Overview

Water resources are stressed and unevenly distributed throughout Kenya, with approximately 85 percent of the country classified as arid or semi-arid. Overall, 33 percent of Kenya's water resources originate outside of the country. Water stress[i] is high as the total volume of freshwater withdrawn by major economic sectors amounts to 33 percent of the total resource endowment[i] and total annual renewable water resources per person is only 617 m^3, below the Falkenmark Water Stress Index[ii] threshold for water scarcity.

Climate change will compound high inter-seasonal variability through increased precipitation and more frequent and intense floods. Studies suggest that Kenya will experience net hydrological gains from increased precipitation, although droughts are also projected to increase.

Five major hydropower dams on the Tana River that also support irrigation have decreased wet season flows to downstream wetlands. Development plans outline additional dams and expanded irrigation to reduce poverty and improve resiliency to drought, which could result in over-abstraction of surface water and impact downstream water users and ecosystems.

Agricultural development and widespread deforestation in the central highlands contribute to increased siltation, sedimentation, turbidity, and runoff into downstream watercourses and reduce recharge needed to sustain base flow rates of rivers, particularly in the Lake Victoria Basin, which accounts for more than half of Kenya's freshwater.

Over abstraction of the Nairobi (Tana Basin) and Merti (Ewaso Ng'iro Basin) aquifers due to poor regulation and concentrated demand for domestic and public water supply have lowered water tables. Nationally, groundwater is underdeveloped, with approximately one-quarter of total renewable groundwater currently exploited.

Groundwater quality issues are not well understood. Saline groundwater has been detected in the northwestern Turkana region, coastal aquifers, and the Merti Aquifer. High concentrations of naturally occurring fluoride have also been detected in parts of the Nairobi Aquifer and throughout the Rift Valley. Pathogenic contamination and high nitrate levels caused by the infiltration of agricultural runoff and poor sanitation systems have been detected in shallow aquifers along the coast and near Lake Victoria.

Water resource management responsibilities have been devolved to provincial and county-level authorities, however, overlapping roles and responsibilities, institutional capacity constraints, and funding shortfalls contribute to sector coordination challenges and impede sound water management.

[i]SDG 6.4.2 measures water stress as the percentage of freshwater withdrawals against total renewable freshwater resources. The water stress thresholds are: no stress <25%, low 25%-50%, medium 50%-75%, high 75%-100%, and critical >100%.

[ii]The Falkenmark Water Stress Index measures water scarcity as the amount of renewable freshwater that is available for each person each year. A country is said to be experiencing water stress when water availability is below 1,700 m^3 per person per year; below 1,000 m^3 is considered water scarcity; and below 500 m^3 is absolute or severe water scarcity.

WINROCK INTERNATIONAL · TETRA TECH · IUCN · mWater · SEI Stockholm Environment Institute · World Resources Institute · The CEO Water Mandate

Water Resources Availability

KEY TAKEAWAYS

- Most of Kenya is arid or semi-arid and three-quarters of all surface water originate in the central highlands. Lake Victoria and the Tana River, which is the longest in Kenya, are the two main surface water bodies.
- The highest-yielding aquifers are in the Rift Valley, Athi, Tana, and Ewaso Ng'iro Basins, although recharge rates are often very low in the arid and semi-arid zones.

This section summarizes key characteristics of surface and groundwater resources. Table 1 summarizes key water resources data and Figure 1 presents key surface water resources, wetlands, and dams.

Surface Water Resources

Five basins account for 90 percent of Kenya's total annual renewable supply. An estimated 75 percent of surface water originates as precipitation runoff from five "water towers" in central and western Kenya.[5] The Lake Victoria Basin is the most productive, accounting for 59 percent of surface water and 54 percent of total renewable freshwater. It features several important but relatively short rivers that drain into Lake Victoria, including the Nzoia, Yala, Nyando, Sondu, and Gucha.[6] Lake Victoria is the largest lake in Africa, spanning the borders of Kenya, Uganda, and Tanzania. Over 80 percent of Lake Victoria's renewable water supply is from direct precipitation, while rivers and streams originating in Kenya and Tanzania account for the rest.[7,8] The Tana River Basin supplies 19 percent of freshwater resources and includes the Thika River, which is a key source of water for Nairobi. The Tana River is the longest in Kenya and flows 1,050 kilometers southeast from the Aberdare mountains and Mt. Kenya through arid and semi-arid lands before discharging into the Indian Ocean. The Rift Valley Basin is an internal drainage basin with no outlets. Its headwaters are in the Mau Forest Complex and it accounts for 14 percent of Kenya's surface water, and includes Lake Turkana, the world's largest permanent desert lake, and Baringo, Naivasha, and Magadi, which range from fresh to brackish to saline. The Athi River Basin accounts for less than 6 percent of Kenya's surface water and extends southwest from Nairobi through the Athi River, which ultimately drains into the Indian Ocean north of Mombasa. The Ewaso Ng'iro Basin covers 36 percent of Kenya in the northeast but only accounts for two percent of the country's surface water resources.

Groundwater Resources

Renewable groundwater constitutes less than 12 percent of total renewable supply.[1] Most boreholes are located in central, southwestern, and southeastern Kenya along

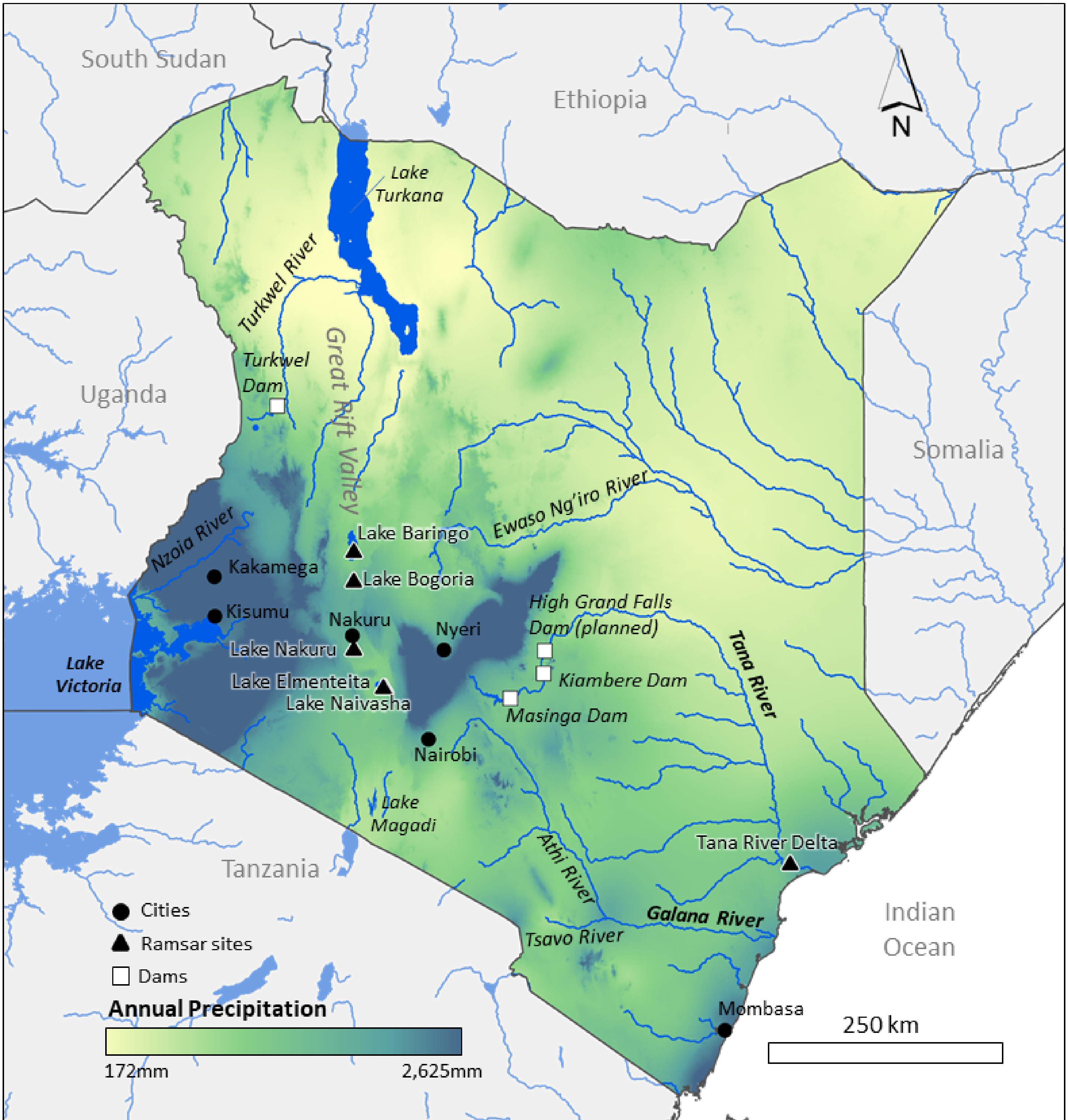
TABLE 1. WATER RESOURCES DATA

	Year	Kenya	Sub-Saharan Africa (median)
Long-term average precipitation (mm/year)	2017	630	1,032
Total renewable freshwater resources (TRWR) (MCM/year)	2017	30,700	38,385
Falkenmark Index - TRWR per capita (m3/year)	2017	618	2,519
Total renewable surface water (MCM/year)	2017	30,200	36,970
Total renewable groundwater (MCM/year)	2017	3,500	7,470
Total freshwater withdrawal (TFWW) (MCM/year)	2002	4,032	649
Total dam capacity (MCM)	2015	10,188[iii]	1,777
Dependency ratio (%)	2017	32.57	22.78
Interannual variability	2013	3.2	1.55
Seasonal variability	2013	1.9	3.15
Environmental Flow Requirements (MCM/year)	2017	18,570	18,570
SDG 6.4.2 Water Stress (%)	2002	33.24	5.70

Source: FAO Aquastat

[iii] This excludes the theoretical storage potential of the Owen Falls Dam in Uganda, which would increase national storage by raising Lake Victoria's water level, as the Dam currently operates as a run-of-the-river hydropower plant.

FIGURE 1: MAP OF WATER RESOURCES



Source:
Cities: World Cities – ArcGIS Hub, **Country Borders:** GADM, **Dams:** FAO Aquastat Dams Database, **Ramsar Sites:** Ramsar Sites Information Service, **Lakes and Wetlands:** WWF - GLWD (Level 1), **Rivers:** WWF – HydroRivers, **Precipitation:** WorldClim, **Flood and Drought:** WRI Aqueduct 2019

the coast, however, groundwater is critical in the arid and semi-arid areas where surface water is less available, including the Ewaso Ng'iro Basin and the northwestern Turkana County.[3] Groundwater salinity in shallow aquifers is high throughout drought-prone Turkana County,[9] however, recent studies have identified large deep aquifer systems that hold approximately 250,000 million cubic meters (MCM). Initial testing indicates that these aquifers have naturally high salinity that may render them unusable for agriculture and domestic use.[10,11]

Kenya's highest-yielding aquifers are the often-confined volcanic rocks underlying the Rift Valley and Nairobi, and in unconfined sedimentary formations in the Athi, Tana, and Ewaso Ng'iro Basins.[12] Complex volcanic aquifers, especially the Nairobi Aquifer, are deep and semi-confined, and underlay shallower, unconfined sedimentary layers. This creates highly variable well yields as well as thickness, depth, and artesian pressure.[13] Aquifers in the Lake Victoria Basin have less total water supply due to their smaller size. Recharge rates, however, are high at approximately 30 percent.[6] Boreholes are deep in most locations, with the average depth ranging between 50 and 150 meters (m) across all provinces, although more shallow aquifers can be found in the coastal plains in the east, near Lake Victoria, and in alluvial fans along rivers.[13]

Surface Water Outlook

KEY TAKEAWAYS

- Approximately 80 percent of total water demand is met by surface water. Irrigation constitutes almost half of total surface water demand in the Athi and Tana Basins while withdrawals for domestic consumption and industrial use account for the rest.
- Surface water demand for irrigation in the Athi and Tana Basins account for half of national surface water use and may soon exceed renewable supply in the basins. Plans to increase irrigation could lead to a 10-fold increase in surface water use.
- Dams on the Tana River generate hydroelectricity and support irrigation, but poor regulation and storage management reduces flow for downstream users and threatens wetland ecosystems in the Tana River Delta.
- Naturally occurring minerals and human activities have reduced surface water quality. Deforestation and soil erosion in the water towers have increased turbidity, sedimentation, and flooding, and are reducing overall storage capacity in Lake Victoria and Lake Naivasha. Sediment levels have also increased 15-fold since the 1970s in the Ewaso Ng'iro and Tana Rivers. Agricultural runoff and untreated industrial effluents has led to eutrophication in the Athi River and its tributaries, as well as Lake Victoria.

This section describes key sources of demand and uses of surface water, and associated challenges stemming from water availability and water quality challenges.

National irrigation goals could increase stress on surface water by 2030. Kenya's 2010-2030 National Water Master Plan (NWMP) proposes a fivefold increase in irrigated cropland, which represents a tenfold increase in demand.[3,15] This would account for 80 percent of renewable water supply.[3] Over-abstraction from irrigation already threatens the sustainability of surface water in the Tana Basin and Lake Naivasha, one of only two freshwater lakes in the Rift Valley Basin. Commercial floriculture and high-value horticulture farms irrigate 2,756 hectares, abstracting 59.8 MCM/year from the Malewa and Gilgil Rivers, which are the main sources of inflow to Lake Naivasha. Lake Naivasha, which has nearly dried up during recent droughts, is projected to decline by three meters as a result of these abstractions.[21–23]

Reservoirs on the Tana River have reduced wet season flows to the Tana River Delta and reduced sediment load needed to rejuvenate soils and sustain agriculture and ecosystems. Five dams on the Tana River produce 60 percent of Kenya's hydroelectric power.[16] The Tana River Delta, which is a Ramsar site, supports livestock and crop irrigation and is almost entirely dependent on upstream flows to maintain wetland coverage. The dams have increased minimum flows by 40 percent during the short rainy season and decreased maximum flows by 20 percent during the long rainy season.[16,18] Sediment load to the delta has declined by more than half, degrading soil and ecosystem health.[16] The planned High Grand Falls Dam on the lower reaches of the Tana River would be Africa's third-largest dam with a capacity of 5,600 MCM and could more than double irrigated cropland. The High Grand Falls Dam, however, could further deplete downstream flows, which would impact mangrove forest habitats and pastoral and fishing livelihoods around the Tana Delta.[19]

Total water demand is expected to exceed renewable supply in the Athi and Tana Basins by 2030. The Athi Basin, which supplies Nairobi and Mombasa, is already stressed and inter-basin transfers from the Tana River are required to meet demand. The Tana Basin's maximum transfer capacity is 181 MCM/year, namely through the Thika and Sasumua Dams in the upper Tana. Water conveyed from the Tana Basin is equivalent to 90 percent of Nairobi's water supply[24] and covers most demand in the Athi Basin.[25] However, the populations of Nairobi and Mombasa are projected to increase by three million by 2030, which will double domestic water demand to 941 MCM/year.[3,26]

Solid waste, sewage, and industrial effluent contribute to high levels of biological oxygen demand (BOD), heavy metals, and bacteriological contamination, particularly on the Athi River and its tributaries. High BOD levels, indicating significant pollution from organic matter, have been measured in the Ngong and Nairobi Rivers.[28,29] Traces of heavy metals such as cadmium, chromium, zinc, lead, and copper also exceed national and WHO guidelines.[28,30] E. coli concentrations also exceed national and WHO guidelines for human consumption and irrigation of certain crops in the Nairobi River, which is used by over three million people and for irrigating 44,000 hectares of farmland.[3,31] E. coli has been sourced to the Dandora Sewage Treatment Plant outside of Nairobi.[31] Contaminant loads from agricultural and industrial wastes are high and progressively increase on the lower reaches of the Athi River.[32]

Inflows of untreated industrial effluent, wastewater, and agricultural runoff have reduced water quality and caused mass fish die-offs in Lake Victoria. The Nzoia River, the largest inflow from Kenya into Lake Victoria, carries effluents discharged from paper mills, sugar factories, breweries, tanneries, slaughterhouses, and other industries.[33] Raw sewage from Kenya's third-largest city, Kisumu, is dumped directly into the lake, and fertilizer runoff from 1.47 million hectares of surrounding farmland have contributed to eutrophication, algal blooms, and invasive hyacinth outbreaks.[34] This has resulted in prolonged anoxic dead zones, a fivefold increase in algal biomass since the 1960s, and water supply reductions due to clogged intakes.[34] Eutrophication in Lake Victoria has caused massive fish die-offs[35] and a recent study found that 76 percent of endemic freshwater species in the Lake Victoria Basin are under threat of extinction.[36]

Gold mining in the Lake Victoria Basin threatens water quality with heavy metals, especially mercury. Artisanal gold mining, namely in the Lake Victoria Basin, provides livelihoods for over 40,000 people.[37] Heavy metal contamination in excess of WHO guideline values for drinking water, including cadmium, lead, arsenic, and mercury, has been detected downstream of the Migori Gold Belt. Maximum mercury values were found to exceed guidelines values ninefold in surface waters flowing to Lake Victoria.[38]

Groundwater Outlook

KEY TAKEAWAYS

- Groundwater is underutilized relative to surface water, although it is an important source for domestic water, with most abstractions occurring in the Athi and Rift Valley Basins.
- Concentrated pumping and over-abstraction have depleted the Merti (Ewasgo Ng'iro Basin) and Nairobi (Tana Basin) aquifers. Over-exploitation of the Nairobi Aquifer has reduced the Athi River's base flow rate. Over-exploitation has also increased groundwater salinity in some aquifers.
- High groundwater salinity has been detected throughout northwestern Turkana County, along the coast, and in the eastern Merti Aquifer. High fluoride levels have restricted groundwater development and pose public health risks in northern Kenya, throughout the Rift Valley, and in the Nairobi Aquifer.
- Infiltration from agricultural runoff and poor sanitation have led to high concentrations of nitrate and pathogenic contaminants in shallow aquifers.

This section describes key sources of demand and uses of groundwater, and associated challenges stemming from water availability and water quality challenges.

Groundwater is predominantly used for domestic needs and irrigation, although there is low risk of over-abstraction. Only 950.9 MCM of the estimated total renewable 3,500 MCM/year is utilized annually.[1,14] Groundwater accounts for 15 percent of all irrigation withdrawals, mostly in the Rift Valley Basin, although the NWMP projects that 8 percent of new irrigation coverage by 2030 will depend on groundwater. Groundwater is the primary resource for domestic supply for water users not served by public water systems in all basins except the Tana and the Ewaso Ng'iro.[14] Public and domestic water supply in the Athi Basin and irrigation in the Rift Valley Basin account for approximately 60 percent of all groundwater withdrawals.[14]

Unsustainable groundwater abstraction from the Nairobi Aquifer is causing the water table to fall and is reducing base flow rates in downstream reaches of the Athi River. The Nairobi Aquifer is the most abstracted groundwater source in Kenya and exploitation rates (58

MCM/year) exceed sustainable yield (37.4 MCM/year).[39,40,iv] Studies suggest that the water table underlying Nairobi has declined six meters per decade (four meters across the regional aquifer). The Athi River's base flow rates have also declined nine percent since the 1950s due to the interconnectivity of surface and groundwater systems.[40] The average depth of boreholes is already quite high (about 150m) due to overexploitation of shallow aquifers. In fact, the government recommends that new wells should drill about 300m to protect the upper aquifer.[13,40]

Groundwater abstraction from the Merti Aquifer within the Ewaso Ng'iro Basin is reaching unsustainable rates due to population growth. The Merti Aquifer is commonly exploited for livestock, domestic needs, and to sustain large refugee camps in the Dadaab area. Abstraction rates (5.3 MCM/year) exceed the aquifer's recharge rate (3.3 MCM/year), which will create sustainability challenges in the long-term as the Merti Aquifer is predominantly non-renewable fossil water.[39,v] Total water demand in the Ewaso Ng'iro Basin is projected to increase 13-fold by 2030, which will increase projected use of groundwater to 40 percent of renewable supply.[3,39]

Groundwater quality is predominantly affected by naturally occurring fluoride, high salinity, and are contaminated by agricultural runoff and poor sanitation. Collectively, these can limit the development and use of groundwater for domestic use as well as certain livelihoods.

Naturally high fluoride in groundwater is common throughout Kenya, and public health risks are particularly high in northern Kenya, the Rift Valley Basin, and the Nairobi Aquifer. Tests indicate that naturally occurring fluoride may be widespread.[41] Boreholes in the Nairobi Aquifer and in Nakuru County in the Rift Valley have recorded fluoride concentrations well above the WHO and national standard guidelines values.[29,42,43] The prevalence of dental fluorosis, which is caused by high fluoride consumption, is estimated to affect 79 percent of the population in this in the Rift Valley.[43] In general, comprehensive water quality mapping is needed to better understand fluoride concentrations, which can be highly variable within and across aquifers.

Sedimentary aquifers in the east, along the coast, and in the northwest have high salinity and total dissolved solids attributed to natural sources and over-abstraction. Total dissolved solids (TDS) in the coastal provinces are well above the WHO's guideline values, with some aquifers showing signs of seawater intrusion caused by over-abstraction.[13,44] Concentrated pumping in the Daadab refugee camps has altered groundwater flow resulting in the mixing of freshwater reserves with saline zones in the Merti Aquifer.[45] In northwestern Kenya, many of the recently discovered aquifers cannot be feasibly exploited for human consumption or agriculture due to naturally occurring salinity.[10,11] The government has plans to build a groundwater desalination plant in Turkana County.[3,46]

Agricultural runoff and poor sanitation systems contaminate shallow groundwater resources with nitrates and pathogens. Unlined pit latrines and soak away pits, which are common in peri-urban and rural areas, have introduced bacteriological contamination and organic compounds into shallow, unconfined aquifers.[47] One study conducted in the urban and peri-urban areas of Kisumu in the Lake Victoria Basin found that pit latrines with an average depth of four meters were interspersed with shallow, poorly protected wells. Coliform bacteria were consistently detected in well samples, in addition to elevated levels of nitrates, chlorides, and other chemical contaminants.[48] In rural areas such as the Kano Plains outside of Kisumu, manure and fertilizer have also increased nitrate concentrations in shallow wells.[49]

Water Resources and Climate

KEY TAKEAWAYS

- Inter-seasonal water availability is high during long (March-May) and short (October-December) wet seasons. Naturally high inter-annual variability in precipitation and La Niña-driven droughts will continue to threaten rainfed agriculture and pastoralists, despite increased precipitation caused by climate change.
- The frequency and severity of flooding is projected to increase due to increased rainfall intensity, threatening livelihoods, infrastructure, and populations nationwide.

This section covers the climate variability and climate change, their impacts on water availability and water quality, and the risks they pose to local communities and their economies.

Climate change is affecting precipitation patterns and increasing temperatures. Average annual precipitation is only 630 mm, the lowest in East Africa,[1,4] and is only 200 mm in the northeast arid zones compared to 1,800 mm in the humid zones around Lake Victoria, in the highlands, and along the Indian Ocean. Kenya has a

[iv] Recharge rate is 109 MCM/year (World Bank). Based on WRMA's assumption that sustainable yield is conservatively 10 percent of the recharge rate. See WRMA 2010 and Meyland 2011.
[v] Fossil water is nonrenewable groundwater often found in deeper geologic layers and derives from precipitation in prehistoric eras.

long rainy season from March–May and short wet season from October–December. Climate change is expected to raise average temperatures by 1.2-2.2 °C by 2050[50] and annual precipitation will increase between five to six percent, with more precipitation in the short rainy season (October-December).[51] Over the past four decades, total rainfall during the long rainy season has declined in parts of eastern Kenya, whereas short wet season precipitation rates have increased in western and northwestern Kenya.[52] Most emissions scenarios indicate that precipitation increases will exceed higher evaporation rates and result in net hydrological gains, although the frequency of extreme drought will also increase.[51,53]

Climate change is expected to increase the frequency of extreme droughts, posing significant threats to livelihoods and food security. Kenya is naturally prone to drought due to high inter-seasonal and inter-annual variability, with recent severe droughts in 2010-2011, 2016-2017, and in 2019 driven by La Niña.[1,54,55] Kenya is particularly vulnerable to drought due to the prevalence of rainfed agriculture and because 60 percent of livestock are in arid and semi-arid lands. The impacts of the 2019 severely impacted over 3 million people, particularly in the northwestern Turkana Region where up to 25 percent of the population experienced malnutrition.[56]

Increased precipitation and intense storms due to climate change will contribute to frequent and severe flooding nationwide. Climate change is projected to increase extreme rainfall events between seven and 30 percent later this century.[51] Heavy rainfall events, coupled with land use changes and development, cause damaging floods that worsen soil erosion, lead to siltation of watercourses, threaten infrastructure and human life, spread water-borne diseases, and cause economic losses.[57] Record rains in late 2019 caused extensive flooding and landslides in 36 out of 47 counties, displaced more than 161,000 people, destroyed more than 8,000 hectares of agricultural land, spurred a cholera outbreak, and created ideal breeding conditions for desert locusts.[58,59]

FIGURE 2: DROUGHT RISK

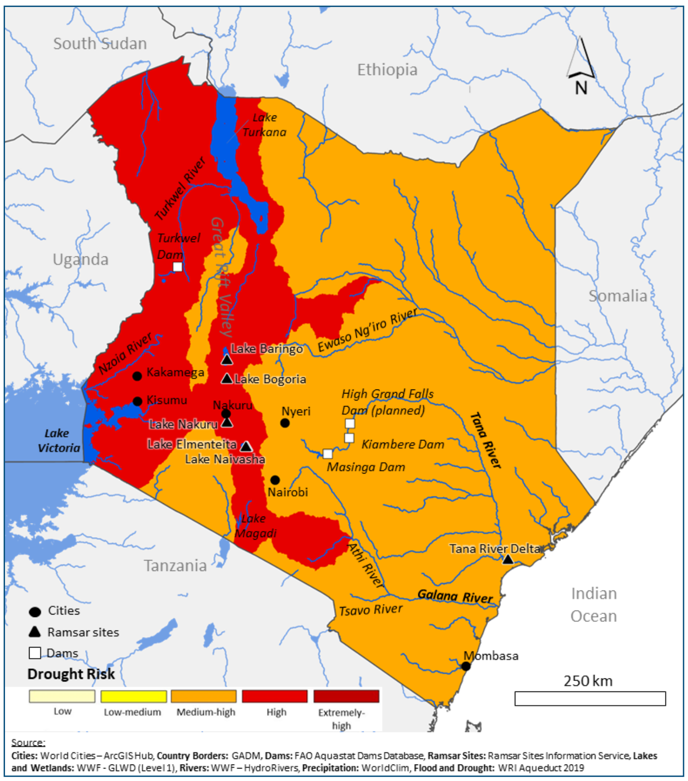
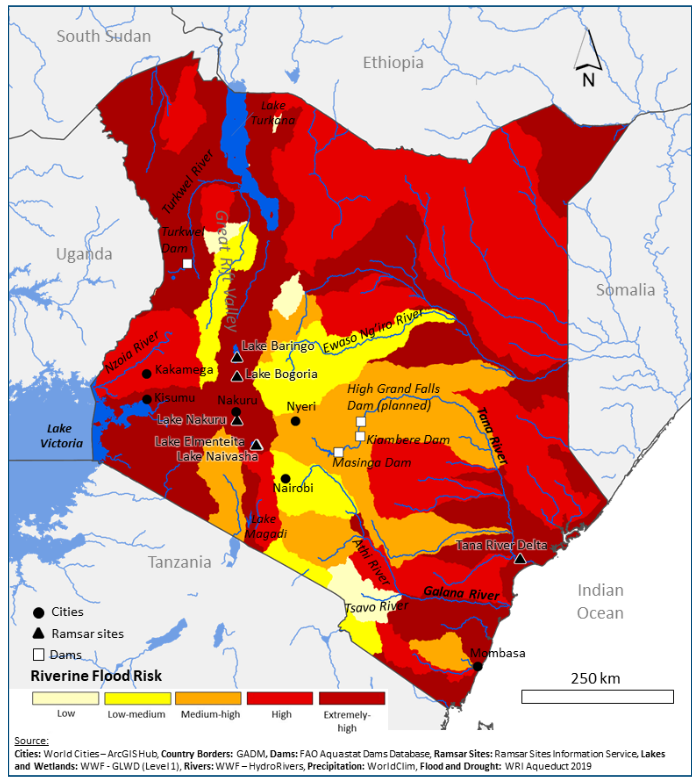


FIGURE 3. RIVERINE FLOOD RISK



Water Policy and Governance

KEY TAKEAWAYS

- Sector fragmentation and poor coordination, limited funding, and slow progress in the establishment of new WRUAS have impeded strategic planning objectives for basin management and hydraulic development. Limited implementation of basin management plans has contributed to land uses that reduce water quality and limited application of environmental mitigation measures.
- Sectoral actors often have overlapping mandates and inconsistent priorities, standards, and targets that affect efforts to coordinate basin management.
- The WRA and NEMA lack the financial and institutional capacity to consistently enforce their water quality monitoring protocols, which are needed to prevent the direct discharge of industrial effluents.

This section provides an overview of key policies, institutions, and management challenges. Key laws, policies, and plans are summarized in Table 2 and the roles and responsibilities of select transboundary, national, and sub-national water management entities are summarized in Table 3.

TABLE 2. KEY LAWS, POLICIES, AND PLANS

Name	Year	Purpose
The Water Act	2016	Establishes the regulatory structure for water resources management, defines stakeholders' responsibilities at the national, basin, and county level, and establishes Basin Water Resource Committees (BWRC).
Water Resources Authority Strategic Plan (2018-2022)	2019	Key operational planning document for the Water Resources Authority (WRA) detailing organizational objectives, activities, resource needs, and monitoring and evaluation approaches during the 2018-2022 timeline.
National Environment Policy (NEP)	2013	Establishes governmental responsibilities for water quality protection, including the development of basin management plans, emphasizing wetland protection, and espouses user and polluter-pays principles.
National Water Master Plan (NWMP)	2014	Creates detailed national level plan for development and use of water resources through the 2030 timeframe.

Implementation of water policy is inhibited by low organizational and technical capacity, monitoring and enforcement capabilities, and funding. Following the adoption of the 2010 constitution, Kenya devolved water management responsibilities from the central government to counties and basin-level institutions. The WRA leads water resources policy implementation through a decentralized management structure. The WRA has developed six Catchment Management Strategies (CMS) areas across five hydrological catchments (Lake Victoria is administratively divided between north and south), which detail plans for data collection methodologies, water allocation plans, and public participation. The WRA often lacks resources and monitoring and enforcement mechanisms needed to oversee implementation of the plans.[62] WRUAs are meant to play an important role in local management of water resources through implementation of Sub-catchment Management Plans (SCMPs).[61] However, only 670 out of 1,237 proposed WRUAs have been established due to resource and capacity constraints within BRWCs, impeding implementation of CMSs at the sub-catchment level. Additionally, WRUAs rely on membership dues, income-generating activities designed to increase participation and ownership, and the national Water Services Trust Fund (WSTF). However, only 150 WRUAs have secured funds from the WSTF. The WRA's Strategic Plan calls for increasing its annual budget by 40 percent, or approximately $40 million, from the government of Kenya, public-private partnerships, and development assistance in order to meet water management goals.[61]

Overlapping mandates and non-uniform basin management standards for regulators, service providers, and government ministries and agencies impede sector coordination. The WRA regulates the use of surface and groundwater whereas the National Water Harvesting and Storage Authority (NWHSA), which was established by the 2016 Water Act, develops public water projects for water harvesting, infrastructure, storage, and flood and drought control. The NWHSA, which is a statutory institution of MWSI, does not always coordinate water permits with the WRA.[3] The WRA's 2018-2022 Strategic Plan notes that the water sector's legal and regulatory frameworks and enforcement mechanisms need to be strengthened to address these challenges and implement the Water Act.

TABLE 3. WATER RESOURCES MANAGEMENT ENTITIES

Mandate	Institution	Roles and Responsibilities
Transboundary	Lake Victoria Basin Commission (LVBC)	Transboundary commission under the East African Community, represented by Kenya, Uganda, Tanzania, Rwanda, and Burundi. Coordinates water resources management and policy towards economic development goals.
	Nile Basin Initiative (NBI)	International partnership consisting of 11 countries within the Nile Basin, which encompasses the Lake Victoria Basin as part of its upper watershed. Coordinates basin development through a Council of Ministers, Technical Advisory Committee, and Secretariat.
National	Ministry of Water, Sanitation and Irrigation (MWSI)	Sets policy on Integrated Water Resources Management (IWRM) and water services, develops national level plans and strategies for the water sector, and coordinates sectoral actors and investments.
	Water Resources Authority (WRA)	State agency under MWSI that designs and enforces standards and regulations for the protection and management of water resources at the catchment-level, including flood mitigation and conservation. Manages six regional and 26 sub-regional offices nationwide. Sets fees and distributes permits for water use and abstraction. Oversees regional Basin Water Resource Committees (BWRC).
	National Environmental Management Authority (NEMA)	Licenses and monitors permit compliance for effluent discharge.
	Water Tribunal	Highest-level judicial body to resolve water disputes, supported by branch offices nationwide.
Sub-national	Basin Water Resource Committees (BWRC)	Manage water resources in each basin by convening stakeholders from the WRA, agriculture, business, and civil society. Advise WRA officials of local needs concerning water resource management, water use, and conservation issues. Submits annual reports and basin area water resources management strategies to WRA. Establish and support county-level Water Resource User Associations (WRUAs).
	Water Resource User Associations (WRUA)	Manage water resources at sub-basin level. Resolves local-level disputes over water access and management.

Water Quality Monitoring

Limited funding and data collection and monitoring challenges impede surface and groundwater quality monitoring systems. The WRA is responsible for monitoring ambient surface and ground water quality. Limited funding, however, has resulted in irregular water quality assessments and functionality issues with telemetric monitoring equipment, which are subject to vandalism, exposed to floods, and not well maintained. As of 2017, only 69 percent of 274 surface water monitoring stations and 61 percent of 140 groundwater stations were operational. From these, only an average of 28 percent of available water quality data was actually transmitted.[14] Further, the data obtained from these stations is often limited, with measurements occurring infrequently and only for limited parameters such as pH, temperature, conductivity, and salinity.[14] WRA and the National Environment Management Authority (NEMA) share responsibilities for monitoring the water quality of effluent discharge through environmental inspections. Both NEMA and WRA may conduct water quality testing to verify self-reporting from permit holders, however, effluent monitoring and enforcement is not conducted systematically by licensees, NEMA, or WRA.

Water Service Providers (WSPs) are primarily responsible for monitoring drinking water quality, which were established by the national Water Services Regulatory Board (WASREB). However, many WSPs lack water safety plans and the frequency and sampling protocols vary significantly. WASREB published guidelines for water safety plans in 2019 that, if implemented successfully, will contribute to standardization and more rigorous monitoring of drinking water quality by the WSPs.

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