

Commodifying Water in Coastal Tanzania: Natural Resource Management and Social Relations, 1926-1937

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Abstract: Based on a close read of colonial archives from Dar es Salaam, this article examines how the commodification and regulation of water led to friction between residents and colonial officials in Mikindani, Tanzania shortly after Britain's acquisition of the territory. Questions of failed development and technology transfer are juxtaposed against African desires for new relationships with material goods to examine how regulatory projects falter for lack of environmental knowledge, investment, and social awareness. Starting with a basic analysis of coastal practices surrounding water, the article delves into the colonial administrative debates over water delivery systems, fee schedules, and surveys as a means to show how colonial assumptions created obstacles for African consumers who wanted to benefit from this modern package of goods.

Introduction

"We Makonde prefer to have food in plenty and go far for our water rather than to sit near the water and starve."¹

Fresh water in coastal Tanzania was long regarded as a communally held resource, shared by all and exclusive to none. Cultural adaptations to extreme fluctuations in fresh water led the Makonde people, who comprised the largest population at Mikindani, to develop social and cultural practices that kept villages safe from flooding. In the coastal township of Mikindani this practice led residents to rely upon natural springs and wells far from the town's center, away from the coastline, along the base of the escarpment. In 1931, Mikindani was a small trading port and British administrative outpost with approximately 2000 African inhabitants and 280 "Asiatics," which included South Asians and "Arabs," who were most likely Swahili traders.² According to colonial officials, the town's "Arabs" [Swahili] were of "two distinct classes . . . holders of large properties who are wealthy and those who are little better off than the natives."³ The African population while less clearly stratified, was far from uniform, comprised of various waves of migration and settlement into the region. The most entrenched identified as Maraba, which helped differentiate between Muslim Makonde and their unconverted kin.⁴ As a country town that once owed allegiance to the Sultan of Kilwa, Mikindani formulated a space where identity was self-constructed and prone to shifts as residents came to understand their relationship with others "based on their own town, putative origins, status or descent group."⁵ Mikindani was a more complex community than its demographics suggest, largely because British colonial officials used broad racial categories that failed to note the social and cultural

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diversity. The African inhabitants expressed an expansive “array of possible ‘ethnic’ characteristics” that proved elusive to define by outsiders’ methods. Coastal patricians constructed their identity through layers of settlement and religion that had little to do with the nomenclature assigned them by administrators.⁶

This paper examines how the residents at Mikindani navigated the fraught process of commodification and regulation of water, a most vital resource. Colonial officials wanted to establish a fee-based water system, but they did so with minimal investment in the water-delivery infrastructure. I argue that Africans proved willing consumers of newly packaged material goods, but defective or ill-suited equipment, irregular water distribution, and unreasonable fee schedules led to tensions between officials and members of the Mikindani population. While other studies by Mattias Tagseth, Heather Hoag and May-Britt Öhman, and Matthew Bender examine late and postcolonial water regulation projects on the slopes of Mt. Kilimajaro and the Rufiji River basin, this study provides an early picture of the complexities in state efforts to regulate and commodify a limited natural resource in an urban setting.⁷ The small administrative station looked like a promising site for an experimental shift from open wells to secured waterlines, which implied improved health for townspeople and, in principle, added convenience. As African complaints about unreasonable fees increased, officials endeavored to criminalize Africans who could not pay. By 1937, open wells disappeared behind fences, replaced by piped water that forced Africans to buy a resource that heretofore was free to everyone.

Cultural differences as well as the inequalities and violence of the colonial state contributed to the conflicts over water access and water levies. The various communities understood their obligations to the scheme in different ways. South Asian merchants and Swahili traders expected fee remissions when they were not using the water supply. The over-burdened African population were not only unwilling, but were unable to pay fees for a service that was inconsistent and peculiar in its demands for monetary exchange when open wells were accessible. Colonial officials focused on the bottom line and argued against further material improvements, such as a new pump for the well.

Mikindani was a remote district office in an impoverished region, with limited potential for economic growth given its shallow harbor. From a purely economic perspective, replacement costs for the pump outweighed the potential gains from improved water flow and delivery. Failed development in this case revealed that several factors coincided to create an insurmountable situation, primarily the colonial state lacked sufficient motivation to develop a reliable and sanitary water supply. The second problem was the administration assumed the income generated from the levies would subsidize the investment, but local opposition against the unreasonable water levies diminished revenues. Mikindani’s residents had yet to fully subscribe to a dependent relationship with the state, largely because the state was unable to provide the much-promised advantages of modernization that it declared was meant to win over its subject populations. Despite the first Colonial Development Act of 1929, which provided up to £1 million annually for development work, no applications were made to that effect for piped water at Mikindani.⁸ Weak infrastructure and lack of sufficient investment were critical factors in the colonial state’s inability to create dependency.



General Map of Tanzania, showing Mikindani in relation to the provincial headquarters at Lindi (approx. 60 km away) and the colonial administrative center at Dar es Salaam (approx. 552 km). Transport between Dar es Salaam and Lindi/Mtwara came via sea. Source: iStock.com

Historicizing Commodification in East Africa

In 1925, British colonial administrators wanted to establish a closed water system to protect its officials and, by proxy, bring sanitary conditions to towns and villages plagued by diseases. In a remote outpost like Mikindani, Britain sought to compensate for what water lacked in “intrinsic value” by altering its status from a survival tool to a “commercial instrument.”⁹ Political ethnographer J. Gus Liebenow elaborates that “the innovating institution must be perceived as beneficial by the individuals whose lives are directly affected,” more so than the views of the “agents of innovation.”¹⁰ Contrary to Juhani Koponen’s more romantic view that pre-colonial communities rarely struggled over water, newer scholarship from Nancy Jacobs, Matthew Bender, and others indicates that rivers, lakes, and furrows were guarded and regulated through cultural practices.¹¹ As Meredith McKittrick has shown, security and insecurity are

related to social pressures, violence, and seasonal fluctuations of resources in a “fickle environment.”¹² Writing about Australia’s experience with limited water, Richard Epstein turned to John Locke’s *Second Treatise of Civil Government*, which addresses the role of government regulation, to remind the reader that water’s flowing and mobile nature prevented any one person or group from wresting complete control away from the wider community.¹³ State control over water opened up new avenues for regulating a resource as a means to cultivate power and control over subject populations. During the early twentieth-century, what Donald Worster referred to as the “faceless and impersonal” power of the state had yet to be achieved in Tanzania.¹⁴ Later attempts by the postcolonial government aimed to promote state authority by delivering a modern good in an economically important region on the slopes of Mt. Kilimanjaro, as Bender and Tagseth show when furrows turned into pipelines of water. Although the water was free of fees, communities resented the dislocation of resource management into government bureaucrats rather than community oversight.¹⁵ The importance of communal rights to a scarce resource imbued with a number of complex values, of which the colonial administration took little if no account, complicates the shift toward fees and regulation under colonial rule.

The significance of this transformation of water from a communal resource and divine medium of life to commodity was tremendous for a generation of Africans who recalled water’s magical properties during Maji Maji (1904-07) and in other rebellions in central Africa.¹⁶ Southeastern Tanzania, as Felicitas Becker shows, was scarred by German military exactions during Maji Maji and further disrupted by fighting between European powers that followed in the Great War.¹⁷ In a region beset by upheaval for the first two decades of the twentieth-century, communities also proved resilient despite their poverty in a colonial system that emphasized cash crops and accumulation.

Limited by poor agricultural yields and low interest in cash crops, villagers did express interest in material good, though not to the scale of Comorans and Zanzibaris in Jeremy Prestholdt’s book that showcased how “African consumer desires” shaped global trade with Africa.¹⁸ Phyllis M. Martin, Justin Willis, and others demonstrate how Africans embraced the shift from once local products to “global” or mass-produced goods.¹⁹ As James Howard Smith indicates, the discourse around development requires a “new direction,” which moves away from universalizing claims toward “Africans’ actions on the ground as they work to transform the present... [through] a prism for reimagining order” in a place bounded by contradictions.²⁰ Smith’s work foregrounds the importance of detailed case studies to understand the specific course that development initiatives (as actions fraught with contradictions) took in specific ethnographic and historical locales. It is within this context that we must study how a generation of townspeople, caught in the transition from water as an openly accessible communal property to water as a restricted commodity, confronted and attempted to negotiate these changes created by the colonial administration.



Map of Mikindani, cir. 1931 (original German map from 1914), showing Mr. Mitchell's proposed changes and location of the pump house at the Mkundi well site, just west of the Boma. The Mchuchu well was located northwest of Jangwani Gemeinde, as shown on the above map. Source: TNA/20408: Mikindani Water Supply: Map of Proposed Improvements.

Coastal Water, Pump, and Schemes for Improvement

During October 1916, Mikindani became a British military outpost and after the war, Tanganyika became the largest of Britain's Mandate Territories granted by the League of Nations.²¹ The British Mandate came into effect in 1922 and granted Britain full legislative and administrative rights, with the caveat that its officials were to "promote 'the material and moral well-being and the social progress of [the] inhabitants' by banning slavery, forced labor...the arms and liquor trades, and abuse of African land rights." So long as the foregoing guidelines were followed, the territory could be readily incorporated into pre-existing administrative practices, and there was "no provision for enforcement against a recalcitrant mandatory."²² Administrative officials carried out preliminary surveys of townships, estates, and social customs, but there is no evidence that the League of Nations provided any direct oversight to the colonial administration of Tanganyika during the interwar years.²³ While a city like Dar es Salaam was likely to attract the occasional dignitary from Europe or the Americas, Mikindani

offered little in visual or cultural pleasures for visiting elites. It was a duty station with few amenities and staffed with a minimal complement of officials.

German officials had initiated a rudimentary system of water standpipes in Mikindani before the Great War, with some local investment by South Asian merchants, but the transition from wells and free use of water to a system based on monetary exchange was incomplete. In addition to cleanliness, the British colonial administration expected household water usage to yield revenues if presented to township residents as a purportedly modern “package” of goods. Officials argued that fees for water were necessary because “special facilities for obtaining a good water supply as compared with public wells, and the expense incurred by Government, recurrent and non-recurrent would seem to justify an extra charge.”²⁴ Water provided a logical first step in developing a dependent relationship cheaply by creating tangible changes, but officials quickly learned that their fiscal and regulatory objectives were delimited by the water supply itself and at odds with cultural standards among Mikindani’s urban population. Although residents in the township responded to the promise of piped water in sophisticated and varied ways, the requisite exchange of money for water was poorly planned.

Coastal settlements emerged where the water was either surface accessible, from rivers, springs, and waterholes, or where open wells were easily constructed.²⁵ Mikindani’s relationship with water was rooted in scarcity. Situated on the shore of a small Indian Ocean bay, Mikindani had multiple mangrove swamps where the high tides mixed with the rain runoff and springs from the plateau to form brackish pools. The swampy ground around these inlets defined the town and gave it an irregular shape as small houses and businesses were clustered on the higher ground, beyond the reach of the tidal swamps.²⁶ One German source noted that “water is bad” in Mikindani, which suggests the supply was limited and possibly unhealthy.²⁷ While the Germans disparaged the water quality, Mikindani’s African and South Asian residents found the town location suitable for their economic interests. As a “country town” in the Swahili trade system, its inhabitants exchanged goods from the interior for materials from India, Arabia, and other East African ports. The water at Mikindani came from a few small springs, which percolated to the surface along the lower ridges of the Makonde plateau (see above map of Mikindani; the springs of note are at Haikata and Mkundi). Houses were clustered near the shoreline, with farmland between the village and the escarpment, where the springs emerged. Residents developed efficient strategies to secure their domestic and agricultural needs for water. Though fresh water was scarce, there was little to suggest that townspeople suffered from want of water. These were sound cultural adaptations to environmental conditions in a landscape with seasonal floods and shallow soils. Settled living conditions at the coast were slow to change this relationship because village women spent long hours walking to springs near Mikindani to collect water for household use.²⁸

An initial colonial survey of buildings in 1926 gives some sense of the township, which had 630 houses. Seventy houses were built of stone, owned by South Asians and Swahili; the remaining 560 houses were African-owned, built of mud and wattle with thatched (*makuti*) roofs.²⁹ British officials argued that it was “necessary to install eight additional standpipes, including that which supplies the Native Hospital,” which conveys a need for a reliable and secure water source for medical gains.³⁰ The administrative building (the Boma) location high on a hill above the town provided the German, and later British, Administration with what

Michel Foucault argued was a “panoptic” view of the township and a strategic location to manage and secure the water storage facility.³¹ Furthermore, the enclosure of the water system promised to discipline the townspeople through distribution channels that turned water from a right into a commodity.³² German authorities installed the water reservoir behind the Boma, 125 feet above sea level. From this tank they plumbed two administrative buildings and ran one mile of pipe through the township with three spigots to dispense water.³³ The Boma had priority with direct access to the water reservoir due to its prominence as the district headquarters and the residence of the District Officer (DO), which required such amenities.³⁴ The other building with direct access to plumbed water appeared to be the Assistant DO’s residence, which was situated at the base of “Boma” hill.³⁵ The pump house and pump were located at the Mchuchu spring 1.5 miles from the Boma, on swampy ground near a tidal creek (following Lindi Str. west of Jangwani), which increased the rate of corrosion in the pipes as the brackish water flowed over exposed portions of the tubing that led to the water reservoir.³⁶

The state’s efforts to commodify water came in fits and starts. Local poverty and environmental limitations when coupled with the state’s economic constraints and technological problems meant that the expectations of the colonial administration exceeded carrying capacity. The spring that supplied the township reservoir had a high mineral content, but officials claimed the quality and quantity were adequate for local needs. Officials estimated the water flow from the well could reach nearly 500 gallons per hour during the dry season. At 125 feet above sea level, the water reservoir worked on a gravity feed through the pipes and spigots of the township. The water, however, had to be pumped up the escarpment from a small spring one and one half miles away.³⁷ To supply the town, officials installed a steam pump, built by Tangyes Limited foundry in Birmingham, England. The “Special’s” most significant market was its use in England for public works operations related to gas, water, and sewage schemes. This particular model was long associated with the progressive era “campaign for public health and safety,” which translated readily into its use as a water pump in a colonial setting, such as Mikindani.³⁸ Its historical and conceptual affiliation with cleanliness crusades in England helped to explain its broader significance in the colonies.

The Tangyes “Special” pump that arrived in 1925 at Mikindani was an older type steam pump that used wood fuel to generate the steam that ran its motors.³⁹ Unlike newer models that were closed systems and ran off a variety of different fuel sources, the older “Special” ran off wood combustion and required routine maintenance. The pump did not require specially machined parts to render repairs because the Tangyes’ works had developed standard replacement stock for each model that was produced.⁴⁰ The Tangyes’ advertisements claimed the “Special” was so simple to operate that, “the attention of an active lad” was sufficient to sustain operations.⁴¹ After one year in operation, the DO despaired its regular malfunctions on the grounds that, “the engine at this station requires thorough overhauling...[it] has lately developed a knock in the pump which if not attended to at an early date my possibly cause serious damage. The native in charge is not sufficiently competent to attend to a matter of this nature and I have no engineering knowledge,” to overhaul the Tangyes steam pump, with its stove, boiler, engine, and pump mechanism.⁴² Reflecting the entrenched bias against African workers colonial officials concluded that the African pump man, employed to run the machine, was incapable of tending to the pump’s routine maintenance, despite the manufacturers’ claims

that it was simple to repair. Without regular care, the European engineer, who was dispatched from Dar es Salaam to check the pump during one of its frequent stoppage periods, expressed concern that the boiler for the steam engine had never been inspected and showed significant wear to the point that the “boiler is in far from safe condition.”⁴³ The Tangyes steam pump’s mechanical failures were a blow to colonial expectations about the role that technology should play in justifying the colonial apparatus. They also reflected colonial officials’ lack of understanding of people’s social practices, cultural logics, and environmental conditions in southern Tanzania.⁴⁴

While the standpipes were idealized as a secure water supply, the persistent mechanical failures at the pump and pipes that filled with sediment prevented government from gaining complete control over the water supply for much of the 1930s. Officials also overestimated the spring’s capacity with the existing technology, during the dry season the water “supply [was] sufficient only to allow the Township to draw water for 2 hours in the morning and 2 in the evening.” Meanwhile, wet season supply was limited by operational costs.⁴⁵ By 1931, the Tangyes’ steam pump operated an average of less than one hour per day, contrary to the expected assessed value of four hours per day. The pump failed to meet the relatively minimal demands of local water use, to which the Senior Assistant Public Works Department engineer declared the pump “both unsafe and not capable of dealing with the work required of it. I also consider it a waste of time and money to repair it.”⁴⁶ In response to the pump’s regular failures, officials noted that villagers increasingly relied on a locally built well, the Mkundi well, for a variety of purposes. The sanitary inspector was alarmed to find that the well was more than a popular location for drawing water. Many townspeople undertook their laundry and utensil washing at this site. To remedy the situation, the sanitation inspector wanted notices placed at the well to discourage household chores in the vicinity and additional construction ordered to provide a safe platform to draw water and to reinforce the well wall to prevent further decay.⁴⁷ The Mkundi well provided townspeople with an alternative water source that was reliable and came at no expense. The hardship associated with the Mkundi site was its distance from dwellings, which explained the frequency of domestic activities on the grounds surrounding the well. Women found it easier to carry their chores to the well rather than transport the water back to their compounds. Performing chores around the well provided some degree of sociability for the women as well.

Despite the pipes, most residents continued to collect their water from wells located around the township. One hundred and seven households from Mirumba continued to rely upon a small natural spring with good quality water since they were too far removed from “a stand[pipe] to derive any benefit from the supply.”⁴⁸ British administrators concluded that more spigots were required to encourage townspeople to use the piped water because the distance from standpipe to house required many householders to transport the water up to 300 yards.⁴⁹ Women chose the ground wells over the spigots because they were more plentiful and given the Makonde views on water, distance was not a decisive factor. The ground wells varied in water quality and some were later found to be unsafe for potable water but acceptable for laundry and basic washing purposes. Overall, there were ten open-wells located throughout the township that provided water to whomever chose to use them. The medical staff, who tested the waters, found three wells met chloride and nitrite levels considered safe for human consumption.⁵⁰ Four

wells were attached to or associated with structures in the central township, one was attached to the house of a prominent Muslim, Mr. Abdulla Remtulla. Two additional wells were part of buildings owned by South Asian religious groups, the Ismaili Mosque and the Hindu Lodge. A fourth well was located in the Hospital Compound. The association of multiple wells with South Asian religious organizations and homes established South Asians as important actors in the township's development in the recent pre-colonial past. Moreover, associated religious practices relied upon physical and ritual cleanliness, through daily ablutions before entry into the mosque or temple.

The four wells in the central township proved to have high levels of chlorides and nitrites. High nitrite levels in these wells indicate they were located in or near areas where human and animal waste accumulated or were washed into the wells by seasonal rains. Contaminated wells were potential sources for serious cholera epidemics, a problem that was documented by European travelers to have struck the Swahili coast at least four times since 1821.⁵¹ Cholera's historical presence in coastal Tanzania turned Mikindani into a prime location for reform and limited investment in infrastructure to protect colonial officials.⁵² Other health problems include various cancers in adults, but most commonly low oxygenation of hemoglobin (often called Blue Baby Syndrome), which can be lethal in children.⁵³

Villagers at Mikindani had formulated some mechanisms to respond to cases of contamination by abandonment or limited use of tainted wells. However, there was no indication that villagers attempted to alter behavior to prevent contaminants from seeping into wells. There are no documents that describe the organization of pit latrines within the township or other possible sources for nitrite contamination in the wells (cattle were not common because this was a known tsetse zone). Two possible explanations for avoidance of some wells can be extracted here. One was, villagers developed a tacit understanding about water quality because without clear epidemiological formulae, Mikindani townspeople reported that they avoided these contaminated wells. The second explanation was that inhabitants told district officials what they thought they wanted to hear. Townspeople claimed to draw their cooking and drinking water from the wells that had tested safe for chlorides and nitrites, despite the lack of advice from public health personnel.⁵⁴

Most residents used either the Haikata or Mkundi wells, outside the village. Although the wells were less convenient than the standpipes, no one suffered outright from lack of water. Old wells provided ready and consistent water for households to use, and their reliability ensured that people had water for drinking, cooking, and washing.⁵⁵ The state failed to comprehend how its scheme complicated rather than eased life for those who attempted to patronize piped water. Cleanliness and security were costly in direct expenses for pipes and fees, but increasingly expensive in lost labor for households who found that the water was not available when they attempted to use the standpipes. Piped water promised convenience, but when people attempted to use water and there was none, the water scheme was costly for what people paid in lost time and energy. Women who attempted to use non-working spigots were forced to walk the added distance to the open wells as secondary choices. As delivery failures increased, the interest in using the piped water surely declined as villagers sought more assured water sources that relied less on technology.

Several wealthy South Asian and Swahili households requested direct access to water with promises to pay higher rates. The desire for plumbed compounds and shops exposed the social and cultural layers of a village like Mikindani to challenge the argument that technology transfer failed to find a market in a remote and culturally entrenched part of the empire. Mikindani's residents were keenly interested in the material improvements that British technological knowhow had placed within their grasp. Wealthy householders expressed intense desires to invest in pipes despite the elevated water levies they faced. Stone house owners wanted the immediate benefits of water plumbed directly into their compounds, to reduce their daily labor in water collection and meal preparation while also improving their general welfare. Along with stone houses, plumbing provided another outward signifier of wealth for Mikindani's distinguished families. Familiarity with plumbing further suggests that those who were willing to pay for such a privilege had acquired some level of status and wealth through either their travels, trade activities, or other associations with the outside world. Moreover, the organized appeal from the Indian Association suggests that South Asians were important conduits of new ideas, goods, and hygiene along the coast.⁵⁶

Mitchell's Survey and Plan for Improvements

The public works review and survey carried out in 1931 provided important information regarding who used the water from the Tangyes pump and who was most inconvenienced by its failures. Although only four Europeans were stationed at Mikindani, their water use per capita was between ten and thirty times higher than their respective South Asian and African subjects. Europeans used approximately seventy-five gallons per person, per day, while South Asians and Africans used eight and two gallons respectively for the same period. Apparent disparities in water use volume were from differences in bathing and cleaning habits. Europeans were not using seventy-five gallons directly; these amounts were used for personal hygiene and to maintain their residences. They required more water per capita because their houses were larger, and surfaces were hard and needed to be kept clean for the sake of improved health and appearances. The Public Works Department projected water use on the assumption that while the populations of all three groups would grow in ten years' time, the amount of water used per capita was factored to be the same.⁵⁷

The colonial state worked under the notion that the easy access to water would not lead to increased use and potential waste of this commodity.⁵⁸ Such naïveté ran contrary to most state planning for water use and consumption. An assured water supply generally led to increased settlement and security, which extended to greater water usage and demand as hygiene programs led persons to bathe, launder, and clean their surroundings with greater frequency.⁵⁹ By creating a more sedentary population, with permanent houses, the colonial state was unwittingly intensifying future demand for water; as population density increased, water needs would too.⁶⁰

The pump's consistently poor performance during 1930/31 appeared to trigger the colonial state's greater interest in the quality of alternative well sites in Mikindani township. The 1931 water survey report uncovered the unfortunate reality that the only population truly troubled by the pump problems and malfunctions was the colonial administration.⁶¹ Officials made several pleas to Dar es Salaam for new pump-works to replace the decrepit wood-burning

steam pump with a more efficient paraffin engine. The steam pump worked intermittently, and when it was operable the amount of water drawn was virtually ineffectual. After four days of operation from 29 November to 2 December, 1930, "there was not sufficient water to supply the Boma with its full requirements."⁶² The DO was most concerned about the lack of water to the Boma. He made no comments about how the pump failure had affected the local townspeople. His omission of the African and South Asian response to the pump failure revealed that lack of piped water was less detrimental to the townspeople. Moreover, his impatience for a new pump reinforces the assertion that these improvements were not meant to develop local infrastructure but to protect the health and welfare of officials. The slow response from Dar es Salaam, possibly owing to the limited communication, required the District Office to continue its reliance upon the old pump.

Unfettered by colonial and local economies of scarcity, Mr. Mitchell, an assistant engineer from Dar es Salaam, proposed a new scheme to improve water quality and quantity at Mikindani. He recommended two important changes, beginning with a new pump motor to improve the supply of water from the pump at the Mchuchu well to the storage tank behind the Boma. Second, he encouraged the state to develop a supplementary pump station at the Mkundi well. As noted earlier, the Mkundi well was popular with the community, which relied upon this free and accessible water source. From Mitchell's perspective, its proximity to the storage tank made it an appealing site for a secondary pump to supply water to the central tank (as demarcated on the map of Mikindani). The water percolated up through the soil at the Mkundi site; there was so much water that it formed a boggy area. Mkundi was clearly one of the percolation points for moisture that had slowly seeped through the plateau. Mitchell noted that "the flow of ground water is from the hillside towards the valley and the water table reaches the surface about 100 feet from the hillside forming a boggy area considerably soiled by decaying vegetable matter and subject to animal and human pollution," which contradicted the report by the Native Hospital that declared this well free of contaminants, issued ten days earlier.⁶³ His scheme was to "intercept" the flow of groundwater around the perceived contamination site and direct it into an infiltration gallery to clear the water of any pollutants before it was pumped into the storage tank.⁶⁴ Several contradictions emerged within a relatively short period, between Mitchell's claims that Mkundi was prone to pollutants, his plan to use this well to provision the reservoir, and the evidence provided by the Native Hospital's test that declared the water free of contaminants.

Mitchell claimed to observe direct evidence of human and animal pollution around the Mkundi site. He focused on human activities around the well because the well was so popular with townspeople. Despite his declaration that visual inspection revealed contamination at Mkundi, he did collect water to send to the government's analytical chemist who found that other than a high mineral content, the water had minimal pollutants, which was "not serious, ...most probably of vegetable origin." Mitchell's anxieties about contamination led him to argue for changes that excluded free-use of the well. He asserted that:

[the best measures to secure a steady and hygienic water supply required] the construction of the infiltration gallery and the exclusion of surface pollution this may confidently be expected to be reduced to negligible proportions. The land to a distance of fifty feet from the infiltration galley should be acquired and fenced

in and pumping carried out for several days before the water is introduced into the distribution system. With these precautions, it is considered that this water will be satisfactory.⁶⁵

Mitchell's scheme created a state-owned monopoly over the potable water supply at Mikindani, all of this under the guise that the townspeople were contaminating and overusing their most assured, free water source. Ostensibly, Mitchell expected that Mkundi's volume and proximity to the water storage tank would prolong the useful life of the new pump and would ensure an increased flow of water to guarantee better sanitation and convenience for Mikindani's townspeople. The scheme provided direct improvements through reliable water for human consumption and a consistent supply to the township. He also planned for added protection from fire since the relocated second pump was expected to make an additional 12,000 gallons of water available for fire abatement. Mitchell planned to use the pump at Mchuchu as a secondary or backup pump.⁶⁶ The critical, but unspoken, factor in tapping the Mkundi water supply was that it placed this reliable water catchment area under the direct control of the colonial state. Africans and South Asians were poised to lose free access to an important source of clean water that allowed households to opt out of the state's water levies in Mikindani. Under Mitchell's plan, except for the well at the Haikata spring, which was at considerable distance from the central township, the state controlled all the safe water sources. Given the Makonde tolerance for living far from water, this scheme was likely to encourage still greater concentrations of people around the Haikata spring.

The Colonial Office and Governor in Dar es Salaam delayed action on Mitchell's recommendations because the Great Depression forestalled investment in Mikindani. Mitchell's agenda, however, did not vanish in the intervening years. The colonial state appeared to bide its time until it had the economic means to reform the water supply, to create a closed system built around an institutionalized relationship with water forming the connection. Mitchell's scheme anticipated villagers' desire for piped water and their eventual resignation to the fee schedule. Townspeople with limited economic means had few choices but to elude payment by using other water sources in the area. These acts were likely to create the very pollution and degradation around the existing springs that Mitchell sought to avoid at Mkundi. The colonial state sought to press Mikindani's residents to comply with water levies by erecting an enclosure around the well's infiltration gallery with the objective to prevent potential circumvention of state control over the Mkundi site. Similar to the enclosure process in England, persons who attempted to collect water from this site would be clearly guilty of theft. Without alternative sources for water, Africans and South Asians would be forced into an extractive revenue system that required direct payment for water and few had recourse to claim otherwise.

The mechanical problems associated with the water supply for Mikindani were twofold: one was the degree of encrustation on the main pipe that exited the pump. A second, and far more pressing problem was the Tangyes steam pump itself. Its daily operations costs were high since it required the services of a pumpman, two firemen, and woodcutters to maintain, stoke and provide wood fuel for the burner that ran the engine.⁶⁷ Four men were required to keep the pump going, feeding it approximately two cubic meters of wood daily. Besides wages for the laborers, the fuel was expensive, at Shs. 1800/- in estimated annual costs.⁶⁸ District Officers reduced the wages for the working men because it was the only budgetary item where cuts

were possible. The pumpman's wages were reduced from the 1926 original allocation of Shs. 50/- per month to Shs. 40/- month; all other expenses remained constant.⁶⁹

In keeping with the notion that empire was self-sustaining, Africans were expected to pay for access to the pipes through a municipal tax on a uniform basis of 2 percent of the corresponding House Tax rate across all residents in the township. The trouble, however, was by 1926, "No municipal tax has yet been charged in Mikindani."⁷⁰ DO A.E. Donne recommended a tiered municipal water levy, wherein African households were expected to pay a water levy of Shs. 2/- while Swahili and South Asians paid Shs. 10/- to yield anticipated revenues of Shs. 1960/- per annum.⁷¹ Despite the estimated revenue, the regular operating costs exceeded the projected income by Shs. 600/- annually. Mikindani's water program started off operating at a deficit. One year later, the new DO, Hickson-Mahony suggested the levy for Africans be reduced to a strictly nominal rate of Shs. 1/- per year, to cut the default rate.⁷² He recommended the nominal rate as an entry into the monetary exchange and a foundation to expand residents' participation in the water program, not as a quick recovery for the state.

Hickson-Mahoney argued that cultivating goodwill with the subject population was far more valuable than extracting payment for a new commodity. Subjects with limited experience paying for services, such as water, were more likely to be incorporated through a small remittance scheme in contrast to one that was economically expedient but untenable.⁷³ In contrast PC, C.H. Grierson believed the standpipes, their organization and their operation "appeared well conceived and efficiently carried out," and he argued that the pipes gave a "great advantage to all inhabitants." Grierson could not grasp how onerous the fee schedule was for the community. What he noted in plans and schematics differed from how residents experienced their daily interactions with inconsistent water output and food shortages in the area. Grierson expected that water rates similar to those in Moshi, in the north, were fair.⁷⁴ He failed to note that Moshi and Mikindani were two extremes in the material poles of Tanzania; the former was heavily missionized and had a thriving cash crop economy while the latter was predominantly Muslim with limited promise for lucrative small producer cash crops.

Mikindani's Intermediaries: Resistance, Compliance, and Interventions

While administrators debated fee schedules at length, the question of sustaining the water infrastructure and extracting payment from consumers was not well planned. Theft appeared to present serious problems in sustaining the water infrastructure in Mikindani. Equipment degradation was poorly managed without the added concerns of thievery, but the pressure gauge for the Tangyes pump appeared to have been stolen. This led to its failure and required the loan of another gauge from the Mikindani Sisal Estates. Some acts of theft (such as the pressure gauge) were associated with loss of machinery and parts for the pump, which had direct consequences on multiple fronts. Lost or damaged pump mechanisms increased equipment maintenance expenses.⁷⁵ A lost pressure gauge was a significant forfeiture; its absence increased the likelihood of additional mechanical failure or boiler malfunction. Who the thieves were and where the part went were never resolved. While attributed to theft, the pressure gauge was a relatively delicate instrument; its absence may also be attributed to damage, misplacement, or neglect, not necessarily an act of malfeasance.

Other forms of theft were costly but less well defined because of cultural differences in understanding social and material expectations between African and British parties. The most common theft, from the administrative perspective, was from residents who were believed to use the standpipes without rendering payment. Colonial officials expected all sectors of the community who used the water to pay a fee for the privilege. Except for the government offices in Mikindani, the only other consistent payers were the proprietors of the Mikindani Sisal Estates and those “non-native” households who were expected to pay Shs. 3/- per month, starting with 1 December, 1931.⁷⁶ The water tax, however, created a double burden on those who traveled. South Asian traders were caught in this bind.

As the most influential and wealthy patricians in coastal society, the South Asian population was far from passive in dealing with the colonial state and made the most coordinated challenge to the fee schedule.⁷⁷ South Asian residents argued against paying for water while they were away from the township. Why pay for water one was not able to use, then turn around and pay for water somewhere else? Under German rule, they had “expressed the hope that they would not be required to pay anything.”⁷⁸ Many argued that they had already invested 3200 rupees (or over £213) in the water reservoir and the pipeline laid during the German period, and they petitioned that South Asians “should not now [1927] be required to pay interest on further capital expenditure.”⁷⁹ The administration countered that “it was only fair that Government should seek to “to recoup itself to some extent for the expenditure incurred in the work and that in all probability payment would be required to cover the cost of maintenance and interest on capital expenditure.”⁸⁰ After the colonial state refused free or low-cost access to the standpipes, the Indian Association mounted a request to buy from government, “conduit pipes and taps in order to have water laid on to their houses, and that they are willing to pay an enhanced water rate to meet the increased consumption of water.” Water, the pipes, and what they symbolized in ease, rights, and sophistication held tremendous appeal, not only for South Asians but also for wealthier Africans and Swahili who were able to pay an elevated water levy.⁸¹ Outward markers of urbanity, from whitewashed stone houses to piped water were important signifiers of patrician status, wealth, and security within coastal society.

After making further investments, by 1932 the Mikindani Indian Association protested against their water levy at Shs. 3/- per month, stating that it was too high “in the present state of depressed trade and asked for a reduction.”⁸² The Indian Association understood that the state was in a weakened economic and extractive position because the steam pump worked intermittently. South Asians demanded a reduced levy to Shs. 2/- for “such periods as the water supply plant is effectively working.”⁸³ The case for inconvenience prevented the colonial state from recovering fees during non-working periods since the pump was not operating efficiently.

The water problems at Mikindani plagued every community that attempted to use the piped supply. The state’s requests for advance payment on water rents received strong objections from all parties, while others defaulted on promises to pay. Most Africans were absent or complained about their state of poverty when officials demanded payment or questioned why they were unable to pay their annual water levy. Everyone in town had ready access to the water taps, there were no controls in place to prevent non-payers from using the spigots, if there was water. Colonial officials found it increasingly difficult to account for all

consumers. To further complicate matters, residents within the township boundaries paid one levy and persons who lived outside of the township's limits were expected to pay their water fees at a rate of three cents per *debe* or four imperial gallons (the amount that fills a standard petrol tin).⁸⁴ Without a guardian to watch over the spigots, many non-residents were tapping into the standpipes, such as "dhow-masters calling and watering without payment."⁸⁵ Confusion abounded for the residents of villages outside the township boundaries since the lines of demarcation were recently altered, yet again. Open taps created a conceptual quandary regarding what constituted theft and who had rights to the water. The Administration expected Africans to comply with demands for payment and regarded their lack of monetary exchange for water as theft.

As indicated in the South Asian protests against their rate, the fee schedule did not account for the frequency of pump failure and stoppage, which proved to be a willing or potential consumer that this technology was unreliable and therefore worthless. Colonial officials demanded payment for water, yet their ability to deliver the promised package of goods failed because the state hedged at investing in the requisite resources to ensure consistent supply. Frequent pump failures during 1930-1931 forced townspeople and the administration to rely on older water sources, such as the Mkundi well. Mr. Mitchell's suggestion to tap Mkundi might ensure consistent water, but the pump had to work properly for this to come to fruition. Without a reliable pump, the standpipes had water on a reduced schedule of less than one hour daily, which led the DO to believe, "there [was] a growing feeling of exasperation at the charge for water, the supply of which is inadequate and irregular, and I anticipate if we press for payment that a most unpleasant situation will arise, and that we shall be met with flat refusal."⁸⁶

The water situation in Mikindani created resentment on all sides and fostered a culture of mistrust. Oddly, water use records were absent but fee remission records were quite extensive. From this scant evidence, Africans and South Asians owed 90 percent of fees, but the only consistent payers were the administrative offices, which paid fees between £15 and £20 annually.⁸⁷ Grierson expressed annoyance about the perceived loss of revenue from Africans using water they had not purchased. Grierson convinced the treasury to nullify the unpaid water levies from 1929/30 and 1930/31, which cost the state Shs.4,356 in lost revenue, and agreed to stop collecting the 1931/32 water fees.⁸⁸ The accusation of theft was easily reversed toward the colonial state, since it failed to deliver the water to most consumers who received "no return at all for their money."⁸⁹ Unable to punish one community without affecting another, Grierson concluded that shutting down the water system was infeasible because the Boma, the hospital, and police required a secure water source; to do otherwise was to plunge officials into unsanitary conditions.⁹⁰ Only a few months after nullifying the water arrears, Grierson lamented government efforts to deliver water via pump and standpipes on the grounds that, "South Asians will refuse to pay. Natives will be unable to pay."⁹¹ Mikindani's water supply failed to return any revenues because the town's 2284 residents never had access to the projected 10,000 gallons per day.⁹²

Public works officials overestimated the carrying capacity for the pump and pipes. The rated capacity for the pump was approximately 1270 gallons per hour, but actual yield for one day's operation was considerably lower at 4000 gallons (since it ran for only four hours) and

cost between 7/- and 9/- in fuel each day. The cost was high for the amount of water generated; the pump was worn and encrusted with mineral sediment.⁹³ The network of pipes use two different size wrought iron pipes (2" and 2.5"), which were in various states of decay from exposure, large segments had corroded. Engineers were unable to efficiently clean and inspect the condition of the water pipes because the current system was completely sealed, built without adequate provisions for sluices and pressure valves, which further restricted water flow. Backpressure, encrustation, and air pockets plagued every stage of the water line, from the holding reservoir to the distribution system.⁹⁴

The colonial government had invested £630 in solid infrastructural improvements between 1925-27 when the Tangyes pump was originally installed and the additional pipe laid. Annual operating costs had increased by one-third, from £150 per year to £200, "without any allowance being made for capital charges" government attempted to continue managing the water supply on the cheap. DOs were held responsible for excessive costs because they were the last line between the government and Mikindani's society. Treasury officials claimed funds to be "quite sufficient and it is not clear that sufficient control of the operation of the plant and of the expenditure is being exercised."⁹⁵ Multiple officials in Dar es Salaam echoed the sentiment that facilities in Mikindani were "extravagant and inefficient," which placed DOs on the defensive.⁹⁶ DOs struggled to maintain good records and ledgers, but made frequent mathematical errors in their calculated receipts. A critical hazard in the mathematics game was the on-going need to pay for resources, wages, and other expenses from a variety of vote books (budgets) for different categories.⁹⁷



Market Str. In Mikindani, showing colonial era structures and more recent houses. (Photo by author, 2008).

Watery Conclusions: Concessions, Change, and Conflict

Administrative efforts to create a hygienic town with piped water for its officials, and by extension, the villagers, failed to yield any tangible benefits to those who wanted to participate in the system. Moreover, the pricing scheme aimed to pass on the costs to the inhabitants. The attempt to recoup the investment in pump and pipe proved that Mikindani's water rates were markedly higher than those for other townships, including Dar es Salaam. The situation was untenable when compounded with the administration's reluctance to install meters and to post standpipe "boys." The most economically expedient solution was to alter the water scheme and provide more appropriate measuring devices based on usage rather than ethnic and class identity. These changes attempted to address some of the legitimate concerns raised by the townspeople.⁹⁸

The Treasurer, in 1937, proposed a metered rate of Shs. 3/- per 1000 gallons, one cent per *debe*, and flat rates for European-run areas such as the hospital, Boma, and police lines. Again, the colonial state was hoping to eventually generate some revenues to offset, at least in part, the initial water scheme investment from 1927. The DO estimated that residents' used approximately 600 *debes* per day, at a rate of one cent per *debe*; he anticipated annual receipts from African and South Asian residents to approach £108, with a further £42 from official and government offices and a small amount of £2 from dhow operators.⁹⁹ Those who used the piped water agreed to pay for each unit they actually used, eliminating the flat rate that charged too much (given also the uneven water supply). Although slow to come about, the new water fee structure promised to limit discontent and tensions between the subject populations and the administration.

These new rates cut the water levy to one-third of their previous rate. Further changes were instituted with small investments in meters and payroll for standpipe attendants. An additional £45 of state budget was required to buy and install the meters, with remaining funds used to build small shelters for the attendants. Of the eleven standpipes that were installed at the beginning of the 1930s, only five were available in 1937 for public access. Three standpipe attendants, at a projected cost of £27 per year (Shs. 15/- per month in wages for each man), were needed to staff five locations, which were operational on a rotating basis to allow the attendants to be present and to establish regular hours of operation.¹⁰⁰ The government anticipated that the new water rate, less the £100 initial cost and standpipe attendant payroll of £27, promised an annual profit of £25. Although the treasury noted that perhaps their estimated profit was somewhat inflated, the treasurer did believe that the standardization "greatly outweigh[ed] any such possible reduction in revenue."¹⁰¹ After a decade of false starts and considerable struggle, the state had managed to bring Mikindani's water situation "into line with that of other township water supplies" across the territory.¹⁰²

The colonial state's goal, to instill an understanding that Mikindani's residents enjoyed the convenience of pumped water, was both capricious and exploitative. The water development scheme became a disciplinary mechanism to control a subject population and force them into a monetized economy, rather than an honest effort to improve public health and water security. Mitchell's efforts to enclose the Mkundi well were never realized, despite his appeals and efforts to plan a better delivery system. Unlike the case on Mt. Kilimanjaro, where post-colonial poverty limited full-implementation of a rural irrigation system, the developmentalist colonial

state of the 1930s was unwilling to take the opportunities available through the Colonial Development Act of 1929 to improve a small town.¹⁰³ Determined to make colonial rational cost-effective goals work, the 1937 water ordinance required all users to sign or affix their mark on an agreement with the Public Works Department, whether the water was directly plumbed to their compounds or measured out per *debe* at the standpipe.¹⁰⁴ While these developments were certainly promising in providing clear guidelines and expectations, the water situation in Mikindani was far from resolved.

When E.A. Leakey became the DO of Mikindani in 1938, he found that over eighty water arrears remained on the district books. Leakey requested to have these arrears eradicated in order to start the system afresh. His enquiries into the water situation revealed that, “the very poor were unable to pay any taxes at all— These persons ordinarily drew water from the springs and wells in the Township.” Leakey’s dispatch showed that several houses changed hands, others were torn down, and six deaths created arrears that remained uncollected.¹⁰⁵ His missive was the first complete accounting of who was not able to remit payments toward the water levy. Leakey’s list was exhaustive; he named each householder, their debt, and the reason for their amnesty.¹⁰⁶ Some residents continued to collect water from non-plumbed sites (wells) because they were unable to afford the *debe* system. These residents argued that since they had not used the piped water they “should have been exempt[ed] from payment of water rate[s]” because they had no benefit from the plumbed water sources.¹⁰⁷ Leakey advocated on their behalf to rescind a debt for a service these villagers never received.

Contrary to frequent assumptions about failed development, the problem was not primarily a result of local resistance or recalcitrance to technological changes and/or potential improvements in people’s quality of life. The failures at Mikindani originated mostly within the colonial state, not with the residents who were interested in having access to clean and regular water supplies. The little clean water that was produced was provided only to a limited number of residents, further reinforcing economic and social divisions. Whereas in 1926 two structures had direct access to water, there were fourteen “private extensions...and water [was] laid on to all the Government buildings” by 1939. The number of public standpipes, with attendants, however, had shrunk back to the 1926 standard of three.¹⁰⁸ The motivation to secure the water supply fell away as officials and resources moved to a new administrative center.

Mikindani’s water supply failed to make any further improvements after 1939 because of the Second World War and subsequent post-war development focused on other areas. Mikindani’s regional marginality and lack of basic infrastructure continued well into the postcolonial era. Household in Mikindani, like many in the south, complained of their marginalization and the state’s lack of investment in the region. While the dependent relationship between citizens and state has been established, the sense of discontent about their resource rights and place in the nation is significant. The Mchuchu well still serves the townspeople as their primary source of water, and though I observed homes with standpipes within their compounds, many rely upon the standpipes dispersed through the town for their daily needs.

Notes

- 1 Proverb of the Makonde people of southern Tanzania. Liebenow 1971, p. 26.
- 2 The colonial sources refer to the Swahili traders and dhow operators as “Arabs.” TNA16/20408: Mikindani Water Supply: 31 October, 1931.
- 3 TNA/14/2: Water Mikindani: “Water Rates,” 27 January, 1927.
- 4 The Makonde origin myth situates them in an area south of the Ruvuma River, but they migrated into southern Tanzania in four different waves. Linguistically similar communities are the Matambwe, Machinga, Mawia, and Maconde (who remained south of the Ruvuma). Alpers 1975, p. 190; Liebenow 1971, bp. 21, 23, 97.
- 5 Spear 2000, p. 284.
- 6 Becker 2008, p. 34.
- 7 Tagseth 2006; Bender 2008; Bender 2011; Hoag and Öhman 2008.
- 8 Colonial Development Act, 1929, p. 3.
- 9 Worster 1985, p. 52.
- 10 Liebenow 1971, p. 5.
- 11 Jacobs 2003; Koponen 1988, 376; Koponen 1986, p. 35; Gordon 2006, p. 20; Bender 2013, p. 204
- 12 McKittrick 2002, p. 3.
- 13 John Locke theorized that water created a “negative community... [where] all may participate but...none may be excluded.” Epstein 2005, p. 26.
- 14 Worster 1985, p. 52.
- 15 Bender 2008, pp. 844, 851-52, 856; and Tagseth 2006, pp. 499-501.
- 16 Select Maji Maji sources: Iliffe and Gwassa 1967; Gwassa 1976; Iliffe 1979, p. 168-98; Monson 2000, pp. 347-72; and Becker 2004, p. 1-22. Important rebellions in Zimbabwe also employed spirit mediumship and water: Lan 1985; Ranger 1999.
- 17 Becker 2010, pp. 296-99.
- 18 Prestholdt 2008, p. 4.
- 19 Martin 1995; and Willis 2002; Bryceson 2002; and Burton 2005.
- 20 Smith 2008, p. 4.
- 21 The War Diaries document daily events at the outpost, established the movement of merchant vessels, and give insight into the tensions between British and Portuguese soldiers. BNA WO/95/5364: War Diaries: Mikindani Post Commandant, Oct. 1916–Feb. 1917.
- 22 Iliffe 1979, 247.
- 23 More recent assessments of the League of Nations gives little indication that it paid much attention to regulating the Mandates, see: Pedersen 2007. Selected Secretariat Files: TNA-AB1299: Native Customs and Laws; AB1240: Provincial Administration; AB1284: Township Surveys.
- 24 TNA/14/2: Water Mikindani: 4 August, 1926.
- 25 Beinart and Hughes 2007, p. 133.
- 26 The swampy ground also provided excellent habitats for mosquito larvae. TNA/14/2: Statement of Expenditure, 1925 - 30 June, 1926; and “Water Rates” 27 January, 1927.

- 27 His Majesty's Government, the Admiralty and War Office, 1916, p. 186.
- 28 Liebenow 1971, p. 26.
- 29 TNA/14/2: Statement of Expenditure Incurred, 1925-30 June, 1926; and "Water Rates," 27 January, 1927. By January, 1927 there were 717 house owners in the town, 660 were African-owned.
- 30 TNA/14/2: Letter, 22 July, 1926.
- 31 While this tower provided the illusion of power, the regulatory nature of a closed water system, if fully realized, does reflect an effort to control and discipline the community. Bentham 2011, pp. 51-54; and Foucault 1979, p. 195.
- 32 Foucault 1979, pp. 141-53.
- 33 TNA/20408: Mikindani Water Supply: 31 October, 1931, p. 2; and TNA/14/2: "Water Rates" 27 January 1927.
- 34 District Officers were called District Commissioners for a time during the 1920s. In the interest of consistency, DO or District Officer will be used throughout this paper.
- 35 TNA/14/2: Letter, 9 April, 1928.
- 36 TNA/14/2: "Mikindani Water Supply" 29 March, 1929; TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 37 TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 38 Waterhouse 1957, p. 31.
- 39 The "Special" was first marketed in 1867. Ibid.
- 40 Ibid., p. 32.
- 41 Ibid. and TNA/14/2: 9 April, 1928.
- 42 TNA/14/2: Letter, 9 April, 1928.
- 43 TNA/14/2: Letter, 2 October, 1930.
- 44 Whether the pumpman engaged in sabotage or the pump failed due to age, corrosion, and sedimentation was not evident. For discussion of silent challenges to colonial power see: Comaroff and Comaroff 1987, pp. 191-209, and Scott 2009.
- 45 TNA/14/2: "Water Rates," 27 January, 1927.
- 46 TNA/14/2: Letter, 23 January, 1931, as quoted in: "Water Rates," 19 February, 1931.
- 47 Officials believed Africans were poor custodians of natural resources, which reflected what Garret Hardin argued in "The Tragedy of the Commons" that individuals will seek self improvement at the expense of the wider population. TNA/14/2: Letter, 21 October, 1931; Hardin, 1968, 1243-48; and Machan 2001.
- 48 TNA/14/2: "Water Rates," 27 January, 1927; and Letter, 21 October, 1931.
- 49 TNA/14/2: "Water Rates," 27 January, 1927.
- 50 TNA/14/2: Letter, 21 October, 1931.
- 51 According to Sandra Hempel, cholera outbreaks tended to last for years because the *vibrio cholerae* bacillus was easily harbored in ground water and swampy areas; Hempel 2007, p. 2; Koponen 1988, pp. 153, 159-61; and Koch 2005, pp. 180-82.
- 52 Hamlin 2009, p. 7, 11.
- 53 US Environmental Protection Agency, 2007.

http://www.epa.gov/teach/chem_summ/Nitrates_summary.pdf

- 54 TNA/14/2: Letter, 21 October, 1931. We have little evidence to shed-light-on how frequently villagers used the lower quality wells in Mikindani.
- 55 TNA/14/2: Letter, 12 February, 1932.
- 56 TNA/14/2: "Water Rates," 27 January, 1927.
- 57 TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 58 TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 59 Machan 2001, xiii-xvii.
- 60 Although most of the other relevant studies about water usage focus on rural communities and irrigation, ready access to water inevitably led to increases in demand. Jacobs 1996, p. 250.
- 61 TNA/14/2: Letter, 21 October, 1931; and TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 62 TNA/14/2: Letter, n.d. (likely after 2 December, 1930).
- 63 TNA/20408: Mikindani Water Supply, 31 October, 1931; and TNA/14/2: Letter, 21 October, 1931.
- 64 TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 65 TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 66 TNA/20408: Mikindani Water Supply, 31 October, 1931. Little mention was made about the frequency of fire in the township. Fire hydrants were idealized improvements that reflected British tastes, not local desires or needs.
- 67 TNA/14/2: Letter, 17 November, 1926.
- 68 TNA/14/2: Water Supply, Mikindani, n.d. (1926/27?).
- 69 TNA/14/2: Letter, 17 November, 1926.
- 70 TNA/14/2: Letter, 4 August, 1926.
- 71 TNA/14/2: Letter, 22 July, 1926.
- 72 TNA/14/2: "Water Rates," 27 January, 1927.
- 73 TNA/14/2: "Water Rates," 27 January, 1927.
- 74 TNA/14/2: Letter, 4 August, 1926.
- 75 TNA/14/2: Letter, n.d. (likely after 2 December, 1930).
- 76 TNA/14/2: Letter, 19 November, 1931.
- 77 Becker 2008, p. 5.
- 78 TNA/14/2: Letter, 26 August, 1926.
- 79 TNA/14/2: "Water Rates," 27 January, 1927.
- 80 TNA/14/2: Letter, 26 August, 1926.
- 81 TNA/14/2: Letter, 25 October, 1926.
- 82 TNA/20408: Extract of letter, 12 February, 1932.
- 83 TNA/20408: Township Ordinance, April, 1932.
- 84 *Debe* is a Kiswahili term that is applied with consistency to these containers because they were adopted as convenient and portable means to collect and store water.
- 85 TNA/20408: Letter, 26 June, 1937. Attempts to prevent dhow operators from free-use of the

- standpipe at the customs warehouse started as early as 1927, when the serving DO suggested that the customs watchman collect the levy. TNA/14/2: "Water Rates," 27 January, 1927. An unnamed European, who lived outside the township, was also using this tap for his water needs.
- 86 TNA/14/2: "Water Supply, Mikindani," 4 November, 1930. Barnes reiterated his concern a few months later in: "Water Rates," 19 February, 1931.
- 87 TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 88 TNA/14/2: Letter, 12 February, 1932; "Water Supply, Mikindani," 4 November, 1930; and TNA/20408: Extract of letter, 8 December, 1931.
- 89 TNA/14/2: "Water Supply, Mikindani," 4 November, 1930
- 90 TNA/20408: Letter, 12 February, 1932.
- 91 TNA/14/2: "Water Supply, Mikindani," 12 February, 1932; and TNA/20408: Letter, 8 April, 1932.
- 92 TNA/20408: Letter, 8 April, 1932; and Mikindani Water Supply, 31 October, 1931.
- 93 TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 94 TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 95 TNA/14/2: Letter, 28 November, 1934.
- 96 TNA/20408: Mikindani Water Supply, 31 October, 1931.
- 97 There are several instances where money from other funds were used to pay wages for the pumpman and other workers, which were presumed to fall under the "water vote": TNA/14/2: Letter, 23 October, 1926; Letter, 17 November, 1926; and "Mikindani Water Supply," 13 December, 1934.
- 98 The term standpipe "boys" was used throughout the documents but clarity about the term's racist and patronizing nature must be provided. These were not children who were expected to operate the standpipes and collect revenue, standpipe "boys" were adult African men.
- 99 TNA/20408: Letter, 26 June, 1937.
- 100 Based upon the figures given, when the £27 is divided over the course of the year and between three men, their wages work out to be approximately 75p each month. Using this factor then Shs 2/- is approximately 10p annually for water. TNA/20408: Letter, 26 June, 1937.
- 101 TNA/20408: Letter, 26 June, 1937.
- 102 TNA/20408: Marginalia, 13 July, 1937.
- 103 Bender 2008, 2013; and Tagseth 2006.
- 104 TNA/20408: Terms and Conditions of Water Supply, P.W.D. No. 50, n.d.
- 105 TNA/14/2: "Water Rate (Obsolete) Arrears," 26 April, 1938.
- 106 TNA/14/2: "List of Debtors and Period of which they were in Arrears," 2 July, 1938.
- 107 TNA/14/2: "Water Rate (Obsolete) Arrears," 26 April, 1938; and Letter, 5 July, 1938.
- 108 TNA/14/2: Letter, 5 July, 1938.

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