



Mukuru | Nairobi, Kenya

2017 Situational Analysis: Mukuru Kwa Njenga, Kwa Reuben & Viwandani

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Mukuru Settlement

2017 Situation Analysis: Report Authors

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Through collaborative, interdisciplinary research and practice, IURD supports students, faculty, and visiting scholars to critically investigate and help improve processes and outcomes that shape urban equity around the world.

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The Katiba Institute (KI), Located in Nairobi, was established in 2011 to promote knowledge and studies of constitutionalism and to facilitate the implementation of Kenya's new constitution. The principal objective of KI is to achieve social transformation through the constitution. In the immediate, KI works to help promote the implementation of the constitution.

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EXECUTIVE SUMMARY

This report is a synthesis of a multi-year collaboration with residents of the Mukuru community and SDI, AMT, Muungano Wa Wanavijiji, Strathmore University, Katiba Institute, UC Berkeley, and IDRC Canada. This report builds from previous studies and presents the situation and complexity that underlies one of Nairobi's largest belt of informal settlements. The data were co-produced with residents, researchers and each contributing organization. The aim of this report is offer a baseline of living conditions in Mukuru and to inform collaborative planning moving forward. This report synthesizes data on existing physical and social factors in Mukuru kwa Ngenga, kwa Rueben, and Vivandani, and key findings include:

1. The community is **spatially segregated** and not fully benefitting from investments and development in the surrounding area;
2. Residents face a significant **poverty penalty** which means that they pay a greater economic and social price for poor quality services such as water, sanitation, childcare and health care;
3. Residents face **multiple burdens** of pollution, lack of clean water, inadequate toilets, and irregular or unaffordable electricity and energy;
4. Residents face significant **health risks**, especially women and children, that are likely to impact the entire City of Nairobi if unaddressed;
5. There is a **robust informal economy that generates approximately 7 billion KSh annually** and supports both local residents and the economy of the entire metropolitan region;
6. Mukuru experiences significant **environmental risks** that will be exacerbated by **climate change** and will significantly increase the vulnerability of the urban poor and others to displacement, disease and risk of premature death;
7. **Overcrowding**, since there are 466 people per acre, compared to 18 people per acre for Nairobi City
8. Residents **mobilize**, inform themselves and organize to get minimal services but many are not able to access basic services, and;
9. Living conditions in Mukuru regularly miss the **Sustainable Development Goals**, particularly around water, sanitation, electricity, gender, and other areas.



a. Community gathered in Mukuru Kwa Njenga

Mukuru and the Sustainable Development Goals

The situation in Mukuru reflects the reality for far too many urban poor and will hinder the ability of Kenya to achieve the **Sustainable Development Goals**. Below we outline a few of the SDGs that must be addressed in Mukuru:

1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have **equal rights to economic resources, as well as access to basic services, ownership and control over land** and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance

1.5 By 2030, build the resilience of the poor and those in vulnerable situations and **reduce their exposure and vulnerability to climate-related extreme events** and other economic, social and environmental shocks and disasters

3.9 By 2030, substantially **reduce** the number of deaths and illnesses from hazardous chemicals and **air, water and soil pollution and contamination**

5.2 **Eliminate all forms of violence against all women and girls in the public and private spheres**, including trafficking and sexual and other types of exploitation displacement, disease and risk of premature death;

6.1 By 2030, achieve **universal and equitable access to safe and affordable drinking water for all**

6.2 By 2030, achieve access to **adequate and equitable sanitation and hygiene** for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

7.1 By 2030, ensure **universal access to affordable, reliable and modern energy services**

9.1 Develop **quality, reliable, sustainable and resilient infrastructure**, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on **affordable and equitable access for all**

11.1 By 2030, ensure **access for all to adequate, safe and affordable housing and basic services and upgrade slums**



11.7 By 2030, provide universal **access to safe, inclusive and accessible, green and public spaces**, in particular for women and children, older persons and persons with disabilities

The key findings of this report can be used to measure progress toward the goals already outlined in the **Nairobi City County Strategic Plan, 2015-2025**, Nairobi's Integrated Urban Development Master Plan, and the Nairobi Metropolitan Services Improvement Project.

This Situational Analysis can also inform processes associated with the **Kenya Informal Settlement Improvement Programme (KISIP)** which aims to enhance security of tenure and improve infrastructure based on plans developed in consultation with local communities.

Background on Mukuru Informal Settlements

Mukuru is one of the largest of over 150 informal settlements in Nairobi, Kenya. Mukuru includes the settlements of Mukuru Kwa Njenga, Mukuru Kwa Reuben, Viwandani, Mukuru Kayaba, Fuata Nyayo, and Mariguini which are situated in Nairobi's industrial zone approximately 7 Km southeast of the central business district (Map 1). In this report we define the Mukuru informal settlement as Mukuru Kwa Njenga, Mukuru Kwa Reuben, and Viwandani.

The Mukuru community is bisected by the Kenya Railway, which runs along the border between Kwa Reuben and Kwa Njenga, and the Ngong River, which divides Kwa Reuben and Viwandani (Map 2).

Mukuru Kwa Reuben dates back to at least 1958, when the land was owned and farmed by a white settler named Reuben. After Reuben's passing, local government took ownership of the land, which was later allocated to private developers for light industry in the 1980s.

Despite the transfer of land titles to private developers, the land remained largely undeveloped and was quickly settled upon by migrant families and industrial workers drawn to jobs in the neighboring industrial zone and Nairobi's city center. As the settlements began to grow and densify, issues of land tenure and threats of eviction intensified the contestation of land ownership in Mukuru.

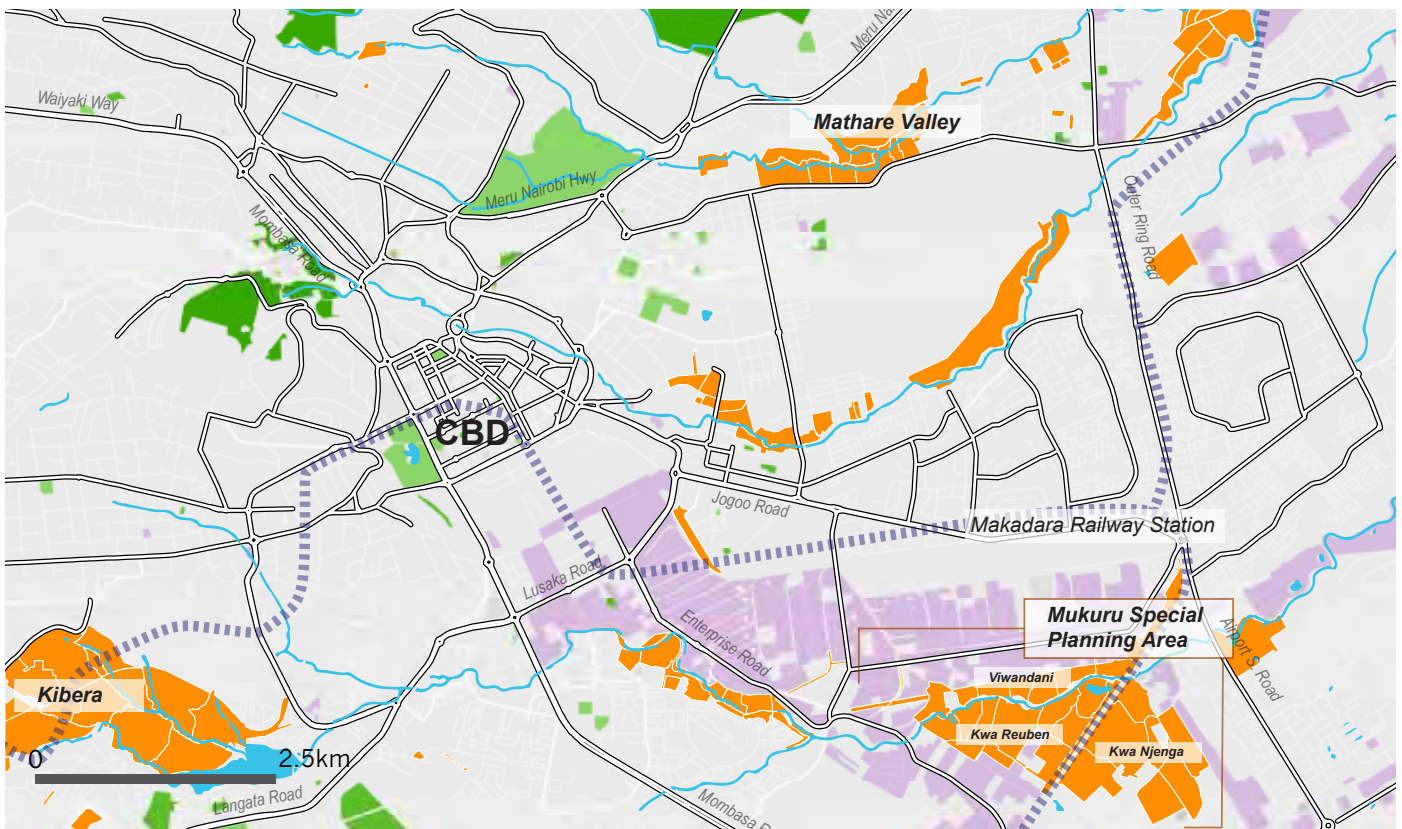
The Mukuru settlements are within Embakasi constituency and four administrative wards, Kwa Reuben, Kwa Njenga, Imara Daima, and Viwandani. Each ward includes not only the informal settlement areas, but surrounding residential estates and other various land uses. The crosscutting ward boundaries create a challenge in utilizing administrative information such as census data that are difficult to disaggregate from surrounding formal areas.



b. Community gathered along the street and children playing in Sepu, Riara, Mukuru Kwa Njenga

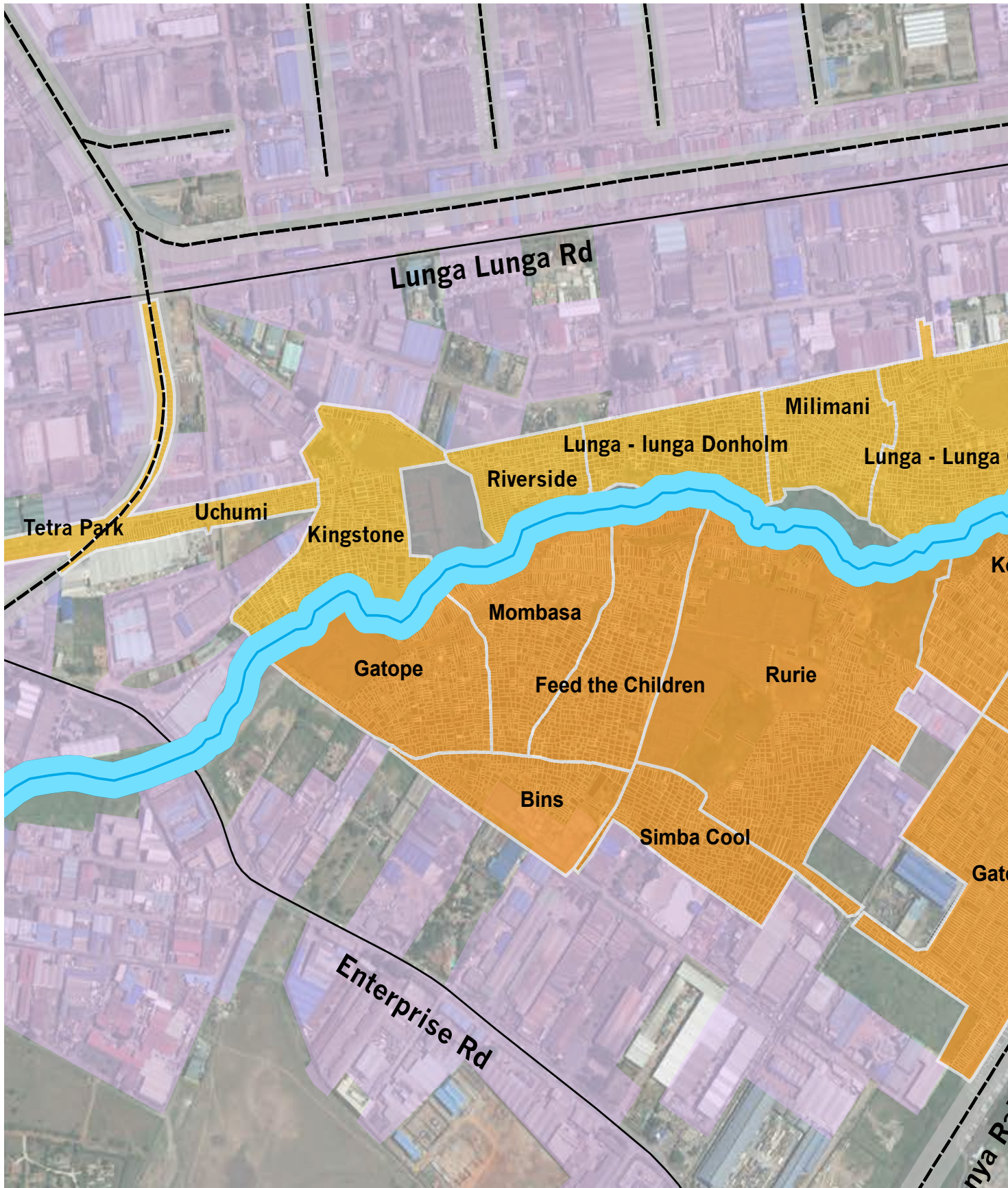


c. Above: compromised and inadequate pathways in Gateway, Mukuru Kwa Reuben



■ Industry ■ Informal settlements ■ Green space - - - Railway ~ Rivers

Map 1. Mukuru and other major informal settlements in Nairobi



Map 2. Mukuru Settlements and Village Names



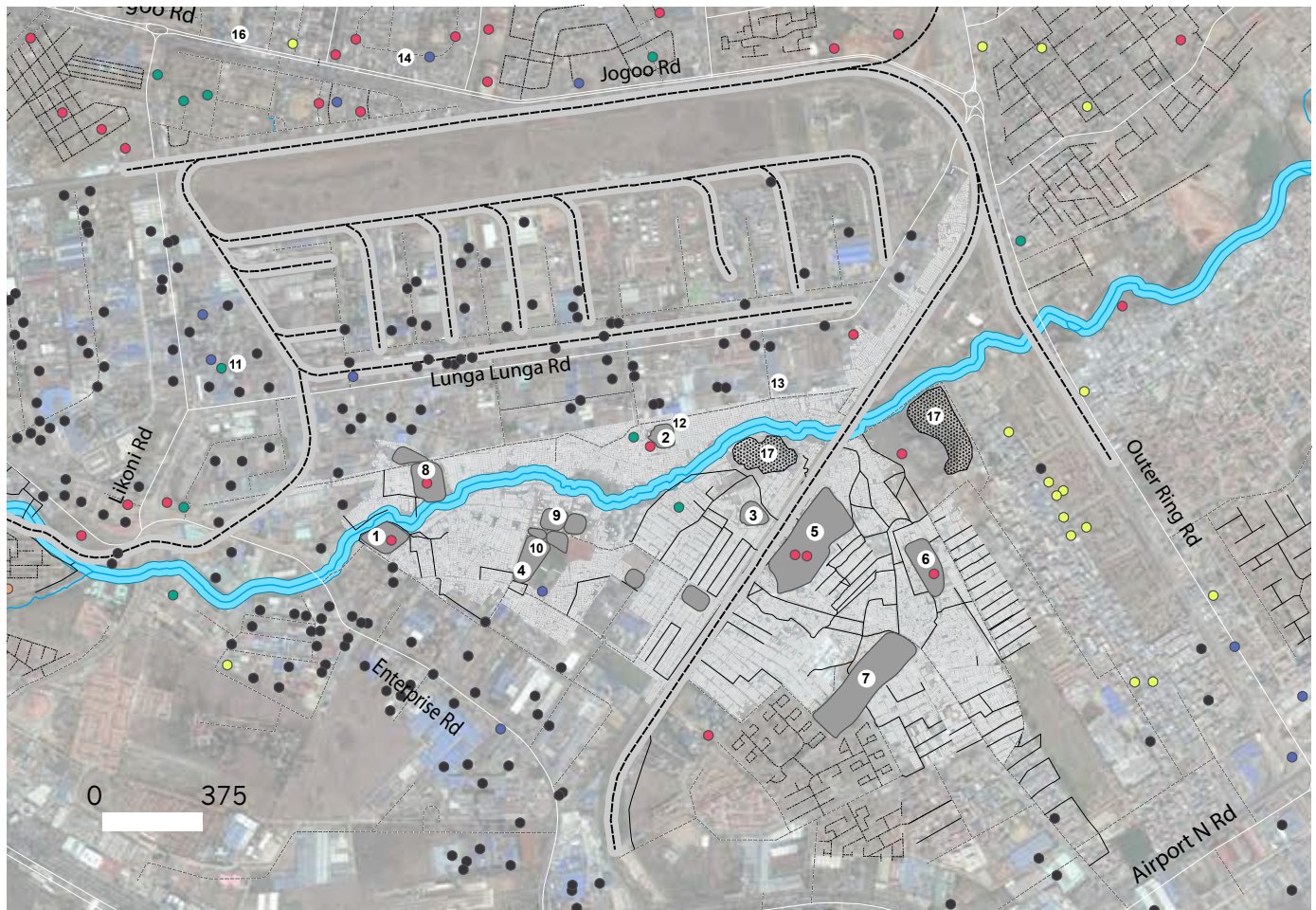


Industry
 Mukuru Kwa Njenga
 Mukuru Kwa Reuben
 Viwandani

CITY AND REGIONAL CONTEXT

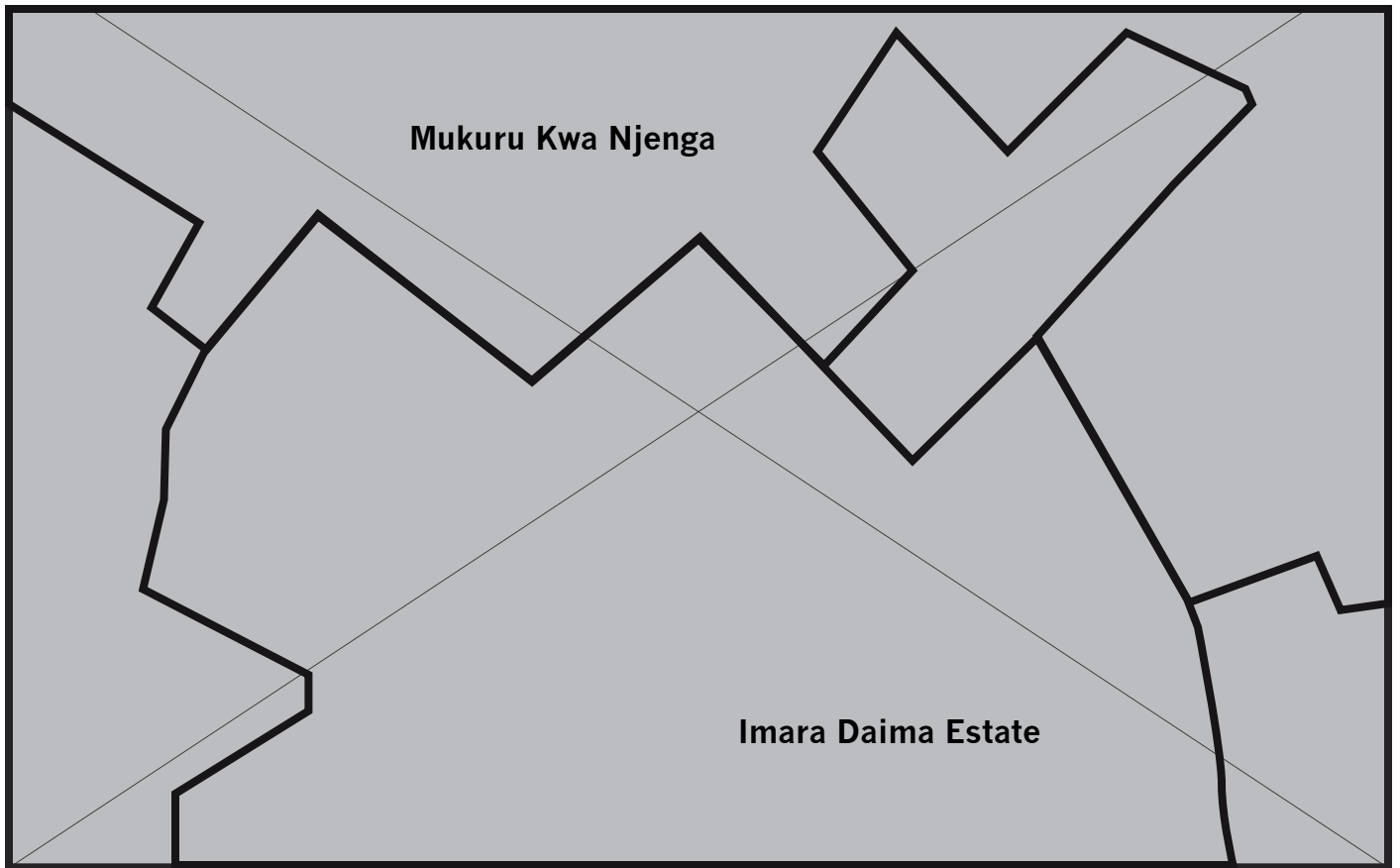
Mukuru & its Surrounding Region

Mukuru is surrounded by an industrial belt of manufacturing and distribution centers. Mukuru is also situated in an area with a growing number of middle class housing estates, along with municipal assets such as hospitals and health clinics, schools, and shopping centers. However, the informal settlement is physically



- Shops
- Hospitals
- Schools
- Industrial facilities
- Administrative

Map 3. Mukuru Regional Assets



Map 4. Mukuru Kwa Njenga bordered by middle class estate

segregated from many of these regional assets.

The river, railway and industries, many with high walls and gates, make access to regional services difficult and time consuming for Mukuru residents. Major roadways bordering the settlements, including Mombasa, Lunga Lunga, Outer-ring, and Airport North Roads act as both vehicle mobility assets but also barriers for pedestrians and are major sources of vehicle-generated air pollution.

Like many informal settlements, Mukuru is not adequately integrated into its surrounding region. Regional integration includes physical access, such as through pedestrian paths, bridges and public transport, as well as social integration through opportunities to utilize economic, health care, and educational facilities.

The Nairobi Integrated Urban Development Master Plan does not provide specific strategies for ensuring Mukuru residents can access the existing and planned railway and transit hubs.

Pedestrian mobility to regional assets is currently limited and unsafe for many Mukuru residents, since there are few bridges or safe crossings over roadways, rivers and railways.

There is also limited direct access for Mukuru residents to the city's nearby public and green spaces. Due to limited access, in terms of both proximity and affordability, to assets in the surrounding area Mukuru residents are forced to provide these services within the community.

MUKURU EXISTING CONDITIONS

Population

Population Estimates

The 2017 population estimate for Mukuru Kwa Njenga, Kwa Reuben, and Viwandani is **301,683 people**. This estimate was calculated based on a detailed household enumeration and a statistical process that found an average household size of three people. The enumeration found a total of 100,561 households in all three settlements. Mukuru Kwa Njenga has the largest population, with 113,032 people; Kwa Reuben has 97,833 people; and Viwandani has 70,818 people. The household counts and population estimates are detailed at the settlement level in Figure 1.

Although Viwandani has the smallest population it is the most dense community, with 513 people per acre. Kwa Njenga has 486 people per acre. **Kwa Reuben has the lowest population density of 415 people per acre, however, this density is 23 times greater than the 2009 population density of Nairobi City, reported as 18 people per acre by the Kenya National Bureau of Statistics.**

Population Projections

Using a conservative six percent annual population growth rate, we estimate that the population of Mukuru will grow to **682,076 persons by the year 2030**. In other words, the population may double in size over the next 12 years.

Assuming no major change in Mukuru's acreage, population density would rise to a staggering **1,053 persons per acre, or 260,202 persons per square kilometer by the year 2030**.

Demographics

The demographic characteristics of the residents in Mukuru suggest that the settlements is a hub for young workers seeking job opportunities in the nearby industrial zone and city center. The population is diverse and young compared to that in the more formal areas of Nairobi. The presence of workers may also explain why over 17% of households in Mukuru are single men, which is 40% more than the average for all of Nairobi. The average length of residency across all of Mukuru is 4.5 years, but some households, particularly in Viwandani have been there for as long as 44 years.

Age: The average age in Mukuru is 27 years old.

Gender: The Mukuru population is approximately 60% male, 40% female.

Religion: The Mukuru population is approximately 95% Christian, 2% Muslim

Ethnicity: 90% of residents identify as one of the following five tribes: Kikuyu, Kamba, Kisii, Luhyia and Luo, with Kamba being the most common.

¹2016 population estimate calculated using household count multiplied by average household size of 3 people consistent with findings across Mukuru.

Mukuru Settlements	2016 Number of Households (HH)	2016 Population Estimate (# people)
Kwa Njenga	44,344	133,032
Kwa Reuben	32,611	97,833
Viwandani	23,606	70,818
Totals	100,561	301,683

Figure 1. 2016 Mukuru household enumeration & population estimates¹

Mukuru Settlements	Area (acres)	Population Density Estimate (people per acre)
Kwa Njenga	274	486
Kwa Reuben	236	415
Viwandani	138	513
Totals	648	466

Figure 2. 2016 population density estimates



Map 5. Nairobi 1986

Nairobi City County Growth 1986 - 2016

Maps 5 and 6 show development in Nairobi City County over a 30 year period between 1986 and 2016. The aerial images depict high levels of urbanization and densification in the city center and surrounding areas. Present day Mukuru is outlined in black in both photos.



Map 6. Nairobi 2016

Maps 7 through 10 reveal the rapid population and built area growth of Mukuru over the past 15 years. Our analyses suggests that in 15 years, the built-up area has doubled in size and **likely tripled in population**.

**Map 7. Mukuru
2002 Google
Earth aerial photo**

In 2002 settlements covered approximately 50% of the area.

The Ngong River riparian zone was largely undeveloped.



**Map 8. Mukuru
2006 Google
Earth aerial photo**

In 2006 settlements covered approximately 75% of the area.

The Ngong River riparian zone remain largely undeveloped.

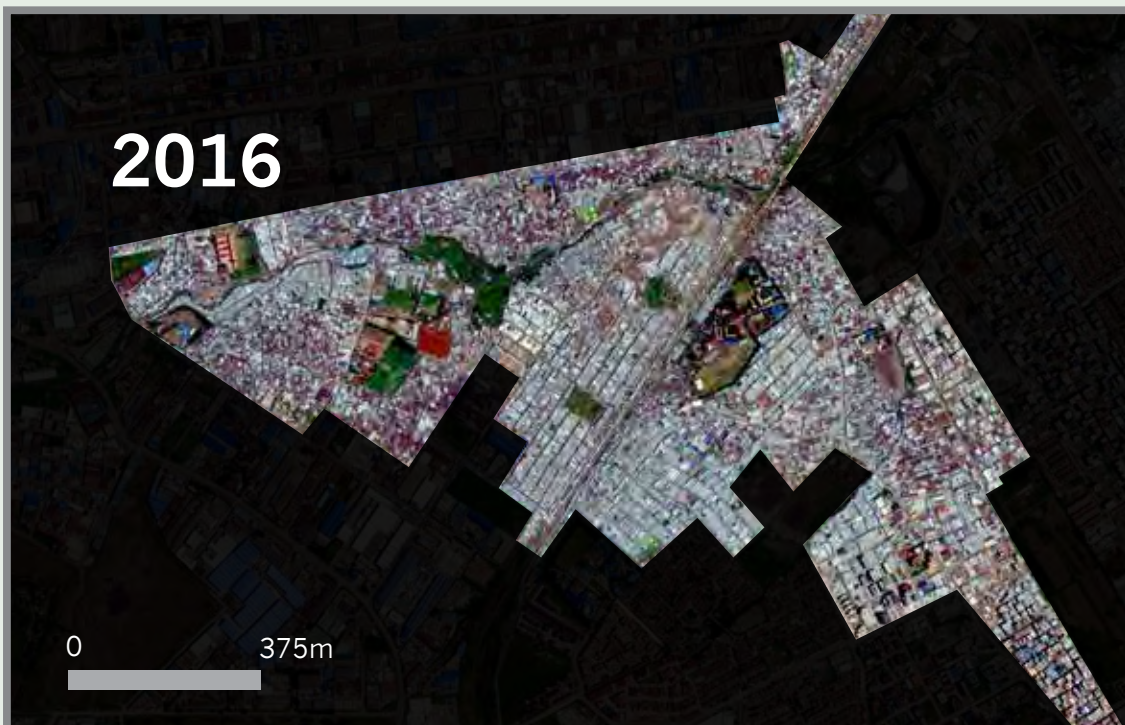




Map 9. Mukuru 2010 Google Earth aerial photo

In 2010 settlements covered approximately 85% of the area.

The Ngong River riparian had a moderate buffer zone, but was rapidly being built upon.

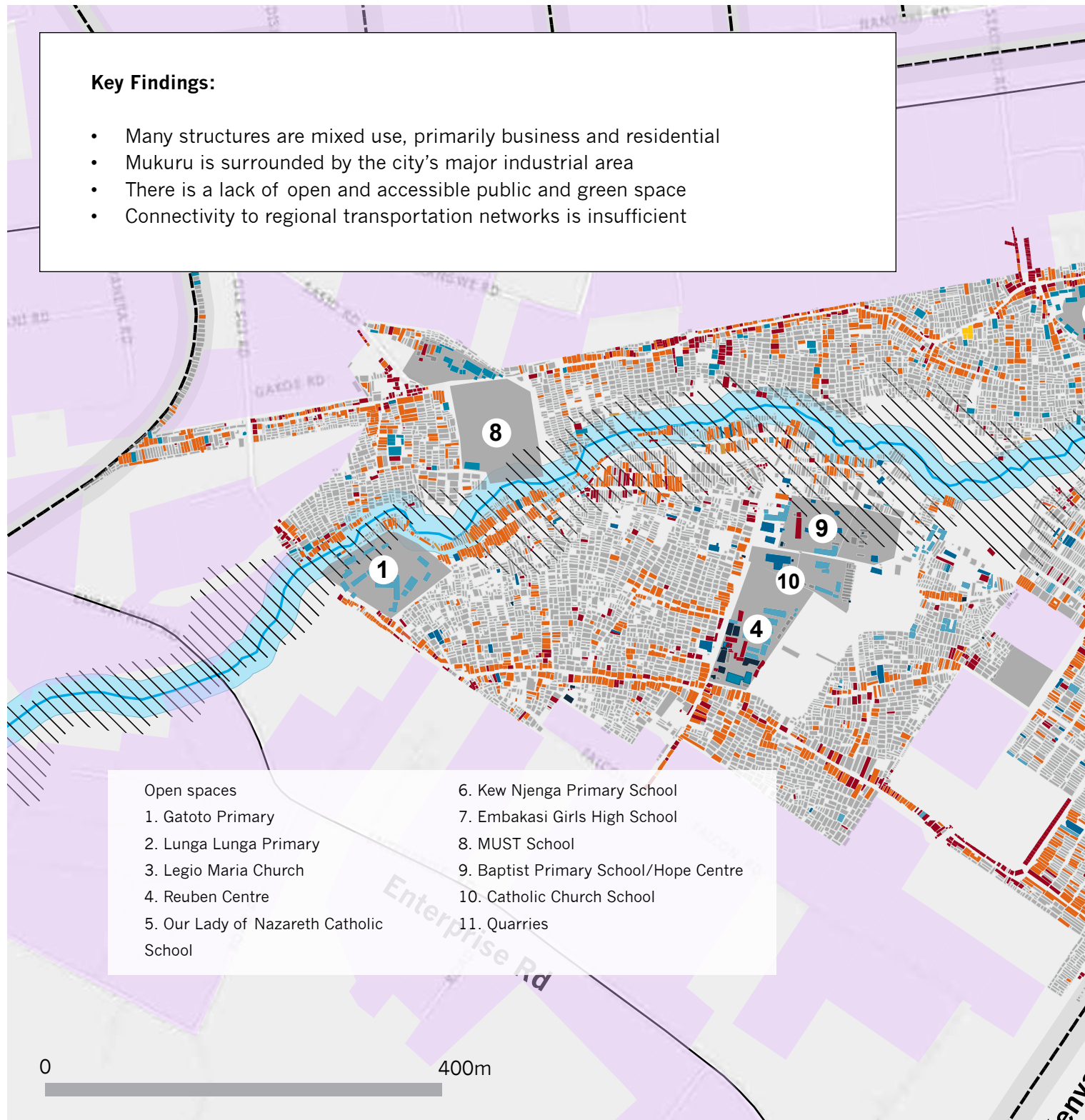


Map 10. Mukuru 2016 Google Earth aerial photo

In 2016 settlements cover approximately 95% of the area.

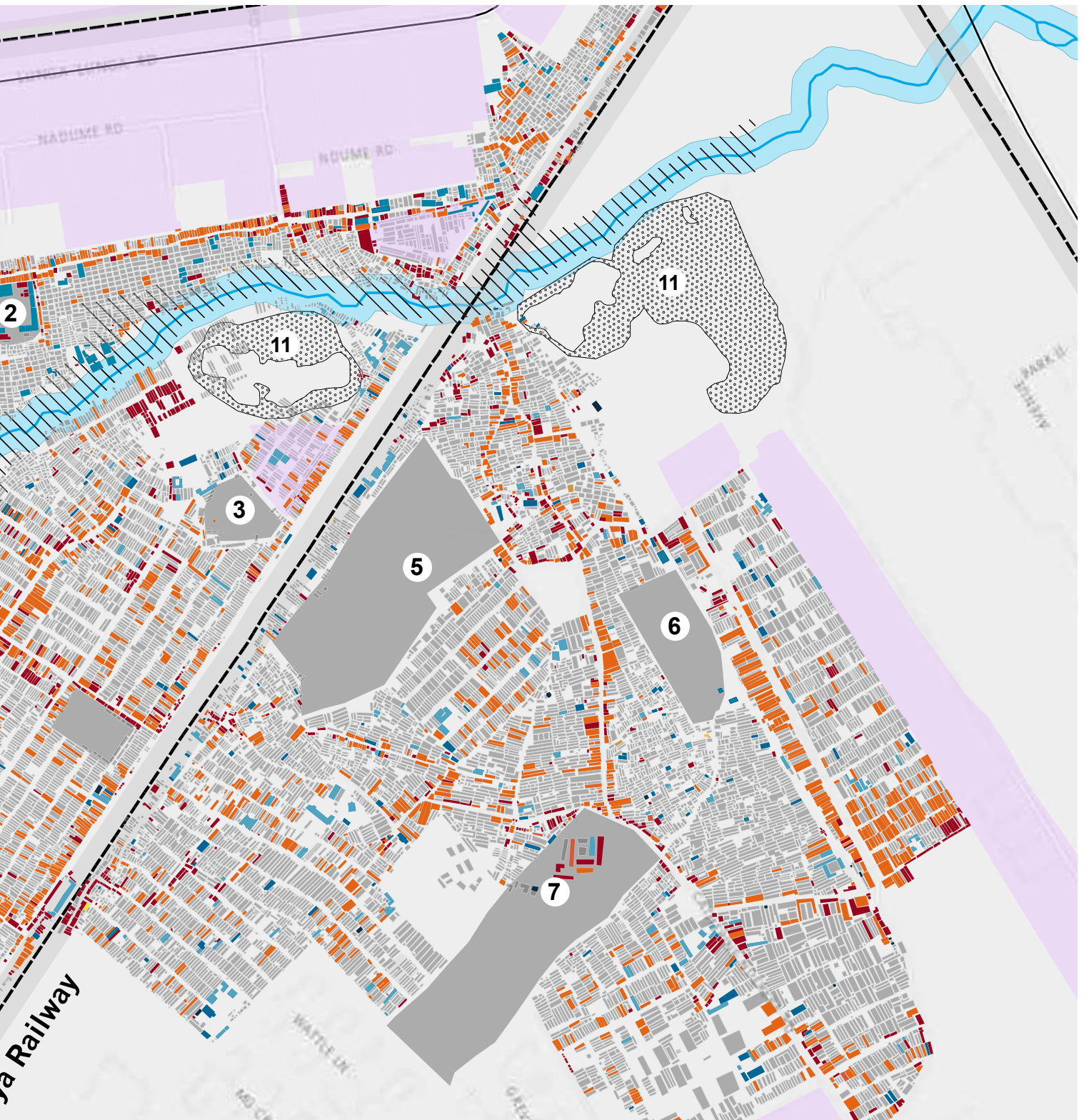
The Ngong River riparian zone is completely developed.

Land Use



Map 11. Business and mixed use structures

Industry Residential structures



Ngong River



Commercial



Residential & Commercial



Educational & Community
Facilities

Economy and Livelihoods

Key Findings

1. Roughly 7 Billion KSh in annual revenue from the Mukuru informal economy
2. Average monthly expenditures of 6,700 KSh and average income of 12,000 KSh
3. Mukuru residents face a poverty penalty on basic services such as water, paying 240 KSh per cubic metre of water versus 55 KSh in formal areas
4. Over 27% of structures are used for business or commercial purposes.

Mukuru is home to a large informal economy and labor force, contributing to economic activity both within the settlements as well as in the surrounding industrial area and Nairobi's central business district. While the informal economy provides a large citywide economic contribution, informal jobs are often very low wage and lack job security, allowing workers to survive but not to build financial savings or change living conditions. Unemployment in Mukuru is approximately 30%. However, gender disparities exist, as women are 25% more likely to be unemployed than men. Casual labor is very common and over 12% of employment is in local industries. The average household reports an average monthly income of 12,000 KSh. Paying for education, food, and health care were reported as the three highest priority financial needs for Mukuru residents.

Average Monthly Expenditures, KSh

Total: 6,679 KSh

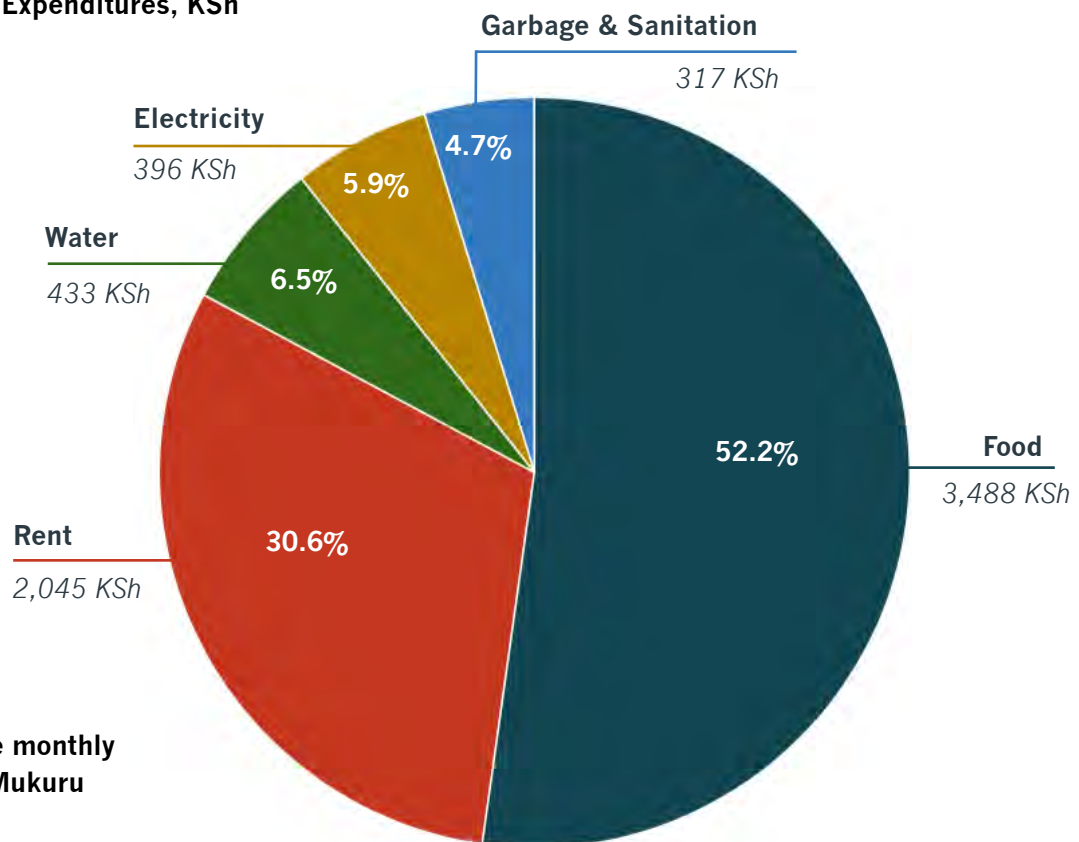


Figure 3. Average monthly expenditures in Mukuru



Map 12. Business corridors

Streets are an important commercial and social space in Mukuru. There are a total of 4,244 business or commercial structures within Mukuru, 2,698 of which are also residences.

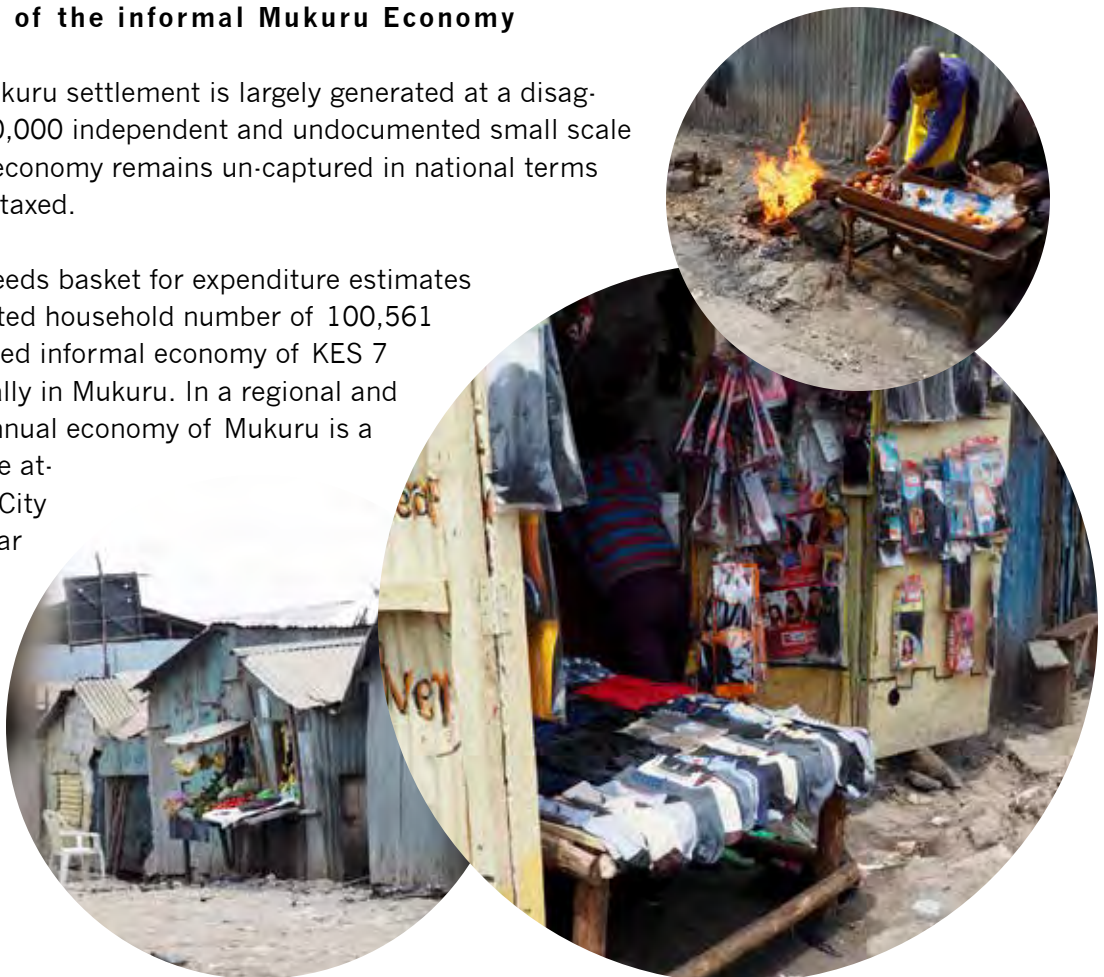
Business structures are predominantly found along primary roads (Map 12)

- Mixed use structures
- Residential structures
- Business structures
- Main roads

Estimating the size of the informal Mukuru Economy

The economy in the Mukuru settlement is largely generated at a disaggregate level by over 20,000 independent and undocumented small scale service providers. The economy remains un-captured in national terms as it is informal and untaxed.

Based on a modified needs basket for expenditure estimates and the 2016 enumerated household number of 100,561 households, an estimated informal economy of KES 7 billion generated annually in Mukuru. In a regional and national context, the annual economy of Mukuru is a fifth of the total revenue attributed to the Nairobi City County for the fiscal year 2015/6 and about 4% of the 2015/6 Kenya government national budget of KES 1.667 trillion.



d. Left, storefront, e. Right, kiosk f. Top, street cooking, all in Sepu, Riara - Mukuru Kwa Njenga

Education and Community Facilities

Key findings:

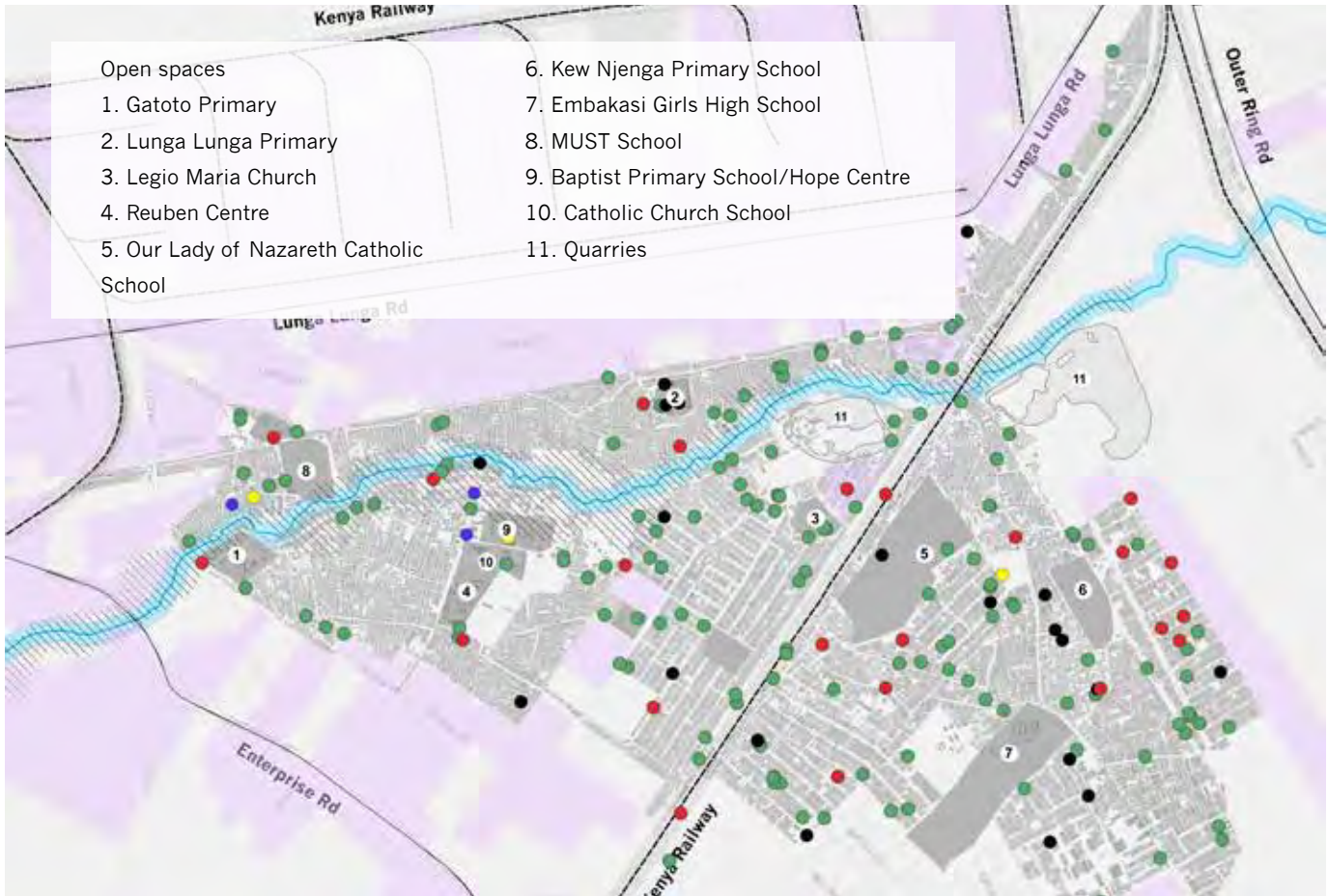
1. Kwa Njenga has approximately 82 schools, but only 1 public primary school.
2. Over 50% of the Mukuru population has at least Form 4, secondary education, which is twice the national average.
3. Open public spaces are inadequate and the few that exist are inaccessible to most residents.

.....
Mukuru has vibrant social networks, community facilities and schools that foster community building and create opportunities for residents (Map 13). Yet, the existing social and educational services are insufficient to meet the high demand and growing population.

A large number of NGOs and missionaries have invested in building schools, clinics, and community centers and providing medical and sanitation related interventions that address specific needs of communities.

Mukuru lacks open public and green spaces for recreation and community activity. Most of the spaces identified as 'open' belong to institutions in the area, mostly schools and a few churches. The open spaces in schools allow children to play in a safe environment, however these spaces are not accessible for all residents and are insufficient to meet the community need for safe public space.

Mukuru has a large number of primary school age children but few City Council schools. Most households pay for low-quality education, and many schools are located in unsafe structures that lack adequate water and sanitation. There is a shortage of teachers resulting in large student-to-teacher ratios.



Map 13. Above: Schools and Community Facilities

● Schools



Left: Mukuru residents in a meeting

Housing

Key Findings

1. Housing consists of 10' x 10' structures with walls and a roof made of sheet metal, frequently with dirt floors
2. Average monthly rent is 2045 KSh, but varies across villages from about 1,580 to 2,750 KSh.
3. 92% of residents in Mukuru are renters/tenants

Housing in Mukuru is low-quality, primarily temporary in nature, and evictions are common. In addition to the use of inadequate construction materials, housing is also strongly influenced by broader land tenure issues, and both social and economic instability in the region. Rapid population growth combined with inadequate construction and high risk densification may amplify the existing challenges in Mukuru. While higher densities can be perceived as an efficient use of land in urban areas facing fast urbanization, they can also increase the likelihood of catastrophic disasters to occur, especially in overcrowded and poorly served environments. At the same time, lower densities translate into horizontal expansion of settlement housing into areas unsuitable for development, such as flood zones or sites containing toxic chemicals. Balancing the issues of density, safety, affordability and livability is vital to the improvement of housing in Mukuru.



i. Left: A 'permanent' informal structure under construction in Mukuru Kwa Reuben. As the population of Mukuru grows, the pressure for increased density has given rise to many informal and unregulated 'permanent' multi-level structures that pose a threat to the safety of residents.

j. Right: Construction of a new settlement community in Mukuru Kwa Njenga



Housing Typologies

The standardized housing type in Mukuru is a ten by ten foot, one story structure with walls and roofs made of iron sheets (figure b). These structures often have metal doors, with either dirt or concrete floors. Most structures lack indoor water taps and toilets. Most have informal electricity connections. Other materials commonly used for the construction of these self-built structures include stones, mud, mesh or wood (figure d).

Household Size & Length of Residency

The average household size in Mukuru and Viwandani is 3 persons. The average claimed length of residency in years across the settlements are as follows: Ruben: 3.73; Njenga: 4.38; Viwandani: 5.48. The statistics corroborate the historical narratives of the settlement with Viwandani considered an older, organic settlement compared to Njenga and Reuben.

Looking for a job is the main reason reported for moving into the informal settlement (over 40%) followed family reasons (approximately 10%). About 2% indicate their reasons to be due to eviction. A third of respondents indicate other reasons for their move.

Rents

Though building materials and room sizes are largely similar for housing units in the settlements, the cost for renting varies significantly from Ksh1,000 - 5,000 with an average of KSh 2,045 per month. Costs are largely driven by relative access to basic services of water, security of tenure and exposure to environmental vulnerabilities such as flooding.



k. Many homes advertise vacancy and rooms for rent

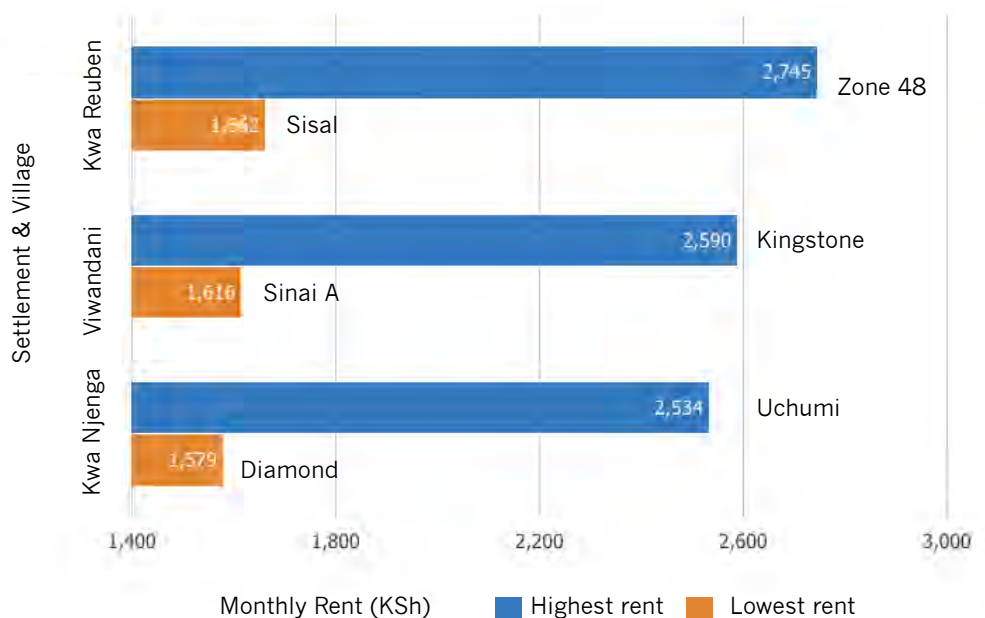


Figure 4. Villages with highest and lowest average rent in Mukuru

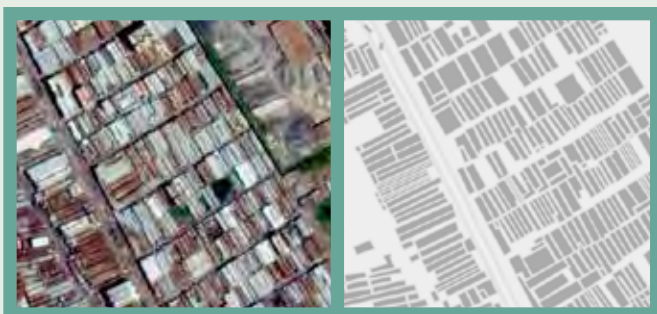


Map 14. Mukuru Villages with different types of organization



High level of structure organization

In this scenario, houses are most often in a formal grid pattern with regular size intervals between lanes, paths or roads. This pattern often provides some space for services and vehicle access in case of emergencies. These are often the newest settlements as indicated by the grey roof color.



Moderate level of structure organization

In this scenario, structures are grouped in both grid and non-grid patterns. Circulation is improved from low-levels of organization but have hindered vehicle and pedestrian access.



l. Highly organized structures, SEPU, Mukuru Kwa Njenga, **m.** Row of structures in SEPU

Community Spatial Layout

The spatial organization of structures varies across Mukuru. Some areas have newer permanent structures organized in a grid pattern while other often older areas are organized in a less consistent pattern. The layout impacts mobility and emergency vehicles, safety, vulnerability to fires, and ability to increase density amongst a host of other issues.



Low - Moderate level of structure organization

In this scenario, the homes may be both haphazardly laid out while also some areas in a more grid-like pattern. In the image to the left, the red looking roofs indicate older, more rusted structures. Service and safety access are limited, often increasing the costs of services for residents.



Low level of structure organization

In this scenario, many of the houses are older and were typically constructed in a more haphazardly way. However, these settlements can have tenants that own their own structure. Service provision is a challenge since there are few open paths to deliver water, sanitation, garbage collection, etc. There is a high degree of danger from fires in this scenario.

Infrastructure, Mobility & Services

Key Findings

1. Walking is the primary mode of transportation for Mukuru residents, but significant mobility barriers include dangerous roads, lack of bridges and flooded paths.
2. Roads and paths are mostly unpaved, present hazards to pedestrians, and impede access for emergency vehicles
3. The few motorable roads in Mukuru limit vehicles exhaust pollution but also prevents matatu access and other affordable transit options
4. Lack of bridges, the railway, and the river act as mobility barriers but could improve circulation within Mukuru.

There are four main levels of road infrastructure in Mukuru including: primary roads; secondary roads; tertiary roads; and footpaths.

Primary roads facilitate major forms of transportation and vehicular access within the settlements. Varying between 4m and 15m, these roads are unpaved, may contain open drainage containing waste water, and are at high risk of flooding. They are generally poorly maintained and in subpar condition which make them challenging for both pedestrians, motorists, and emergency vehicles to utilize, particularly during rainy seasons.

The secondary roads are connected to primary roads, and act as feeders to tertiary roads and footpaths. Secondary roads are unpaved, vary between 2.5m and 9m, and have a mix of motorable and non-motorable roads which suffer similar issues of drainage and flooding.

Tertiary roads vary between 3m and 8m, and connect footpaths to the secondary roads. These roads are major destinations for solid waste disposal

given that structures along the roads are mostly residential with few commercial uses. This makes tertiary roads difficult to utilize during both dry and rainy seasons.

Footpaths facilitate the major mode of movement throughout the settlements. They vary between 1 to 2m and are the most direct routes to individual housing units. Most of them drain into shallow concrete drains that then direct waste water onto either the tertiary roads or the secondary roads.



n. Unimproved secondary road in Mukuru Kwa Njenga



o. Residents walk along the railway in Mukuru Kwa Reuben

Water

Key Findings

1. Only 1% of residents in Mukuru have access to a private or individual water source
2. There are an average of 234 households per public water tap in Mukuru
3. Mukuru households are water insecure, since they have access to 1.8 cubic metres of water per month, while the international recommendation for health and hygiene is 4 cubic metres per month.

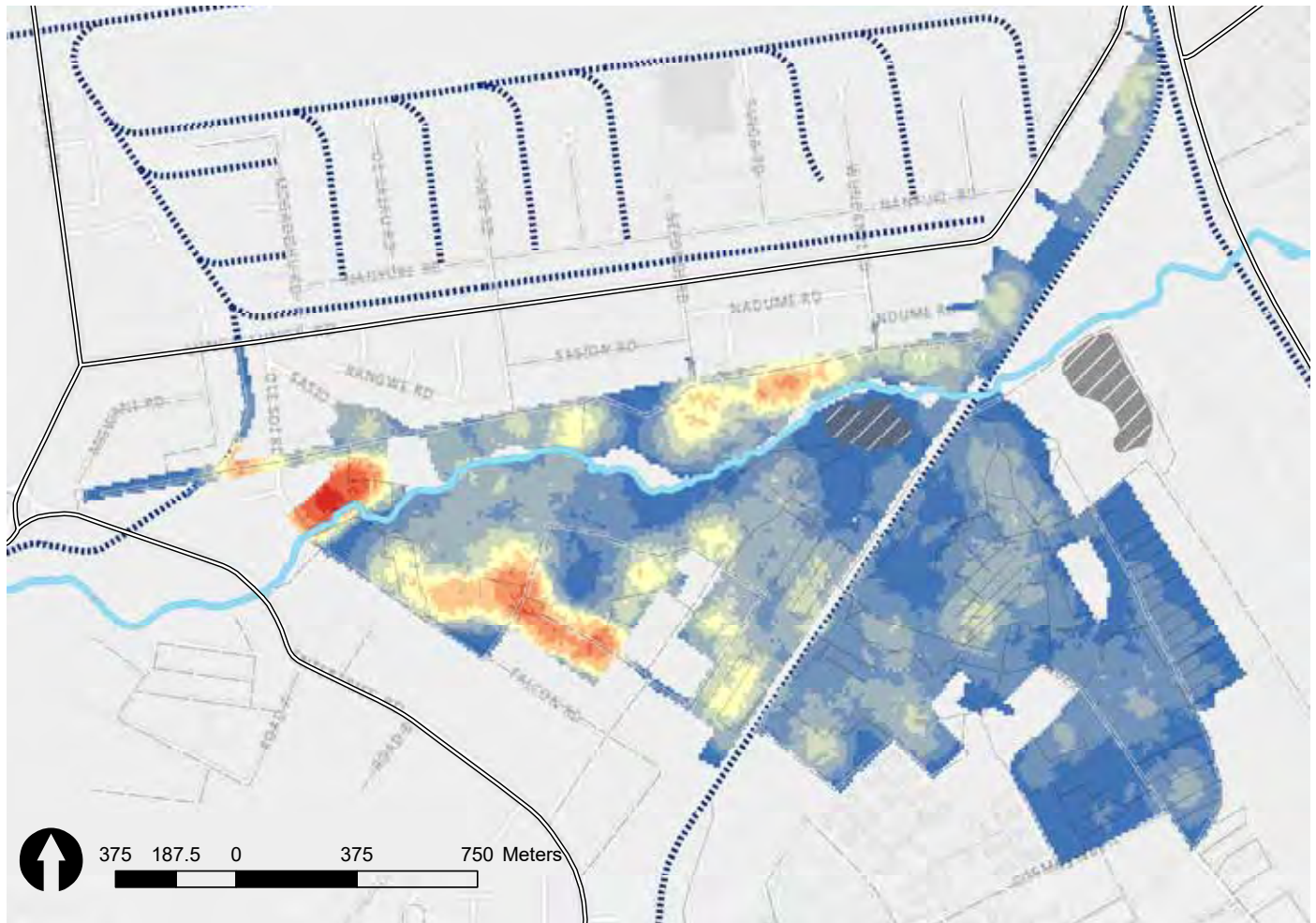


p. Water tapping in Riara, Mukuru Kwa Njenga

For drinking, washing and other uses Mukuru residents utilize either a standing tap or a water kiosk.

Household in Mukuru purchase about three 20 litre containers of water daily at a cost of KSh 3-5 per jerry can, this is roughly 1,800 liters, or 1.8 cubic metres per month at a cost of 433 KSh.

Hygiene and health studies recommend a minimum household monthly consumption of water as 4 cubic meters. This suggests the Mukuru households are water insecure, most likely due to a combination of poor quality and infrequent service/access & poverty.



Map 15. Water access density map

High density Low density

Density of water points

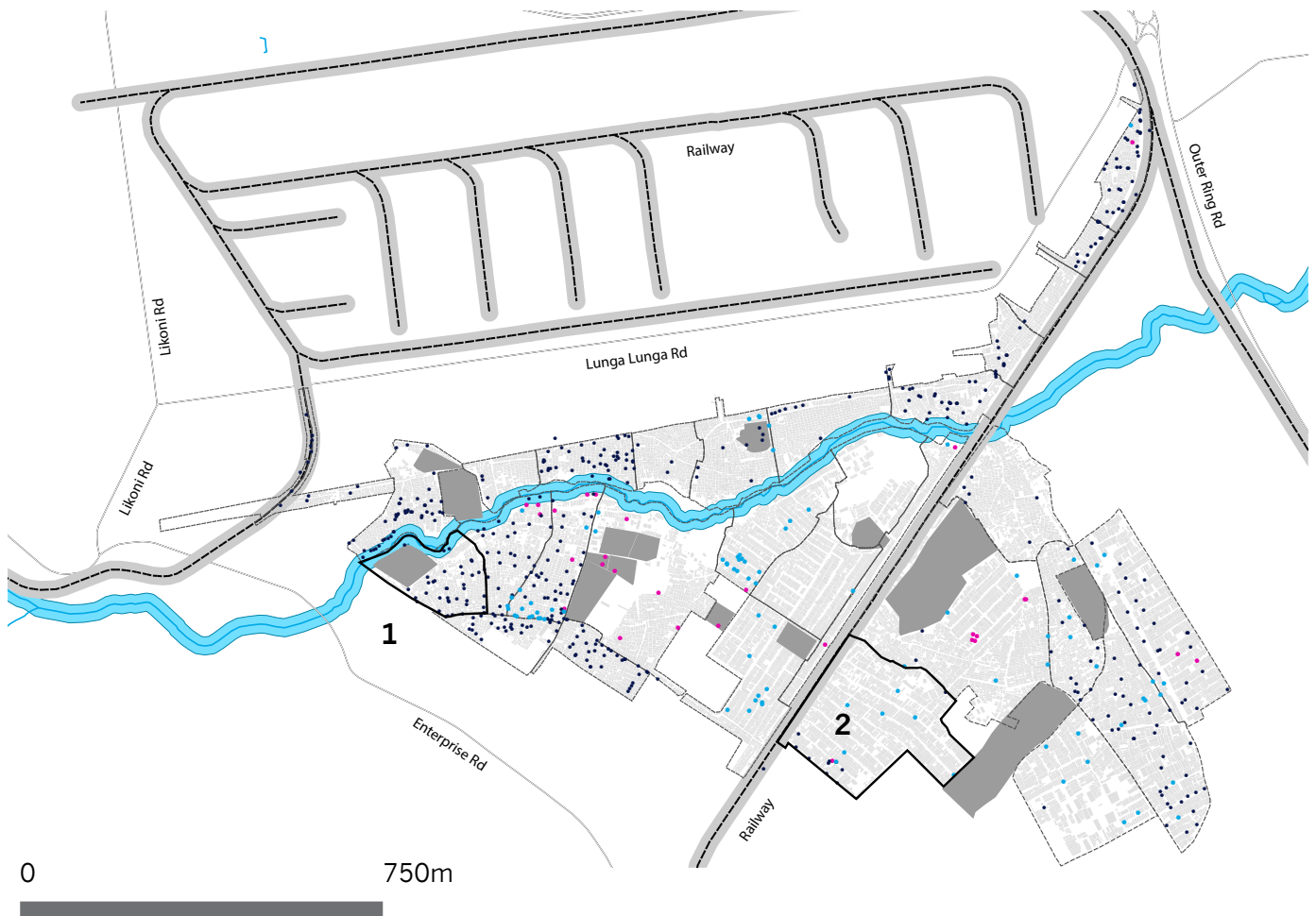
The map above displays the density of all public, private and yard-shared water access points in Mukuru Kwa Njenga, Kwa Reuben, and Viwandani. Red and orange areas are areas of high density, and these are primarily found in the western side of Mukuru Kwa Reuben and Viwandani. These areas have the closest proximity between water points, with an average 25-50 meter distance between each point. Lowest density areas displayed as light green and blue are found throughout Mukuru Kwa Njenga and the eastern side of Mukuru Kwa Reuben bordering the railway. This map offers a broad view of the concentration of all water access points. However, the private and yard-shared water taps are only accessible to a limited number of households and the public facilities vary in quality and frequency of operation.

Public Water Access

Water points in Mukuru and Viwandani can be classified as public, yard-shared, and private. Public water points are the most common, found at highest densities in western Mukuru Kwa Reuben. Many areas in eastern Kwa Reuben, central Viwandani and all of Kwa Njenga have little to no water points within a 300 meter range.

Water Service Provider	Avg. Monthly cost (KES)
County Government	636
Private	423
Community	619
Other	460
Average cost	433

Figure 5. Mukuru Average Water costs

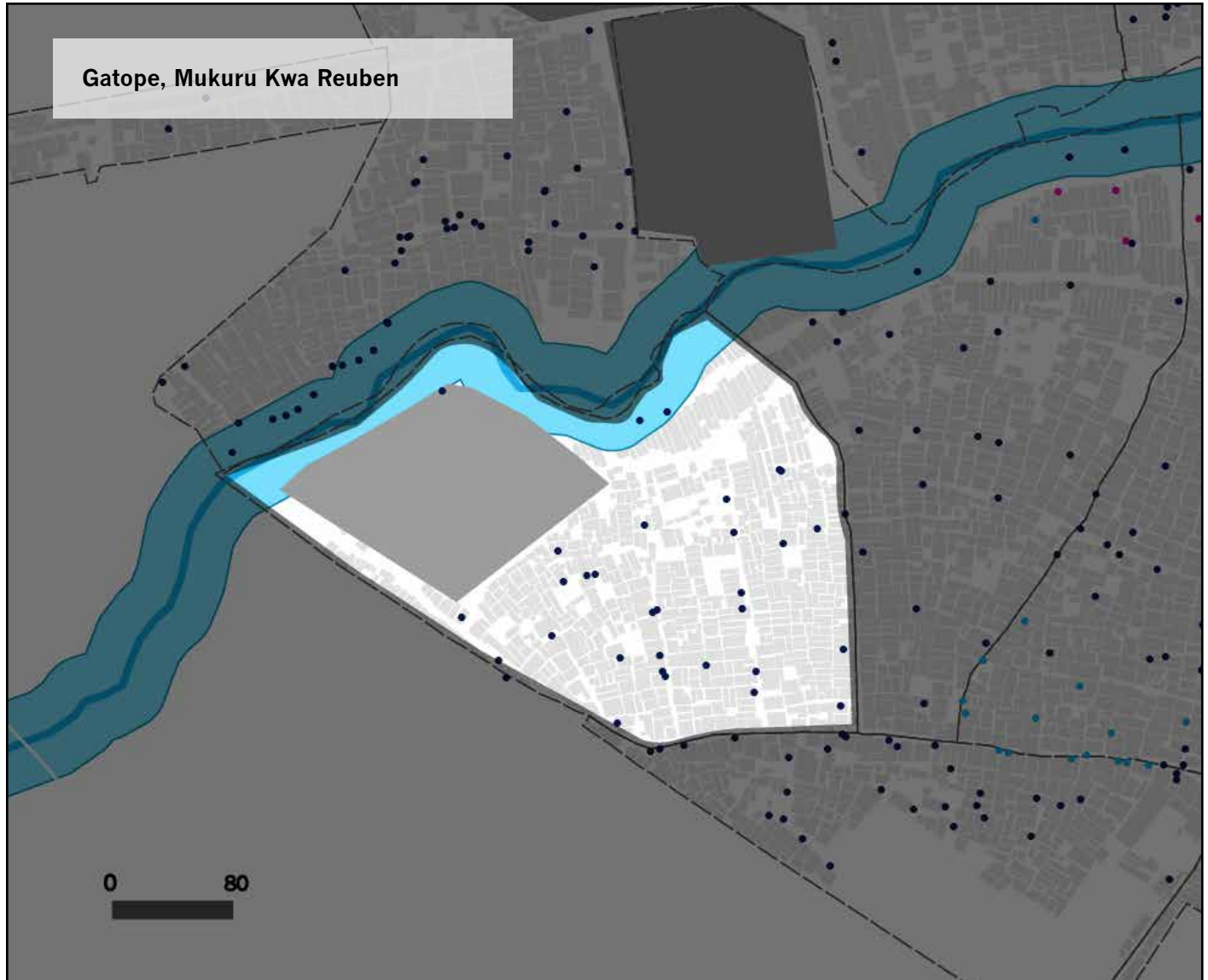


Map 16. Different types of Mukuru water points

● Public ● Yard-shared ● Private

1 Highest density WP area (see detail below)

2 Lowest density WP area (see detail below)



Map 17. Highest density water point area ● Public ● Yard-shared ● Private
* each structure contains multiple households ■ Residential structure

Highest density water points: public

The highest density of water points is found in the village of Gatope, Mukuru Kwa Reuben. The water points are primarily public, depicted in red in the map above. Distance between water points ranges from 25-80 meters.



Map 18. Lowest density water point area ● Public ● Yard-shared ● Private
* each structure contains multiple households ■ Residential structure

Lowest density water points: yard-shared

One of the areas with the fewest number of water access points is the village of Riara in Mukuru Kwa Njenga. The water points in Riara are primarily yard-shared, with less than 20 water points total within the village boundaries. Yard-shared water points are shared between a group of 10-12 households, and are generally more accessible for residents in the immediate area. However, low density of yard-shared water taps in Riara means that most residents must rely on public taps that require walking far distances and taking additional time to collect potable water.

Water Tap Classifications

Key

10' x 10' household

Individual Toilet Yard Shared Toilet Public Toilet

Individual

Shared by 1 household



Photo individual

Yard Shared

Shared by an average of 12 households

Photo yard shared





Photo

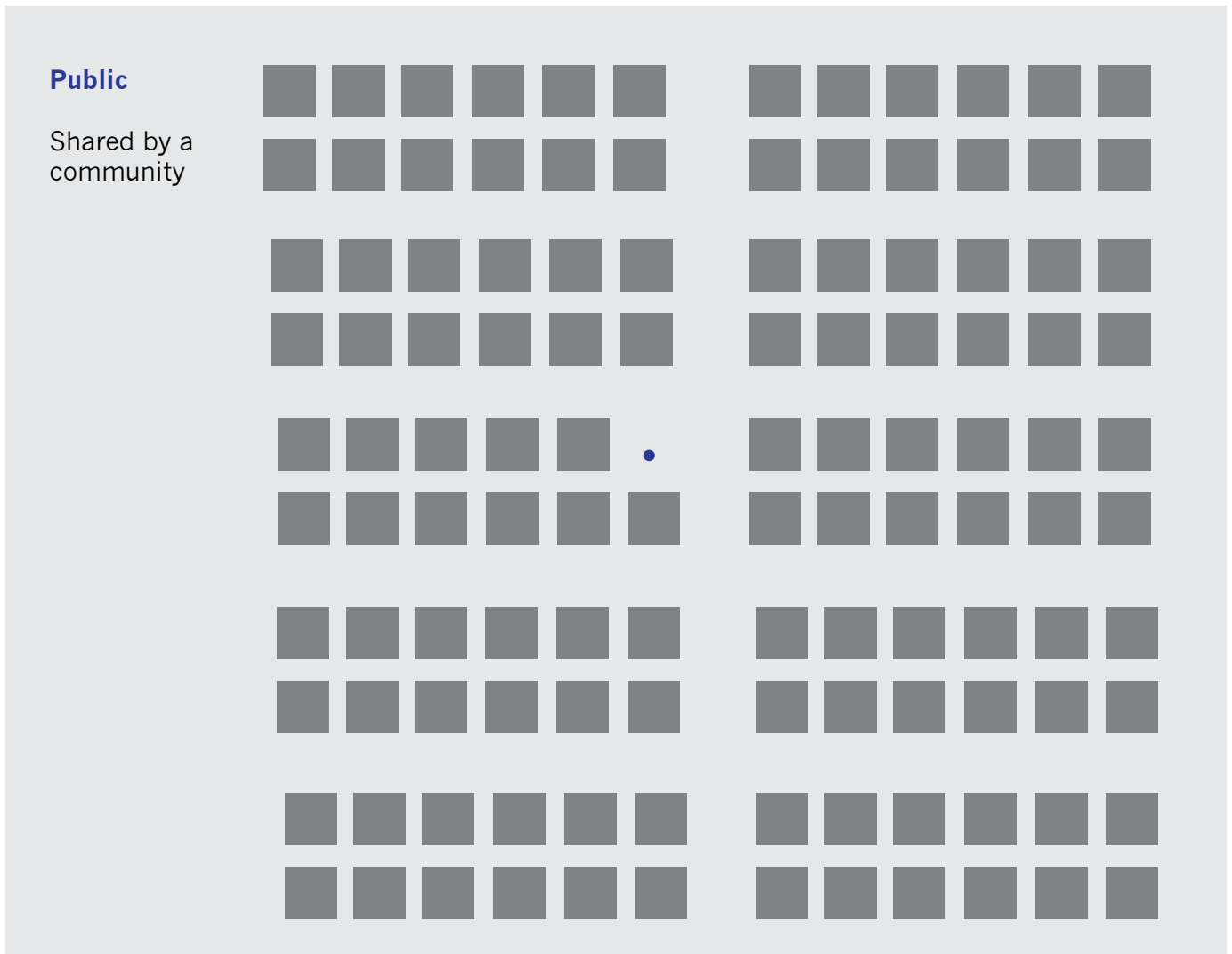


Figure 6.

Sanitation

Key Findings

1. 1% of residents in Mukuru have access to a private, in home toilet
2. An average of 547 households share one public toilet in Mukuru
3. Lack of privacy, hygiene and waste treatment make inadequate toilets one of the greatest threats to human health, especially for women and girls, in Mukuru.

The most common types of toilets in Mukuru are public and private pit latrines, and few toilets are connected to sewers that treat waste off-site.

Pit latrines require manual emptying. The common disposal method is the manual exhauster. Residents who provide this service have organized themselves into a group. It costs between KSh. 300-600 per drum to completely empty a pit latrine, depending on the distance from the disposal site. Due to this

cost, pit latrines are not fully emptied on a regular basis. They are usually improperly maintained and not regularly emptied, so they often overflow, particularly during the rainy seasons. The manual exhausters are emptied directly into the stream water, Ngong River or on the open sewage.

Due to an absence of state investment in sanitary infrastructure, toilet social enterprises are common in Mukuru. Organisations such as FreshLife

Toilet access

Across Mukuru, nearly 50% of the households report using a shared pit latrine (covered or uncovered). 20% indicate use of a shared flush toilet with 18% indicating use of a covered surface latrine (Freshlife). However, the prevalence of the Freshlife type of toilets appears to be high in Ruben compared with Njenga and Viwandani, with Ruben accounting for two-thirds of those indicating use of Freshlife.

Common toilet typology in Mukuru



Public toilets

Most communal toilets are pit latrines owned by NGOs, community groups or city government. They tend to be closed at night and are not connected to a sewer line.



Yard shared toilets

Yard shared toilets are pit latrines shared by a block of residential structures and owned by structure owners. Maintenance is often poor, and toilets are not connected to a sewer line.

Sanergy and Rose toilets, are entrepreneurs that provide a pit latrine and collect the human waste. Faulu Savings Scheme gives loans to groups to establish FreshLife toilets and bio centers as a business investment. Sanergy sells their FreshLife toilet to consumers at about 20,000 KSh. The bio-centers are built and managed often by NGO groups and provide toilets and, after capturing the off-gas from solid waste, spaces for cooking and hot water for bathing.

The Lixil Corporation targets their Rose toilets to learning institutions. They construct permanent toilets, and an organized group offers to provide 6 months of maintenance and recycling services before the institutions fully take over. There is also a service known as the “4 am service.” Families leave their flying toilets in front of their door/plot, and in the early morning, they are collected and disposed.

Collectors are mainly male youth in their 20s. The costs of toilet use are unaffordable to some residents. This makeshift toilets a common practice. Flying toilets are when people defecate into a plastic bag, plastic tin or piece of paper and throw it, usually into the sewer, on the roads, or onto their roof. This practice also occurs when toilets have yet to be opened, especially very early in the morning and at night.

Inadequate sanitation creates particular challenges for women and girls, whom are the most severely affected. Women are vulnerable to sexual violence, health problems and a lack of dignity. Women and girls are at risk of sexual assault when trying to use a toilet without lighting or a lock at night.



Individual toilets

Private toilets are toilets that are primarily used by one structure or family. These may or may not be connected to a sewer line, and are uncommon in Mukuru.



Open defecation

Due to lack of access to toilet facilities, residents often have little choice but to defecate in the open, or into bags or receptacles that are then disposed of in the surrounding environment

Toilet costs

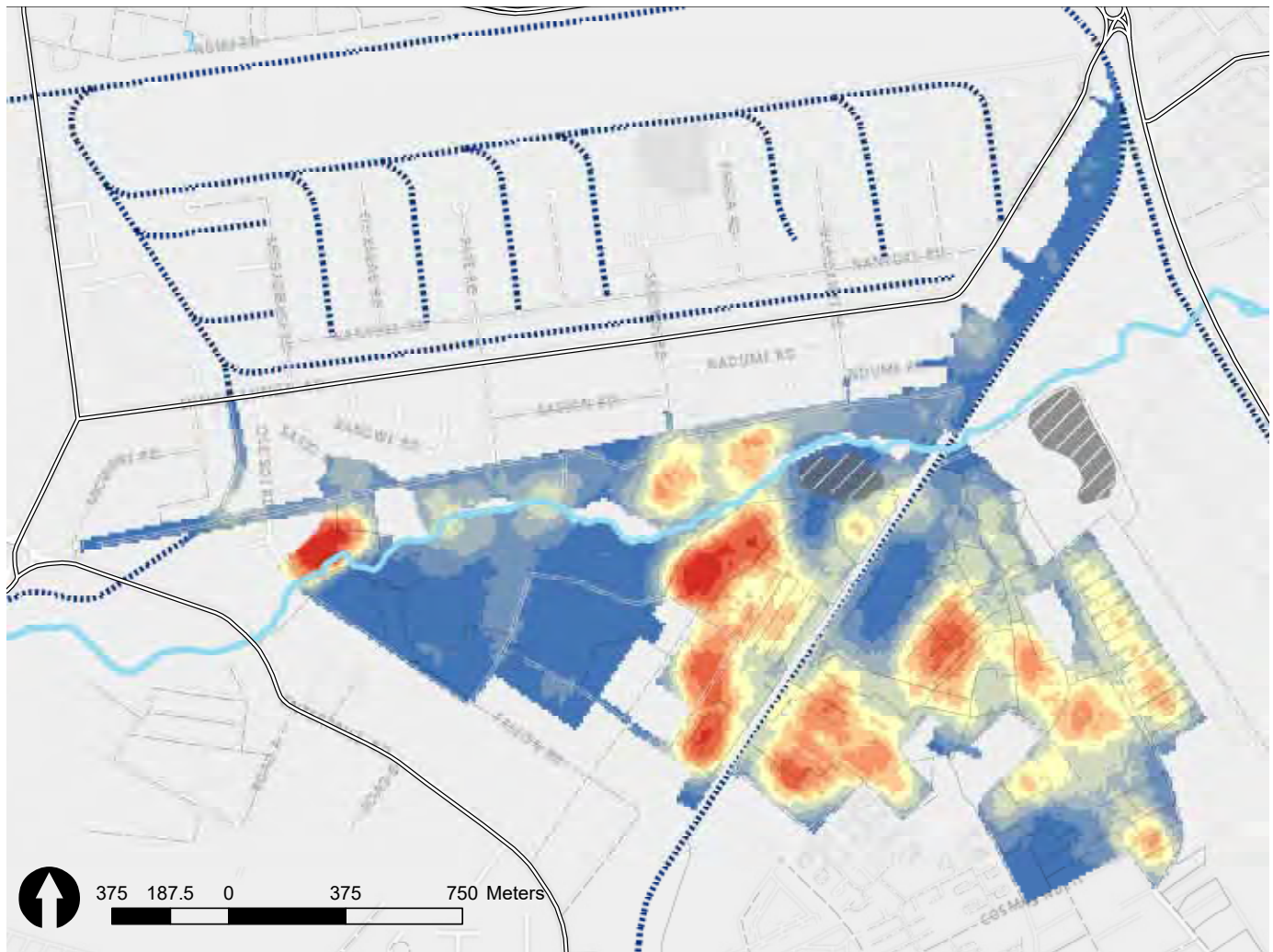
A majority of Mukuru residents (84.5%) pay for toilet use on a daily or per use basis. The average cost is 5 KSh for one-time use of a pit latrine. Only 14% of residents report that they pay monthly for toilet access. The average monthly cost, however, does not significantly change across the different types of toilets, with monthly costs averaging 218 KSh across all villages in Mukuru.

Type of toilet	Monthly cost
Shared covered pit latrine	216
Covered ventilated improved latrine	199
Shared uncovered pit latrine	226
Shared flush toilet	232
Covered surface latrine (freshlife)	213
Average cost	219

Figure 7. Toilet cost by type

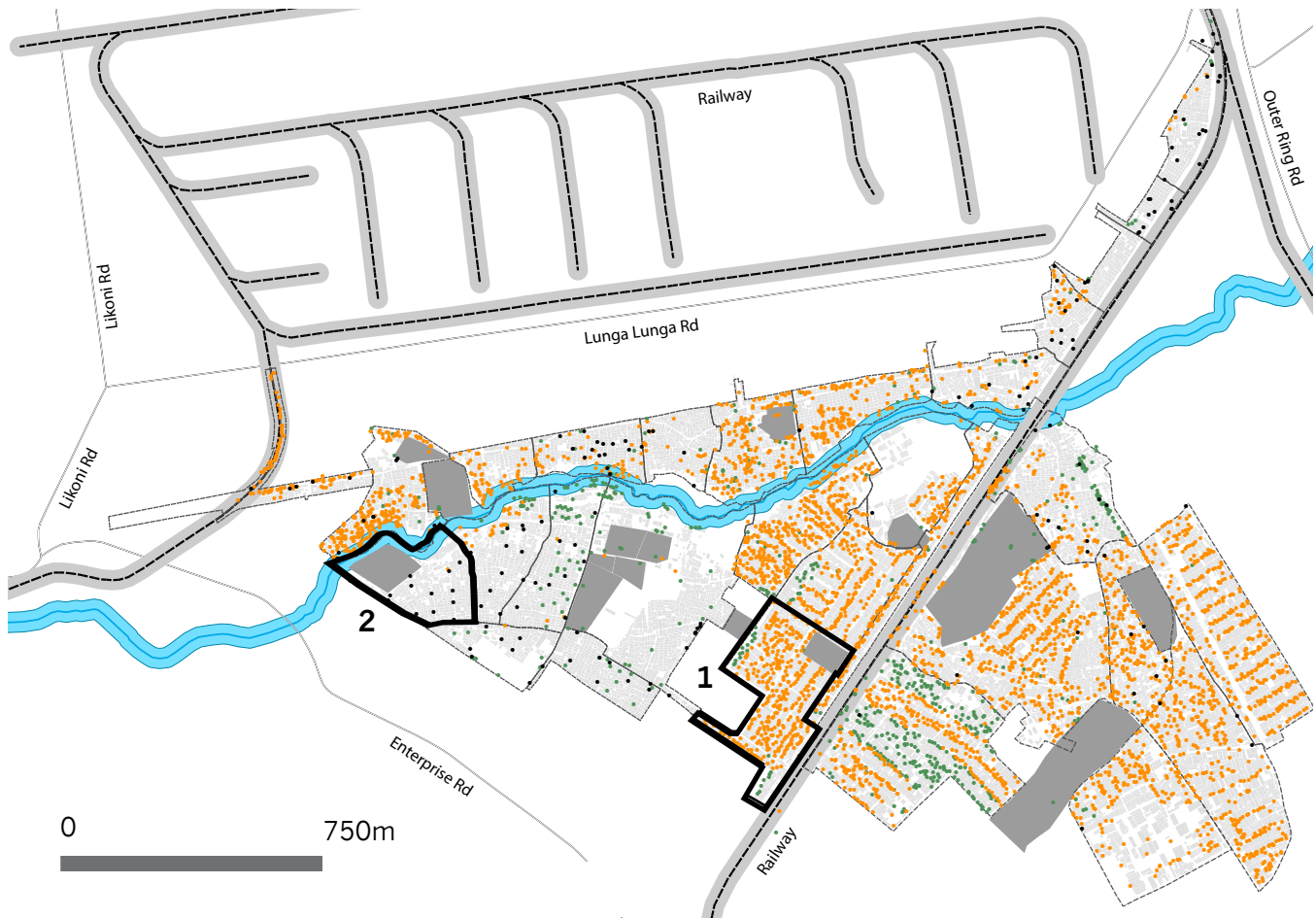
Toilet density

The toilet density map (#18 below) shows the distribution of public, private, and yard-shared toilets in Mukuru Kwa Reuben, Mukuru Kwa Njenga, and Viwandani. Highest density areas are found in the eastern half of Kwa Reuben facing the railway, the majority of Kwa Njenga, as well as the center of Viwandani. High density areas have an average of 10-20 meters between each toilet. Lowest density areas found in the western half of Kwa Reuben and peripheries of Viwandani have an average distance of 50 meters between toilets.



Map 19. Mukuru Toilet Density Heat Map

High density Low density



Map 20. Mukuru Toilets ● Public ● Yard-shared ● Private

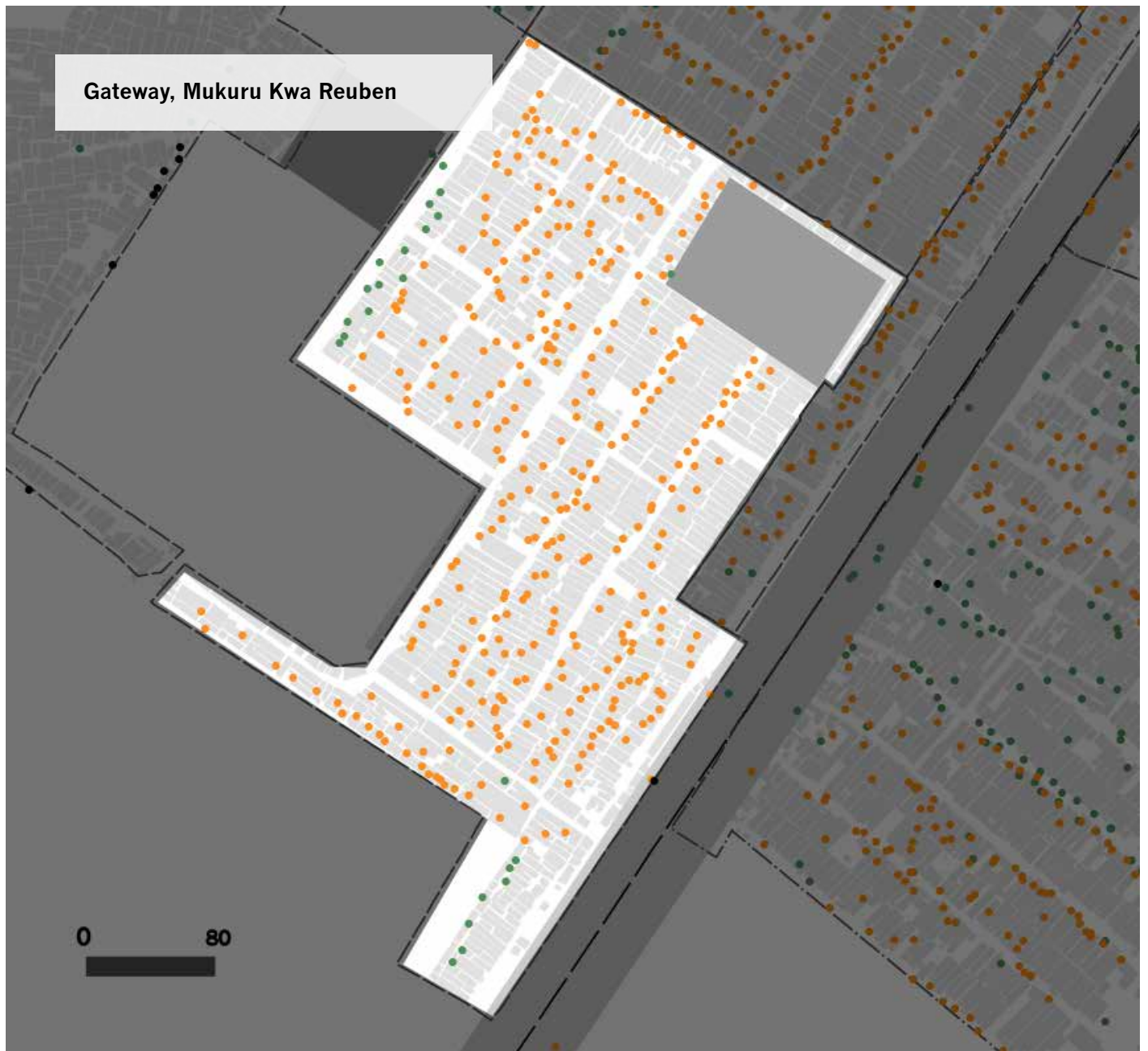
Village outlines: ■ Kwa Reuben ■ Viwandani ■ Kwa Njenga

1 Lowest density toilet area (see map #)

2 Highest density toilet area (see map #)

Toilet distribution by type

Map 20 above depicts the distribution of public, yard-shared and private toilets. The most common type of toilet throughout the settlements is yard-shared, with the exception of the western side of Mukuru Kwa Reuben. There are significantly less public and private toilets, however the village of Riara in Kwa Njenga has a high relative concentration of private toilets and western Kwa Reuben has primarily public toilets. Areas 1 and 2 outline villages with extreme low and high density of toilets, and in are depicted in more detail in map x and x.



Map 21. Highest density toilets

● Public Toilet ● Yard-shared Toilet ● Private Toilet

* each structure contains multiple households ■ Residential structure

Highest density: yard-shared

An example of high density toilets is the village of Gateway in eastern Mukuru Kwa Reuben. The most common toilet type in Gateway is yard-shared, with an average distance of 10-20 meters between toilets. The yard shared toilets are shared by a block of households within longer structures, with approximately 10-15 households sharing one toilet.



Map 22. Lowest density toilets ● Public Toilet ● Yard-shared Toilet ● Private Toilet
 * each structure contains multiple households ■ Residential structure

Lowest density: public

One of lowest density of toilets is found in Gatope village in western Mukuru Kwa Reuben. The lowest density toilets are public, however private toilets also show low density throughout the settlement. Average distance between public toilets in wester Kwa Reuben is approximately 50 meters, meaning residents must walk long distances to use the rest room. Public toilets may be inaccessible at night, therefore residents in this area may be forced to urinate and defecate openly, creating health and environmental hazards.

Toilet Classifications

Individual
 Shared by 1 household

Key

- 10' x 10' household
- Individual Toilet
- Yard Shared Toilet
- Public Toilet

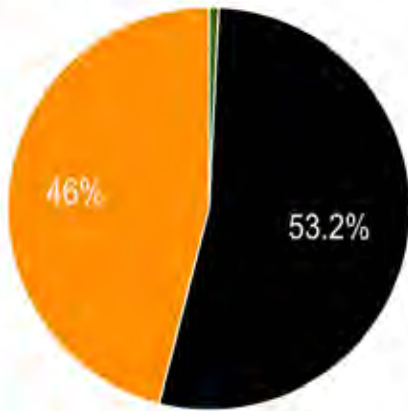
Yard Shared
 Shared by an average of 12 households

Public
 Shared by a community

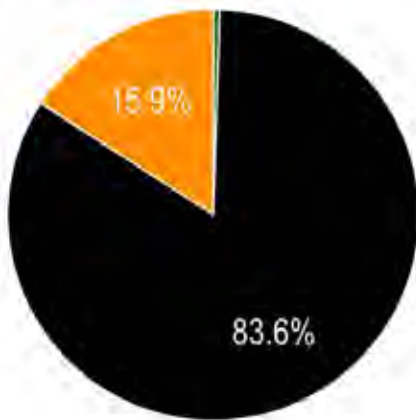
Figure 8. Toilet classifications

*structures are not drawn to scale

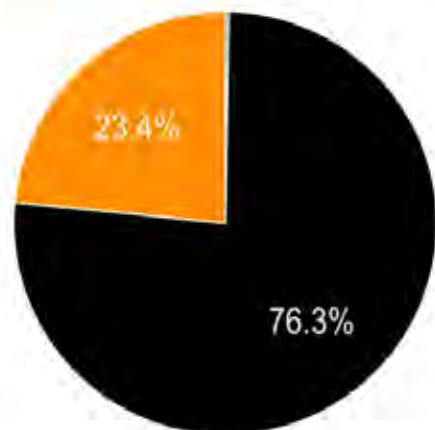
Kwa Njenga



Kwa Reuben



Viwandani



Toilet access in Mukuru

Text



- Public
- Yard-shared
- Private

Figure 9. Share of public, yard-shared, and private toilets

Solid Waste Management

Key Findings

1. There is almost no city solid waste collection and the work is primarily done by youth groups.
2. Lack of waste management contributes to odours, disease, clogged drains and flooding.
3. Only 46% of Mukuru household can afford informal waste collection services

Garbage collection from City Council rarely occurs in Mukuru and informal service providers comprised of mostly youth, have become the de facto waste managers. A few landlords manage solid waste for their plots, often for an additional charge. The youth waste collection organizations, such as those called Oasis, Cactus and Mukuru Youth Association, charge a weekly fee of about KSh 20 per household. Waste is either removed or burned.

Other informal practices include dumping on the roads and open spaces as well as in sewage drains and the river. The sewers drains are open trenches that are mostly constructed by residents. The solid waste accumulates and clogs sewer drainage, causing foul smells and pools of sewage. These informal methods are largely due to the lack of management services and result in waste scattered throughout the settlements.

Costs

The average monthly cost for garbage per household is about KSh 95, translating to a weekly fee of about KSh 24. The costs of these services prevent some households from participating in formal means of garbage collection. Our findings reveal that only 46% of respondents across the settlements pay for garbage collection, with 94% of

the costs set as weekly or monthly payments.

However, there are significant differences related to paying garbage collection across the settlements. About 50% of residents of Mukuru Kwa Reuben pay for garbage, compared to 31% in Mukuru Kwa Njenga and only 20% in Viwandani.



q. Human waste collection in Sepu, Riara - Mukuru Kwa Njenga

Electricity & Energy

Key Findings

1. Over 85% of electricity connections are informal or 'sambaza'
2. Informal connections are dangerous and put community at risk for fires and electrocution
3. Monthly average of 434 KSh for electricity

Formal and Informal Connections

Kenya Power Company, the national electricity distributor, is the primary installer of formal lines of electricity distribution. Kenya Power, as the primary provider, has installed transformers within the settlement as a method of electricity distribution. Most of the formal lines, however, tend to serve the factories that exist within the settlement. This arrangement often leads to illegal connections that frequently overload the transformers and eventually lead to widespread power outages. In addition to the electricity provided to the factories, Kenya Power also provides electricity to a few landlords who in turn redistribute the power to neighboring tenants.

Kenya Power installs transformers within a specific area on the basis of an application made by

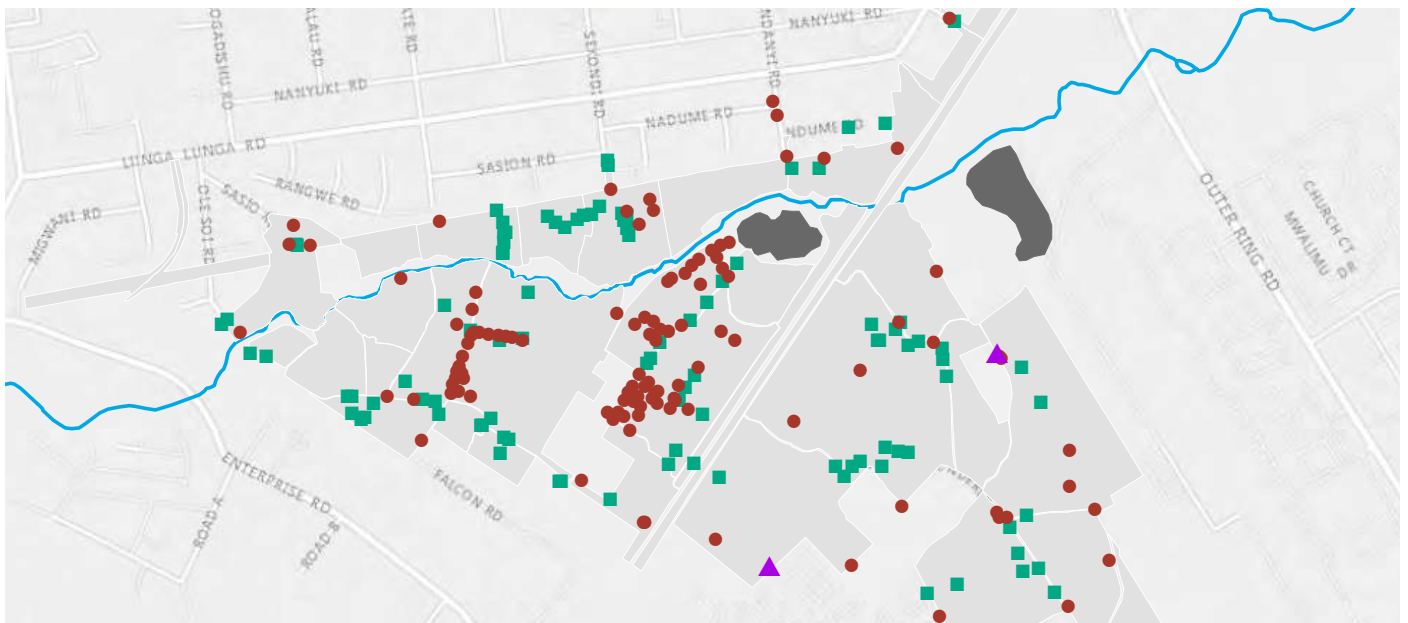
an electricity vendor. Fees for the installation of a single phase meter often range from about KSh 32,000 – KSh 75,000. Vendors are typically structure owners and this allows them to be eligible to connect to the formal grid and have a meter installed. The money used to pay for the installation is either raised from savings funds or from loans acquired from neighboring micro-finance groups. Furthermore, there is a second tier of vendors who are provided with the rights to tap the formal connections through a direction negotiation with the original vendors.

In contrast to the formal system of electricity supply, there exists an informal sambaza method. The informal connections consist of formal connections that are either tapped at the distribution lines or at existing structures that house the electric meters. Within Mukuru Kwa Reuben, current households are connected to electricity at 86% in comparison to a 75% household connection within Mukuru Kwa Njenga.





r. sambaza electricity connections



▲ Floodlights ● Street lights ■ Transformers

Map 23. Inadequate night time street lighting

Environmental and Climate Change Vulnerability

Key findings:

1. Low elevation and fill soil type results in frequent flooding and unstable buildings
2. Surrounding industrial activities contribute to toxic pollution
3. Local particulate matter (PM) air pollution regularly exceeds WHO guidelines
4. Climate change is making Mukuru residents more vulnerable to heat related illnesses, flooding and displacement, as well as infectious disease
5. 50% of residents went without enough food at least once during the past year (compared with 30% in formal Nairobi) and 12% went without food most days.

Topography



Map 24. Mukuru topography



r. Flooding and waste in Mukuru Kwa Njenga

Environmental risks

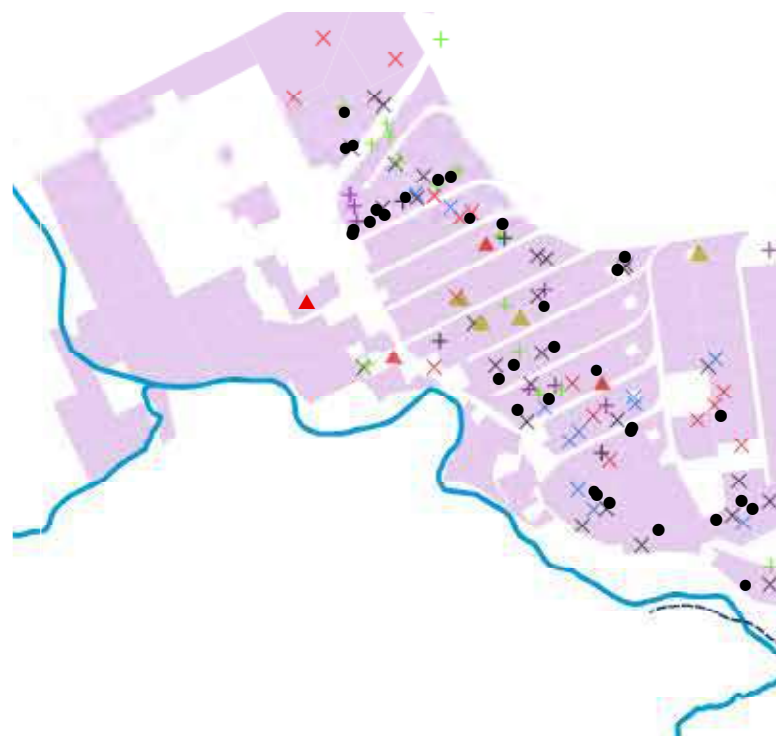
Mukuru is traversed by the Ngong River. The settlement sits in a low lying area of Nairobi, with an elevation between 1618 -1623 meters. The average elevation for Nairobi is 1661 meters. The low elevation results in frequent flooding.

The soil composition of Mukuru exacerbates flooding. Mukuru's top layer of soil is mainly comprised of 50-70 cm of solid waste, including plastics and glass. The remaining layers consist of 150-200 cm of soil dumping, 70-100 cm of sand soil, and rock. The solid waste layer is particularly alarming because it reduces the ability of soil to absorb rainwater.

Surrounding Industrial Activities

Figure 12. Industrial facilities by type

INDUSTRIAL FACILITIES	COUNT	SYMBOL
Main Categories		
Retail/wholesale/distribution	55	X
Chemicals and allied products	51	X
Food and beverage processing	33	+
Metal products	28	+
Motor vehicles	22	X
Construction and building materials	16	▲
Paper and allied products	15	+
Petroleum products	12	▲
Other Categories		
Nonclassified other	41	●
Machinery and equipment	16	●
Textiles and apparel	11	●
Lumber and wood	10	●
Furniture	6	●
Glass and stone	6	●
Horticulture and fresh produce	5	●
TOTAL	327	



Key Findings

1. There are over 300 different industries within 1,500 metres of Mukuru’s population
2. The industries range in type from distribution to chemicals to metal machinery.
3. The industries offer employment and support the Nairobi and Kenyan economy
4. The industries are also a major source of toxic air, surface water and soil pollution.

There are over 300 industrial facilities within 1,500m of residents living in Mukuru. Emissions from these facilities comes from smoke stacks, effluent pipes and night time dumping. The facilities cover a range of industrial activities including: food and beverage processing; metal products; motor vehicles; construction and building materials; paper; petroleum products; and retail, wholesale, and distribution (Map 25).



Map 25. Industries near Mukuru & Viwandani

Interviews and field research found that residents regularly observe air pollution and surface pollution, such as oily, coloured liquid, in drains and on roadways. At least 1/3 of residents surveyed reported foul-smelling odors, eye and throat irritation, and coughing or other respiratory irritations at least once in the past month. Field reports noted that industrial waste was dumped and burned at dump sites within the community and directly discharged into the Ngong River.

Air Pollution

Key Findings

1. Pilot air sampling revealed elevated concentrations of particulate matter (PM) and toxic air pollution (volatile organic compounds or VOCs).
2. Mukuru regularly has more dangerous air quality than the rest of Nairobi
3. A number of air pollution sources combine to make the air unsafe.

Mukuru is located adjacent to Nairobi's industrial area, bounded by four major roads: Mombasa Road, Lunga Lungu, Outer ring Road and Airport North Road (Map 26). **Air quality in Mukuru is poor due to industrial and vehicle emissions, waste burning, cooking fuels and dust.**

Air pollution is a significant environmental health risk for residents living in and around Mukuru. Industries, particularly chemical factories, are a source of toxic air pollutants, such as volatile organic compounds (VOCs). VOCs play a major role in the formation of ozone and photochemical oxidants associated with urban smog. Some industrial waste is deposited at the dump sites and burned. The burning of waste at dump sites emits particulate matter (PM), black carbon (BC), and toxic air pollutants.

Roadway dust and vehicle emissions are a major source of PM.

Lack of access to clean energy results in cooking that also contribute to air pollution. Solid fuels and kerosene for cooking and heating is the largest source of indoor air pollution. Solid fuels include coal and wood. These fuels emit CO, NO_x, sulfur oxides (SO_x), and toxic air pollutants, such as benzene, formaldehyde and polyaromatic compounds.



s. Industry adjacent to Mukuru Kwa Reuben

The combustion of kerosene emits PM, CO, NO_x, sulfur dioxide (SO₂), and toxic air pollutants – formaldehyde and polycyclic aromatic hydrocarbons (PAHs). Women and young children are vulnerable to indoor air exposures because they spend a large portion of their time indoors. Poor ventilation elevates household air pollution.

These major sources can lead to pollutant levels that exceed WHO guidelines. One study found average fine particulate levels (PM_{2.5}, diameter < 2.5 μm) in Viwandani to be 67 micrograms per cubic meter (μg/m³) (Egondi et al. 2016). The WHO guideline for PM_{2.5} is 25 μg/m³. These levels are also higher than the urban background site at the University of Nairobi, where average levels of PM_{2.5} were found to be 21 μg/m³ (Gaita et al. 2014). This suggests that residents in Mukuru are highly exposed to air pollution and there is an inequitable burden. Poor air quality adversely impacts health.

Climate Change & Health

Key Findings

1. Urban poor are at highest risk for climate change induced hazards due to lack of adequate infrastructure, poverty and high density.
2. The community will likely experience flooding, heat waves, drought, sinking land, and food/water insecurity, due to a changing climate and related weather events.
3. There is no climate change adaptation plan for this or other informal settlements in Nairobi.

The urban poor are particularly vulnerable to climate change induced hazards. In Mukuru, climate change vulnerability includes likely flooding events, heat waves, drought induced drinking water scarcity, land slides, and food insecurities. All of these climate change induced vulnerabilities are exacerbated by the current lack of adequate infrastructure.

Basic infrastructure and services can act as the first line of defense against the impacts of climate change on the urban poor. Adequate drainage, sanitary infrastructure, municipal water supply and refuse collection are essential services for reducing climate change vulnerability in informal settlements.

City officials can build resilience by mainstreaming risk reduction into urban management. Climate change adaptation and disaster risk reduction can be best addressed and sustained over time through integration with existing urban planning and management practices.

People in low-income neighborhoods are made even more vulnerable by overcrowded living conditions, unsafe housing, and lack of health services. These conditions often turn a manageable challenge into an epidemic and city-wide disaster. Climate change can lead to massive displacement of the urban

poor and make them even more vulnerable since they can lose their livelihoods in the process.

Land tenure can act as a resilience strategy. Lack of security of tenure can limit local investments in housing improvements, infrastructure and social services. Security of tenure can also contribute to more stable housing, fewer threats of eviction and stronger social ties - all of which can contribute to community climate change resilience. The urban poor rely on the informal sector for their income and thus they have limited access to formal safety nets.

Strong social networks are important for some communities where residents work together to build resilience at the local level. Traditionally vulnerable individuals and communities have managed risk through ad hoc coping mechanisms that draw on their local knowledge of hazards and community resources. In slums where social networks and kinship ties are stronger, communities tend to be more resilient.

Human health is a complete state of mental and physical wellbeing, the absence of debilitating infectious and noncommunicable diseases, and regular access to quality and affordable care.

The economic, social and political stability of Mukuru can be compromised by regular episodes of diseases for residents and/or their family members.

Women are disproportionately burdened by disease, since they face unique risks such as unsafe toilets, that do not impact men the same way, and women are more likely to be care-givers for the sick. Illness can lead to missed school days for girls, missed work for women, and extra-household expenditures, such as increased need for water during diarrhea and when caring for other infectious diseases.

Health pathway diagrams (Figure 17 & 18.) are useful tools for mapping the spread of disease or negative health impacts from root causes to intermediate exposures and ultimately to the specific health outcomes associated with the exposure.

HEALTH IMPACTS OF POOR AIR QUALITY

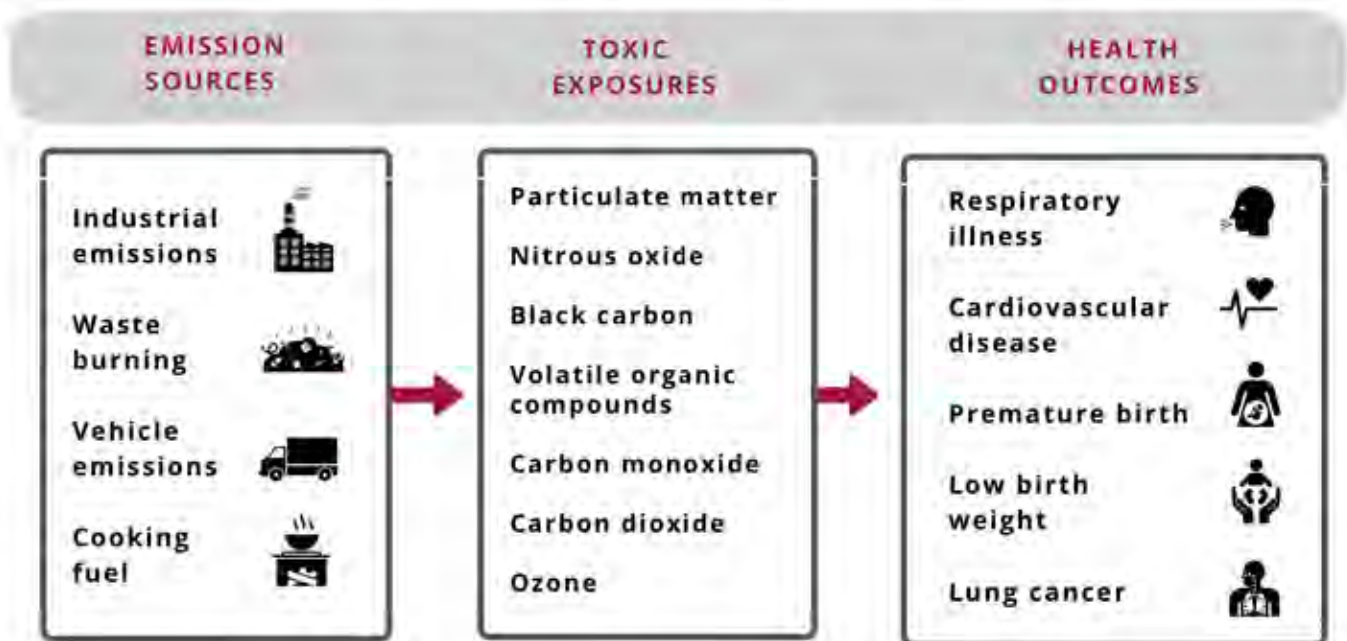


Figure 13. Impacts of poor air quality pathway diagram



Map 26. Health facilities in Mukuru ● Public Clinic ● Private Clinic ● Dispensary

The lack of public policies and management systems to protect residents from unjust human exposure to solid waste are linked negative health impacts in Mukuru, including diseases like diarrhea, typhoid, amoebiasis and cholera.

The risky environmental conditions contribute to elevated rates of self-reported malaria and other mosquito-borne illnesses, typhoid and gastrointestinal disease.

The Figure on the following page depicts a **health pathway diagram** that focuses on malnutrition. The pathway diagram begins with the lack of planning and policy for community health leading to inadequate sanitation, open drainage, water and food contamination, and ultimately poor health outcomes such as diarrhea and malnutrition. Instead of focusing on individual behavior or only examining immediate sources of exposure, the health pathway diagram gives a comprehensive picture of health risks stemming from a lack of planning and inadequate infrastructure. Viewing poor health outcomes in the context of policy level decisions helps community members and policy makers identify concrete steps that can be taken to protect the health of residents and improve living conditions.



t. Children play next to exposed sewage adjacent to school in Sepu, Riará - Mukuru Kwa Njenga

Community Health Workers



u. Nancy, community health worker in Mukuru Kwa Reuben

Community Health Workers (CHWs) are an important health asset and community mobilizing group in Mukuru and Viwandani.

- There are 170 CHWs in Mukuru Kwa Reuben alone
- All CHWs are volunteers, most work additional full time jobs
- CHWs distribute medication and health information door to door and through house calls
- CHWs raise awareness around important public health issues such as water contamination
- CHWs aid women with reproductive health
- Often provide social services and support with issues such as domestic violence

Nancy, pictured left, is a CHW in Mukuru Kwa Reuben. She has been a resident of Mukuru for 20 years, and a CHW for 15. Her full time job is running her home front clothing shop.

MIPANGO YA JUMUIA NA KUHARA COMMUNITY PLANNING & DIARRHEA

Kuboresha ubora wa maji kwa njia ya uwekezaji na mipango inaweza kusaidia kuzuia kuharisha

Improving water quality through investment and planning can help prevent diarrhea

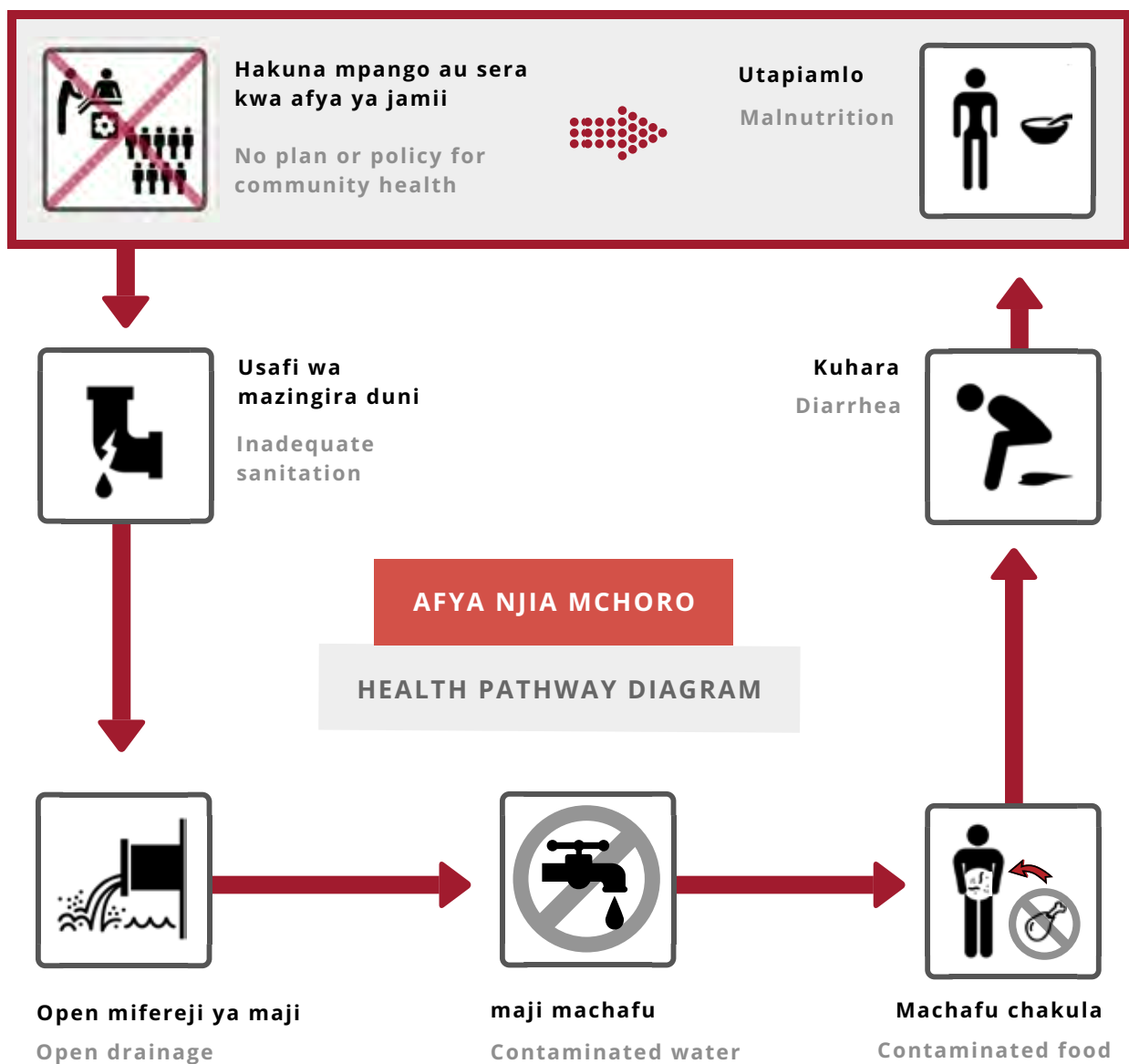


Figure 14. Health pathway diagram example

SITUATIONAL ANALYSIS CONCLUSIONS

This report has highlighted the existing conditions facing residents of Mukuru. The Mukuru informal settlement is crucial for the survival of the City and County of Nairobi, since it houses hundreds of thousands of working residents that support key industries. Mukuru residents may face grave dangers and cost the City greater in terms of disability, disease and death if nothing is done to improve living conditions and reduce poverty.

This report has revealed that residents in Mukuru currently:

- (1) have limited access to regional services and transport;
- (2) are exposed to industrial pollution from surrounding activities;
- (3) suffer from economic poverty but also survive on a robust informal economy that generates roughly 7 billion KSh/year;
- (4) pay high cost for low quality services, including water, toilets, waste collection and electricity;
- (5) face physical danger due to flooding, unstable soil, and other environmental risks;
- (6) live in very crowded housing conditions, with approximately 466 people per acre, compared to 18 people per acre for Nairobi City;
- (7) manage the burdens of preventable diseases that are likely limiting children's physical and cognitive development;
- (8) lack public open spaces for children to play and for other social and economic interaction, such as markets;
- (9) have a strong network of schools, community facilities and other informal services, but these come at a high cost to residents;
- (10) participate in self-governance that can be supported to ensure any and all development activities include and benefit existing residents.

