

Schramm, S.; Kasper, M.; Bohlen, S.; Mwenje, E. and Wamuchiru, E. 2023.  
Governing pandemic waterscapes: Covid-19 and Nairobi metropolitan  
services as co-catalysts of waterscape changes.  
Water Alternatives 16(3): 750-768



---

## Governing Pandemic Waterscapes: Covid-19 and Nairobi Metropolitan Services as Co-Catalysts of Waterscape Changes

### Sophie Schramm

International Planning Studies, Department of Spatial Planning, TU Dortmund, Germany; [sophie.schramm@tu-dortmund.de](mailto:sophie.schramm@tu-dortmund.de)

### Moritz Kasper

International Planning Studies, Department of Spatial Planning, TU Dortmund, Germany; [moritz.kasper@tu-dortmund.de](mailto:moritz.kasper@tu-dortmund.de)

### Simon Bohlen

International Planning Studies, Department of Spatial Planning, TU Dortmund, Germany; [simon.bohlen@tu-dortmund.de](mailto:simon.bohlen@tu-dortmund.de)

### Emmanuel Mwenje

Department of Urban and Regional Planning, University of Nairobi, Nairobi, Kenya; [e.mwenjeh@gmail.com](mailto:e.mwenjeh@gmail.com)

### Elizabeth Wamuchiru

Department of Urban and Regional Planning, University of Nairobi, Nairobi, Kenya; [ewkanini@uonbi.ac.ke](mailto:ewkanini@uonbi.ac.ke)

---

**ABSTRACT:** The Covid-19 pandemic and the initial focus on handwashing measures have highlighted the importance of water access as an essential service in protecting public health. Although handwashing was ultimately deemed less relevant in curbing transmissions of the airborne SARS-CoV-2 (Covid-19) virus, the pandemic presented a dilemma for water providers and residents in water-deprived urban areas as they had to adhere to new hygiene standards and requirements with limited water access. As such, a deeper understanding of pandemic urban waterscapes – infrastructure, governance systems, technologies, and everyday practices – is necessary for ongoing debates on (post)pandemic or zoonotic cities. We therefore focus on changes in urban (water) governance and government water projects in Nairobi since the onset of the Covid-19 pandemic in early 2020. We show that Covid-19 has contributed to changes in Nairobi’s waterscape, though only in conjunction with recent changes in the city’s overall governance structure. Whether these waterscape changes will lead to greater equity in water access or have a long-lasting impact in alleviating water deprivation in sections of the city is more than questionable.

**KEYWORDS:** Urban waterscape, Covid-19, boreholes, urban governance, Nairobi, Kenya

---

### INTRODUCTION

The emergence and spread of Covid-19 has undoubtedly affected cities across the globe. At the onset of the pandemic, health experts recommended frequent and regular handwashing. The water sector was thus initially deemed critical in the fight against the virus (Hawkins, 2021; WHO, 2020), but hygiene-related efforts were constricted by uneven geographies of water provision and access. Though the World Health Organization (WHO) ultimately recognised in 2021 that SARS-CoV-2 is primarily airborne (Lewis,

2022), the importance of safe water access and regular hygiene practices for human health remains universal (Hawkins, 2021). In addition, others warned of airborne transmissions between water users who needed to share water points, queue for water distribution, and interact with water suppliers, particularly in dense urban areas where households do not have direct, piped water connections (Ekumah et al., 2020; Staddon et al., 2020; UN-Habitat, 2021). The pandemic further challenges water policy makers and service providers, requiring urban populations to find creative and adaptive ways to respond to changing demand patterns, decreased revenues, governmental directives, and economic and health effects of the pandemic (UN-Habitat, 2020; Wilkinson, 2020).

To contribute to critical conversations on (post)pandemic or zoonotic cities (cf. Gandy, 2022; Ruszczyk et al., 2022), we consider the case of Nairobi, Kenya, with its historically uneven and highly contested geographies of water (Ledant, 2013; Schramm and Ibrahim, 2019). Specifically, we present an exploration of how the pandemic has shaped Nairobi's waterscape by investigating interventions and policies regarding water supply during the pandemic. Whereas a growing body of studies of urban Africa discusses different responses to increased water demand during the pandemic (cf. Jiwani and Antiporta, 2020; Smiley et al., 2020), the intricate ways in which such interventions and policies may have changed urban waterscapes during the pandemic are yet to be investigated. We mobilise the concept of waterscapes to understand any arising changes in Nairobi's geographies of water provision and access since the start of the pandemic. The term 'waterscape' directs attention to the "contested geographies of water", where urban water flows that are mediated by networked infrastructure systems, as well as everyday water practices and technologies, reflect uneven power relations (Karpouzoglou and Vij, 2017). Accordingly, our central objective is to analyse how Nairobi's waterscape is shaped by, and in turn shapes, emerging urban water supply policies and governance intended to meet new health requirements. Although we follow Bhan and others (2020) in their distrust of the "desire at play in monumental analytic claims and certainties" during this pandemic, we remain open to the possibility that this global event may be a "portal" (Roy, 2020) to reconfigured place-specific waterscapes.

The paper is based on a comprehensive literature review and analysis of books, articles, government websites, policy documents, government directives, and media reports on the pandemic and water-related issues in Nairobi and beyond, which we use to explain the historical production of Nairobi's waterscape and its pre-pandemic (water) governance structure. To explore recent changes to the city's governance structure and Covid-19's impact on Nairobi's waterscapes through water policies, governance, and projects, we carried out several field visits and 21 semi-structured interviews with actors in Nairobi's water sector, including representatives of municipal and national governments, government agencies, utilities, private water vendors, private sector companies, NGOs, international organisations, and urban planners. We further used insights from previous interviews that the authors conducted as part of past research projects to complement our data sources for the case of Nairobi. This article is organised into nine sections. After the introduction, we explain how we use the waterscape concept to analyse complex interdependent water and societal issues. We then present the historical production of Nairobi's uneven waterscape, and further elaborate on the city's pre-pandemic water governance. After that, we explain recent changes in Nairobi's overall governance structure and their impact on the city's waterscape. We go on to explore the role of Covid-19 in changing water-related policies and projects in Nairobi, and then turn to the specific role and importance of free water points and new boreholes. In our ensuing discussion and conclusion, we ultimately point out that Covid-19 has indeed contributed to changes in Nairobi's waterscape and that the observed changes were catalysed by recent changes in the city's overall governance structure, and vice versa. We further argue that these interventions may mark a move away from the city's concentration on centralised, piped networks and related governance arrangements for water supply towards the inclusion of off-grid or non-networked technologies and related governance structures. Whether or not these and future waterscape changes will lead to greater equity remains questionable since a) both Nairobi's governance changes and the focus on water-related

hygiene practices were rather short-lived, and b) the further heterogenisation of Nairobi's water supply that we anticipate does not indicate a positive (or negative) trajectory for the city's waterscape.

## UNDERSTANDING PANDEMIC WATERSCAPES

We evoke the notion of the "urban waterscape" as a situated "key terrain" (Loftus and Lumsden, 2008) for our study on Nairobi's pandemic water landscape. We draw on urban political ecology perspectives foregrounding the situated relations between societies, natures, and materials (cf. Karpouzoglou and Vij, 2017). Swyngedouw first proposed the notion of the waterscape as a way to "overcome the dualisms of the nature/society divide" in water research (1999). Since then, waterscapes have been often referred to as "water landscapes", which may involve different waters and water uses, such as drinking water (Lavie et al., 2020; Rusca et al., 2017), water for agricultural use (Budds, 2008; Mehta and Karpouzoglou, 2015), water for mining purposes (Budds and Hinojosa, 2012), and more.

Research on waterscapes in cities of the Global South places particular, but not exclusive, focus on issues such as groundwater extraction (Budds, 2008; Sultana, 2013), splintering urban infrastructures (Wright-Contreras et al., 2017), and water governance (Budds and Hinojosa, 2012; Sutherland et al., 2015). Waterscapes research has the potential to bridge the gap between global, national, regional, community, and bodily scales (Truelove, 2019) since "water is constantly in flux, thereby perpetually shifting through physical geographies (...) but also cultural, social, and symbolic landscapes" (Karpouzoglou and Vij, 2017; cf. Gandy, 2004). At the same time, such wide perspectives do not negate the ways in which local waterscapes are shaped by "place-specific dynamics and daily lived practices" (Truelove, 2011). Embedded in the notion of waterscapes is the entanglement of society, technology, and nature within hybrid hydro-social relations (Swyngedouw, 1999). To untangle those relations, we base our understanding on key characteristics of waterscapes: 1) waterscapes are produced, 2) waterscapes are relational, and 3) waterscapes involve humans, natures, and technologies.

Firstly, most waterscape studies emphasise processes through which situated hydro-social relations are constantly (re)worked and (co)produced (Ahlers et al., 2014; Karpouzoglou and Vij, 2017). Accordingly, waterscapes are produced, involving everyday practices of users and suppliers, historical and governance processes, and planning policies and interventions – or the lack thereof (Kooy, 2014; Mehta and Karpouzoglou, 2015; Niranjana, 2021). With the practices of diverse actors over diverse temporal and spatial scales come questions of power and agency (Díaz-Caravantes and Wilder, 2014) as "agency to change, adapt, or ignore the available arrangements is circumscribed by social relations" (Ahlers et al., 2014). Specific agency, powers, and practices are performed or mediated by an ensemble of actors, discourses, technical infrastructures, and – in particular – governmental bodies, which all constitute place-specific "water governance configurations" (Sutherland et al., 2015). These configurations are key in producing local waterscapes.

Secondly, the above makes obvious the relational character of waterscapes that "situates water within social, natural, material and discursive processes" (Mehta and Karpouzoglou, 2015). The relational character of waterscapes emerges from their production through the practices of users, providers, and other actors (cf. Loftus, 2006). Yet, this relational character is already grounded in the fluid nature of water. Since water constantly moves and flows, it constantly creates connections and relations.

Thirdly, in line with the premise that water research needs to bridge the nature/society dualism, most waterscape studies are inherently focused on the entanglements of humans/societies, natures/waters, and technologies/infrastructures. Situated arrangements of this kind involve different human actors and groups, such as governments, utility companies, and urban dwellers (cf. Bakker, 2003; Loftus, 2007; Truelove, 2011). Together with natures, waters, technologies, and infrastructures, these actor-constellations then constitute waterscapes. Technologies and infrastructures may range from large-scale networked infrastructures to small-scale artefacts and technologies (cf. Lavie et al., 2020; Mehta and Karpouzoglou, 2015; Tiwale, 2019).

Following the propositions above, we understand waterscapes as situated and hybrid constructs produced through multiple relationships between humans, natures, and technologies. For our study on the ways Covid-19 has changed waterscapes in Nairobi, we thus consider the fluid relations and practices that involve water users, water providers, authorities, sourced water for human use, SARS-CoV-2, handwashing stations, and boreholes. In particular, we use the notion of pandemic waterscapes to unravel and contextualise how urban governance, policies, and specific projects have changed Nairobi's waterscape since the outbreak of the pandemic.

### **THE HISTORICAL PRODUCTION OF NAIROBI'S UNEVEN WATERSCAPE**

Nairobi's waterscape is deeply intertwined with broader socio-spatial relations and urbanisation dynamics. In a fashion typical of colonial urban and infrastructure planning, Nairobi's urbanisation hinged on a paradoxical stance of the city's colonial planners: they wanted Nairobi to be as 'European' as possible and hence restricted Africans' residence in the city; yet, the city needed Africans as a workforce (Hirst and Lamba, 1994). This, together with the increasing dependence of many Africans on paid labour, led to the creation and rapid growth of often informalised and underserved settlements sometimes in direct proximity to the wealthy European quarters. These socio-spatial inequalities were reflected in, and exacerbated by, uneven and heterogeneous access to water. These inequalities in water access are thus not naturally caused but rather "socially and politically manufactured" (Truelove, 2019). Considering the lived experiences and water practices of Nairobi's slum residents, Akallah and Hård (2020) explain that from the founding of the city onward, "people's daily experiences with water did not take place in a homogenous waterscape. The multiplicity of sources connotes a differentiated system of the supply, use, nature and meaning of water".

In 1899, British colonialists chose 'Enkare Nairobi', Maasai for 'cool water', as the place for a railway depot. The depot soon evolved into the rapidly growing colonial city of Nairobi, which became the capital of Britain's East Africa Protectorate in 1907 (Hirst and Lamba, 1994). Seeing its location as a 'tabula rasa', where planning models of the time could be applied from scratch (Sorrenson, 1968; Thornton White et al., 1948), settler-colonialists confiscated land and water resources there, disregarding the interests and practices of the Maasai and Kikuyu peoples (Hirst and Lamba, 1994). Along with broader national water governance shifts in the 1920s, the Municipality of Nairobi assumed direct responsibility for urban water supply in 1922 (Nilsson and Nyanhaga, 2008). In a fashion typical for colonial urbanisation, the municipalisation of Nairobi's water supply did not contribute to increased socio-spatial equity. Instead, the majority of the African population in early Nairobi accessed water via boreholes, streams, and other sources beyond the emerging colonial water network (Akallah and Hård, 2020). The heterogeneity of Nairobi's water supply – a key characteristic of the city's waterscape today – is thus a reflection of, and evolution from, planned segregation during Nairobi's colonial beginnings.

By the time of the municipalisation of Nairobi's water supply and the expansion of sources for the gravity-fed pipe network far into the city's hinterland, many Africans were living in precarious settlements outside the formal city boundaries. On the other hand, large villas with servant quarters were the norm for wealthy Europeans and a part of the Asian population living in the high-lying, ventilated, and green areas north and northwest of the city (Werlin, 1966). Nairobi's calculated water demand at the time was based on these inequalities, assuming that Europeans consume more water than Indians and Africans (Nilsson, 2016). Although Nairobi's waterscape experienced an expansion of its supply sources after World War II, networked infrastructure remained insufficient to cover the demand of the growing urban population (Nilsson, 2016; Thornton White et al., 1948). While categories to calculate Nairobi's water demand have changed, they continue to rest on differentiations between people residing in different areas (Interview: Nairobi City County, 2015).

Since Kenya's independence in 1963, a complex interplay of strategies, policies, and practices of urban administrations, residents, and elites have accumulated to increasingly stress networked water supply in

Nairobi (Nyanchaga, 2007; Were, 2019). Thus, as Nyamai and others (2022) have shown, not only are high-income areas in Nairobi six times more likely to receive sufficient water supply than low-income areas, but modes of water delivery continue to differ significantly (ibid; Ledant, 2013; Sarkar, 2020). Even within neighbourhoods, Nairobi's waterscape remains defined by the entanglements and overlaps of networked infrastructures and multiple non-networked water supply modes, such as "privatized enclave infrastructures, water vending practices, private boreholes and rain water harvesting" (Wamuchiru, 2017). Myriad actors, such as private vendors, urban residents, plumbers, and NGOs, may engage in buying and selling water, installing tanks, constructing or manipulating the network of pipes, and other activities to access water (Akallah and Hård, 2020; Chakava et al., 2014; Kimari, 2019; Sarkar, 2020; Schramm and Ibrahim, 2019). Hence, Nairobi's heterogeneous waterscape is fundamentally shaped by negotiations, contestations, and accommodations of actors within and outside of formal water governance and management bodies, who make more or less collective decisions and come to agreements outside stipulated laws and policies. Due to the perpetual inability of the networked water system to supply the growing city, non-networked water sources (specifically boreholes) and heterogeneous supply modes, such as water delivery with bowsers or handcarts, have become increasingly important elements in Nairobi's waterscape. Thus, water access depends increasingly on the ability to access water beyond the network. In this situation, higher-income, well-connected estates are able to mitigate the insufficient and erratic network supply, often using water delivery services or private boreholes. Many middle- and lower-income areas, however, are still largely dependent on network supply, with or without individual connections, and on the multiple non-networked supply modes that source water both from the network and from non-network sources, including boreholes. To reveal the tensions between network expansion and borehole drilling that shape Nairobi's waterscape – an understanding of which in turn helps in assessing how Covid-19-related interventions have shaped Nairobi's waterscapes – we explain related water governance arrangements in the next section.

### **NAIROBI'S PRE-PANDEMIC WATERSCAPE GOVERNANCE**

*Right now, our demand is about 820,000 cubic meters per day. Our capacity right now is 525,600 cubic meters per day. That leaves us with almost 300,000 cubic meters per day deficit (Interview: NCWSC, 2021).*

Currently, Nairobi's utility network only covers an estimated 65% of the city's calculated water demand, and this estimated calculation is in itself skewed as it assumes low water demand by low-income residents. Across the city, about 8,000 licensed boreholes cover the gap in networked water supply, supplying an estimated 33% of the city's water demand – about 270,000 cubic meters per day (Interview: WRA, 2021). On top of the roughly 8,000 boreholes licensed in Nairobi, an estimated 4,000 boreholes have been drilled without licenses, according to media reports (Lang'at, 2016). Thus, boreholes have become key, albeit hardly recognised, elements of Nairobi's waterscape. We argue that the tension between the boreholes and the utility network, or rather the attention that policymakers and planners give to one over the other, is key to understanding the impacts of pandemic-related interventions in the city's waterscapes. More specifically, water sector policies, investments, and governance reforms at the national level and concerning Nairobi's waterscape, as well as related critical debates, have since the 1990s mostly focused on the water network, the ways it may be expanded to draw water from new sources, and the ways it may be governed efficiently in line with current ideals of commercialisation, full cost-recovery, and efficiency (cf. Akallah, 2019).

The boreholes, in the meantime, have multiplied comparatively silently and have become essential elements of Nairobi's waterscape while remaining under the radar of intense policy debates or water sector reforms. Indeed, the boreholes are governed by one key actor, which is the Water Resources Authority (WRA). WRA is in charge of all natural water resources in Kenya, regulating abstraction,

checking quality, issuing permits, and collecting fees. Thus, WRA instructs the local utility on the quantity and method of its water abstractions from reservoirs, groundwater, and other sources. For all boreholes drilled by utilities and private actors, WRA tests water quality and issues permits. WRA may deny such permits if a new borehole is not appropriately distanced from existing ones (at least 150 meters) or if the borehole would abstract from a highly stressed groundwater area. Off-the-record conversations with drilling companies and real estate developers revealed however that those rules and bans are not always enforced.

The flows of water through the network of pipes toward or through Nairobi have been mediated via a more complex governance arrangement, which has been subject to water sector reforms and intense scholarly debate since the early 2000s. The water sector reforms' core goal was the commercialisation of water that in turn was to lead to greater efficiency of water governance and hence an increased network coverage that would stretch into the city's hardly served informalised settlements and other low-income areas (Interview: Athi Water Services Board, 2014). Especially pushed in Kenya by German organisations such as GTZ and KfW in the 1990s (K'Akumu and Appida, 2006), the international agenda of privatisation and commercialisation of (urban) water supply since the 1980s also led to the creation of several parastatal institutions tasked with decentralised planning, governance, and regulation of local water sectors across Kenya (Nyanchaga, 2016; see also: Jaglin, 2002). Thus, in line with the Kenya Water Act of 2002 (later replaced by the 2016 Water Act) as well as the 2010 Constitution of Kenya, the reforms led to the creation of three main actors supposed to govern and manage water: a water utility responsible for network maintenance and repairs that is able to recover its costs from water tariffs, an institution that owns and develops water infrastructure, as well as a government regulatory body responsible for regulating local water sectors, for example in terms of water tariffs. As of today, Nairobi's top-down water governance is defined by four key entities: a) the aforementioned national authority, WRA; b) the Nairobi City Water and Sewerage Company (NCWSC), a water utility that holds responsibility for network maintenance and repairs; c) the Athi Water Works Development Agency (AWWDA), a government agency that owns and develops water infrastructure; and d) the Water Service Regulatory Board (WASREB), a national regulatory body responsible for regulating local water sectors on issues such as water tariffs. Today, these three entities – in collaboration with the Nairobi City Council (NCC) govern and manage Nairobi's networked water infrastructure.

AWWDA is the legal proprietor of large-scale water and sewerage infrastructure in the wider Nairobi area. AWWDA plans, acquires funding for, and contracts the construction of dams, distribution lines, and other major infrastructures. While AWWDA is currently expanding its infrastructures – e.g. through the construction of the Northern Collector Tunnel (cf. Blomkvist and Nilsson, 2017) – several projects have been delayed for years and additional infrastructure investments are necessary to actually cover Nairobi's current and future water demand (Interview: AWWDA, 2021). There are, however, plans to internalise responsibilities for completed infrastructures and "to operate the bulk water systems and sell water in bulk" as a form of revenue generation for future projects (AWWDA, n.d.).

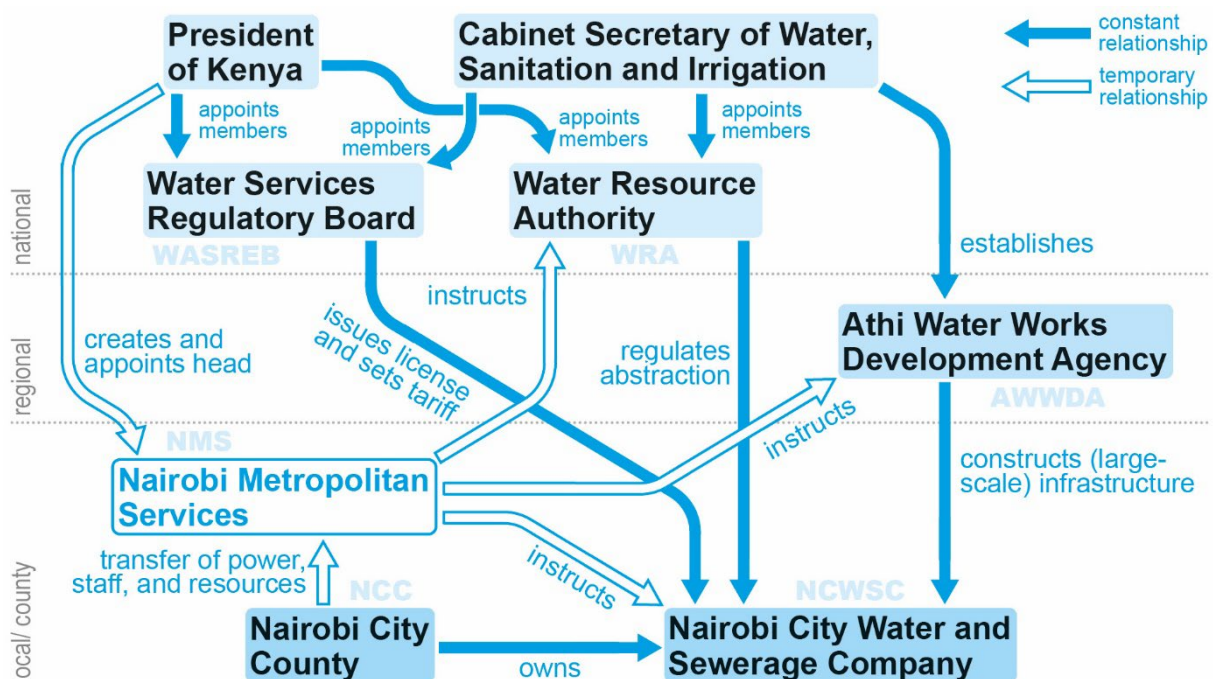
Before piped water is sold to Nairobi's consumers, WASREB assesses and re-issues licenses to the utilities and sets up local tariff structures. Additionally, WASREB is supposed to license and monitor small-scale Water Service Providers (WSPs) in the county, such as water bowsers, private boreholes engaged in commercial water supply, and water projects by NGOs. However, only over the course of the Covid-19 pandemic was the registration of small-scale WSPs followed up on, and it has yet to produce effective results. WASREB and WRA see NCWSC as being in charge of regulating these WSPs given its mandate to distribute water in Nairobi County, but NCWSC is reluctant to shoulder such a non-revenue-producing task (Interviews: NCWSC & WRA, 2021).

NCWSC is a commercialised public utility tasked with managing Nairobi's water and sewerage in a financially feasible manner that promotes accessibility, affordability, and equity (WASREB, 2019). Except for a separate provider in the affluent suburb of Runda (Interview: Runda Water, 2021), NCWSC is the only official water service provider in Nairobi County, and it therefore has a quasi-monopoly on

networked water provision (Akallah, 2019). Being in operation since 2003, however, NCWSC has never been able to provide sufficient water to all the city’s residents. According to their latest numbers, the company only reaches 76% of all households (NCWSC, n.a.) in the city. In response to their massive water deficit, NCWSC has implemented the so-called "equitable distribution programme", through which neighbourhoods only receive water on assigned days of the week for some hours (ibid). On paper, the equitable distribution program provides water on only two or three days every week, with different neighbourhoods receiving water on different days. In reality, however, the number of weekly water days and their reliability can be highly erratic, particularly in lower-income areas (Goswami, 2018; Nyamai et al., 2022). In line with Kenya’s overall push towards the commercialisation of water, NCWSC is bound to 'the ideal of full cost-recovery'. This results in a limited capacity for staffing and investments, which further exacerbates the persistent issues of supply (cf. Akallah, 2019; Schramm and Ibrahim, 2019; Schwartz et al., 2017) and results in a dependence on government actors to actually invest in infrastructure.

The issue of resources has been the key issue for providing services. (...) The company [Nairobi Water] is mandated to work in commercially viable areas. So, as much as they are working to have extra resources and push services to areas which are commercially not very viable, it means that now the government has to come in (Interview: NMS, 2021).

Figure 1. Relationships of selected key actors in Nairobi’s water governance in 2020/21.



The actors governing and planning Nairobi’s water supply have different perspectives on these challenges of lacking investment, insufficient upstream supply, and incomplete devolution, albeit hardly questioning the route towards commercialisation and full cost-recovery. WASREB, for example, sees lacking implementation of devolution policies in the 2016 Water Act and the 2010 Constitution of Kenya as a root cause for current water issues (WASREB, 2019; cf. Gachenga, 2019). AWWDA plans to sell bulk water to NCWSC in order to independently create revenue for their large-scale infrastructure projects. Finally, the question of who is to regulate small-scale WSPs remains unresolved. Amidst these debates on formal water governance, boreholes have become an important mode for providing water to Nairobi’s residents. Nonetheless, since they exist outside of the utility network, and therefore function outside the scope of

the actors formally governing Nairobi's water system, these boreholes, together with water accessed indirectly from the utility grid and related negotiations and accommodations between actors within and outside formal water governance, have largely remained absent in mainstream water debates. This was the case at least until the onset of the global pandemic, when a new governing actor was created: the Nairobi Metropolitan Services (NMS).

### **RE-CENTRALISING URBAN GOVERNANCE: THE EMERGENCE OF THE NAIROBI METROPOLITAN SERVICES (NMS)**

*We have functions that are devolved, water is one. (...) But if a county government, for any reason, cannot perform a certain function, which is mandated by the law, the national government cannot sit back and leave the citizens without services (Interview: NMS, 2021).*

On 18 March 2020, coincidentally only six days after Kenya's first case of SARS-CoV-2, NMS was officially instated, resulting in a transfer of several governmental mandates from the NCC to NMS. The creation of NMS and the partial transfer of power were the results of long-standing conflicts between national and county governments, accompanied by accusations of mismanagement and misappropriation of funds by the county government. Although NMS was initially instated as a temporary solution extending until February 2022 (Interview: NMS, 2021), the creation of NMS has contested the constitutional devolution of urban (water) governance and resulted in distinct changes in Nairobi's waterscape.

NMS is quite a young outfit (...) by February next year, it is supposed to go away (...) previously, Nairobi Water was a department of the City County. So, we are totally owned by the county. Now it is NMS-stroke-county (...) but then, it is an organisation that is here in passing, because we don't know what will happen in February 2022 (Interview: NCWSC, 2021).

Before the installation of NMS, the NCC was responsible for allocation of funds, tax collection, the planning and coordination of the water sector, and various other municipal tasks. Later charged with constitutional offenses and other misconducts that led to his impeachment in late 2020 (Oduor, 2020), the former governor signed a deal with the national government in February 2020 to transfer governance power in four key departments – Health and Transport, Public Works, Utilities and Ancillary Services, and County Government Planning and Development. The political and governmental reasoning was that the NCC and its governor were not able to govern the city appropriately and could not find solutions to its most pressing issues, such as its water supply situation, due to rampant corruption and the involvement of so-called cartels (Njeru, 2021; Interview: NMS, 2021). Thus, on 18 March 2020, Kenya's president appointed an Air Force General as head of NMS, which later became an official public office directly under the president (Omulo, 2020a). This unprecedented development largely stripped NCC of its revenues and financial resources, which were reallocated to NMS with additional funding. However, the "political vehicle" of NMS (Interview: NCWSC, 2021) was initially designed as a temporary solution for two years only, and various urban development projects that NMS had rapidly implemented in 2020 were already showing signs of stalling in the same year (Omulo, 2020b). In late 2021, simultaneous with the installation of a new interim county governor, the National Treasury cut the budget of NMS for 2022/23 to nearly zero, further indicating its impending demise (Ambani, 2021; Daily Post, 2021). Yet, during another visit to Nairobi in April 2022, NMS was still active, and respondents of our study were rightfully certain that NMS would remain active until the then-upcoming general elections that August, or even longer (Interviews: AWWDA, NMS & SHOFCO, 2021). The NMS was ultimately dismantled in late 2022.

The creation of NMS not only resulted in a transfer of power and resources but also of personnel. Except for its upper management, the majority of NMS staff had previously worked for the NCC. Roughly 6,000 employees were transferred, most of them remaining in the same positions and the same offices/buildings as before (Okoth, 2021; Interview: NMS, 2021). This resulted in a relatively smooth transition with a quick implementation or finalisation of urban development projects mostly, but not



exclusively, targeted at informalised settlements (Kebaso, 2020; Kinyanjui, 2020; Mueni, 2021). While those developments did not permeate to all informalised or lower-income areas of Nairobi (Interview: Katiba Institute, 2021; conversations with residents in Kibera, 2021), the rapid implementation of projects by NMS highlights that plans for interventions had been available all along (Corburn, 2021; Interviews: NCWSC & NMS, 2021).

Nairobi residents perceived NMS and its directorship positively (Interviews: KWAHO & Undugu Youth Group, 2021; Wandede, 2021). Despite its popularity, the installation of NMS has been a contested development because devolution – the 'democratic decentralization' of power from the national to county level – is anchored in Kenya's constitution and further stipulated in the 2016 Water Act. Accordingly, for a vast section of governmental responsibilities – e.g. the planning and coordination of local water sectors – county governments are "neither agents nor subordinates to the center" but independent yet fiscally connected entities (Kanyinga, 2016). Since the installation of NMS transferred power back from the county to the national government, a Kenyan activist and politician challenged it in court in June 2020, claiming that "the purported creation of the Nairobi Metropolitan Services was unlawful and unconstitutional and, therefore, invalid, null and void ab initio" (Kenya Law, 2020). Ultimately, however, the creation of NMS was upheld (Okoth, 2021). Thus, NMS presents a unique example of the national government reclaiming direct power over municipal responsibilities and urban governance. It questions the independence of the NCC to self-govern. A heavily top-down, albeit temporary, structure was installed that in turn shifted the power relations and governance of Nairobi's waterscape (see Figure 1).

Since NMS took over the responsibility for water sector planning and project implementation from the county government, power relations among the key actors formally governing Nairobi's waterscape changed. As a county-owned WSP, NCWSC now received directives from, and collaborated with, NMS instead of the NCC. Thus, NMS became instrumental in implementing changes to Nairobi's waterscape during the Covid-19 pandemic since the transfer of power to NMS also meant that planning, funding, and governance of the public water sector in Nairobi was now a national task. As we elaborate below, their interventions focused on non-networked water supply technologies such as boreholes and water bowsers rather than on the long-anticipated investments into the expansion of water sources, as was planned by AWWDA and other institutions.

### **THE IMPACTS OF COVID-19 ON NAIROBI'S WATERSCAPE**

Upon confirmation of Kenya's first official case of a SARS-CoV-2 on 12 March 2020 (Ministry of Health, 2020), the Kenyan government imposed measures such as travel bans targeting highly affected counties and a nationwide curfew. Increased handwashing, social distancing, and mask wearing in all public spaces were promoted and enforced, which was all complemented by a vaccine roll-out from March 2021 onwards. Over the course of 2020 and 2021, travel bans for certain counties were dynamically adapted, and the nationwide response measures were completely lifted in early 2022 (Reuters, 2022), at which point the rate of fully vaccinated adults had only reached 29% for Kenya and 47% for Nairobi County (Ministry of Health, 2022). Covid-19 and related responses had a significant impact on economic livelihoods, food security, and mobility, particularly in informalised or low-income settlements (cf. Pinchoff et al., 2021; Schmidt et al., 2020; Shupler et al., 2021). Until now, however, the implications of pandemic-related governmental directives and implemented projects for Nairobi's waterscape are yet to be investigated.

After decades of neglect, the public health crisis created by Covid-19 exposed the uneven geographies of water access in Nairobi. While many, albeit not all, residents of upper- and middle-class neighbourhoods could retreat to homes with piped water connections or borehole supply, Nairobians in lower-income or informalised settlements faced limited and intermittent supply from water points or water delivery services. Additionally, some private water vendors increased their prices significantly –

from KSh 3-5 to KSh 10-20 for fetched water jerry cans (20 litres) or from KSh 20-30 to up to KSh 80 for delivered jerry cans – according to conversations with residents in Kibera in 2021. Simultaneously, people spent more time at home and were repeatedly instructed to use more water for regular handwashing and other hygiene tasks (Interview: NCWSC, 2021). Given the simultaneous changes in Nairobi's governance structure, NMS now oversaw and implemented these efforts.

The most significant policy change for Nairobi's waterscape was announced on 6 April 2020 in the form of a presidential and nationwide directive. With the goal to "ensure continuous supply of water and adequate sanitation" so that "people have adequate water for domestic use and for washing of hands", the directive provided binding guidelines for county governments (UN Habitat, 2021):

1. Direct all [WSPs] to provide free water to informal settlements and vulnerable groups for the next three months, April-June 2020. Other consumers will pay for the water and sewerage services; (...)
3. Ensure WSPs suspend disconnection of water for the next three months that is April-June 2020; (...)
6. Ensure handwashing points are accessible in strategic locations to serve needy communities.

The directive was extended to September 2020, and in Nairobi the "free water to informal settlements" instruction and the promotion of handwashing stations were de facto both still active in early 2022. NCWSC was furthermore directly affected by the guideline to suspend disconnections. According to NCWSC, the company experienced a significant revenue drop in the first months of the pandemic caused by a decrease in water consumption by commercial entities and an increase in non-payments by customers. Either believing that the free water directive would apply to them, simply counting on the non-disconnection directive, or just not having the financial resources due to the economic downturn, some customers stopped paying their water bills. Over the course of 2020 and 2021, NCWSC's revenue returned to pre-pandemic levels. However, despite some World Bank-funded support, the missing revenue from 2020 remains a problem for NCWSC and its already strained financial capacity (Interview: NCWSC, 2021).

Simultaneously, since increased handwashing was an initial key strategy to prevent the spread of the virus, Nairobi experienced a rapid increase in handwashing stations, installed primarily by government actors and NGOs in public spaces, places of worship, and so on. All informants highlighted the importance of such stations for the increase in handwashing, but their long-lasting effect on increased hygiene routines across the city is questionable since ownership of, and responsibility for, these stations is often ambiguous. Initially, the government and NGOs equipped and serviced several stations, but their maintenance was handed over eventually to local residents and organisations, such as CBOs or churches. How many of those stations are still functioning is thus unclear, since not all the new owners are willing or able to regularly maintain and fill them. In addition, vandalism and theft were commonly reported, and of the 500 stations installed by NCWSC in the city centre in 2020, none are operational anymore (Interviews: KWAHO, NCWSC & SHOFCO, 2021). While the materiality of handwashing stations and their gradual disappearance make visible small-scale changes in Nairobi's waterscape, some changes to urban water governance and project implementation are less visible. On one hand, some projects or programs – from small WASH interventions by NGOs to larger plans by utilities and agencies – have been pushed back or were affected by the reallocation of resources (Interviews: AWWDA, KWAHO & NCWSC, 2021). On the other hand, the pandemic was also a trigger for a further digitalisation in the waterscape. Smart water infrastructures were already on the rise in Nairobi (cf. Guma et al., 2019), but utilities and government agencies have now implemented, or are at least considering, additional digital or web-based applications and services (Interviews: NCWSC & WRA, 2021). What all those diverse, sometimes ambiguous changes show, however, is how Covid-19 resulted in rather spontaneous reactions that were hardly part of long-term solutions to pre-existing inequalities in Nairobi's waterscape.

## ENGINEERING SOLUTION TO PANDEMIC WATER STRESS: 193 BOREHOLES

*You don't just identify a borehole and drill it (Interview: Water Trust Fund, 2021).*

In April 2020, NMS started to purchase more than 20 water bowsers that extracted water from NCWSC's network to deliver it to public water points. These points were spread across the whole city but were primarily located at the margins of informalised settlements (Interviews: NCWSC & NMS, 2021). While other stakeholders confirmed that free water was delivered, in Kibera, the regularity of provision has loosened over the course of 2021 (Interview: KDI, 2022). However, the delivery to water points was accompanied by the sinking of nearly 200 new government boreholes in 2020. Following the above directive, NMS – via the Ministry of Water, Sanitation, and Irrigation and the National Treasury – allocated KSh 1.62 billion for its water supply projects, including the drilling and equipping a total of 193 boreholes and the construction of raised steel water tanks that should have the capacity to supply about 30 million litres a day. Moreover, the World Bank gave an additional KSh 6.9 billion grant to the Ministry to aid the operations of WSPs across the country (Interview: Water Sector Trust Fund, 2021). In collaboration with other government bodies, NMS quickly sank and operationalised those boreholes over the course of a few months based on plans that were already available (Interviews: AWWDA, NMS & WRA, 2021).

The rapid installation of 193 boreholes – of which 143 were in 'underserved areas' (Khaduli, 2021) – was led by NMS and coordinated by a multi-agency team consisting of representatives from the Ministry of Water, Sanitation, and Irrigation; NMS; AWWDA; WRA; NCWSC; and WASREB. First, NMS proposed borehole locations, mainly on public land, which were then reviewed by WRA and the Ministry: "When we got the funds, we already had a list. It's not like we were just sent out and decided" (Interview: NMS, 2021). For the approved locations, AWWDA tendered orders to private drilling companies. The constructed boreholes were transferred eventually from AWWDA to NCWSC, which currently remains responsible for their maintenance and operation in collaboration with private service providers who take care of repairs and water treatment (Interviews: Davis & Shirliff, NCWSC & WRA, 2021). In addition to electricity costs, treatment, and maintenance, NCWSC pays 50 cents per 1,000 litres to WRA for the extraction of water – the standard fee for water abstraction in Kenya. Those running costs are partly funded by the aforementioned World Bank grant (Water Sector Trust Fund, 2021). However, daily management of boreholes lies not with NCWSC but with community water committees:

The committees were recruited from the community in consultation with the area elders and the local administration. (...) there will be a representative from Nairobi Water, there will be either a pastor or someone senior. (...) They will choose people from among themselves. I think the total is about eight to ten people. Only one or two will be from Nairobi Water. The other ones, they are area elders (Interview: AWWDA, 2021).

Those committees and additional staff work voluntarily to operate the pumps and attached water kiosks (Interviews: NCWSC & Undugu Youth Group, 2021). The management and implementation of new boreholes thus involved various levels – from the ministry to NMS to community groups – working together to provide free water to informalised settlements. However, in order to reveal the actual impact of these interventions, we will discuss some key issues related to the borehole drilling.

The actual functionality of the boreholes is a key consideration. According to official accounts, 20% of the newly constructed boreholes are non-functional largely due to lacking power supply (Interview: WRA, 2021). Other studies have shown that residents across various informalised settlements in Nairobi continued to struggle with water access and affordability during the pandemic (Joshi et al., 2022; Tompsett et al., 2021), which raises further questions about the actual impact and scope of the free water initiative. In addition, governance agencies' relative secrecy regarding the actual position of the boreholes as well as field visits and conversations with non-governmental stakeholders raise reasonable doubt concerning the official percentage of functional public boreholes. The lack of functionality is a general feature of free water points (some including boreholes), with local researchers and activists

struggling to find operational, publicly accessible, and properly managed points in various informalised settlements, such as Mathare, Mukuru, and Kibera (Interviews: Katiba Institute, KDI & KWAHO, 2021/22).

So, [in Kibera] the government sunk those boreholes with these huge metallic tanks. But many have not worked yet, because of the operation of it, I think. You know, who manages the water, are they selling it or giving it out for free, if the pumps breaks, who repairs it? (Interview: KDI, 2022)

Now that free water is supplied to informal settlements, you find that there are people who are taking most of the water. So, for you to get it, you have to pay them something. It is free, but people have patronized it now. So, they take the free water and resell it (Interview: KWAHO, 2021).

Furthermore, even where boreholes are functional, they provide water for certain hours of the day only (Observations; Interview: Undugu Youth Group, 2021). As this may result in long queues, water users often continue to rely on other sources. Furthermore, as reported from other African countries, free water policies during the pandemic may increase the risk of exposure to SARS-CoV-2 since "free water at standpipes has led to large crowds with long lines of people waiting to fill buckets with water" (Baron and Guigma, 2021; cf. Shang-Quartey, 2021). Taking these aspects together, not only do many of the installed boreholes or free water points not work, but even if they work, their actual relation to virus transmissions is unclear since handwashing – despite its overall benefits – does not play a major role in preventing the transmission of SARS-CoV-2 (Hawkins, 2021; Lewis, 2022).

Considering the long-term impact of the boreholes on Nairobi's waterscape beyond the pandemic, the picture is more complex. This is because with the dismantling of NMS, the future of the free-water policy and the boreholes themselves, is highly uncertain. There are plans to fully incorporate the boreholes into Nairobi's networked water infrastructure and connect them to the grid (Interview: NCWSC, 2021). This would mean that NCWSC will have to operate them, which it already does only hesitantly given the associated financial burden. However, despite these plans, the future of the boreholes appears highly uncertain to private water vendors as well as local residents. Private water vendors reportedly reacted to the installation of the boreholes with intimidations, harassment, and even sabotage, which indicates that they considered them a serious threat to their water businesses (Interview: Undugu Youth Group & Vajra Drillers, 2021). Kibera's water users, for instance, neither know who was responsible for the creation of the borehole nor how the future water supply would be regulated. Instead, most assumed that the free water supply will remain (conversation with residents in Kibera, 2021). Despite the involvement of community water committees in the management of individual boreholes, available information apparently did not reach the respective water users.

Relatedly, the future of Nairobi's entire waterscape is uncertain because of two factors. Firstly, the use of boreholes for the city's water supply will further stress Nairobi's ground water aquifers, which already "might not be able to support the projected groundwater demand, and the shortfall between demand and supply is expected to start before the middle of the century" due to rapid and ongoing urbanisation (Oiro et al., 2020). Secondly, the role of NCWSC as a key actor in the governance and management of Nairobi's water flows has become increasingly uncertain amidst the current governance changes and interventions into the technological system of water supply. This is because the free water policy, the non-disconnection directive, and the installation of boreholes as such further strains their financial and personnel capacities. The difficulties NCWSC currently experiences when trying to regulate or manage off-grid technologies, such as the boreholes, and small WSPs do not indicate that boreholes will be less prolific elements in Nairobi's waterscape. Instead, the installation of new boreholes has provided a multiplicity of futures in Nairobi's waterscapes, in which some boreholes are used and operated by NCWSC; some are run by private engineers, plumbers, or community groups; some are used for schools and other public facilities only; and some might just disappear. This may lead to a situation where it is mostly the higher- and middle-income groups who may decide to go off-grid, while, in a kind of reverse "infrastructural bypassing" (Graham and Marvin, 2001), NCWSC may be left with providing water to those who cannot afford such strategies, meaning residents of low-income settlements.

Overall, the rapid installation of free water points and new boreholes in Nairobi was clearly a timely and reasonable endeavour at the onset of the pandemic. It ensured better water quality for those able to receive free borehole water due to monitored sourcing by WRA and the treatment of the water (Interviews: NCWSC & WRA, 2021) – two activities which are not features of most non-networked provision of water in Nairobi. However, the publicly governed parts of Nairobi's waterscape have fragmented further; some people have received free water while many others in the same neighbourhoods have not. Further, power relations between actors have shifted, with NCWSC unwillingly responsible for an unclear number of operational boreholes, water cartels and vendors challenged but still operational, communities and water users left in the dark about the future of (free) water supply in underserved areas after the dismantling of NMS. In the end, even if the boreholes might be out of operation sooner rather than later, and while they have hardly changed Nairobi's uneven water geographies or eased the city's water deficit, they demonstrate once more the fundamental difficulties in installing a centrally governed water supply system in Nairobi.

### **RE-PRODUCING NAIROBI'S PANDEMIC WATERSCAPE: CATALYSTS AND CHANGES**

As demonstrated, Nairobi's waterscape has indeed experienced significant changes in terms of governance constellations, policy interventions, and implementations of new infrastructures, such as handwashing stations, free water points, and public boreholes. We argue however that these changes – which are rather antithetical towards the city's long-running fixation on networked infrastructures – can by no means be explained by the pandemic alone. As much as Covid-19 triggered the reallocation of funds and a stronger focus on water delivery to underserved areas (namely informalised settlements), the disruptive event of the pandemic, along with the coincidentally simultaneous installation of NMS, co-catalysed changes and plans that have been possible and available all along. The urgency of the pandemic and the presidential authority and financial resources of the NMS made otherwise unlikely interventions possible. When asked directly if interventions, such as free water points and public boreholes, would have been possible with only one of those catalysts, respondents of our research voiced significant doubt (Interviews: KWAHO & NMS, 2021). Without NMS, water-related responses to Covid-19 would likely have been less streamlined and less financially equipped. The fact that, apart from a smaller government project on borehole drilling in Nakuru in 2021, no other county or city in Kenya experienced such investments and interventions (Interview: WRA, 2021) underlines the importance of NMS in these developments. On the other hand, without the urgency of the pandemic and the initial focus on water use and hygiene practices, NMS might have used its temporary authority and resources in other ways. While speculations on potential changes in the waterscape without NMS or Covid-19 are unlikely to be productive, we want to highlight the actual reconfigurations of Nairobi's waterscape during two pandemic years. For this, we turn back to our understanding of waterscapes as situated and hybrid constructs produced through multiple relationships between humans, natures, and technologies.

Firstly, since waterscapes are constantly (re)worked and (co)produced water landscapes (Loftus, 2007; Rusca et al., 2017), the combination of Covid-19 and NMS – with its implications on governance, policy, and project level – has without a doubt reconfigured Nairobi's waterscape and its underlying production, even if only temporarily. The place-specific "water governance configurations" (Sutherland et al., 2015) were altered, and new public infrastructures, i.e. boreholes, are now part of the everyday (re)production of Nairobi's waterscape. In combination with historical developments – from colonial planning legacies to the commercialisation and devolution of recent decades – and the everyday practices of users, vendors, and others, the policy and project interventions since 2020 are likely to reverberate into a post-pandemic waterscape that is still shaping up. While the magnitude of such reconfigurations remains to be seen, we argue that instead of actually addressing pre-existing inequalities, the changes brought by NMS and Covid-19 have the potential to contribute to a further, more fine-grained fragmentation of Nairobi's waterscape, in which boreholes provide benefits only to those who either live close by or are

able to erect their own. Additionally, the long-standing fundamental difficulties in providing universal and equal water access through large-scale infrastructures and networks have not decreased considering the additional economic struggles for many water users during the pandemic, the general problem of unsustainable groundwater abstraction via boreholes, and the increasingly burdened and deteriorated position of NCWSC.

Secondly, when approaching waterscapes as highly relational constructs (cf. Loftus, 2007; Truelove, 2019), we can identify three key changes in relationships and flows within Nairobi's waterscapes: 1) the flow of water itself was partially, but maybe only temporarily, changed through the use of bowsers and boreholes in some formerly underserved areas; 2) the power relations of water actors were altered, with a now further weakened NCWSC, a temporary override of urban governance responsibilities by the national government through NMS, a streamlined collaboration between government agencies, and reconfigured relationships between water vendors, communities, and government agencies around free water points and new boreholes; and 3) new pandemic-specific relations between humans, natures, and infrastructures emerged, in which one *nature* – i.e. Covid-19 – triggered changes in infrastructures to provide another *nature* – i.e. water – for the benefit of local communities. Again, the long-lasting ramifications of these altered relations and flows remains to be seen, but they are nevertheless a key aspect of Nairobi's pandemic waterscape, its governance, and its (re)production.

Thirdly, by specifically using the notion of waterscapes to bridge the nature/society dualism, we hope to have shown the intricate, situated entanglement of humans/societies, natures/waters, and technologies/infrastructures (cf. Rusca et al., 2017; Swyngedouw, 1999). Although we have used pandemic-specific water governance and policies as our starting point for this paper, the openness and inclusiveness of waterscapes as situated "key terrains" (Loftus and Lumsden, 2008) allowed for an in-depth exploration and discussion of urban water supply and access in pandemic times. Ultimately, understanding (post)pandemic waterscapes involves multiple scales (from a global pandemic to local water points), temporalities (from historical developments to acute health crises), actors (from national governments to water users), technologies (from large-scale infrastructures to single boreholes), and natures (from groundwater aquifers to viruses). We thus argue that despite a necessary but empirically grounded fixation on certain elements of the waterscape (in this case, water governance and policies as well as boreholes), we were able to work out how changes in Nairobi's waterscapes were made possible only through the combination of different natures, different humans and institutional actors, and different technologies, which were visible through the concept of the waterscape.

## CONCLUSION

After waiving all Covid-19 restrictions in early 2022 and with only moderate uptake in vaccination rates since then, the pandemic has become yet a smaller a factor in Nairobi residents' daily lives. After all, official numbers show that Kenya has only seen a moderate impact from Covid-19 when compared with global norms (Cabore et al., 2022; Ministry of Health, 2023; Mwale, 2022). Also, since SARS-CoV-2 is primarily airborne, it is unlikely that public boreholes have played any role in curbing the spread of Covid-19 in Nairobi. Yet, the initial focus on water and handwashing in 2020 has led to some changes in Nairobi's waterscape that remain visible. Handwashing stations are still ubiquitous across Nairobi, although their actual use has visibly declined. The large metal tanks above newly installed boreholes clustered with logos of government agencies are still towering above some informalised settlements, though their future remains unclear. Thus far, NMS' short-lived reign over Nairobi's urban governance is clearly over, as it was fully dismantled and absorbed into the NCC under the city's newly elected governor in late 2022 (Mueni, 2022). It remains to be seen how much of an echo the unprecedented installation of NMS might have created in the political, infrastructural, and governmental landscape of Nairobi.

Starting in early 2020, water users across the city faced economic struggles, changing policies and governance structures, new supply modes in their communities (or the lack thereof), and continuing yet

granularly altered inequalities in Nairobi's waterscape. How the city's waterscape, with its new infrastructures and relations, has been experienced and (re)produced on an everyday level through creative adaptations and practices by regular residents needs to be investigated further. It also remains to be seen how far Nairobi's now-emerging post-pandemic waterscape will reflect the changes brought by the coincidental overlap of Covid-19 and NMS. What is clear though is that those changes have further manifested the heterogeneity of water supply modes (cf. Wamuchiru, 2017) since even governmental actors moved from their exclusive fixation on centralised and piped networks to off-grid or post-networked technologies like bowsers and boreholes. Amidst these changes, issues of equity and sustainability remain to be tackled. Nevertheless, while Covid-19 might not have been a "portal" (Roy, 2020) to drastically new arrangements in Nairobi's waterscape, it was still a co-catalyst for (temporary) change. Further, given the unprecedented use of off-grid supply modes by state actors, the pandemic years might provide an opportunity to advance more place-specific imaginations of water supply beyond a network system to enhance equitable access to water supply across the city.

### ACKNOWLEDGEMENTS

The empirical research for this paper was conducted as part of a research project titled "Urban waterscapes and the pandemic: Changing water practices, technologies and infrastructures in Nairobi" (2021-2022). Funded by the German Research Foundation (Deutsche Forschungsgemeinschaft (DFG), project number: 468099064), the project was a collaboration by Technische Universität Dortmund and the University of Nairobi.

### REFERENCES

- Ahlers, R.; Cleaver, F.; Rusca, M. and Schwartz, K. 2014. Informal space in the urban waterscape: Disaggregation and co-production of water services. *Water Alternatives* 7(1): 1-14.
- Akallah, J.A. 2019. In the technological footprints of urbanity: A socio-political history of water and sanitation in Nairobi, 1899-2015. PhD thesis, Technische Universität Darmstadt, Darmstadt, Germany.
- Akallah, J.A. and Hård, M. 2020. Under the historian's radar: Local water supply practices in Nairobi, 1940-1980. *Water Alternatives* 13(3): 886-901.
- Ambani, B. 2021. Slashed budget signals end of the road for NMS. *The Nation*, 17 November 2021.
- AWWDA. n.d. *Strategic Plan 2018-2022*. Nairobi, Kenya: Ministry of Water, Sanitation and Irrigation.
- Bakker, K. 2003. Archipelagos and networks: Urbanization and water privatization in the South. *The Geographical Journal* 169(4): 328-341.
- Baron, C. and Guigma, L. 2021. The paradox of free urban water: Burkina Faso's Fight Against Covid-19. In McDonald, D.A.; Spronk, S.J. and Chavez, D. (Eds), *Public water and Covid-19: Dark clouds and silver linings*, pp. 375-391. Kingston; Amsterdam; Buenos Aires: Municipal Service Project; Transnational Institute; Latin American Council of Social Sciences (CLACSO).
- Bhan, G.; Caldeira, T.; Gillespie, K. and Simone, A. 2020. The pandemic, southern urbanisms and collective life. [www.societyandspace.org/articles/the-pandemic-southern-urbanisms-and-collective-life](http://www.societyandspace.org/articles/the-pandemic-southern-urbanisms-and-collective-life) (accessed 12 May 2022)
- Blomkvist, P. and Nilsson, D. 2017. On the need for system alignment in large water infrastructure: Understanding infrastructure dynamics in Nairobi, Kenya. *Water Alternatives* 10(2): 283-302.
- Budds, J. 2008. Whose scarcity? The hydrosocial cycle and the changing waterscape of La Ligua River Basin, Chile. In Goodman, M.K.; Boykoff, M.T. and Evered, K.T. (Eds), *Contentious geographies: Environmental knowledge, meaning, scale*, pp. 59-68. Farnham: Ashgate.
- Budds, J. and Hinojosa, L. 2012. Restructuring and rescaling water governance in mining contexts: The co-production of waterscapes in Peru. *Water Alternatives* 5(1): 119-137.

- Cabore, J.W.; Karamagi, H.C.; Kipruto, H.K.; Mungatu, J.K.; Asamani, J.A.; Droti, B.; Titi-ofei, R.; Seydi, A.B.W.; Kidane, S.N.; Balde, T.; Gueye, A.S.; Makubalo, L. and Moeti, M.R. 2022 COVID-19 in the 47 countries of the WHO African region: A modelling analysis of past trends and future patterns. *The Lancet Global Health* 10(8): e1099-e1114.
- Chakava, Y.; Franceys, R. and Parker, A. 2014. Private boreholes for Nairobi's urban poor: The stop-gap or the solution? *Habitat International* 43: 108-116.
- Corburn, J. 2021. Healing cities: Toward urban climate justice & slum health. [www.buildingsandcities.org/insights/commentaries/cop26-healing-cities.html](http://www.buildingsandcities.org/insights/commentaries/cop26-healing-cities.html) (accessed 12 May 2022)
- Daily Post. 2021. End of the road for General BADI as UHURU cuts NMS budget to zero after the swearing in of KANANU as Nairobi Governor. 17 November 2021.
- Díaz-Caravantes, R.E. and Wilder, M. 2014. Water, cities and peri-urban communities: Geographies of power in the context of drought in northwest Mexico. *Water Alternatives* 7(3): 499-417.
- Ekumah, B.; Armah, F.A.; Yawson, D.O.; Quansah, R.; Nyieku, F.E.; Owusu, S.A.; Odoi, J.O. and Afitiri, A.-R. 2020. Disparate on-site access to water, sanitation, and food storage heighten the risk of COVID-19 spread in Sub-Saharan Africa. *Environmental Research* 189, [www.sciencedirect.com/science/article/abs/pii/S0013935120308318](http://www.sciencedirect.com/science/article/abs/pii/S0013935120308318)
- Gachenga, E. 2019. Kenya's Water Act (2016): Real Devolution or Simply the 'same Script, Different Cast'. In Kameri-Mbote, P.; Paterson, A.; Ruppel, O.C.; Orubebe, B.B. and Kam Yogo, E.D. (Eds), *Law | Environment | Africa*, pp. 429-452. Baden-Baden: Nomos Verlagsgesellschaft.
- Gandy, M. 2004. Rethinking urban metabolism: water, space and the modern city. *City* 8(3): 363-379.
- Gandy, M. 2022. The zoonotic city: Urban political ecology and the pandemic imaginary. *International Journal of Urban and Regional Research* 46(2): 202-219.
- Goswami, S. 2018. Nairobi's water crisis likely to continue till 2026. *Down to Earth*, 31 March 2018.
- Graham, S. and Marvin, S. 2001. *Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition*. London; New York: Routledge.
- Guma, P.K.; Monstadt, J. and Schramm, S. 2019. Hybrid constellations of water access in the digital age: The case of Jisomee Mita in Soweto-Kayole, Nairobi. *Water Alternatives* 12(2): 636-654.
- Hawkins, M. 2021. Yes, we should be keeping the healthier hand-washing habits we developed at the start of the pandemic. *The Conversation*, 19 October 2021.
- Hirst, T. and Lamba, D. 1994. *The struggle for Nairobi: The story of an urban environment built at 'the place of cold waters'*. Nairobi: Mazingira Institute.
- Jaglin, S. 2002. The right to water versus cost recovery: Participation, urban water supply and the poor in sub-Saharan Africa. *Environment and Urbanization* 14(1): 231-245.
- Jiwani, S.S. and Antiporta, D.A. 2020. Inequalities in access to water and soapmatter for the COVID-19 response in sub-Saharan Africa. *International Journal for Equity in Health* 82, <https://equityhealth.biomedcentral.com/articles/10.1186/s12939-020-01199-z>
- Joshi, N.; Lopus, S.; Hannah, C.; Ernst, K.C.; Kilungo, A.P.; Opiyo, R.; Ngayu, M.; Davies, J. and Evans, T. 2022. COVID-19 lockdowns: Employment and business disruptions, water access and hygiene practices in Nairobi's informal settlements. *Social Science & Medicine* 308, <https://doi.org/10.1016/j.socscimed.2022.115191>
- Karpouzoglou, T. and Vij, S. 2017. Waterscape: A perspective for understanding the contested geography of water. *WIREs Water* 4(3), <https://wires.onlinelibrary.wiley.com/doi/full/10.1002/wat2.1210>
- Kebaso, G. 2020. NMS sinks 25 boreholes in city since inception. *People Daily*, 17 June 2020.
- Kenya Law. 2020. Petition 52 of 2020-Okiya Omtatah Okoiti v Nairobi Metropolitan Service & 3 others; Mohamed Abdala Badi & 9 others (Interested Parties). <http://kenyalaw.org/caselaw/cases/view/196949> (accessed 12 May 2022)
- Khaduli, B. 2021. NMS Drafts Bill to Improve Water and Sanitation. *Kenya News Agency*, 17 August 2021.
- Kimari, W. 2019. The story of a pump: Life, death and afterlives within an urban planning of "divide and rule" in Nairobi, Kenya. *Urban Geography* 42(2): 141-160.
- Kinyanjui, M. 2020. NMS targets informal settlements within Kibra for upgrade. *The Star*, 26 May 2020.



- Kooy, M. 2014. Developing informality: The production of Jakarta's urban waterscape. *Water Alternatives* 7(1): 35-53.
- Lang'at, P. 2016. Kenya: 4,000 Nairobi Boreholes Sunk Illegally. *The Nation*, 10 March 2016.
- Lavie, E.; Crombé, L. and Marshall, A. 2020. Reconceptualising the drinking waterscape through a grounded perspective. *The Geographical Journal* 186(2): 224-236.
- Ledant, M. 2013. Water in Nairobi: Unveiling inequalities and its causes. *Les Cahiers d'Outre-Mer* 66(263): 335-348.
- Lewis, D. 2022. Why the WHO took two years to say COVID is airborne. *Nature* 604(7904): 26-31.
- Loftus, A. 2006. Reification and the Dictatorship of the Water Meter. *Antipode* 38(5): 1023-1045.
- Loftus, A. 2007. Working the socio-natural relations of the urban waterscape in South Africa. *International Journal of Urban and Regional Research* 31(1): 41-59.
- Loftus, A. and Lumsden, F. 2008. Reworking hegemony in the urban waterscape. *Transactions of the Institute of British Geographers* 33(1): 109-126.
- Mehta, L. and Karpouzoglou, T. 2015. Limits of policy and planning in peri-urban waterscapes: The case of Ghaziabad, Delhi, India. *Habitat International* 48: 159-168.
- Ministry of Health. 2020. First Case of Coronavirus confirmed in Kenya. [www.health.go.ke/wp-content/uploads/2020/03/Statement-on-Confirmed-COVID-19-Case-13-March-2020-final-1.pdf](http://www.health.go.ke/wp-content/uploads/2020/03/Statement-on-Confirmed-COVID-19-Case-13-March-2020-final-1.pdf) (accessed: 12 May 2022)
- Ministry of Health. 2022. Kenya Covid-19 Vaccination Program – Daily Situation Report. [www.health.go.ke/wp-content/uploads/2022/03/ministry-of-health-kenya-covid-19-immunization-status-report-11th-march-2022.pdf](http://www.health.go.ke/wp-content/uploads/2022/03/ministry-of-health-kenya-covid-19-immunization-status-report-11th-march-2022.pdf) (accessed 24 february 2023)
- Ministry of Health. 2023. Kenya Covid-19 Vaccination Program – Daily Situation Report. [www.health.go.ke/wp-content/uploads/2023/02/ministry-of-health-kenya-covid-19-immunization-status-report-february-16th-2023.pdf](http://www.health.go.ke/wp-content/uploads/2023/02/ministry-of-health-kenya-covid-19-immunization-status-report-february-16th-2023.pdf) (accessed 24 february 2023)
- Mueni, J. 2021. NMS opens 3 new hospitals in Nairobi's informal settlements. *Capital News*, 17 September 2021.
- Mueni, J. 2022. Sakaja assures NMS employees they will be absorbed into County Govt. *Capital News*, 30 September 2022.
- Mwale, S. 2022. Covid-19 in Africa: Kenya, Côte D'Ivoire and Ghana disprove generalisations. *The Africa Report*, 29 March 2022.
- Nilsson, D. 2016. The Unseeing State: How Ideals of Modernity Have Undermined Innovation in Africa's Urban Water Systems. *NTM Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin* 24(4): 481-510.
- Nilsson, D. and Nyanchaga, E.N. 2008. Pipes and politics: a century of change and continuity in Kenyan urban water supply. *The Journal of Modern African Studies* 46(1): 133-158.
- Niranjana, R. 2021. Between fragments and ordering: Engineering water infrastructures in a postcolonial city. *Geoforum* 119: 1-10.
- Njeru, B. 2021. Friends betrayed me, ex-Nairobi Governor Sonko says on sour relationship with NMS. *The Standard*, 24 November 2021.
- Nyamai, M.; Wright, J.; Mutembei, H. and Thumbi, S.M. 2022. Spatio-temporal patterns of domestic water distribution, consumption and sufficiency: Neighbourhood inequalities in Nairobi, Kenya. *Habitat International*, 119, [www.sciencedirect.com/science/article/pii/S019739752100165X](http://www.sciencedirect.com/science/article/pii/S019739752100165X)
- Nyanchaga, E.N. 2007. Historical timeline on water governance in Kenya (1895-2002). In Juuti, P.S.; Katko, T.S.; Mäki, H.R.; Nyanchaga, E.N.; Rautanen, S.-L. and Vuorinen, H.S. (Eds), *Governance in water sector – Comparing development in Kenya, Nepal, South Africa and Finland*, pp. 18-37. Tampere: Tampere University Press.
- Nyanchaga, E.N. 2016. *History of water supply and governance in Kenya (1895-2005)*. Tampere: Tampere University Press.
- Oduor, M. 2020. Flamboyant Nairobi governor Mike Sonko officially impeached by senators. *Africanews*, 18 December 2020.
- Omulo, C. 2020a. Nairobi Metropolitan Services Now a Public Office. *The Nation*, 4 June 2020.
- Omulo, C. 2020b. NMS now appears to be running out of steam with several stalled projects. *Nairobi News*, 4 August 2020.

- Pinchoff, J.; Kraus-Perrotta, C.; Austrian, K.; Tidwell, J.B.; Abuya, T.; Mwanga, D.; Kangwana, B.; Ochako, R.; Muluve, E.; Mbushi, F.; Nzioki, M. and Ngo, T.D. 2021. Mobility patterns during COVID-19 travel restrictions in Nairobi urban informal settlements: Who is leaving home and why. *Journal of Urban Health* 98(2): 211-221.
- Reuters. 2022. Kenya lifts remaining COVID restrictions. 12 March 2022.
- Roy, A. 2020. The pandemic is a portal. *Financial Times*, 4 March 2020.
- Rusca, M.; Boakye-Ansah, A.S.; Loftus, A.; Ferrero, G. and van der Zaag, P. 2017. An interdisciplinary political ecology of drinking water quality. Exploring socio-ecological inequalities in Lilongwe's water supply network. *Geoforum* 84: 138-146.
- Ruszczuk, H.A.; Castán Broto, V. and McFarlane, C. 2022. Urban health challenges: Lessons from COVID-19 responses. *Geoforum* 131: 105-115.
- Sarkar, A. 2020. Everyday practices of poor urban women to access water: Lived realities from a Nairobi slum. *African Studies* 79(2): 212-231.
- Schmidt, M.; Stephan, C.; Musa, K.J. and Kioko, E.M. 2020. "Life on these stones is very hard" – House helps in Covid-19 Nairobi. <https://developingeconomics.org/2020/11/13/life-on-these-stones-is-very-hard-house-helps-in-covid-19-nairobi> (accessed 12 May 2022)
- Schwartz, K.; Tutusaus, M. and Savelli, E. 2017. Water for the urban poor: Balancing financial and social objectives through service differentiation in the Kenyan water sector. *Utilities Policy* 48: 22-31.
- Shang-Quartey, L. 2021. Covid-19 And The Hope for Democratic Water Ownership In Ghana. In McDonald, D.A.; Spronk, S.J. and Chavez, D. (Eds), *Public water and Covid-19: Dark clouds and silver linings*, pp. 265-270. Kingston; Amsterdam; Buenos Aires: Municipal Service Project; Transnational Institute; Latin American Council of Social Sciences (CLACSO).
- Shupler, M.; Mwitari, J.; Gohole, A.; Anderson de Cuevas, R.; Puzzolo, E.; Čukić, I.; Nix, E. and Pope, D. 2021. COVID-19 impacts on household energy & food security in a Kenyan informal settlement: The need for integrated approaches to the SDGs. *Renewable and Sustainable Energy Reviews* 144, [www.sciencedirect.com/science/article/pii/S1364032121003087](http://www.sciencedirect.com/science/article/pii/S1364032121003087)
- Smiley, S.L.; Agbemor, B.D.; Adams, E.A. and Tutu, R. 2020. COVID-19 and water access in Sub-Saharan Africa: Ghana's free water directive may not benefit water insecure households. *African Geographical Review* 39(4): 398-404.
- Sorrenson, M.P.K. 1968. *Origins of European settlement in Kenya*. Oxford, UK: Oxford University Press.
- Staddon, C.; Everard, M.; Mytton, J.; Octavianti, T.; Powell, W.; Quinn, N.; Uddin, S.M.N.; Young, S.L.; Miller, J.D.; Budds, J.; Geere, J.; Meehan, K.; Charles, K.; Stevenson, E.G.J.; Vonk, J. and Mizniak, J. 2020. Water insecurity compounds the global coronavirus crisis. *Water International* 45(5): 416-422.
- Sultana, F. 2013. Water, technology, and development: Transformations of development technonatures in changing waterscapes. *Environment and Planning D: Society and Space* 31(2): 337-353.
- Sutherland, C.; Scott, D. and Hordijk, M. 2015. Urban water governance for more inclusive development: A reflection on the "Waterscapes" of Durban, South Africa. *The European Journal of Development Research* 27(4): 488-504.
- Swyngedouw, E. 1999. Modernity and hybridity: Nature, regeneracionismo, and the production of the Spanish waterscape, 1890-1930. *Annals of the Association of American Geographers* 89(3): 443-465.
- Thornton White, L.W.; Anderson, P.R. and Silberman, L. 1948. *Nairobi: Master plan for a colonial capital*. London, UK: Stat. Off.
- Tiwale, S. 2019. Materiality matters: Revealing how inequities are conceived and sustained in the networked water infrastructure – The case of Lilongwe, Malawi. *Geoforum* 107: 168-178.
- Tompsett, A.; Baum, A.; Bukachi, V.; Kipkemboi, P.; K'oyoo, A.O.; Varela, A.V. and Mulligan, J. 2021. Changes to household income in a Kenyan informal settlement during COVID-19. *medRxiv* [Preprint], <https://doi.org/10.1101/2021.06.15.21254693>
- Truelove, Y. 2011. (Re-)Conceptualizing water inequality in Delhi, India through a feminist political ecology framework. *Geoforum* 42(2): 143-152.
- Truelove, Y. 2019. Rethinking water insecurity, inequality and infrastructure through an embodied urban political ecology. *WIREs Water* 6(3), <https://wires.onlinelibrary.wiley.com/doi/full/10.1002/wat2.1342>

- UN-Habitat 2020. *COVID-19 in African cities: Impacts, Responses and Policies Recommendations*. Nairobi, Kenya: UN-Habitat.
- UN-Habitat 2021. *Cities and pandemics: Towards a more just, green and healthy future*. Nairobi, Kenya: UN-Habitat.
- Wamuchiru, E. 2017. Rethinking the networked city: The (co-)production of heterogeneous water supply infrastructure in Nairobi, Kenya. PhD thesis, Technische Universität Darmstadt, Darmstadt, Germany.
- Wandede, N. 2021. Majority of Kenyans say Nairobi is safe in General Badi's hands, TUKO.co.ke poll. *Tuko*, 24 August 2021.
- WASREB. 2019. *A performance report of Kenya's water services sector – 2017/18*. Issue No. 11/2019. Nairobi, Kenya: WASREB.
- Were, N.W. 2019. The conflict between privatisation and the realisation of the right to water in Kenya. In Kameri-Mbote, P.; Paterson, A.; Ruppel, O.C.; Orubebe, B.B. and Kam Yogo, E.D. (Eds), *Law | Environment | Africa*, pp. 497-518. Baden-Baden: Nomos Verlagsgesellschaft.
- Werlin, H.H. 1966. The Nairobi City Council: A study in comparative local government. *Comparative Studies in Society and History* 8(2): 181-198.
- WHO. 2020. Modes of transmission of virus causing COVID-19: Implications for IPC precaution recommendations. [www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations](http://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations) (accessed 12 May 2022).
- Wright-Contreras, L.; March, H. and Schramm, S. 2017. Fragmented landscapes of water supply in suburban Hanoi. *Habitat International* 61: 64-74.

THIS ARTICLE IS DISTRIBUTED UNDER THE TERMS OF THE CREATIVE COMMONS ATTRIBUTION-NONCOMMERCIAL-SHAREALIKE LICENSE WHICH PERMITS ANY NON COMMERCIAL USE, DISTRIBUTION, AND REPRODUCTION IN ANY MEDIUM, PROVIDED THE ORIGINAL AUTHOR(S) AND SOURCE ARE CREDITED. SEE [HTTPS://CREATIVECOMMONS.ORG/LICENSES/BY-NC-SA/3.0/FR/DEED.EN](https://creativecommons.org/licenses/by-nc-sa/3.0/fr/deed.en)

