African Journal of Social Sciences and Humanities Research
ISSN: 2689-5129
Volume 3, Issue 6, 2020 (pp. 204-215)
www.abjournals.org

IMPACT OF COVID-19 CRISIS ON DRINKING WATER UTILITIES IN NZOIA RIVER BASIN, KENYA

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ABSTRACT: *This study was conducted on drinking water utilities in Nzoia River Basin to gauge the impacts of COVID-19; the challenges utilities are facing and the responses they are undertataking to address the COVID-19 pandemic. The results are a snapshot of the time we went to the survey between July and August, 2020. The most common utility challenges reported were: social distancing practices at utility offices or facilities; revenue generation; supply of personal protective equipment (PPE); supply of water treatment chemicals, sustaining water supply operations due to absenteeism of staff, the strain caused by COVID-19 on field operations and water treatment plant operations; and irregular supply of other materials for water supply operations besides water treatment chemicals. The survey revealed that utilities have taken a number of mesures to protect their operations and staff against the COVID-19 pandemic. These included: developing actions to manage risk and plan for contingencies (eg. restrictions on visitors/customers entering offices or other facilities); delaying anticipated capital construction, reducing anticipated maintenance and repair schedules and suspending capital construction that was in progress so as to avail money for emergency COVID-19 programmes; introducing spending adjustments in response to COVID-19 (eg. travel for training/conferences); assisting customers affected by the economic fallout (eg. suspending customer water shut-offs); taking on board a number of workforce and human resources efforts due to Covid-19 (eg. illness reporting); collaborating with other agencies to assist in COVID-19 response (eg. coordinating with local health department); preparation of COVID-19 pandemic plans; setting the primary factors to be considered before re-opening (eg. ability to supply masks, hand sanitizer, etc); taking steps to protect employees from possible COVID-19 infection (eg. enhanced disinfecting and sanitizing procedures of workspaces; reduce size of inperson meetings to maintain social distance, etc). The current COVID-19 crisis clearly demonstrates the dangers of unequal access to water services. Clean water and soap are essential to preventing most infections, COVID-19 included. Water utilities should assist customers affected by the COVID-19 economic fallout by suspending shut-offs so* that everyone gets access to a minimum level of water supply. *If water services get affected, it will mean spikes in coronavirus outbreaks, particularly in high-density communities where social distancing is not possible.* Utilities *should prioritize access to vulnerable communities and informal settlements. Given the importance of clean portable water supply, and the current pressure placed on our utilities by the COVID-19 crisis, the national and county governments in Nzoia River Basin should subsidise the utilities to keep water running. This paper provides useful insights for water sector policy makers in their fight against the COVID-19 pandemic.*

KEYWORDS: Nzoia River Basin, Water Utilities, COVID-19 Pandemic, COVID-19 Water Utility Challenges, COVID-19 Water Utility Responses.

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) is defined as illness caused by a novel coronavirus now called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; formerly called 2019-nCoV), which was first identified amid an outbreak of respiratory illness cases in Wuhan City, Hubei Province, China (CDC, 2019). It was initially reported to the WHO on December 31, 2019. On January 30, 2020, the WHO declared the COVID-19 outbreak a global health emergency (Gallegos, 2020). On March 11, 2020, the WHO declared COVID-19 a global pandemic, its first such designation since declaring H1N1 influenza a pandemic in 2009 (The New York Times, March 11, 2020). Illness caused by SARS-CoV-2 was termed COVID-19 by the WHO, the acronym derived from "coronavirus disease 2019." The name was chosen to avoid stigmatizing the virus's origins in terms of populations, geography, or animal associations (The New York Times, February 11, 2020).

The Centers for Disease Control and Prevention (CDC) had postulated that this situation could result in large numbers of patients requiring medical care concurrently, resulting in overloaded public health and healthcare systems and, potentially, elevated rates of hospitalizations and deaths. The CDC advised that nonpharmaceutical interventions will serve as the most important response strategy in attempting to delay viral spread and to reduce disease impact (CDC, February 29, 2020). The feasibility and implications of strategies for suppression and mitigation have been rigorously analyzed and are being encouraged or enforced by many governments around the world in order to slow or halt viral transmission. Population-wide social distancing of the entire population plus other interventions (eg, home self-isolation, school and business closures) was strongly advised. These policies may be required for long periods to avoid rebound viral transmission (Ferguson, et.al 2020). According to the CDC, individuals at high risk of infection include persons in areas with ongoing local transmission, healthcare workers caring for patients with COVID-19, close contacts of infected persons, and travelers returning from locations where local spread has been reported (CDC, March 8, 2020). The CDC has also provided recommendations for individuals who are at high risk of COVID-19–related complications, including older adults and persons who have serious underlying health conditions (eg, heart disease, diabetes, lung disease). Such individuals should consider precautions as stocking up on supplies, avoiding close contact with sick people, washing hands often, staying home as much as possible in locations where COVID-19 is spreading and developing a plan in case of illness (CDC, March 8, 2020).

Signs and symptoms for COVID-19 have ranged from asymptomatic/mild symptoms to severe illness and mortality. Symptoms may develop 2 days to 2 weeks following exposure to the virus (CDC, January 26, 2020). COVID-19 may present the following symptoms: fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting and diarrhea. Other reported symptoms have included: sputum production, malaise, respiratory distress and neurologic (eg, headache, altered mentality). The most common serious manifestation of COVID-19 appears to be pneumonia (CDC, May 13, 2020). As at October 22, 2020, remdesivir, an antiviral agent, is the only drug approved for treatment of COVID-19 disease in hospitalized adults and children aged 12 years and older who weigh at least 40 kg (FDA, October, 22, 2020). No vaccine is approved yet, although several vaccine candidates have moved into phase 3 testing. Avoidance is the principal method of deterrence.

The water and sanitation sector comprises (1) water supply—the abstraction, treatment, and distribution process for the product (drinking water) to the customers, and (2) sanitation—the collection and treatment of wastewater so that it can be safely discharged to the environment or reused. Public utilities, both local government and state-owned, typically operate water supply systems serving the consumers. In a few countries (such as Chile and Vietnam), private companies own and operate water systems. In several countries, the private sector operates time-limited concessions and other public-private partnerships to deliver water services to consumers. Nearly one-third of people globally lack access to safely managed drinking water services. Over half lack access to safely managed sanitation facilities (WHO/UNICEF, 2015).

Prior to COVID-19, the global water sector was impacted by five major trends: (1) global warming, which has led to an increase in extreme floods and droughts, challenging the resilience of water and sanitation systems, (2) increasing number of people living in areas facing water stress (currently 2 billion), which increases supply vulnerabilities, (3) rapid urbanization, which strains existing water resources and ecosystems, (4) the emergence of megacities, which adds the challenge of extending water and sanitation services to about 1 billion people living in informal settlements not served by water grids, (5) aging infrastructure, which has increased pressure to accelerate investments in more advanced markets, following decades of underinvestment. Water is a labor-intensive industry with high energy utilization and consistent demand for chemical supplies and other consumables. These account for the bulk of operating expenses for water utilities. Capital expenses comprise mostly networks and treatment facilities. Water utilities' operations are typically funded by customer receipts (comprising water tariffs and one-off connection charges), grants, and taxes. Tariffs are often set to achieve socio-political objectives at levels that are insufficient to recover operating costs. Therefore, the water utilities require support from other sources, usually the government budget. Additional revenue pressures come from inefficient operations such as high non-revenue water (leakages, water theft, uncollected revenues), which exceeds 40 percent in several emerging market economies. Capital expenditures are mostly funded through borrowing and public financing, with private capital covering a small share of capital expenditure.

With a few exceptions, the outbreak of COVID-19 is projected to slow down investments in the water sector worldwide. It has also increased the importance of operational reliability due to the cost of disruption. These operational needs derive from shifts in demand patterns, supply disruptions, and the various emergency measures employed by governments to cope with the pandemic. The world's poorest received the COVID-19 shock on top of existing major urban water and sanitation services deficits, all pointing towards a potentially overwhelming burden to contain the virus. Low access, reliability, and the quality of water, sanitation, and hygiene (WASH) present risks in Africa. Large cities also face risks stemming from population density and informal settlements. Many large users of water have downscaled or reduced activities resulting in declining industrial demand. A decline in demand from large industrial and commercial users due to lockdowns and travel restrictions will significantly reduce revenues to water utilities. Deeper revenue loss is projected across the whole water supply chain, including operators, technology companies, contractors, chemical suppliers, and consultants.

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Several countries have announced crisis emergency measures that will affect revenues. The partial suspension of water billing for low-income users and moratoriums on water service cut-offs have been the most common responses to the crisis. Specific measures adopted include (1) deferments on or exemptions from utility bill payments for vulnerable groups, (2) moratoriums on cutting off the water supply (justified by the importance of hygiene in reducing the spread of the virus), and (3) suspensions of meter reading and invoicing. In the medium term, well-governed markets are likely to compensate for revenue losses through installment payments of deferred amounts, government transfers, and possibly tariff adjustments. These measures might also impact utility governance and user payment culture, especially if prolonged for extended periods. Capital expenditures will decline in the short to medium term. New capital projects are likely to be delayed as municipalities prioritize operations and emergency response.

Operations could be affected by the increased risk of contagion among utility staff, including both routine operations and construction works. Operational continuity and flexibility are key to keep essential water and sanitation services running, while also pushing forward ongoing construction. Many governments identified people working in the water and sewerage industry as essential workers, enabling utilities to maintain continuity of service. However, social distancing protocols mean that utilities can only retain operationally critical staff on site. Supply chain and logistics disruptions have also been reported. Water utilities are also undertaking communication campaigns to raise awareness of the importance of good hygiene practices to prevent the spread of COVID-19. Utilities can spread educational messages on water, sanitation, hygiene, and disease prevention to change behaviors. Communications and community engagements should focus on the role of women, who carry a disproportionate burden—besides being primary caregivers, they make up 70 percent of healthcare and social workers. With automation, water utilities with good systems to remotely control and operate networks and treatment plants will perform better during this crisis as automation protocols for responding to occurrences (such as pipe bursts) allow for efficient response, with a lower degree of physical interaction among staff.

MATERIALS AND METHODS

Study Area

Nzoia River Basin is located between latitudes $1^0\,30^{'}$ N and $0^0\,05^{'}$ S and longitudes 34^0 E and $35^0 45^{'}$ E in Western Kenya and covers an area of 12,959 km^2 with a river length of 334 km up to its outfall into Lake Victoria (Figure. 1). The area has a population of approximately 3.5 million people that is rising rapidly with the majority of the people living in rural areas. The basin covers the nine counties of Elgeyo/Marakwet, West Pokot, Trans Nzoia, Uasin Gishu and Nandi (in former Rift Valley province); Kakamega,

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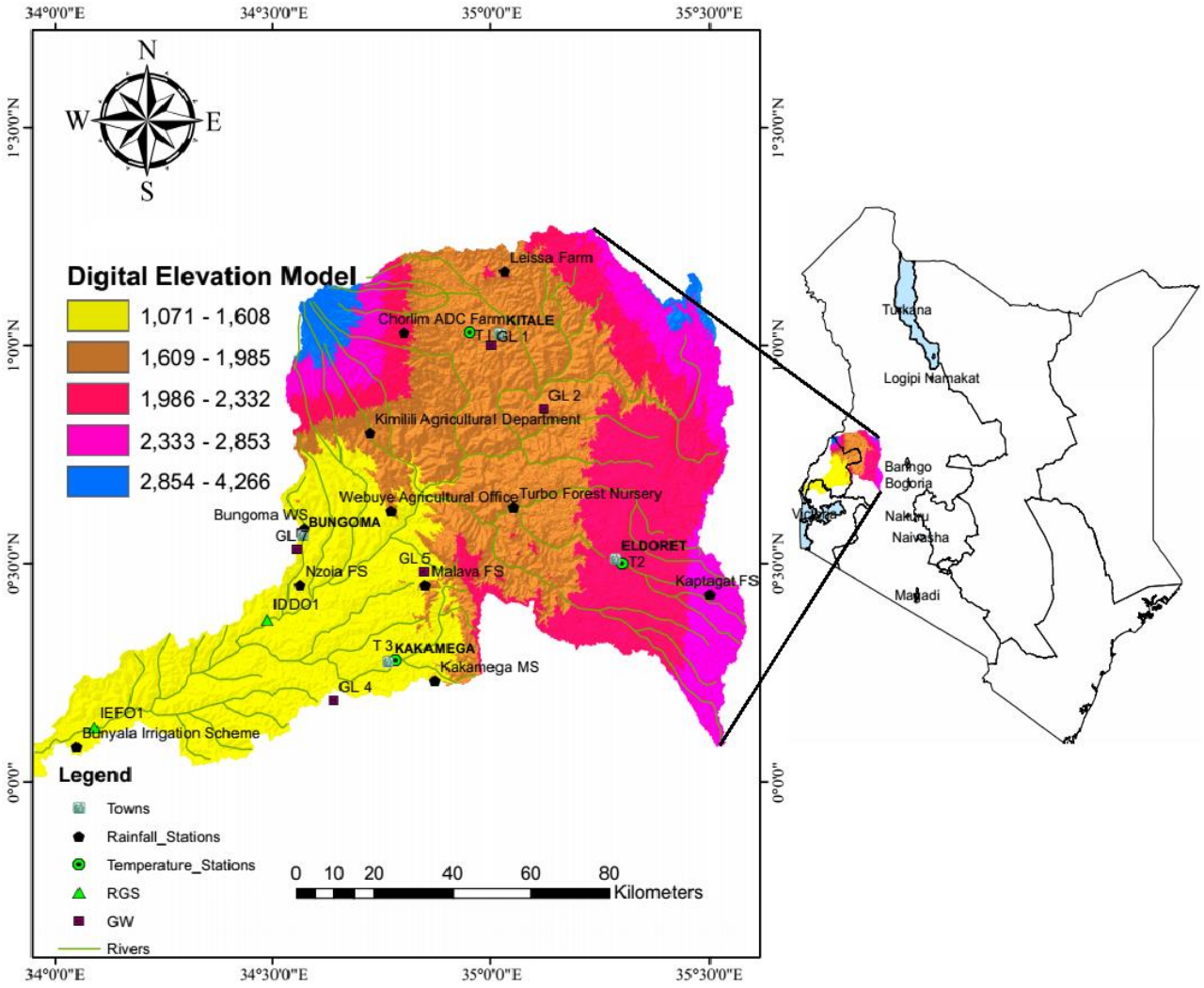

Figure. 1: Map of Nzoia River Basin, Kenya

(Source: Researcher, 2017)

Bungoma and Busia (in former Western province) and Siaya (in former Nyanza province). The basin is characterised by three physiographic regions namely; the highlands (characterised by Mt. Elgon and Cherangani hills); the upper plateau (which includes Eldoret and Kitale); and the lowlands (which includes Busia that experiences the majority of flooding in the basin). The dominant topography consists of rolling hills and lowlands in the Eldoret and Kitale plains. Nzoia river is one of the largest rivers in Western Kenya which drains into Lake Victoria contributing to the waters that form the source of River Nile (Odwori, et.al 2018).

The Climate of Nzoia River Basin is predominantly tropical humid, but it varies from county to county due to varying landscape and elevations in the basin. The region experiences four seasons due to the inter-tropical convergence zone (ITCZ), however, the local relief and influences of Lake Victoria modify the regular weather patterns. There are two rainy seasons

and two dry seasons, namely, short rains (October to December) and the long rains (March to May). The dry seasons occur in the months of January to February and June to September. The mean monthly rainfall in the basin for the period 1970 to 2001 varies from about 16.26 mm in January and December (Chorlim ADC. Farm) to about 300.79 mm in April (Kaimos Tea Estate). The basin experiences lowest monthly maximum tempratures occuring in July at 16.1 ^{0}C (Eldoret), minimum tempratures in January, July and September at 10.0 ^{0}C (Eldoret) and mean tempratures in July at 16.1 ^{0}C (Eldoret) whereas the highest monthly tempratures in the basin for the maximum occurs in February and March at 29.5 ^{0} C (Kakamega), minimum in April at 15.1 ^{0} C (Kakamega) and mean in March at 22.0 ^{0} C (Kakamega). Temperature trends in the basin are linked to altitude since the lowest temperatures are found at highest altitudes and highest temperatures at lowest altitudes.

Agriculture is the dominant land use in the region and the agricultural activities of the basin mainly depend on rainfall as most of the crops are under rain-fed agriculture with very limited irrigation being practiced. The main food crops grown are maize, sorghum, millet, bananas, groundnuts, beans, potatoes, and cassava while the cash crops include coffee, sugar cane, tea, wheat, rice, sunflower and horticultural crops. The inhabitants of the basin also practice dairy farming together with traditional livestock keeping. Nzoia river and its many tributaries provide water for domestic use, agriculture, industrial and commercial sectors. Nzoia River Basin has the soil type textures forming: clay (77%), loamy (9%) and sandy (14%). In the basin, the Ferralsol form well drained soils found mostly on level to undulating land. The Acrisols in the basin form clay-rich soils associated with humid tropical climates and supports forestry; whereas Nitisols compose deep well drained red tropical soils found mostly in the highlands occupying more than 75% of the catchment.

Methodology

The data used in this study was obtained through a number of ways. Questionnaires were sent out to water utilities in Nzoia River Basin to gauge the impacts of COVID-19; the challenges utilities were facing and the actions they are undertaking to address the COVID-19 pandemic. Each question provided an option of “unable to answer” in order to ensure results are as accurate as possible. All “unable to answer” responses have been removed from analysis. In-depth expert-interviews were conducted with selected stakeholders who included key policymakers, academia, scientists and practioners on water utilities and COVID-19 pandemic impacts. Field observations were carried out in the study area. Field observation involved watching stakeholder activities and processes, and documenting processes and results. The Field observations had the added benefit of enabling the Researcher to identify processes or activities that may have been missed during surveys or interviews.

RESULTS AND DISCUSSION

This study was conducted on water utilities in Nzoia River Basin to gauge the impacts of COVID-19; the challenges utilities were facing and the responses they are undertaking to address the COVID-19 pandemic. The results are a snapshot of the time we went to the survey between July and August, 2020.

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Results

Utility challenges caused by Covid-19

The most common utility challenges reported were: social distancing practices at utility offices or facilities; revenue generation; supply of personal protective equipment (PPE) (N95 masks and/or Elastomeric respirators, Alternative mask options (e.g. surgical, cloth, etc.), Face shields and/or Protective eye wear, Nitrile and/or latex gloves, Tyvek suites and/or disposable coveralls, and Sanitizing wipes, sprays for cleaning workspaces and gels for hand sanitizing); supply of water treatment chemicals, sustaining water supply operations due to absenteeism of staff resulting from Covid-19 crisis, the strain caused by COVID-19 on field operations (meter reading, repairs, etc.) and water treatment plant operations; and irregular supply of other materials for water supply operations besides water treatment chemicals.

Social distancing practices at utility offices or facilities was a major problem for the large water utilities where it was reported at 100%. The smaller utilities reported it at 31%. This may be attributed to the large number of workforce engaged by the large water utilities as opposed to the smaller community and private institutions operated shemes. Revenue generation was reported as a problem affecting the large utilities at 100% and the smaller utilities at 85%. The smaller utilities have limited operations and can still operate with limited revenue flows unlike the larger utilities which may require external subsidies. Supply of personal protective equipment (PPE) (N95 masks and/or Elastomeric respirators, Alternative mask options (e.g. surgical, cloth, etc.), Face shields and/or Protective eye wear, Nitrile and/or latex gloves, Tyvek suites and/or disposable coveralls, and Sanitizing wipes, sprays for cleaning workspaces and gels for hand sanitizing) was equally spread across both utilities, but the worst hit were the large utilites reporting 67% and the smaller community and private institutions operated utilities 23%. Large water utilities have large workforces operating in a small space with complex operations and urgently require uninterrupted supply of personal protection equipment to discharge their duties. Supply of water treatment chemicals was further complicated by the problem of low revenue flows at the large utilities. These utilities consume a lot of chemicals and with low revenue flows may require bail out from the national and county governments.The large utilities reported the problem of inadequate and irregular water treatment chemicals supply at 100% compared to the smaller utilities which showed 46%. Sustaining water supply operations due to absenteeism of staff resulting from COVID-19 crisis was not a serious problem for both the large and small utilities as the management was able to contain the challenge using available staff. The large utilities reported none as compared to the smaller utilities which showed 15%. The strain caused by COVID-19 on field operations (meter reading, repairs, etc.) and water treatment plant operations was equally not a serious problem for both the large and small utilities as the management was able to contain the challenge using the available staff. The large utilities reported none as compared to the smaller utilities which showed 30%. Irregular supply of other materials for water supply operations besides water treatment chemicals was a major problem at the large utilities which recorded 67% as compared to the small utilities with 31%. This is because large utilities have complex operations that require additional supplies apart from the water treatment chemicals to accomplish their operations. Both the large utilities (county water and sanitation companies) and the small utilities (community/private institution utilities) were asked to indicate which of the above challenges they thought would persist in

the following months; the results from both utilities indicate that all challenges are anticipated to persist in the following months.

Utility responses to Covid-19 crisis

This study established that the utilities are undertaking a number of measures to keep the supplies operational in their areas. The survey established that most of the utilitis have developed actions to manage risks and plan for contingencies in this era of COVID-19. The measures in place to manage risks associated with COVID-19 and plan for contingencies include: restrictions on visitors/customers entering offices or other facilities; plans to continue essential operations for field and/or plant employees and others who can't work from home; employee health provisions and assessments; shift change or other policies revised to incorporate social distancing; contractor health provisions and assessments; travel restrictions; work from home/telework policy for non-field employees; and plans for operators/essential plant workers to live on-site if needed.

As a measure towards managing the impact of COVID-19 on water services, the utilities are now delaying anticipated capital construction; reducing anticipated maintenance and repair schedules; and suspending capital construction that was in progress so as to avail money for operations and emergency programmes.

Most of the utilities have also made spending adjustments in response to COVID-19. The affected areas in the spending adjustments include: travel for training/conferences; capital improvements; travel for other business reasons; workforce - hiring freeze; training or continuing education budget; repairs; workforce - pay cuts/wage freeze; workforce - furloughs or layoffs; and marketing/public outreach. Others responses made towards spending adjustments are: not buying anything we do not need at this time in office supplies, etc.; hazardous pay for field personnel; reduced or delayed contracts; and putting off unnecessary purchases until later in the year.

The survey has also established that the utilities have taken a number of actions to assist customers affected by the COVID-19 economic fallout. These include: suspending customer water shut-offs; flexible payment plans; deferring payments; returning suspended accounts to service; waiving Service Fees; rate reductions/billing assistance rate; and issues handled on a case by case basis.

The utilities have also taken on board workforce and human resource issues relating to COVID-19. The workforce and human resource issues included are: illness reporting; modifying medical leave policy to encourage early illness reporting; hazardous duty pay; testing for COVID19; measures for coping and dealing with increased absenteeism; special compensation (e.g. residing at work or sheltering in place); grief counselling; special measures to earn contact hours; benefits assistance, such as medical guidance or hotline; close contact assessments; freezing of vacant positions; and pandemic-specific training.

It was established that utilities are collaboration with other agencies as a responce to the COVID-19 pandemic. They collaborated with other sister utilities, public health departments, Regulatory agency- Water serverces regulatory board, etc. The Public Health Department had barred utilities from holding Public Board Meetings which presents serious challenges to Regulatory compliance, however, most of the large utilities have now streamed them online.

Some utilities have COVID-19 pandemic plans. Utilities were urged to examine what best describes its pandemic plan prior to COVID-19, what best describes its actions now regarding adjustments in the pandemic plan - and if the utility is documenting lessons learned and planning to develop an after-action report. The study also established that for the utilities to keep operations running (or reopen facilities that had been closed), their were standard procedures to be adhered to such as: ability to supply masks, hand sanitizer, etc; guidance from national/county governments; being able to effectively social distance in physical office space; staff feeling it is safe to return to/work in office; guidance from health offices/medical personnel; being able to conduct staff temperature checks; being able to offer flexible schedules and/or work from home; being able to stagger arrival and departure times, and availability of poly screens for counter staff.

The water utilities surveyed in Nzoia River Basin were found to be taking steps to protect their employees from possible COVID-19 infections while at work. The steps taken to protect employees from possible COVID-19 infection are: enhanced disinfecting and sanitizing procedures of workspaces; reduce size of inperson meetings to maintain social distance; requiring face coverings or masks; reduced office capacity (e.g. alternating inoffice schedules to maintain a reduce workforce in office); flexible policies to allow work from home for employees if they desire; reorganize desks to maintain social distance; take employees' temperature prior to shift or entering building; alternating inoffice schedules to maintain a reduce workforce in office; closing high touch common areas like break rooms or kitchens; and building upgrades such as touchless faucets, etc. Other responses include: office closed to public; conduct virtual meetings; only have a few employees in building; lobby continues to be closed; propping doors open to avoid touching; installing plexiglass between customers and staff, social distancing stickers on floors, posters with reminders on COVID-19 protocols, drive thru option for payments, limited public access, working to increase vendor payments using contactless customer payments, virtual meetings; added signage to remind employees of safe work habits; installation of Plexiglass dividers; doors modified so they can be opened by foot, signage- wear masks wash hands; installed protective barriers for customer service staff, and no in-person meetings.

Discussion

The impact of COVID-19 on water utilities is as significant as any other sector. The immediate response has been to ensure the safety of our workforce and maintaining a supply of clean, safe, and affordable drinking water. The long-term impact on our utilities is becoming clearer and will be far-reaching. We are beginning to understand the financial stress utilities will experience in the coming months, driven by economic disruption and historic unemployment. Many utilities are now in discussion over layoffs, budget reductions and historic rate increases as a possible way out of the current problem. Some relief may come from the national and county government stimulus to invest in infrastructure or offset declines in utility income. But utilities will need to focus on capturing every shilling of revenue available to minimize the impact of COVID-19 on employees, ratepayers, and suppliers.

Most utility income sources will decline as a result of COVID-19. Our utilities fund themselves through a variety of revenue streams. The primary revenue source for most utilities comes from charges to customers for water and wastewater services. Water is delivered to utilities through extensive networks of distribution piping, and the volume of

water delivered to a customer is measured, in most cases, by water meters. In many instances, bills for wastewater service are generated from the reading of these water meters based on the concept of "water in, water out." COVID-19 is directly affecting the demand for water. For example, residential and multifamily housing units are consuming more water as people increasingly work from home. In comparison, commercial businesses like restaurants use less water due to closures or restrictions on the number of customers they can serve. Overall, the consumption of water is expected to decline significantly due to declining economic output driven by COVID-19. Other revenue streams include sales taxes, income taxes, capital-gains taxes and property taxes. Most, if not all, these sources will decline due to COVID-19. For example: (1) Sales tax declines driven by the closure of businesses due to quarantine-like measures, (2) Significant reductions in income tax on the heels of scaling unemployment and reduced wages going forward, (3) Lower capital-gains tax revenues from equity transactions after significant stock market declines, and (4) Property taxes are likely to decline following an economic reset, thereby undercutting municipal revenues over time. Large portions of the Kenyan economy have been shut down for weeks/months, and the loss of jobs and business is already staggering.

Utilities will face new constraints in the post-COVID-19 period. Most people view water as an essential need. Turning off water service due to non-payment has always been a last resort for most utilities. COVID-19 has increased this perceived need because water is essential for handwashing and hygiene, which, in turn, is critical to reducing the spread of COVID-19. Most utilities have now said they will not turn off water to customers who are late paying their bills during the COVID-19 emergency. The Governors within Nzoia River Basin have ordered public water utilities to suspend water shutoffs during this emergency. Some are allowing customers to defer payments during the pandemic. Not all water utilities in the basin have the same vulnerabilities as analysts say, however, all will be affected in some way by changes in water use patterns and prohibitions on turning off water services. They will have customers who are suddenly jobless and cannot pay their bills on time. Late payments could increase. With businesses closing, commercial and industrial water sales, which fund a significant portion of most utility budgets, will decline. This is especially true for utilities that rely on a few large industries and institutions (universities, colleges, etc.) for the bulk of their revenue. Most utilities finance capital-improvement projects using a variety of debt instruments. Debt-service payments are a fixed expense placing additional stress on utility income statements. Debt payments will have to be made, further constraining available cash desperately needed to sustain operations. In general, our water utilities have a significant portion of their budget allocated to fixed expenses, which are difficult to reduce over the short term. Even a small reduction in revenue has a substantial impact on operations and workforce because there aren't many expenses that can be cut in the short term.

Utilities have few options to offset declining revenues. Their limited options to offset declining revenues due to COVID-19 include: (1) Workforce reduction, (2) Cut operational and maintenance expenses, (3) Stop or reduce short-term capital improvement projects, (4) Increase rates, and (5) Accurately measure and bill for water delivered. Unfortunately, utilities must contemplate a resolution to the revenue gap caused by COVID-19 and attempt to predict when or if consumption patterns will return to normal. In the short-term, utilities are focused on cutting costs and potential budget reductions. With personnel costs being a large portion of the operating budget, utility leaders face cutting vacant positions, possible furloughs, and a reduction in force. Water utilities in the basin are also challenged by aging

infrastructure. Reduction of capital-improvement projects, in many cases, may provide short-term cash flow relief. In the long term, outdated infrastructure will continue to increase the burden on already stretched maintenance staff and utility budgets. Many utilities are contemplating rate increases, however, rate increases will have a disproportionate impact on the neediest of our society especially in severe economic stress. At this time of COVID-19, digitization of water provides a host of opportunities to improve employee safety, employee effectiveness, operational efficiency, capital expenditure efficiency and revenue. Employee safety is essential and critical to proper utility operations. Revenue is the second-most important factor to drive exceptional utility operations.

CONCLUSION

The COVID-19 virus has not been detected in drinking-water supplies and based on current evidence, the risk to water supplies is low. Conventional water treatment methods, which include disinfection with oxidants like chlorine, are effective for inactivating COVID-19. Water utilities in Nzoia River Basin are facing serious challenges as they strive to keep water flowing during these trying moments of COVID-19 pandemic. The COVID-19 crisis poses three main challenges for the water utilities. The first is the loss of revenue. Most utilities surveyed have taken a number of measures to assist customers affected by the economic fallout such as suspending customer water shut-offs, deferring payments and returning suspended accounts to service, etc. Already, some utilities are reporting significant revenue reductions. The second challenge is the reduced availability of critical elements for operations, such as chemicals for water treatment, fuel for water pumps, or spare parts. Water utilities are also facing challenges of social distancing practices at utility offices or facilities, covering labor costs and providing adequate personal protective equipment (PPE) to their staff at a time when income is drying up. They are also adding costs as they rush water services to vulnerable communities by increasing access to water points, tanker services, and other enhanced delivery mechanisms.The third challenge stems from the deferment of critical investments to meet the more urgent necessity of funding emergency responses. This is affecting areas such as the expansion of services, asset rehabilitation, and other capital expenditures. Over the past few decades, Kenya, and in particular, Nzoia River Basin had made significant improvements in water and sanitation sector governance and utility performance. This had resulted in increases in the number of people reached by sustainable services; yet the current crisis risks backsliding and losing these hard-won gains. The COVID-19 pandemic has highlighted the importance of effective governance in the water and sanitation sector. The national and county governments in Nzoia River Basin should put a concerted effort in helping utilities at this crucial moment to ensure that they fulfill their vital function, so that they can provide safe water and sanitation services in the present COVID-19 crisis and build resilience against major risks in future.

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