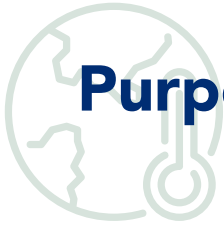




# Climate Risk Assessment: Limuru Water and Sewerage Company (LWSC)



# Purpose & Scope

This climate risk assessment is prepared for **Limuru Water and Sewerage Company (LWSC)** as part of the Water Resilience Solutions Hub (WRSB), a facilitated collaboration platform connecting Kenyan and Ugandan water utilities with WASH innovations to build climate resilience. Its purpose is to translate the utility's operational experience of climate-related stress into a structured, shared evidence base. This is meant to ground the subsequent enterprise matchmaking and co-design phase in concrete, prioritized challenges that build on the realities of the WSP.

The assessment is bounded to LWSC's own service area, assets and operations within the current planning horizon, and draws on operational data, staff input and site observations rather than a full engineering or hydrological study. The scope covers the utility's operational exposure to climate challenge areas, distinguishing climate symptoms from root causes to provide pointers towards potential types of solutions. Based on the engagement with the WSP it further identifies entry points for short- and longer-term mitigation options and potential for collaboration with WASH enterprises and innovators.

## How the assessment will be used

The assessment is meant to provide LWSC with a structured climate risk assessment and will be shared with WASH enterprises as the basis for them to develop concrete engagement ideas: proposals for how their solutions could help LWSC address specific, identified climate challenges.



## PPC under the WRSB

The WRSB seeks to foster Public Private Collaboration (PPC) that goes beyond conventional infrastructure contracting. We are not seeking one-off arrangements in which a private company builds or installs infrastructure, is paid, and the engagement ends there. Instead, we are interested in longer-term collaborations in which WASH enterprises take on an ongoing operational role, assuming delegated responsibility for specific tasks or service areas that currently sit with the utility. What unites these models is that the **enterprise takes on genuine, ongoing operational responsibility, relieving the utility of specific recurring burdens while directly addressing one of its priority climate challenges**. The utility retains overall ownership and oversight, while the private partner brings specialised capacity, technology, or financing to sustain performance over time, rather than delivering a fixed asset and stepping away.

Concretely, this could take a variety of forms depending on a utility's needs and priorities such as the following examples:

- Wastewater treatment could be offered as a service, with an enterprise designing, financing, and operating a treatment facility and being paid for the treatment delivered. This would spare the utility the upfront capital outlay for the plant and the need to build and maintain in-house wastewater treatment expertise, while still securing reliable treatment performance and treated wastewater as an alternative water source to reduce pressure on water supply.
- Pressure or water quality monitoring could be handled through an enterprise's own sensor and data systems, deployed and maintained at the enterprise's expense, while the utility would commit to paying for water quality data. In this way the utility avoids the upfront investment in monitoring equipment, does not need to establish its own procedures and staffing for pressure or quality management, and instead reliably receives the data it needs to monitor pressure surges or declines in water quality to respond to emerging challenges and builds more resilient management of its network.
- A specific network section or district metered area that is exposed to specific climate challenges (landslides, flooding / pressure surges or limited water supply) could be placed under a performance-based contract or delegated management, with an enterprise taking on day-to-day operational responsibility for that zone (covering, for instance, non-revenue water reduction, meter management, or preventive maintenance) so the utility is relieved of an operational burden in that zone without having to expand its own establishment, while benefiting from an operator whose performance incentives are aligned with keeping that section running well.

# System & Setting

## SOURCING

Limuru Water serves Limuru and surrounding areas in Kiambu County. LWSC draws on a diversified but ageing source base of 25 operational boreholes, four of which are solarized, and two dams. One dam is affected by siltation, while the other, surrounded by tea plantations, currently faces no silt problems. In the water-scarce Ndeiya scheme, expansion depends on developing a new, approximately 200 m deep borehole (envisaged yield of 40 m<sup>3</sup>/hour) to lift current production from 45 m<sup>3</sup>/hour toward an estimated demand of over 100 m<sup>3</sup>/hour; output already falls to as little as 24 m<sup>3</sup>/hour by the end of the dry season. Private water vendors operating at prices comparable to the utility's own tariff further point to an unmet demand gap in parts of the service area.

## TREATMENT & WATER QUALITY

Surface water is treated in the Bathi treatment plant through flocculation and rapid sand filtration. Reported water quality has risen from 78% to 97% compliance. Treatment nonetheless relies on high volumes of Alum (between 50 and 115 kg per day during dry and rainy season respectively) reflecting raw water quality pressures at the source. The utility's sand filters are 40 years old and require replacement, a constraint on both treatment reliability and further gains in water quality.

### WSP AT A GLANCE

# of water connections: 14,870

# of sewer connections: ~1,200

**Operating cost coverage:** 92%

**Average Tariff:** 155 KES per m<sup>3</sup>

**Metering ratio:** 100%

**NRW:** 32%

**Collection efficiency:** 96%

**Water Quality:** 97%



## DISTRIBUTION

Limuru delivers water through five water supply schemes, each run by its own scheme manager. Varying conditions across the service area result in uneven service levels: Limuru town enjoys 24/7 supply, while Ndea receives less than 12 hours of supply, at times only two days a week. While most of LWSC's service area can be characterized as rural, Ndeiya's distribution network remains particularly sparse, with one zone at 4 - 6 connections per km of pipe across 600 connections, with a further 200 connection requests pending. Other schemes such as Thigio has 4200 connections. In the mid-term it is assumed that the network in Ndeiya will expand to 2,000 connections, contingent on new source development.

## NRW

NRW stands at 32% overall for FY 2025/2026, with an estimated split roughly 30% physical and 70% commercial losses. NRW rises above 50% in the dry season, particularly in Lari. Although 84 DMAs have been established, NRW management remains largely manual. More than ten DMAs exceed 60% NRW, and at the current pace the utility estimates it would take over three years to bring these down, with no system yet in place to sustain reductions once achieved. Lari is the site of active illegal-connection enforcement, incl. cases of concealed, switchable bypasses. Ndeiya's NRW of 34% is attributed to illegal connections and ageing PVC pipes.

## SANITATION

Limuru town operates a mechanized wastewater treatment plant served by 38 km of sewer and approximately 1,200 sewer connections. The plant runs significantly under capacity, treating around 1,700 m<sup>3</sup>/day against a capacity of 6,500 m<sup>3</sup>/day.





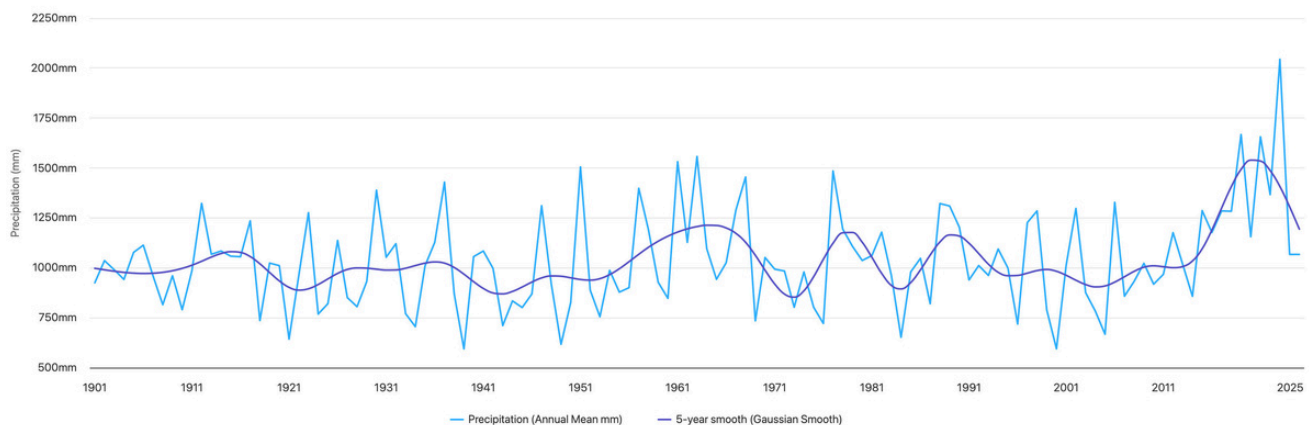
# Climate Context

LWSC's service area lies in Kiambu County's higher-altitude western zone (Limuru, Kikuyu, and Lari sub-counties, parts of Lari reaching 1,800–2,550m), under Kenya's bimodal rainfall regime: long rains March–May, short rains October–December, dry spell July–September. County rainfall ranges 600–1,300mm annually, with higher-altitude areas exceeding 1,000mm. Over 1985–2015, long-rains totals declined slightly while short-rains totals and mean temperatures both trended upward. Lari communities report worsening flooding, landslides, and erosion on its steep terrain; Limuru county reports drainage-linked flooding and deforestation-driven land degradation, consistent with LWSC's own account of turbidity, siltation, and landslide damage in Lari.

Projections point to continued long-rains decline through roughly 2040 before recovery, alongside an intensifying short-rains season (5-day rainfall totals up 6–16mm, raising flood/landslide risk), substantially rising temperatures through 2060, dry spells exceeding 40 days more often by 2040 (worsening scarcity like that seen in Ndeiya), and sharper heat-stress increases in the county's southwest. The Kenya Meteorological Department's October–December 2025 outlook already reflects this pattern: near-to-below-normal short rains overall, but with occasional heavy, landslide-triggering downpours and warmer-than-average temperatures. This reflects the same wet-extreme/dry-extreme volatility expected to define Limuru's climate risk going forward.

Sources: [Kenya County Climate Risk Profile: Kiambu County — CGIAR/CGSpace](#); [Kiambu County Climate Change Action Plan 2023–2027](#); [Kiambu County Participatory Climate Risk Assessment Report, October 2023](#); [Kiambu County OND 2025 Seasonal Weather Forecast — Kenya Meteorological Department](#)

## Observed Timeseries of Annual Precipitation Kiambu, Kenya 1901-2025



Source: Climate Knowledge Portal, World Bank Group; URL: <https://climateknowledgeportal.worldbank.org/country/kenya/climate-data-historical>

# Assessment Summary

## KEY CLIMATE RISKS

Four main climate risks that were prioritized for LWSC ahead of the field visit and were further assessed in the field are:

- Energy costs of KES 5+ M make up around one third of the utility's costs.
- NRW stands at 32% overall, rising to more than 50% during the dry season.
- The scheme in **Ndeiya** is affected by **water scarcity**, due to declining borehole yields.
- **Lari** faces 20–30 **landslide**-related damage instances and **high levels of turbidity**.

Each is addressed in its own section on the following pages.

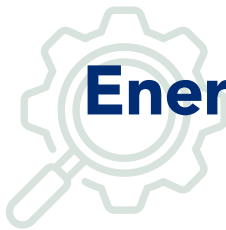
## POTENTIAL ENTRY POINTS

Around the risk various potential entry points for PPC were identified, which are described in the following risk sections:

- Source development, pot. through BOT arrangement w/ a bulk purchase agreement
- Aquifer recharge measures to sustain yields. and reduce costs for new boreholes.
- Digitalizing monitoring & analytics of NRW and water quality.
- Systematizing NRW reduction.

These entry points are indicative and are not meant to be exhaustive and enterprises are encouraged to propose other collaborative solutions.





# Energy Costs & Grid Dependence

|                        |                               |                                                |                                                     |
|------------------------|-------------------------------|------------------------------------------------|-----------------------------------------------------|
| 5.5 M KES              | 40 M KES                      | ~1.1 kWh                                       | 47%                                                 |
| per month paid to KPLC | outstanding debt owed to KPLC | energy used per m <sup>3</sup> of water pumped | of demand at solarized boreholes now met from solar |

Energy has historically consumed roughly a third of Limuru's revenue: the utility used to pay approximately 7 million KES per month to Kenya Power and Lighting Company (KPLC). Initial solarization of 4 boreholes and an overhaul of pumping stations has brought this down to about 5.5 million KES per month. 40 million KES of debt to KPLC remains outstanding, with an agreed payment plan established.

At one of the boreholes visited during the assessment (a 5.5 kW motor pumping 22 hours a day), a planned 7–8 kWh solar system is assumed to be able to cover approximately 7 hours of daily pumping. A solar operator has proposed installing and operating the system, selling energy to the utility at 18 KES/kWh (against 24 KES/kWh for grid power) until the investment is recovered.

On average, pumping 1 m<sup>3</sup> of water uses ~1.1 kWh. At the boreholes that have already been solarized, the utility has managed to cover 47% of energy demand from solar, though these systems have not yet completed a full year of operation.

## NRW: Scale & Detection Gaps

|                           |                                                     |                                          |                    |
|---------------------------|-----------------------------------------------------|------------------------------------------|--------------------|
| 32%                       | ~70%                                                | 84                                       | >10                |
| NRW overall across Limuru | of losses assumed to be commercial, vs 30% physical | DMAs established across the service area | DMAs above 60% NRW |

NRW stands at 32% overall, rising during the dry period to above 50% in some areas, especially Lari. Losses are estimated to split roughly 30% physical and 70% commercial, pointing to illegal connections, poor metering and billing gaps as the larger share of the problem.

The utility has established 84 DMAs, but detection remains manual: daily meter readings are transferred to Excel and analyzed to spot dips, which then trigger either a production correction (e.g. leakages in draw pipes) or targeted NRW activities. More than 10 DMAs already run above 60% NRW.



# Ndeiya: Water Scarcity Amid Rising Demand

|                                      |                                   |                         |                                    |
|--------------------------------------|-----------------------------------|-------------------------|------------------------------------|
| < 12 hrs                             | 45 → 24 m <sup>3</sup> /h         | > 100 m <sup>3</sup> /h | 32% NRW                            |
| daily supply vs. 24/7 in Limuru town | pumped, falling by dry-season end | projected demand        | due to illegal connect. & PVC pipe |

The Ndeiya scheme is run by a scheme manager with 7 zonal officers, a secretary, a customer service officer and a meter-reading officer. Ndeiya has **low population density** and coverage below 50% (excluding community water projects). Supply runs less than 12 hours a day - sometimes only two days a week - against 24/7 in Limuru town. Connections consume around 5 m<sup>3</sup>/month on average, and 200 connection requests are currently pending.

**NRW in Ndeiya stands at 32%**, driven by illegal connections and ageing PVC pipes. This is expected to erode the benefit of new source development unless tackled in parallel.

Only about **45 m<sup>3</sup>/hour** are currently pumped, **against estimated demand of more than 100 m<sup>3</sup>/hour**. Production falls further to around 24 m<sup>3</sup>/hour by the end of the dry season in September.

Water levels in boreholes are monitored with dippers, and pumps are lowered as levels drop.

A new borehole is envisaged to produce 40 m<sup>3</sup>/hour, pumping to tanks roughly 50 m above the source from an aquifer at a depth of approximately 200 m. The new borehole would be expected to enable connections to grow from 600 today to a planned 2,000.

## ENTRY POINTS

The utility has stated openness to a **Build-Operate-Transfer** arrangement **for the new ~200 m deep, 40 m<sup>3</sup>/hour Ndeiya borehole and its elevated tank** (~50 m of lift). Network expansion to the 2,000 planned connections could be financed by the utility itself.

**Source conservation & recharge:** Borehole development paired with a conservation and recharge concept is a relevant entry point given that water levels in Ndeiya boreholes already drop each dry season, requiring pumps to be lowered.

At 40% NRW driven by illegal connections and old PVC pipe, **loss-reduction** work alongside the new borehole would **protect the yield gains** and could help serve the 200 pending connection requests. LWSC also flagged challenges related to the current SPA ERP system.



# Lari: Siltation, Landslide Exposure & Network Damage

|                                    |                                    |                                          |                                   |
|------------------------------------|------------------------------------|------------------------------------------|-----------------------------------|
| 20–30                              | 94%                                | > 10                                     | > 50%                             |
| landslide-related damages per year | NRW recorded in one DMA last month | illegal connections unearthed in 3 weeks | NRW across Lari in the dry period |

Lari faces 20–30 landslide-related damage instances per year. The utility is currently conducting El Niño preparations (cleaning drains and installing linings in some) and has mapped high-risk areas ahead of the season.

The Lari scheme draws from a dammed reservoir where source water carries high silt loads during the rainy season, raising treatment costs and straining the ageing treatment plant.

Climate stress compounds an illegal-connection problem: more than 10 illegal connections were unearthed in Lari in the last three weeks alone. Some have controllable bypasses that let owners shut them off ahead of inspections.

Enforcement has focused on farm-owning customers, who tend to irrigate with stolen water at the end of the dry season. One area recorded 94% NRW last month, sharply up, though this DMA usually runs above 60%.

**NRW** already rises above 50% across Lari during the dry period (against 32% av.), and Lari has more meter issues than the rest of the schemes. Landslide damage, dry-season stress & metering gaps reinforce one another here.

## ENTRY POINTS

**Accelerating DMA-level intervention:** With over 10 DMAs above 60% NRW and the current approach, the NRW team would need more than 3 years to work through them, a dedicated or outsourced reduction campaign could compress that timeline substantially.

**Digitalizing monitoring & analytics:** Automated monitoring, replacing manual, Excel-based meter reading, could speed up NRW detection in Lari and across all 84 DMAs, matching the utility's own priority. The same approach could be used to improve water quality monitoring, cutting treatment costs.

Limuru has mapped its high-risk landslide areas. While no clear PPC entry point to prevent landslides emerged, solutions to reduce the resulting damage could still be significant.

# Key insights

## ISING TURBIDITY & TREATMENT CHEMICAL COSTS

Of the utility's two dams, the one that supplies the scheme in Lari has a silt problem that drives turbidity into the treatment process. This illustrates how upstream land use in combination with extreme weather events directly shapes downstream treatment cost.

At the treatment plant, the process uses between 50 and 115 kg of Alum per day. One of the utility's two sand filters in the treatment plant is 40 years old and due for replacement. Here ageing infrastructure further compounds the turbidity-driven chemical burden.

**Treatment process optimization** was named directly by the utility as a PPC priority, aimed at the highly variable Alum dosing (50 to 115 kg per day) at the water treatment plant.



# cewas

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