COUNTY GOVERNMENT OF KIAMBU

URBAN CLIMATE RISK PROFILE

FOR
KIKUYU MUNICIPALITY

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Disclaimer:

The Kikuyu Municipality's Urban Climate Risk Profile (2025) is intended solely for planning and informational purposes. The analysis and forecasts are subject to uncertainties in climate science and changing local conditions, and they are based on data available at the time of publication.

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Foreword

Climate change is no longer a distant threat; it is an increasingly visible reality for the people of Kikuyu Municipality. Intense rainfall has led to flooding in some areas, while changing weather patterns continue to affect infrastructure, livelihoods, and the wellbeing of our communities.

The Kikuyu Urban Climate Risk Profile has been developed to strengthen our understanding of the climate hazards facing the municipality and the vulnerabilities within our communities, infrastructure, and natural systems. Through consultations with municipal departments, ward representatives, and community stakeholders, this document identifies key climate risks and provides an evidence base to support adaptation planning.

This profile will inform the development of the Kikuyu Integrated Climate Risk Management Plan and guide future investments aimed at building resilience across the municipality. I encourage all departments, partners, and residents to use this document as we work together to build a resilient and climate-responsive Kikuyu Municipality.

Paul Waruhiu Mwendia

Manager, Kikuyu Municipality

Kiambu County

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Executive Summary

Urban areas are increasingly vulnerable to the impacts of climate change due to rapid population growth, expanding infrastructure, and increasing pressure on natural resources. Kikuyu Municipality, located within Kiambu County and forming part of the Nairobi Metropolitan Region, is experiencing significant urban development that may heighten exposure to climate-related risks.

This Urban Climate Risk Profile provides an assessment of the key climate hazards, vulnerabilities, and risks affecting Kikuyu Municipality. The assessment was developed through a review of climate data, municipal information, and available research on climate trends and urban development patterns. Climate data from the World Bank Climate Change Knowledge Portal and other publicly available sources were used to support the analysis.

The assessment identified several climate hazards that may affect the municipality, including flooding, landslides, drought, and heat stress. Among these, flooding represents the most significant climate risk due to intense rainfall events, increasing urbanization, and limitations in stormwater drainage infrastructure. Flooding has already been observed in parts of the municipality during heavy rainfall events, affecting roads, residential areas, and local economic activities.

Rapid urban expansion, increasing population density, and pressure on natural ecosystems contribute to the municipality's exposure and vulnerability to climate hazards. Urban systems such as residential settlements, transport infrastructure, waste management systems, and peri-urban agricultural areas may experience varying levels of climate risk depending on their location and sensitivity to climate variability.

The analysis highlights that residential areas, transport infrastructure, ecosystems, and agricultural activities represent some of the most vulnerable sectors within Kikuyu Municipality. Degradation of wetlands and encroachment on natural drainage corridors may further increase flood risks, while prolonged dry periods may affect water availability and agricultural productivity in peri-urban areas.

To address these risks, a range of climate adaptation opportunities have been identified. These include improvements to stormwater drainage systems, protection and restoration of wetlands and riparian areas, strengthened land-use planning and development controls, and the expansion of urban green spaces to reduce heat stress.

Strengthening institutional capacity, improving climate data and monitoring systems, and integrating climate resilience into municipal planning processes will also be important for reducing long-term climate risks. By implementing targeted adaptation measures, Kikuyu Municipality can enhance its resilience to climate change while supporting sustainable urban development.

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Acronyms and Abbreviations

Acronym	Full Meaning
CC	Climate Change
CRVA	Climate Risk and Vulnerability Assessment
GIS	Geographic Information System
IPCC	Intergovernmental Panel on Climate Change
KMD	Kenya Meteorological Department
LULC	Land Use and Land Cover
NDMA	National Drought Management Authority
NDC	Nationally Determined Contribution
NEMA	National Environment Management Authority
UCRP	Urban Climate Risk Profile
UN	United Nations
UNDRR	United Nations Office for Disaster Risk Reduction
UNOSAT	United Nations Satellite Centre
WB	World Bank
WBCCKP	World Bank Climate Change Knowledge Portal

1. Context

1.1 Objective of the Urban Climate Risk Profile

The Urban Climate Risk Profile for Kikuyu Municipality aims to identify and assess the key climate hazards, vulnerabilities, and risks affecting the municipality. The profile provides a structured understanding of how climate change may impact urban systems, infrastructure, livelihoods, and ecosystems within the municipality.

This assessment supports evidence-based planning and decision-making for climate resilience by highlighting areas of high exposure and vulnerability to climate hazards such as flooding, drought, landslides, and increasing temperatures. The findings are intended to inform municipal planning processes, infrastructure investments, and climate adaptation strategies.

The Urban Climate Risk Profile also supports the integration of climate risk considerations into urban development planning in Kikuyu Municipality in alignment with national climate policies and county development frameworks. By identifying climate risks and potential adaptation measures, the document contributes to strengthening the municipality's capacity to respond to current and future climate challenges.

1.2 Urban Context

1.2.1 Geographic Area

Kikuyu Municipality is located within Kiambu County in the central region of Kenya, approximately 20 kilometers northwest of Nairobi. The municipality serves as an important peri-urban center within the Nairobi Metropolitan Area and plays a significant role in supporting residential, commercial, and agricultural activities. The administrative boundary of Kikuyu Municipality is illustrated in Figure 1.

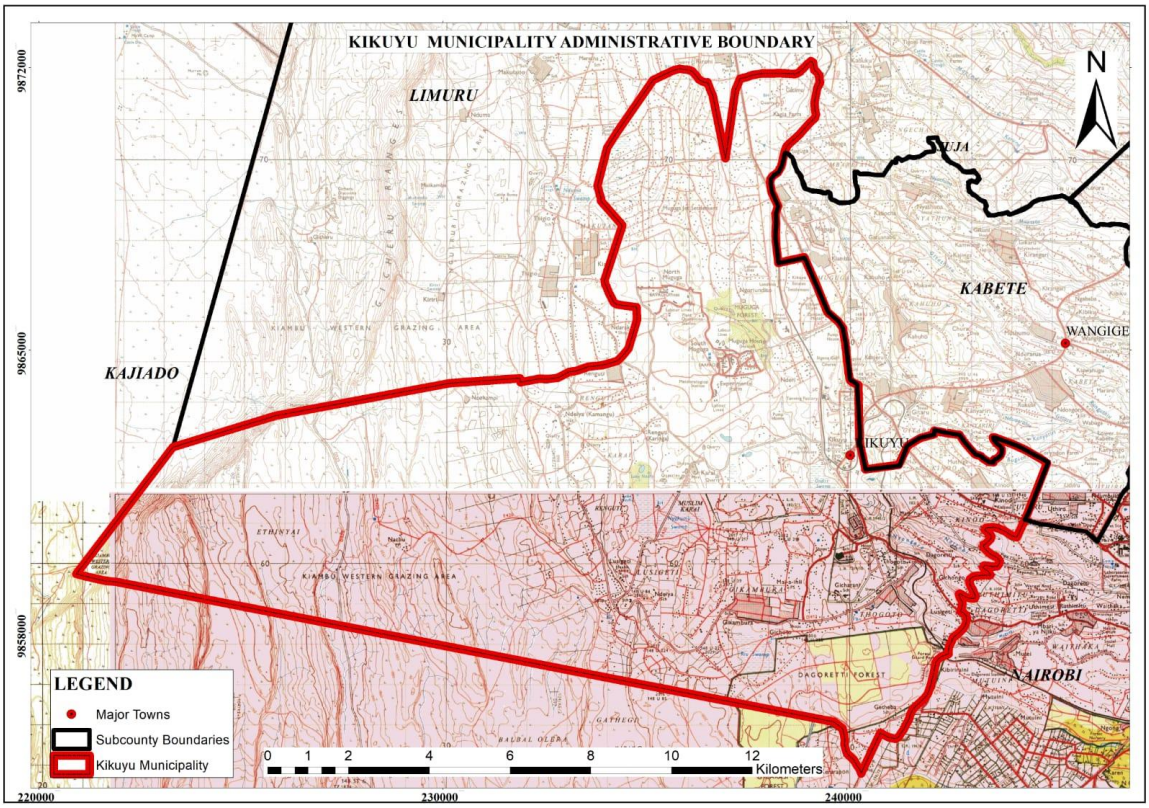

Figure 1: Administrative Boundary of Kikuyu Municipality

Source: *Kiambu County MAUD*

The municipality covers several urbanizing settlements and surrounding peri-urban areas that are experiencing rapid population growth and land-use change driven by their proximity to Nairobi. Kikuyu's location along key transport corridors enhances its role as a commuter town and commercial hub serving both local residents and neighboring communities.

The area is characterized by a mix of built-up urban centers, agricultural land, wetlands, and river systems. Key environmental features include the Ondiri Swamp, which is an important ecological area and the source of the Nairobi River. The presence of such natural ecosystems contributes to biodiversity conservation but also introduces environmental sensitivities that must be considered in urban planning and climate resilience efforts.

1.2.2 Governance Structure

Kikuyu Municipality is administered under the Government of Kiambu County in accordance with the Urban Areas and Cities Act. The municipality is managed by a Municipal Board that oversees urban governance, service delivery, and development planning within the municipal area.

The Municipal Board works in collaboration with the County Government departments responsible for sectors such as environment, infrastructure, land use planning, and public health. These departments play key roles in implementing policies and programs related to climate resilience, environmental management, and urban development.

Municipal governance structures also engage with community stakeholders, private sector actors, and development partners to support inclusive urban development and sustainable service delivery.

1.2.3 Socio-Economic Context

Kikuyu Municipality has experienced significant population growth in recent years, driven largely by its proximity to Nairobi and its role as a commuter settlement for residents working in the capital city. The population is diverse and includes a mix of long-term residents, new urban migrants, and peri-urban farming communities.

Economic activities within the municipality are varied and include retail trade, small-scale manufacturing, service provision, and agriculture in surrounding peri-urban areas. Informal economic activities also play an important role in supporting livelihoods for a significant portion of the population.

Rapid urbanization has placed increasing pressure on infrastructure, housing, and municipal services such as waste management, drainage, and transportation. These pressures can exacerbate vulnerabilities to climate hazards, particularly in densely populated or underserved areas.

1.2.4 Economic Context

The local economy of Kikuyu Municipality is supported by commercial activities within urban centers, including retail markets, transport services, hospitality businesses, and small enterprises. The municipality also benefits economically from its strategic location along major transport routes connecting Nairobi to other parts of Kiambu County and the wider central region.

Agriculture remains an important economic activity in peri-urban areas surrounding the municipality, where smallholder farming contributes to food supply and household incomes. However, agricultural productivity can be affected by climate variability, including changes in rainfall patterns and prolonged dry periods.

Continued economic growth in Kikuyu Municipality will depend on strengthening climate-resilient infrastructure and protecting natural resources that support local livelihoods and economic activities.

1.2.5 Land-Use Context

Land use in Kikuyu Municipality is characterized by a combination of residential development, commercial areas, institutional land, agricultural zones, and environmentally sensitive ecosystems. Urban expansion has led to increasing conversion of agricultural land into residential housing and commercial developments.

Key environmental assets such as wetlands, rivers, and green spaces play an important role in regulating hydrological systems and supporting climate resilience. However, unplanned development and inadequate waste management can threaten these natural systems and increase the risk of flooding and environmental degradation.

Effective land-use planning and enforcement of development regulations are therefore critical to ensuring that urban growth occurs in a manner that minimizes climate risks and protects important ecological resources.

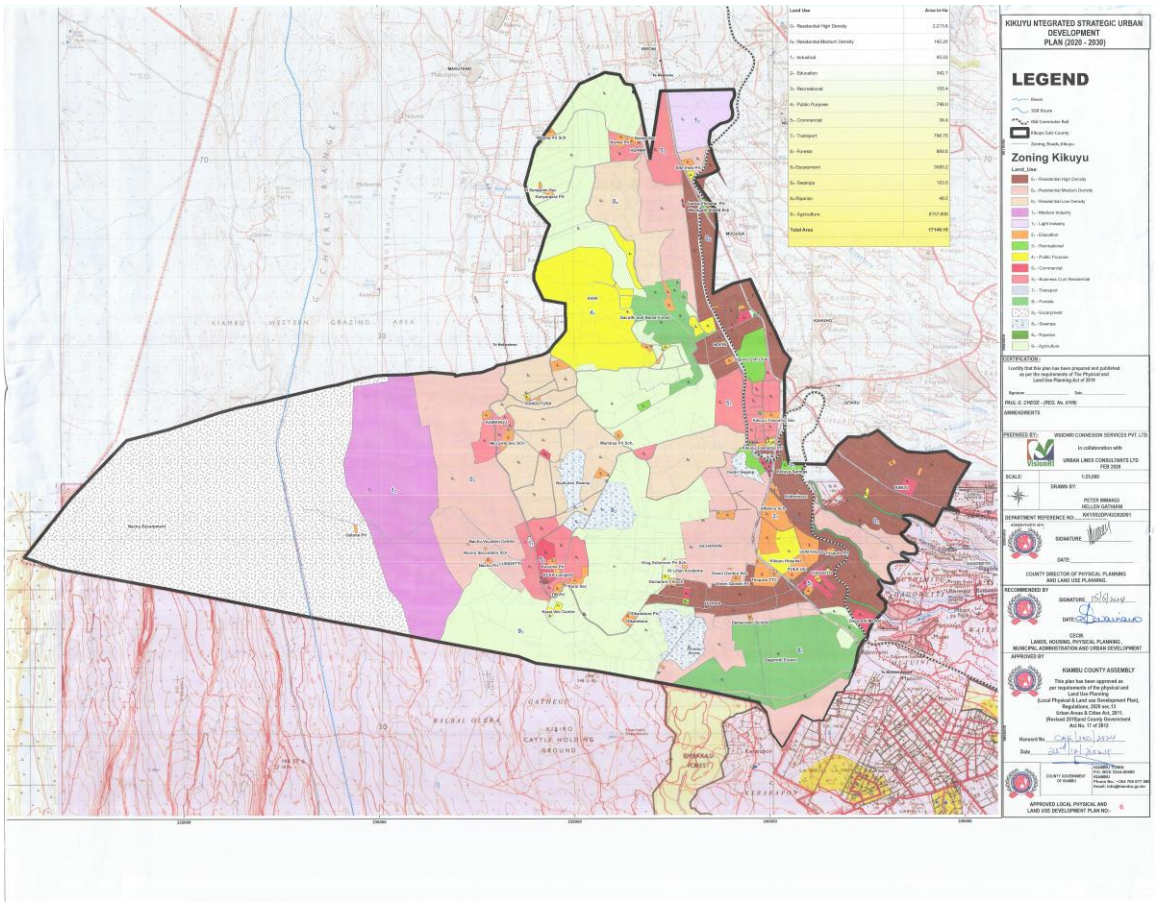

Figure 2: Kikuyu Municipality Land use map

1.3 Key Stakeholders and Inclusiveness

Addressing climate risks in Kikuyu Municipality requires collaboration among a wide range of stakeholders, including government institutions, community organizations, the private sector, and development partners.

Key stakeholders include the Kiambu County Government, the Kikuyu Municipal Board, national government agencies responsible for environment and climate policy, local community groups, and civil society organizations. The participation of these actors is important for identifying local climate risks, implementing adaptation strategies, and ensuring inclusive decision-making processes.

Inclusive engagement of vulnerable groups, including women, youth, informal settlement residents, and small-scale farmers, is particularly important in ensuring that climate resilience initiatives address the needs of those most affected by climate impacts.

Stakeholder mapping (Influence–Interest Matrix):

	Low Interest	**High Interest**
High Influence	National government agencies (KFS, KEFRI, KMD) Kiambu County Executive	Kikuyu Municipal Board Ward Administrators Kikuyu Water Company
Low Influence	Residents of Kikuyu Municipality Private developers	Community Based Organisations (CBOs) Farmers' cooperatives Boda boda associations PWD self-help groups Youth groups

Figure 2: Stakeholder mapping for Kikuyu Municipality

1.4 Methodology

This Urban Climate Risk Profile for Kikuyu Municipality was developed using a qualitative assessment approach that combines climate data analysis, literature review, and urban risk assessment methods. The methodology draws on guidance from urban climate risk assessment frameworks developed by international organizations and development partners.

The assessment involved reviewing available climate information, municipal planning documents, and relevant national and county-level policies related to climate change and urban development. Climate trends and hazard information were informed by publicly available datasets, including climate projections and indicators from the World Bank Climate Change Knowledge Portal.

The analysis focused on identifying key climate hazards affecting the municipality and assessing their potential impacts on urban systems such as housing, infrastructure, economic activities, and natural ecosystems. Exposure and vulnerability were evaluated based on known environmental conditions, patterns of urban development, and the sensitivity of different sectors to climate variability.

Based on this information, a climate risk assessment was conducted by examining the interaction between hazards, exposure, and vulnerability. The assessment helped identify priority climate risks and potential adaptation opportunities that could support resilience-building efforts within Kikuyu Municipality.

Key components of the assessment included:

- Identification of major climate hazards affecting the municipality
- Analysis of exposure of urban systems and infrastructure
- Assessment of vulnerability across key sectors
- Development of a climate risk matrix
- Identification of potential adaptation and resilience measures

This approach provides a structured basis for understanding climate risks and informing future climate-resilient urban planning and investment decisions.

2. Hazard Assessment

2.1 Key Climate Hazards

Kikuyu Municipality is exposed to several climate-related hazards that are influenced by both natural environmental conditions and increasing urbanization. Climate change is expected to intensify the frequency and severity of certain hazards, which may have significant implications for infrastructure, livelihoods, and ecosystem health within the municipality.

Table 1: Hazard screening for Kikuyu Municipality

Hazard	Hazard Likely (Y/N)	Significant Impact (Y/N)	High Priority (Y/N)	Key Hazard (Y/N)
Heat Stress				
Average surface temperature increase	Y	Y	Y	Y
Average ocean temperature increase	N	N	N	N
Extreme heat	Y	Y	Y	Y
Marine heatwaves	N	N	N	N
Cold Stress				
Average surface temperature during winter	N	N	N	N
Extreme cold (e.g., cold spells, frost)	N	N	N	N
Snowfall and ice storms	N	N	N	N
Flooding				
Changes in precipitation patterns	Y	Y	Y	Y
Pluvial (surface level) flooding, including flash flooding and urban flooding	Y	Y	Y	Y
Fluvial (river) flooding	Y	Y	Y	Y
Sea level rise	N	N	N	N
Coastal flooding, including storm surges	N	N	N	N
Waterlogging	Y	Y	Y	Y
Water Stress				
Drought (meteorological, hydrological)	Y	Y	Y	Y
Groundwater salinization	N	N	N	N
Saline intrusion	N	N	N	N
Wildfire				
Wildfires & bushfires	Y	N	N	N
Storms				
Extreme wind	Y	Y	N	N
Tropical cyclones	N	N	N	N
Sand and dust storms	N	N	N	N
Hailstorms	Y	N	N	N
Mass Movement				
Landslides	Y	Y	Y	Y
Coastal erosion	N	N	N	N
Gully erosion	Y	Y	Y	N
Marine Conditions				
Ocean acidification	N	N	N	N
Geophysical*				
Subsidence	N	N	N	N
Earthquakes	Y	N	N	N
Volcanos	N	N	N	N

The hazard screening indicates that Kikuyu Municipality is most vulnerable to flooding, landslides, drought, and increasing temperatures that lead to heat stress. These hazards

are largely driven by climate variability, changes in rainfall patterns, rapid urbanization, land-use changes, and the physical landscape of the area.

1. **Flooding and Waterlogging**

Sigona: Areas around Kanyanjara frequently experience seasonal flooding during heavy rains due to inadequate drainage systems and runoff from nearby roads and built-up areas.

Kikuyu Town: Low-lying sections of the town experience urban flooding and surface runoff, particularly during intense rainfall events when drainage systems are overwhelmed.

Ondiri Wetland: Areas surrounding the wetland and the source of the Nairobi River are prone to waterlogging and localized flooding, especially during periods of heavy rainfall because wetlands naturally accumulate runoff.

2. **Landslides and Soil Erosion**

Ndeiya: The steep terrain and escarpment slopes increase the risk of landslides and soil erosion during heavy rainfall events.

Thigio: Hilly terrain and agricultural land clearing can contribute to slope instability and erosion, particularly during prolonged rainfall.

3. **Drought and Water Stress**

Kinoo: Rapid urban growth has increased demand for water, making the area vulnerable to water shortages during prolonged dry periods.

Karai: Agricultural communities often experience water stress and reduced crop productivity during drought periods.

4. Heat Stress and Rising Temperatures

Zambezi and Kinoo: These rapidly urbanizing areas with dense settlements and commercial activities can experience higher temperatures due to reduced vegetation and the urban heat island effect.

Overall, flood-prone zones tend to occur in low-lying areas near rivers, wetlands, and poorly drained urban centres, while landslides and erosion occur in hilly and escarpment areas, and water stress and heat stress are more common in rapidly urbanizing zones with growing populations and infrastructure pressure. Examples of localized flooding events in Kikuyu Municipality are shown in Figure 3 a & b.

Figures 3a & b: Surface flooding affecting residential areas in Kikuyu Municipality

Source: *Kikuyu Municipality / Field observation*.

Table 2 provides a summary of the key climate hazards affecting Kikuyu Municipality and the primary drivers associated with each hazard.

Table 2: Key Climate Hazards Affecting Kikuyu Municipality

Hazard	Description	Key Drivers
Flooding	Temporary inundation of land due to intense rainfall and poor drainage capacity	Heavy rainfall events, urbanization, blocked drainage systems
Landslides	Movement of soil or rock down slopes triggered by saturated ground conditions	Prolonged rainfall, steep slopes, land disturbance
Drought	Extended periods of below-average rainfall affecting water availability	Climate variability, rainfall deficits
Heat Stress	Increased temperatures leading to uncomfortable or hazardous urban conditions	Rising temperatures, urban heat island effects

2.2 Climate Indicators and Hazard Thresholds

Climate hazards are typically monitored using specific indicators that help identify the conditions under which hazards are likely to occur. These indicators are based on meteorological observations, environmental characteristics, and historical hazard events.

For example, flooding is commonly associated with short-duration, high-intensity rainfall events that overwhelm drainage systems and natural waterways. Landslides are often triggered when soils become saturated following prolonged rainfall, particularly in areas with unstable slopes.

Similarly, drought conditions may be identified through extended periods of below-average rainfall and declining soil moisture levels, which can affect water availability and agricultural productivity. Rising average temperatures and heatwaves can also serve as indicators of increasing heat stress in urban environments.

Table 3 summarizes key indicators used to monitor the climate hazards identified in Kikuyu Municipality.

Table 3. Climate indicators and hazard thresholds selected for the assessment

Key Hazard	Climate Indicator	Data Source	Low	Medium	High
Flooding (Pluvial & Fluvial)	Maximum 1-day precipitation (mm/day)	Kenya Meteorological Department (KMD); World Bank Climate Change Knowledge Portal	< 20 mm/day	20–50 mm/day	> 50 mm/day
Heat Stress	Number of hot days (Temperature >30 °C) per year	Kenya Meteorological Department; World Bank Climate Change Knowledge Portal	< 10 days	10–30 days	> 30 days
Drought / Water Stress	Consecutive dry days (CDD)	ICPAC; Kenya Meteorological Department; World Bank Climate Change Knowledge Portal	< 10 days	10–20 days	> 20 days
Landslides	3–5 day cumulative rainfall on slopes (mm)	Kenya Meteorological Department; Geological Survey of Kenya	< 50 mm	50–100 mm	> 100 mm
Rainfall Variability / Waterlogging	Number of heavy rainfall events (>30 mm/day) per season	Kenya Meteorological Department; World Bank Climate Change Knowledge Portal	0–2 events	3–5 events	> 5 events

These indicators provide a useful basis for monitoring climate trends and identifying early warning signs of hazard events. Strengthening climate monitoring systems and improving access to climate data can therefore support better preparedness and risk management within the municipality.

2.3 Current Hazard Levels and Climate Projections

Climate trends observed across Kenya indicate increasing climate variability, characterized by changes in rainfall patterns, more frequent extreme weather events, and rising temperatures. According to climate data available through the World Bank Climate Change Knowledge Portal, Kenya has experienced gradual increases in average temperatures over recent decades, alongside increasing variability in seasonal rainfall.

Rainfall patterns in central Kenya, including Kiambu County, are typically characterized by two rainy seasons: the long rains occurring between March and May and the short rains between October and December. However, these seasonal patterns have become less predictable in recent years. Periods of intense rainfall have occasionally resulted in localized flooding in urban and peri-urban areas, particularly where drainage systems are insufficient to accommodate heavy runoff.

At the same time, extended dry periods have also been observed between rainy seasons. These conditions can contribute to water stress, particularly in areas that rely on rainfall for agriculture or where water supply infrastructure is limited.

Climate projections for East Africa suggest that temperatures are likely to continue increasing over the coming decades. Higher temperatures may contribute to increased evaporation rates and heat stress in urban areas, particularly in densely built environments with limited vegetation cover.

Future climate projections also indicate that rainfall events may become more intense even if overall annual rainfall totals do not change significantly. This trend could increase the likelihood of urban flooding in municipalities such as Kikuyu where rapid urban development and increased impervious surfaces reduce natural infiltration and increase stormwater runoff.

Table 4. Current and future hazards levels for Kikuyu Municipality

	Hazard Level				
Hazard	**Current (Baseline)**	**2050 SSP2-4.5**	**2050 SSP5-8.5**	**2100 SSP2-4.5**	**2100 SSP5-8.5**
Flooding (Pluvial & Fluvial)	Medium	Medium	High	High	High
Heat Stress	Medium	High	High	High	Very High
Drought / Water Stress	Medium	Medium	High	High	High
Landslides	Medium	Medium	High	High	High

For this Urban Climate Risk Profile, hazard levels should be interpreted in accordance with the table below.

Table 5. Interpretation of hazard levels

Level	Interpretation
High	Hazard events that are likely to occur with high frequency and/or intensity
Medium	Hazard events that are likely to occur with moderate frequency and/or intensity
Low	Hazard events that are likely to occur with low frequency and/or intensity

Understanding these trends is important for planning climate adaptation measures that address both current and future climate risks affecting the municipality.

2.3.1 Historical Climate Hazard Events

Historical hazard events provide important insight into the types of climate impacts that have already affected Kikuyu Municipality and surrounding areas. Observed flooding events in the Nairobi metropolitan region and Kiambu County demonstrate the potential impacts of intense rainfall on infrastructure, housing, and mobility.

Flooding has been reported in various parts of the Nairobi metropolitan region during periods of heavy rainfall, affecting transport networks, residential areas, and drainage systems. Similar localized flooding events have been observed within Kikuyu Municipality, particularly in areas with limited drainage capacity or where development has occurred near waterways and wetlands.

Table 3 summarizes selected examples of climate-related hazard events that have affected the wider region and may have implications for Kikuyu Municipality.

Table 6: Selected Historical Climate Hazard Events Affecting Kikuyu and the Nairobi Metropolitan Region

Year	Hazard Event	Observed Impacts

2016-2017	Drought and Water Shortages – Karai and Kinoo	Reduced rainfall led to declining water levels in local sources and reduced agricultural productivity
2017	Landslides and Soil Erosion in Ndeiya and Thigio	Increased slope instability, damaging farmland and rural access roads
2018	Heavy rainfall and flooding in Kikuyu Town, Kinoo and Sigona	Heavy rainfall caused flooding of roads, homes, and businesses, mainly due to blocked drainage systems and rapid urban development.
2020	Intense rainfall during long rains season	Localized flooding in low-lying areas and near rivers
2022	Periods of below-average rainfall	Reduced water availability and agricultural stress
2024	Heavy rainfall and flooding	Flooded infrastructure, disruption of transport networks. Low-lying sections of Kikuyu town and areas along drainage channels were the most affected.

The occurrence of these events highlights the importance of strengthening urban infrastructure, drainage systems, and land-use planning in order to reduce future climate risks within Kikuyu Municipality.

2.3.2 Future Climate Projections

Climate projections for Kenya indicate a continued increase in temperature and greater variability in rainfall patterns over the coming decades. According to projections from the World Bank Climate Change Knowledge Portal, mean annual temperatures in Kenya are expected to increase by approximately 1.5–2.5°C by the 2050s under intermediate emissions scenarios. In addition, rainfall patterns are expected to become more erratic, with an increase in the intensity of extreme rainfall events. These changes are likely to increase the risk of flooding, landslides, and water stress in rapidly urbanizing municipalities such as Kik

2.4 Current and Future Hazard Impact Areas

The impacts of climate hazards are not evenly distributed across the municipality. Certain locations may be more exposed to specific hazards due to environmental conditions, land-use patterns, and infrastructure limitations.

Table 7. Current and Future Hazard Impact Areas

Hazard	Current Impact Areas	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Drought / Water Stress	Kinoo and Karai	Higher soil moisture stress; increased water demand	Same as SSP2-4.5 but higher intensity	Persistent agricultural drought; seasonal water shortages	Persistent drought; water rationing; shift to drought-tolerant crops
Extreme Heat	Kikuyu Township CBD & dense estates, major roads, low-canopy estates such as Gitaru Estate, Muthara Estate, and	Expansion of high-heat areas; warmer nights	More intense heat days; vulnerable populations affected	Town-wide heat exposure increase	Frequent extreme heat; high health risks; increased cooling demand

	parts of Kinoo.				
Landslides	Ndeiya Ward – Western hilly and escarpment slopes within Kikuyu Municipality Thigio Ward –Slopes near farms and residential plots. Sigona Escarpments –Upper hilly areas prone to soil instability	Minor landslides more frequent; slope instability rises	More frequent small-scale slope failures	Larger areas at risk; moderate damage to roads/farms	High-risk zones expand; potential major slope failures; infrastructure & settlements affected

Flooding risks are generally higher in low-lying areas, locations near rivers and wetlands, and densely developed areas where drainage systems may be insufficient. For example, areas near wetlands and natural watercourses may experience periodic flooding during intense rainfall events.

Landslide risks are more likely to occur in areas with steep slopes and unstable soils, particularly where vegetation cover has been reduced or where land has been disturbed through construction activities.

Peri-urban agricultural areas may experience greater vulnerability to drought conditions due to their reliance on rainfall for crop production. Meanwhile, densely built urban areas with limited green space may experience higher levels of heat stress due to reduced natural cooling effects.

Table 8 summarizes typical areas of hazard exposure within the municipality

Table 8: Typical Hazard Exposure Areas in Kikuyu Municipality

Hazard	Areas of Exposure	Potential Impacts
Flooding	Low-lying areas, river corridors, wetlands	Property damage, infrastructure disruption
Landslides	Steep slopes and disturbed land areas	Infrastructure damage, safety risks
Drought	Peri-urban farming areas	Reduced agricultural productivity
Heat Stress	Densely built commercial and residential areas	Public health risks, reduced comfort

Understanding where these hazards are most likely to occur provides an important basis for identifying priority areas for climate adaptation and risk reduction measures within the Municipality.

Future climate conditions are expected to intensify the impacts of existing hazards within Kikuyu Municipality. Increased rainfall intensity may lead to more frequent flooding in low-lying areas and along drainage corridors, while rising temperatures may contribute to heat stress and increased water demand. These projections highlight the importance of integrating climate resilience into urban planning and infrastructure development.

3. Exposure and Vulnerability Assessment

3.1 Overview of Exposure and Vulnerability

Exposure and vulnerability are key components of climate risk. Exposure refers to the presence of people, infrastructure, ecosystems, and economic activities in areas that may be affected by climate hazards. Vulnerability describes the degree to which these systems are susceptible to damage and their capacity to cope with or adapt to climate impacts.

In Kikuyu Municipality, exposure and vulnerability are shaped by a combination of environmental factors, urban development patterns, and socio-economic conditions. Rapid urbanization, increasing population density, and pressure on infrastructure and natural ecosystems contribute to the municipality's susceptibility to climate hazards such as flooding, landslides, drought, and heat stress.

Urban systems such as housing, transportation infrastructure, waste management systems, and local economic activities may be affected differently depending on their location, design, and level of preparedness. Identifying the most exposed and vulnerable sectors is therefore essential for prioritizing climate adaptation actions.

3.2 Urban Elements

Table 3. Urban elements inventory

Category	**Subcategory**	**Included in RCRA (Y/N)**	**Available in GIS (Y/N)**	**Description**
Infrastructure & Services				
Stormwater Drainage	Stormwater conveyance network	Y	N (partial)	Open drains, culverts along main roads; mostly absent in informal areas.
	Stormwater storage	N	N	No dedicated storage; Odiri swamp acts as natural retention.
Water & Wastewater Mgmt	Pumping stations	Y	Y	KIWASCO 38 has pumping stations.
	Groundwater abstraction	Y	N	Private boreholes in kamangu and thogoto.
	Water treatment facilities	N	N	Proosed in kikuyu springs area
	Water supply networks	Y	Y	Piped system coverage ~70%; intermittent supply.

	Sewer networks	Y	Y	Only in kikuyu town 85% use septic tanks.
	Wastewater treatment facilities	Y	Y	kikuyu WWTP (trickling filters).
Solid Waste Management	Transfer facilities	N	N	None in kikuyu.
	Landfills and dump sites	Y	Y	Uncontrolled dumpsites (lucigate and thogoto
	Recycling centers	Y	N	Informal sector; no formal facility.
	Collection fleet	Y	Y	1 TIPPER
Transport and Mobility	Road networks	Y	Y	200 km tarmac, 200 km murram; many roads in poor condition.
	Bridges	N	N	NIL
	Public transport networks	Y	N	Matatu routes (Kikuyu–Nairobi, kikuyu-thika ,kikuyu limuru).
	Transportation terminals	Y	Y	kikuyu Town bus park.
	Non-motorised transport	N	N	Few dedicated pedestrian/cycle lanes.
Energy	Poles and power lines	Y	Y	Kenya Power network; frequent outages during storms.

	Transformers and substations	Y	Y	5 substations.
	Streetlighting	Y	Y	Solar and grid-powered; mostly in town centre.
Economic Infrastructure	Markets	Y	Y	Kikuyu town market , Dagoretti Mkt,lucigate market ,Kinoo market.
	Businesses and commercial hubs	Y	N	~700 formal SMEs, many informal traders.
	Industrial zones	Y	Y	Magana indudtrial area
Social Infrastructure	Government buildings	Y	Y	Municipal headquaters
	Education facilities	Y	Y	~97 ECDE(Public and private), 69 primary, 10 secondary, 9 vocational centre.
	Healthcare facilities	Y	Y	Lussigate level 4 hopspital ,thogoto level 4 hospital(under construction.)
	Public spaces	Y	Y	Gikambura stadium,.
	Faith-based buildings	N	N	Numerous churches.
Emergency Services	Fire stations	Y	Y	1 fire station (town centre); limited capacity.
	Police stations	Y	Y	2 police stations, 4 posts.

	Early warning systems	N	N	None.
	Disaster management centers	N	N	None; rely on Kiambu County.
Populations				
Urban Residents	Population	Y	Y	See Section 1.2.
	Households	Y	Y	60,000 households; average size 3.4.
Informal Settlement Residents	Population in informal settlements	Y	N	Free Town (~2,500), kamangu ,parts of lucigate (~1,800),
	Households lacking land tenure	Y	N	~1,200 households.
	Households lacking basic services	Y	N	Limited water, sewer, waste collection.
Vulnerable & Marginalized	Low-income households	Y	N	~40% of households below poverty line.
	Women-headed households	Y	N	34% of households.
	Children and youth	Y	Y	<18 years: 45% of population.
	Elderly persons	Y	N	>65 years: 8% of population.
	People with disabilities	Y	N	~5% of population (estimated).

	(PWD)			
	Unemployed youth	Y	N	22% unemployment rate.
	Seasonal workers	Y	N	Construction labour.
Natural Assets				
Urban Green Infrastructure	Urban parks and gardens	Y	Y	Kikuyu peoples park , small green spaces.
	Green corridors	N	N	None formalised.
	Urban forests	Y	Y	Remnant indigenous trees, eucalyptus woodlots.
Urban Blue Infrastructure	Natural wetlands	Y	Y	Odiri wetland (key biodiversity site).
	Rivers	Y	Y	Nderu, Kamiti, Ngecha, Tigoni.
	Riparian zones	Y	N	Encroached, poorly mapped.
	Lakes/ponds	Y	Y	Small farm dams.
Peri-urban & Agricultural	Peri-urban agriculture	Y	N	Vegetables, dairy, poultry.
Systems	Agroforestry	Y	N	Scattered on farms.
	Forests and reserves	Y	Y	Parts of Muguga forest.Dagoretti forest.

3.3 Exposure, Vulnerability, and Impacts of Climate Hazards on Urban Elements

For this Urban Climate Risk Profile, exposure and vulnerability levels should be interpreted in accordance with the table below.

Table 10. Interpretation of exposure and vulnerability levels

Level	Exposure Level Interpretation	Vulnerability Level Interpretation
High	A large number and high-value urban elements are located within the hazard footprint.	The urban element is vulnerable to the hazard due to high sensitivity and limited adaptive capacity.
Medium	A moderate number or mix of low- and medium-value elements are located within the hazard footprint.	The element is somewhat vulnerable due to moderate sensitivity and adaptive capacity
Low	Few or no critical urban elements lie within the hazard footprint.	The element is minimally vulnerable due to limited sensitivity and/or high adaptive capacity.

For this Urban Climate Risk Profile, the following matrix summarizes likely impacts on each urban element by combining the assigned exposure and vulnerability levels.

Table 11. Impact Matrix

		Vulnerability Level		
		Low	**Medium**	**High**
Exposure Level	**High**	Moderate	Major	Catastrophic
	Medium	Minor	Moderate	Major
	Low	Insignificant	Minor	Moderate

Table 12. Exposure, Vulnerability, and Impacts of Flooding on Urban Elements

Hazard: Flooding

Hazard 1: Flooding (Pluvial & Flash Floods)

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage	Inadequate drainage in Kinoo, Sigona and within residential estates	High	Clogged drains, poor maintenance	High	High
Water & Wastewater Management	Water treatment plants at risk of contamination	Medium	Limited flood-proofing	Medium	Medium-High
Solid Waste Management	Dumpsites near streams prone to overflow	Medium	Weak institutional control	Medium	Medium

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Transport and Mobility	Roads along low-lying areas flood frequently	High	Poor alternative routes	High	High
Energy	Transformer stations in flood-prone zones	Medium	Vulnerable equipment	Medium	Medium
Economic Infrastructure	Markets, shops, banks in flood-prone areas	High	Lack of insurance	High	High
Social Infrastructure	Schools, hospitals near rivers	Medium	Limited emergency planning	Medium	Medium-High
Emergency Services	Fire stations, ambulance access blocked	Medium	Limited resources	Medium	Medium-High
Populations					
Urban Residents	Residents along streams, low-lying neighborhoods	High	Poor housing quality	High	High
Informal Settlement Residents	Informal settlements near rivers and drainage lines	High	Minimal flood protection	Very High	Very High
Vulnerable & Marginalized Groups	Elderly, disabled, children	High	Dependence on public services	High	High
Natural Assets					
Urban Green Infrastructure	Parks, urban forests in floodplains	Medium	Erosion, soil saturation	Medium	Medium
Urban Blue Infrastructure	Rivers, streams, dams	High	Sedimentation, overflow	High	High
Peri-urban & Agricultural Systems	Smallholder farms along streams	Medium	Crop loss, soil erosion	Medium	Medium-High

Table 13. Exposure, Vulnerability, and Impacts of Extreme heat on Urban Elements

Hazard 2: Extreme Heat

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage	Less direct, but pavements and impervious surfaces absorb heat	Medium	Limited cooling infrastructure	Medium	Medium
Water & Wastewater Management	Water demand spikes, treatment stressed	High	Limited capacity to meet peak demand	High	High
Solid Waste Management	Waste decomposition accelerates	Medium	Manual waste handling, health risks	Medium	Medium
Transport and Mobility	Roads and pavements heat-stressed	Medium	Asphalt damage, health risks	Medium	Medium
Energy	High electricity demand (cooling)	High	Limited supply, outages	High	High
Economic Infrastructure	Markets, outdoor vendors exposed	High	Worker health risk, productivity loss	High	High
Social Infrastructure	Schools, clinics	High	Heat exposure for students/patients	High	High
Emergency Services	Firefighters, ambulance staff	Medium	Exposure during peak heat	Medium	Medium
Populations					
Urban Residents	Residents with limited cooling	High	Poor housing, no AC/fans	High	High
Informal Settlement Residents	Dense housing, no shade	Very High	Very low adaptive capacity	Very High	Very High
Vulnerable & Marginalized Groups	Elderly, children, outdoor laborers	High	High sensitivity	High	High
Natural Assets					
Urban Green	Limited shade	Medium	Heat	Medium	Medium

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure	trees		amplification		
Urban Blue Infrastructure	Lakes, rivers moderate local temps	Low	Degraded streams reduce cooling	Medium	Medium
Peri-urban & Agricultural Systems	Crops heat-sensitive	Medium	Limited irrigation	Medium	Medium

Table 15. Exposure, Vulnerability, and Impacts of drought on Urban Elements

Hazard 3: Drought

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage	Low direct exposure	Low	Limited recharge of water sources	Medium	Medium
Water & Wastewater Management	Water supply shortages	High	Dependence on piped water, inadequate storage	High	High
Solid Waste Management	Low direct exposure	Low	Water scarcity affects cleaning	Medium	Medium
Transport and Mobility	Low exposure	Low	Heat-induced road damage	Medium	Medium
Energy	Hydropower reliance limited, high cooling demand	Medium	High demand, supply gaps	Medium	Medium
Economic Infrastructure	Agriculture, food markets affected	High	Crop failure, reduced income	High	High
Social Infrastructure	Clinics & schools	Medium	Water scarcity, hygiene issues	Medium	Medium-High
Emergency Services	Fire risk increases	Medium	Limited firefighting water	Medium	Medium

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Populations					
Urban Residents	Water rationing, hygiene issues	High	High dependency on piped water	High	High
Informal Settlement Residents	High exposure	Very High	No secure water access	Very High	Very High
Vulnerable & Marginalized Groups	Elderly, children, PWDs	High	Health impacts, dehydration	High	High
Natural Assets					
Urban Green Infrastructure	Parks & trees die	Medium	Limited irrigation	Medium	Medium
Urban Blue Infrastructure	Streams, small dams dry	High	Reduced water availability	High	High
Peri-urban & Agricultural Systems	Farms face water stress	High	Crop yield loss	High	High

Table 16. Exposure, Vulnerability, and Impacts of Landslides on Urban Elements
Hazard 4: Landslides

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage	Hillside drainage channels prone to collapse	Medium	Poor slope stabilization	Medium	Medium
Water & Wastewater Management	Pipelines in slope areas	Medium	Buried pipelines vulnerable	Medium	Medium
Solid Waste Management	Waste deposits on slopes	Low-Medium	Destabilizes soil	Medium	Medium
Transport and Mobility	Roads cut along slopes	High	Road failure during landslides	High	High
Energy	Poles and transformers on	Medium	Vulnerable to collapse	Medium	Medium

Category	Exposure (Description)	Exposure Level	Vulnerability (Description)	Vulnerability Level	Impact Level
	slopes				
Economic Infrastructure	Shops on slopes	Medium	High damage potential	Medium-High	Medium-High
Social Infrastructure	Schools, clinics on hills	Medium	Structural collapse risk	Medium	Medium
Emergency Services	Access blocked	Medium	Rescue delayed	Medium	Medium
Populations					
Urban Residents	Housing on unstable slopes	High	Poorly constructed homes	High	High
Informal Settlement Residents	High-risk slope areas	Very High	Minimal structural support	Very High	Very High
Vulnerable & Marginalized Groups	Children, elderly, low-income households	High	High sensitivity	High	High
Natural Assets					
Urban Green Infrastructure	Trees stabilize slopes	Medium	Deforestation increases risk	Medium-High	Medium-High
Urban Blue Infrastructure	Surface runoff triggers slides	Medium	Poor water management	Medium	Medium
Peri-urban & Agricultural Systems	Farms on slopes	Medium	Soil erosion, crop loss	Medium-High	Medium-High

3.4 Key Drivers of Vulnerability

Several underlying factors contribute to climate vulnerability within Kikuyu Municipality. Rapid urbanization has led to increased pressure on land and infrastructure, while population growth has increased demand for housing, transport, and municipal services. In some cases, development has expanded into environmentally sensitive areas such as wetlands and flood-prone zones.

Inadequate drainage systems and poor waste management practices may also contribute to increased flood risks by blocking waterways and reducing the capacity of drainage infrastructure during heavy rainfall events.

Additionally, the degradation of natural ecosystems such as wetlands and riparian areas can reduce the municipality's natural capacity to regulate water flows and buffer against extreme weather events. Protecting and restoring these ecosystems can therefore play a critical role in strengthening climate resilience.

4. Climate Risk Assessment

4.1 Current and Future Climate Risks on Urban Elements

Climate risk arises from the interaction between climate hazards, exposure of people and assets, and the vulnerability of systems to those hazards. In Kikuyu Municipality, climate risks are shaped by increasing urbanization, environmental degradation, and the changing intensity and variability of climate conditions.

As identified in the previous sections, the municipality faces several key climate hazards including flooding, landslides, drought, and heat stress. These hazards interact with urban systems such as housing, transport infrastructure, economic activities, and natural ecosystems to produce a range of potential impacts.

Flooding poses one of the most significant risks due to intense rainfall events, limited drainage capacity, and the presence of low-lying areas and wetlands within and around the municipality. Landslides may occur in areas with steep slopes during prolonged rainfall, while drought conditions may affect water availability and agricultural productivity in peri-urban areas.

Understanding the level of risk associated with each hazard is important for identifying priority areas for climate adaptation and resilience-building interventions.

For this Urban Climate Risk Profile, the following matrix summarizes overall risk for each urban element by combining the assessed hazard level and the estimated impact level.

Table 17. Risk matrix

		Hazard Level		
		Low	**Medium**	**High**
Impact Level	**Catastrophic**	High	Very High	Very High
	Major	Medium	High	Very High
	Moderate	Low	Medium	High
	Minow	Low	Low	Medium
	Insignificant	Very Low	Low	Low

For this Urban Climate Risk Profile, risk levels should be interpreted based on the table below.

Table 18. Interpretation of risk levels

Level	Interpretation
Very High	Very high risks are unacceptable. Risk should be avoided, reduced or transferred. Immediate planning and implementation of risk reduction measures is required. Allocate resources and coordinate interventions to prevent or minimize impact.
High	High risks should be actively addressed. Develop and implement mitigation actions promptly. Monitor environmental indicators and ensure readiness of emergency or adaptation measures.
Medium	Medium risks should be managed. Plan and implement mitigation activities to reduce them to acceptable levels. Regularly review climate data and risk levels.
Low	Low risks are acceptable under current conditions. Minimal control or monitoring is needed, provided they remain stable and do not escalate.
Very Low	Very low risks are negligible in terms of likelihood and consequences. No immediate action is required beyond routine monitoring and periodic review.

Table 19: Summary of Flooding Risks – Kikuyu Municipality

Categories	Impact	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Infrastructure & Services						
Stormwater Drainage	High	High	High	Very High	Very High	Very High
Water & Wastewater	Medium-	Medium-	High	High	High	Very

Categories	Impact	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Management	High	High				High
Solid Waste Management	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Transport and Mobility	High	High	Very High	Very High	Very High	Very High
Energy	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Economic Infrastructure	High	High	Very High	Very High	Very High	Very High
Social Infrastructure	Medium-High	Medium-High	High	High	High	Very High
Emergency Services	Medium-High	Medium-High	High	High	High	Very High
Populations						
Urban Residents	High	High	Very High	Very High	Very High	Very High
Informal Settlement Residents	Very High	Very High	Very High	Very High	Very High	Very High
Vulnerable and Marginalized Groups	High	High	Very High	Very High	Very High	Very High
Natural Assets						
Urban Green Infrastructure	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Urban Blue Infrastructure	High	High	Very High	Very High	Very High	Very High
Peri-urban & Agricultural Systems	Medium-High	Medium-High	High	High	High	Very High

Table 20: Summary of Extreme Heat Risks – Kikuyu Municipality

Categories	Impact	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Infrastructure & Services						
Stormwater Drainage	Medium	Medium	Medium	Medium-High	Medium-High	High
Water & Wastewater	High	High	High	Very High	High	Very

Categories	Impact	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Management						High
Solid Waste Management	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Transport and Mobility	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Energy	High	High	Very High	Very High	Very High	Very High
Economic Infrastructure	High	High	Very High	Very High	Very High	Very High
Social Infrastructure	High	High	Very High	Very High	Very High	Very High
Emergency Services	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Populations						
Urban Residents	High	High	Very High	Very High	Very High	Very High
Informal Settlement Residents	Very High	Very High	Very High	Very High	Very High	Very High
Vulnerable and Marginalized Groups	High	High	Very High	Very High	Very High	Very High
Natural Assets						
Urban Green Infrastructure	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Urban Blue Infrastructure	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Peri-urban & Agricultural Systems	Medium	Medium	Medium-High	Medium-High	Medium-High	High

Table 21: Summary of Drought Risks – Kikuyu Municipality

Categories	Impact	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Infrastructure & Services						
Stormwater Drainage	Medium	Low-Medium	Medium	Medium	Medium	Medium-High
Water & Wastewater	High	High	High	Very High	High	Very High

Categories	Impact	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Management						
Solid Waste Management	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Transport and Mobility	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Energy	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Economic Infrastructure	High	High	Very High	Very High	High	Very High
Social Infrastructure	Medium-High	Medium-High	High	High	Medium-High	High
Emergency Services	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Populations						
Urban Residents	High	High	Very High	Very High	High	Very High
Informal Settlement Residents	Very High	Very High	Very High	Very High	Very High	Very High
Vulnerable and Marginalized Groups	High	High	Very High	Very High	High	Very High
Natural Assets						
Urban Green Infrastructure	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Urban Blue Infrastructure	High	High	Very High	Very High	High	Very High
Peri-urban & Agricultural Systems	High	High	Very High	Very High	High	Very High

Table 22: Summary of Landslides Risks – Kikuyu Municipality

Categories	Impact	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Infrastructure & Services						
Stormwater Drainage	Medium	Medium	Medium-High	Medium-High	Medium-High	High

Categories	Impact	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Water & Wastewater Management	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Solid Waste Management	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Transport and Mobility	High	High	Very High	Very High	Very High	Very High
Energy	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Economic Infrastructure	Medium-High	Medium-High	High	High	High	Very High
Social Infrastructure	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Emergency Services	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Populations						
Urban Residents	High	High	Very High	Very High	Very High	Very High
Informal Settlement Residents	Very High	Very High	Very High	Very High	Very High	Very High
Vulnerable and Marginalized Groups	High	High	Very High	Very High	Very High	Very High
Natural Assets						
Urban Green Infrastructure	Medium-High	Medium-High	High	High	High	Very High
Urban Blue Infrastructure	Medium	Medium	Medium-High	Medium-High	Medium-High	High
Peri-urban & Agricultural Systems	Medium-High	Medium-High	High	High	High	Very High

4.2 Climate Risk Hotspots

Climate risk hotspots refer to areas where the combined effects of hazard exposure and vulnerability create particularly high levels of climate risk. Identifying these locations is

important for prioritizing investments and planning interventions that can reduce future climate impacts.

Within Kikuyu Municipality, potential climate risk hotspots may include low-lying areas near rivers and wetlands that are susceptible to flooding during intense rainfall events. Rapidly developing residential areas with limited drainage infrastructure may also face increased flood risks.

Figure 4a & b: Surface flooding affecting residential areas in Kikuyu Municipality

Source: *Kikuyu Municipality / Field observation*

Steep slopes and areas undergoing significant land-use changes may be vulnerable to landslides during periods of prolonged rainfall. Meanwhile, densely built urban areas with limited green space may experience higher levels of heat stress.

5. Climate Adaptation and Resilience Opportunities

5.1 Overview

Strengthening climate resilience in Kikuyu Municipality requires a combination of infrastructure improvements, environmental management, policy interventions, and community engagement. Based on the climate risks identified in the previous sections, targeted adaptation actions can help reduce vulnerability and enhance the municipality's capacity to respond to climate hazards.

Adaptation measures should focus on addressing the key climate risks associated with flooding, landslides, drought, and heat stress while also supporting sustainable urban development. Integrating climate resilience considerations into municipal planning and infrastructure development will be essential in reducing long-term climate risks. Additionally, addressing drainage challenges will be important in reducing flood risks within the municipality.

Table 23: Climate Adaptation and Resilience Solutions Recommended for Kikuyu Municipality

Category	Immediate	Mid-term	Long-term
Infrastructure & Services			
Stormwater Drainage	• Routine desilting and clearing of drainage channels • Mapping flood-prone zones and enforcing drainage maintenance	• Upgrade and expand stormwater drainage systems • Construct retention ponds and infiltration trenches	• Develop integrated urban drainage master plan • Implement nature-based drainage systems (bioswales, permeable pavements)
Water & Wastewater Management	• Promote rainwater harvesting at household and institutions • Repair leaks in water supply systems	• Expand water storage reservoirs and boreholes • Upgrade wastewater treatment facilities	• Develop climate-resilient water supply systems • Introduce wastewater reuse and recycling systems
Solid Waste Management	• Strengthen waste collection in flood-prone areas • Public awareness on proper	• Establish waste segregation and recycling programs • Improve landfill	• Develop circular economy waste management systems • Construct modern

Category	Immediate	Mid-term	Long-term
	waste disposal	management and drainage around disposal sites	waste treatment and resource recovery facilities
Transport and Mobility	• Repair damaged roads and drainage along roads • Improve maintenance of road culverts	• Upgrade roads to climate-resilient standards • Improve pedestrian walkways and non-motorized transport infrastructure	• Develop integrated resilient transport systems • Introduce climate-resilient urban mobility planning
Energy	• Promote energy efficiency and solar lighting in public facilities • Improve maintenance of power distribution lines	• Expand solar energy use in municipal buildings • Strengthen electricity distribution infrastructure	• Develop decentralized renewable energy systems • Invest in resilient smart energy grids
Economic Infrastructure	• Climate risk awareness for businesses • Improve drainage around markets and commercial areas	• Climate-proof key economic infrastructure (markets, industrial areas) • Promote climate-resilient business practices	• Relocate or redesign high-risk economic infrastructure • Promote green economy initiatives
Social Infrastructure	• Improve ventilation and cooling in schools and health facilities • Conduct climate risk awareness programs	• Retrofit schools and hospitals for climate resilience • Provide reliable water supply in public facilities	• Develop climate-resilient public buildings • Establish green infrastructure around social facilities
Emergency Services	• Strengthen disaster preparedness and response systems • Equip emergency teams and develop evacuation plans	• Establish early warning systems for floods and landslides • Improve emergency access routes	• Develop integrated disaster management centers • Invest in climate-resilient emergency infrastructure
Populations			
Urban Residents	• Public awareness on climate risks and preparedness • Promote household rainwater harvesting	• Promote climate-resilient housing improvements • Encourage energy-efficient housing	• Develop resilient urban housing policies • Promote climate-smart urban planning
Informal Settlement Residents	• Improve drainage and sanitation in informal areas	• Upgrade informal settlements with resilient infrastructure	• Planned relocation from high-risk areas • Develop affordable

Category	Immediate	Mid-term	Long-term
	• Support community disaster preparedness	• Improve secure access to water and sanitation	climate-resilient housing
Vulnerable and Marginalized Groups	• Provide targeted climate awareness programs • Strengthen social protection systems	• Improve access to healthcare and water during extreme events • Establish community support networks	• Integrate climate resilience into social protection programs • Develop inclusive climate adaptation policies
Natural Assets			
Urban Green Infrastructure	• Tree planting in public spaces and streets • Protect existing urban green areas	• Expand urban parks and green corridors • Promote community greening initiatives	• Develop urban green infrastructure master plan • Increase urban forest cover
Urban Blue Infrastructure	• Protect rivers, wetlands, and riparian buffers • Remove waste and restore clogged streams	• Restore degraded rivers and wetlands • Construct urban retention ponds	• Develop integrated watershed management systems • Protect and expand natural water retention areas
Peri-urban and Agricultural Systems	• Promote water conservation and soil management practices • Support farmers with climate information services	• Introduce drought-resistant crops and irrigation systems • Improve soil conservation measures	• Promote climate-smart agriculture • Develop sustainable land and watershed management systems

5.2 Priority Climate Adaptation Measures

A number of potential adaptation measures can be implemented to address the climate risks identified in this assessment. These measures include improvements to urban infrastructure, protection of natural ecosystems, and strengthening of municipal planning processes.

Table 24 summarizes key adaptation measures that could support climate resilience in Kikuyu Municipality.

Table 24: Potential Climate Adaptation Measures for Kikuyu Municipality

Sector	Climate Risk	Potential Adaptation Measures
Urban drainage and infrastructure	Flooding	Upgrade drainage systems, improve stormwater management, maintain culverts and drainage channels
Land-use planning	Flooding and landslides	Enforce zoning regulations, restrict development in flood-prone areas, integrate climate risk into spatial planning
Ecosystem management	Flooding and drought	Protect wetlands and riparian buffers, restore degraded ecosystems
Urban greening	Heat stress	Increase tree planting, develop urban green spaces and parks
Agriculture	Drought	Promote climate-smart agriculture, improve water management and irrigation
Waste management	Flooding	Improve waste collection systems and prevent dumping in drainage channels

As shown in Table 23, a combination of structural and nature-based interventions can help reduce climate risks across multiple sectors.

5.3 Nature-Based Solutions

Nature-based solutions play an important role in strengthening urban climate resilience by working with natural systems to reduce climate risks. Protecting and restoring ecosystems such as wetlands, riparian corridors, and green spaces can help regulate water flows, reduce flood risks, and moderate urban temperatures.

In Kikuyu Municipality, ecosystems such as wetlands and river systems provide valuable environmental services that contribute to climate resilience. For example, wetlands can absorb excess rainfall and reduce flood impacts, while urban trees and green spaces can reduce heat stress and improve urban livability.

Integrating nature-based solutions into urban planning and development processes can therefore provide cost-effective and sustainable approaches to climate adaptation.

5.4 Institutional and Policy Considerations

Strengthening institutional capacity and governance frameworks is also critical for addressing climate risks in Kikuyu Municipality. Climate resilience should be integrated into municipal development plans, infrastructure investment decisions, and land-use planning processes.

Collaboration between the municipal administration, county government departments, national agencies, and local communities will be essential for implementing effective climate adaptation measures. Partnerships with development partners and research institutions can also support access to climate data, technical expertise, and funding opportunities.

Building awareness of climate risks among communities and stakeholders can further support the successful implementation of climate resilience initiatives.

5.5 Next Steps

Moving forward, the findings of this Urban Climate Risk Profile can support the development of targeted climate adaptation strategies and investments within Kikuyu Municipality. Key next steps may include conducting more detailed risk assessments for priority sectors, integrating climate risk considerations into municipal planning processes, and identifying financing mechanisms to support climate resilience initiatives.

Strengthening climate monitoring systems and improving data collection can also support better decision-making and enhance preparedness for future climate hazards. By proactively addressing climate risks, Kikuyu Municipality can support sustainable urban development while protecting communities, infrastructure, and ecosystems from climate-related impacts.

Table 25: Summary of Climate Risks Affecting Urban Elements – Kikuyu Municipality

Category	Current	Mid-term (2050)	Long-term (2100)
Infrastructure & Services			
Stormwater Drainage	Flooding	Flooding, Extreme Heat	Flooding, Extreme Heat, Landslides
Water & Wastewater Management	Flooding, Drought	Flooding, Drought, Extreme Heat	Flooding, Drought, Extreme Heat
Solid Waste Management	Flooding, Extreme Heat	Flooding, Extreme Heat	Flooding, Extreme Heat, Drought
Transport and Mobility	Flooding, Extreme Heat	Flooding, Extreme Heat, Landslides	Flooding, Extreme Heat, Landslides
Energy	Extreme Heat	Extreme Heat, Drought	Extreme Heat, Drought
Economic Infrastructure	Flooding, Extreme Heat	Flooding, Extreme Heat, Drought	Flooding, Extreme Heat, Drought, Landslides
Social Infrastructure	Flooding, Extreme Heat	Flooding, Extreme Heat, Drought	Flooding, Extreme Heat, Drought, Landslides
Emergency Services	Flooding, Extreme Heat	Flooding, Extreme Heat, Drought	Flooding, Extreme Heat, Drought, Landslides
Populations			
Urban Residents	Flooding, Extreme Heat	Flooding, Extreme Heat, Drought	Flooding, Extreme Heat, Drought, Landslides
Informal Settlement Residents	Flooding, Extreme Heat	Flooding, Extreme Heat, Drought	Flooding, Extreme Heat, Drought, Landslides
Vulnerable and Marginalized Groups	Flooding, Extreme Heat	Flooding, Extreme Heat, Drought	Flooding, Extreme Heat, Drought, Landslides
Natural Assets			
Urban Green Infrastructure	Flooding, Extreme Heat	Flooding, Extreme Heat, Drought	Flooding, Extreme Heat, Drought, Landslides
Urban Blue Infrastructure	Flooding, Drought	Flooding, Drought, Extreme Heat	Flooding, Drought, Extreme Heat, Landslides
Peri-urban and Agricultural Systems	Drought, Flooding	Drought, Flooding, Extreme Heat	Drought, Flooding, Extreme Heat, Landslides

Notes / Observations:

1. Flooding dominates risk in stormwater, transport, and low-lying urban areas, increasing over time due to urban expansion and extreme rainfall.
2. Extreme Heat impacts energy, social infrastructure, and populations, with growing intensity under SSP5-8.5 scenarios by 2100.

3. Drought primarily affects water supply, agriculture, and urban green/blue infrastructure.
4. Landslides emerge as a long-term hazard, especially for hillside settlements, transport corridors, and peri-urban farming systems.
5. By 2100, most urban elements are affected by multiple hazards simultaneously, highlighting the need for integrated climate adaptation strategies.

6. References

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- Kiambu County Government. County Integrated Development Plan (CIDP).
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Annex 1. Data Sources

Page	Data	Data Source