

A roadmap to address Addis Ababa's chronic water supply issues is urgently needed

A call for immediate action



Source: GlobalGiving

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Contents

- 2** Authors
- 5** Summary
- 5** The reason
- 7** 1. Substantial investment in new water resources is needed
- 8** 1.1 The need for major surface water development
- 10** 1.2 Consider water transfer across basins and balance the use of surface water and groundwater
- 12** 1.3 Consider local resources and an aquifer storage and recovery systems
- 14** 1.4 Invest in water use efficiency improvement including the reduction of non-revenue water and encourage “Fit for Purpose” use
- 17**
- 17** 2. Proper pricing, private sector involvement and affordable hydroelectricity key to improving operations in Addis Ababa water supply
- 19** 2.1 Consider proper pricing for cost recovery, fairness and to encourage efficient water use
- 19** 2.2 Consider leveraging and bringing in the private sector into the mix
- 23**
- 23** 3. Build an institutional setup that addresses concerns for water use: Source to delivery

Addis Ababa urgently needs Big, Bold Solutions!

The current gap between supply and demand in Addis Ababa is HUGE and concerning. Closing this gap requires substantial investment, and even then, such investment must cater to the city's water needs for the next 20 to 30 years, as is common in typical municipal water supply planning. To address this water crisis, it is imperative to think beyond conventional methods and make bold and unprecedented investments. Addis Ababa's per capita water usage is expected to rise significantly in the coming years, following the trajectory often observed in developing countries when their economies experience sustained growth. Therefore, it is crucial to ensure adequate and sustained water supply right from the onset of this economic expansion. Such an approach will not only solve barriers to economic development of the city, but also will be less costly to the city and its residents overall.

Summary

In a previous publication ([available here](#)), we shed light on the chronic water issue faced by Addis Ababa. We discussed the magnitude of the problem and explored the various ad-hoc “solutions” adopted by the city’s residents. In summary, we emphasized the substantial gap between the current water supply and the growing demand. Consequently, addressing this issue requires a comprehensive approach that considers a broader context and involves government authorities at all levels.

The response and feedback we have received have been overwhelmingly positive and extensive. The article has garnered significant attention and has been widely cited as a source in multiple media outlets setting discussion topics ([VOA](#), [BBC](#), [Deutsche Welle](#), [Sheger Radio](#), [Addis Fortune](#) as well as numerous social media platforms). These discussions and engagements have served to highlight the severity of the issue, which has resonated with the city’s residents and created the opportunity for public engagement and meaningful discussions.

In this follow up piece, we offer a set of urgently needed measures, forming a strategic roadmap towards a comprehensive resolution of the chronic water shortage in Addis. This strategic roadmap calls for a diversified investment in various water sources, encompassing both surface water and groundwater conjunctive utilization, along with inter basin transfers. We emphasize that the current and future water demand can only be addressed by major investments in water resource infrastructure. To facilitate this, we strongly recommend the establishment of a collaborative and integrated Water Commission involving the administrations of Addis Ababa City, Oromia State, and Federal government agencies like Ministry of Water and Energy (MOWE). Such a commission would be responsible for project planning, fund mobilization, execution of major infrastructure projects, and overseeing water governance across political boundaries.

We also make a case for proper tariffs towards full cost-recovery, as essential for financing operational costs and new infrastructures. Furthermore, a pivotal aspect involves curtailing water losses to increase overall efficiency. The integration of pioneering underground storage and recovery technologies may be relevant for Addis Ababa, alongside the establishment of an all-encompassing institutional framework. These practices have demonstrated their efficacy as exemplary benchmarks in numerous global cities.

The reason?

Addis Ababa currently faces a huge demand-supply imbalance, with only 40% of the required water supply reaching customers. Consequently, the residents of the city are currently in a dire situation, struggling to fulfill their daily water needs – as one resident put it “በቂ አይደለም። ቆሽሽን ነው በቃ ፤ እንቆሽሻለን ። ምንም አይበቃም ። ለሽንትቤት ፤ ግቢያችን ቢቆሽሽ ፤ ቤታችን ቢቆሽሽ። ልብሳችን ቢቆሽሽ። በየቀኑ ለማጠብ በጣም አስቸጋሪ ነው።”. This inadequacy poses a significant challenge, not only for meeting the present needs of residents but also for ensuring future water requirements are met, considering the typical long-term planning horizon of 10 to 20 years needed to build urban water supply infrastructure in cities like Addis Ababa.



A ROADMAP TO AVERT ADDIS ABABA'S CHRONIC URBAN WATER SUPPLY IS NEEDED:

1. Substantial investment in new water resources is needed

It is important to establish from the onset that groundwater has often been the most accessible and relatively easy-to-reach water source in many cities worldwide. A few examples include New York, [Tampa Bay](#), Beijing, and Sana'a, which utilized groundwater for several decades or even centuries until their resources became unsustainable. Of course, groundwater is not an infinite reservoir beneath us, waiting to be tapped without limits. Numerous cities across the globe have followed a similar path as Addis, relying on groundwater as a primary water source for their residents.

In response to the challenges posed by unsustainable groundwater use, both New York and Beijing authorities recognized the issue of groundwater depletion and successfully transitioned to surface water resources, ensuring a stable water supply for millions of their residents. Tampa Bay, on the other hand, relied entirely on groundwater for its urban water supply, which led to significant environmental damage. Recognizing the problem in the late 1990's, authorities in Tampa Bay took action and [diversified their water supply portfolio](#). They incorporated two types of surface water sources, implemented an offsite reservoir to store excess summer rainfall, and introduced desalinated sea water as to supplement other sources. However, in the case of Sana'a, the city continued to excessively exploit ground water by digging deeper, reaching depths of up to 1 km (an equivalent the length of 10 football fields) and as a result, Sana'a continued to face severe water shortages; this problem predates the current war in Yemen.

Unfortunately, there appears to be a misconception in Addis Ababa regarding the potential of groundwater as a solution to the city's water challenges. Despite evidence indicating that the mid-range wellfields, reaching depths of approximately 250 meters, have already dried up, there is a belief among some that harnessing more groundwater by digging even deeper will be sufficient. This perspective seems to be influenced by the assumption that a sufficiently large fraction of the seasonally heavy rainfall in the city, which averages over 1200 mm per year, will recharge the groundwater. The sustainable recharge of groundwater requires sufficient open permeable land and time. The large change in land cover and land use in Addis has reduced permeable surfaces and may have also increased run-off, posing a big question mark on whether it is even possible to have sufficient recharge to replace the current withdrawals. Additionally, there is a scientifically debatable assumption that the groundwater watershed, the area contributing to the underlying aquifers that supply the city, is extensive and possibly involves underground interbasin flows. While a conclusive study is yet to provide a definitive answer to this hypothesis, it is imperative that it be verified. However, the evidence is clear: the current groundwater use is not sustainable, as indicated by a troubling increase in the number of drying wells installed within the past two decades.

It's important to recognize that surface water and groundwater are interconnected, and both rely on rainfall for replenishment. By implementing an integrated investment planning that incorporates both systems, it is possible to optimally exploit the seasonal nature of each water source. The development of additional surface water resources (reservoirs) will enable the utilization of groundwater in accordance with its replenishment rate and the nature of the underlying aquifers that Addis Ababa utilizes. Such an approach will ensure a more sustainable and balanced water management strategy.

1.1 The need for major surface water development

Assuming a per capita demand of 100-Liters as the minimum water per person per day (not gross per capita) Figure 1 shows the current gap between supply and demand. Ignoring the inequalities in access (geographic, and income related), the per capita consumption is currently suppressed to much lower values for Addis Ababa. If Addis Ababa was to grow into a flourishing capital city with rapid economic development, the per capita demand would significantly increase with socio-economic development; the level of suppression and inequalities would then increase if sufficient supply infrastructure were not developed urgently.

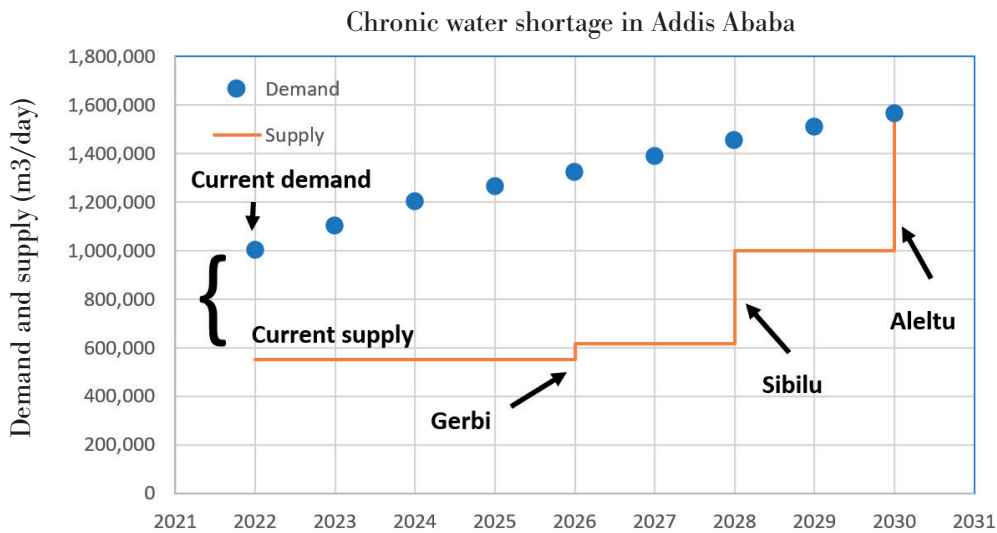


Figure 1. Addis Ababa water need and supply

The current water source mix in Addis Ababa is unbalanced with about 65% groundwater and 35% surface water, leading to unsustainable groundwater use. To counter the impact of highly seasonal rainfall in the catchments of these sources, it's crucial to expand the city's surface water capacity. The city experiences rainfall only during three to four months, which needs to be captured in reservoirs to ensure a continuous water supply during drier months.

However, Addis Ababa lacks adequate water storage capacity compared to the daily demand and source variability. At the moment, the combined surface water storage is around 70-75 million cubic meters, equivalent to approximately two months of Addis Ababa's present water supply requirements. This meager storage capacity was established when the city's population was much smaller than it is today, making it inadequate for the current needs. Addressing this requires a substantial water reserve to meet growing demands effectively.

Considering the city's current population growth, the undersized water storage capacity emphasizes the urgent requirement for larger, robust water storage infrastructure. To supply a rapidly expanding city like Addis Ababa, quick action is paramount. While ongoing projects are being studied by the Addis Ababa Water and Sewage Authority (AAWSA), expediting these and initiating new projects promptly is necessary. Timely and efficient execution of such projects is essential to ensure a reliable and sustainable water supply for the residents of Addis.

Big, bold solutions are needed.

Why?

The current gap between supply and demand in Addis Ababa is HUGE and concerning. Closing this gap requires substantial investment, and even then, it must cater to the city's water needs for the next 20 to 30 years, as is common in typical municipal water supply planning. To address this water crisis, it is imperative to think beyond conventional methods and make bold and unprecedented investments. Addis Ababa's per capita water usage is expected to rise significantly in the coming years, following the trajectory often observed in developing countries when their economies experience sustained growth. Therefore, it is crucial to ensure adequate and sustained water supply right from the onset of this economic expansion. Such an approach will not only solve barriers to economic development of the city, but also will be less costly to the city and its residents overall.

To initiate discussion on the need for urgent planning and investment in solving Addis Ababa's chronic water shortage, we propose the following roadmap as a starting point.

1.2 Consider water transfer across basins and balance the use of surface water and groundwater

Supplying water to a large, concentrated population has been a challenge throughout history. However, ingenious solutions have been implemented successfully in various contexts, both in the past and present. One example is the ancient city of Rome, where extensive long aqueducts from far away supplied the original city of Rome to meet the water needs. In addition, the recent water crisis of Beijing, with a population of over 20 million inhabitants, overcame its water crisis through the ambitious South to North Water Diversion Project, involving a remarkable 1000-mile water transmission line. Many coastal cities in the US also developed during the 20th century with planning that included interbasin transfers.

Addis Ababa finds itself in a comparable situation, situated at an escarpment with limited access to a small watershed. Fortunately, Addis Ababa is adjacent to a very humid watershed. A study conducted by AAWSA highlights that these adjacent watersheds benefit from generous annual rainfall exceeding 1200 mm per year, and are home to streams with conducive reservoirs (storage) sites, ideally suited for water storage and interbasin transfers.

In anticipation of the growth of Addis Ababa and its surrounding towns, AAWSA and other Federal water authorities developed a series of water resource exploration and master plans during different time periods starting from the first inception of AAWSA. Among these plans, studies have been conducted to supply Addis Ababa from rivers in the Blue Nile Basin by constructing dams and long transmission lines. These existing studies should be reconsidered and implemented promptly to avert the water crisis that is manifesting in the city. The AAWSA study can be summarized in Figure 1 by showing the demand and potential supply forecast up to 2030. It is evident that the current supply is far below the demand line (dots). The Gerbi project, which is about to start construction, will add about 70,000 m³/day, while potential dams like Siblu and Aleltu could together provide 10 times more water than Gerbi, with 400,000 m³/day and 600,000 m³/day respectively. Figure 2 shows the preliminary location of the dam and route to the city.

The Aleltu project, the largest water supply project, should have been implemented yesterday, not in 2030!

We recommend a rapid appraisal study of these projects and timely action. In addition to the technical study, we also recommend an institutional framework that facilitates collaboration. This will require a legal and institutional framework involving Addis Ababa City government, Oromia state as well as the Federal government”

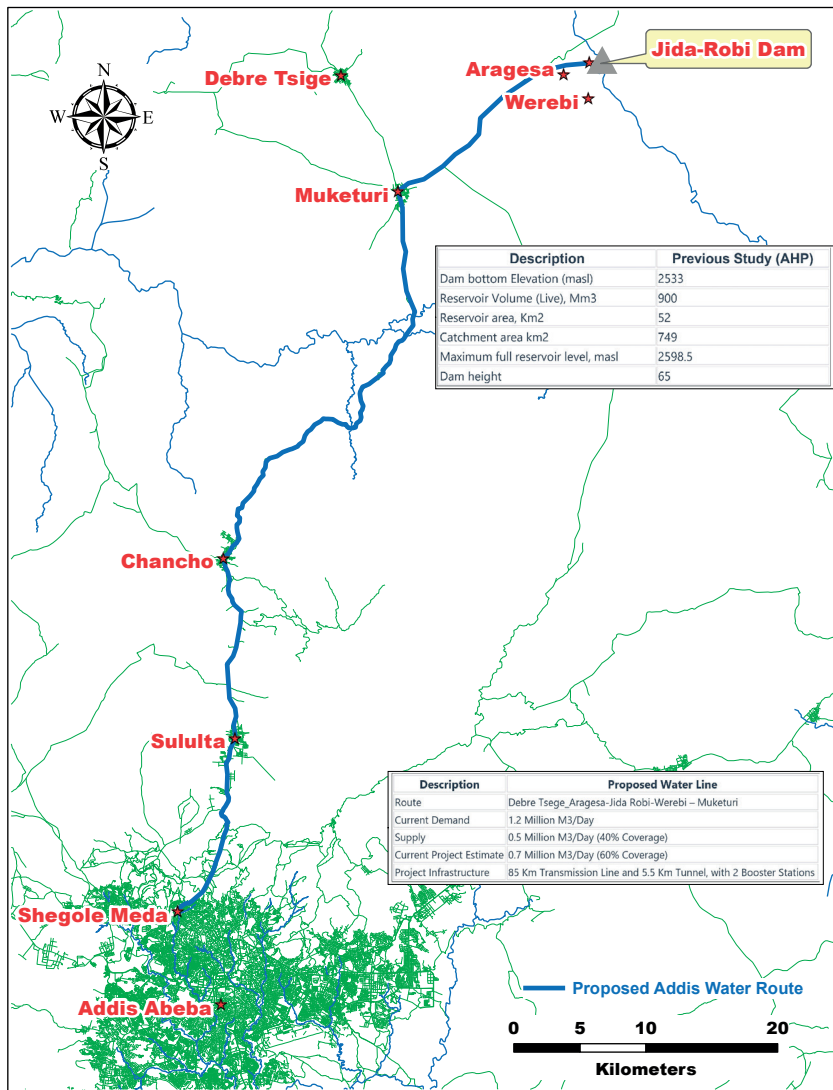


Figure 2. One of the few options for a potential dam location and transmission line for a project that brings water to Addis Ababa from Jida-Robi.

Disclaimer: This is only a representation based on prior studies and we picked one of the many options on transmission line and in NO way a recommendation for specific transmission line. That needs to be studied further.

An appraisal study of these projects and subsequent action is strongly recommended. Alongside the technical study, an institutional framework should be established to facilitate collaboration among stakeholders in the region where the water resources are developed. This will involve the participation of Addis Ababa City government, Oromia state, and the Federal government in creating a legal and institutional structure. Further details about the framework are provided in the subsequent section. The institutional framework will also play a vital role in mobilizing the financial resources required for the projects. We recommend a rapid appraisal study of these projects and timely action. In addition to the technical study, we also recommend an institutional framework that facilitates collaboration. This will require a legal and institutional framework involving Addis Ababa City government, Oromia state as well as the Federal government.

In addition to the new water resource projects, we also consider the following undertakings that have a potential to increase water demand and increase water use efficiency.

1.3. Consider local resources and an aquifer storage and recovery systems

While these options may not be as extensive as surface water developments, both in terms of cost and expected supply quantity, they should not be disregarded and can be valuable components of an all-of-the-above solution that Addis Ababa needs. Aquifer storage and recovery (ASR) technology has been widely applied worldwide, especially in regions with highly seasonal surface water sources, experiencing a few months of rainy season followed by several months of dry conditions, like Addis Ababa. Our experience indicates numerous successful examples of implementing this technology around the world, including in areas where we reside. Thus, there is great potential to explore and implement this technology in and around the city.

Approximately half to one-third of the current Addis above ground storage in Addis Ababa can potentially be stored underground during the wetter season, increasing the overall water storage capacity and use for dried season. This approach is particularly valuable in areas lacking extensive overland storage areas. The concept of Aquifer Storage and Recovery (ASR) involves alternating recharge and extraction wells throughout the year. Recharged wells take advantage of heavy seasonal flooding, capturing, and storing water deep underground during the three to four months of high flow. Subsequently, recovery wells pump this stored water for use during the rest of the year. This can also work on exiting dried pockets of aquifer that are currently abandoned.

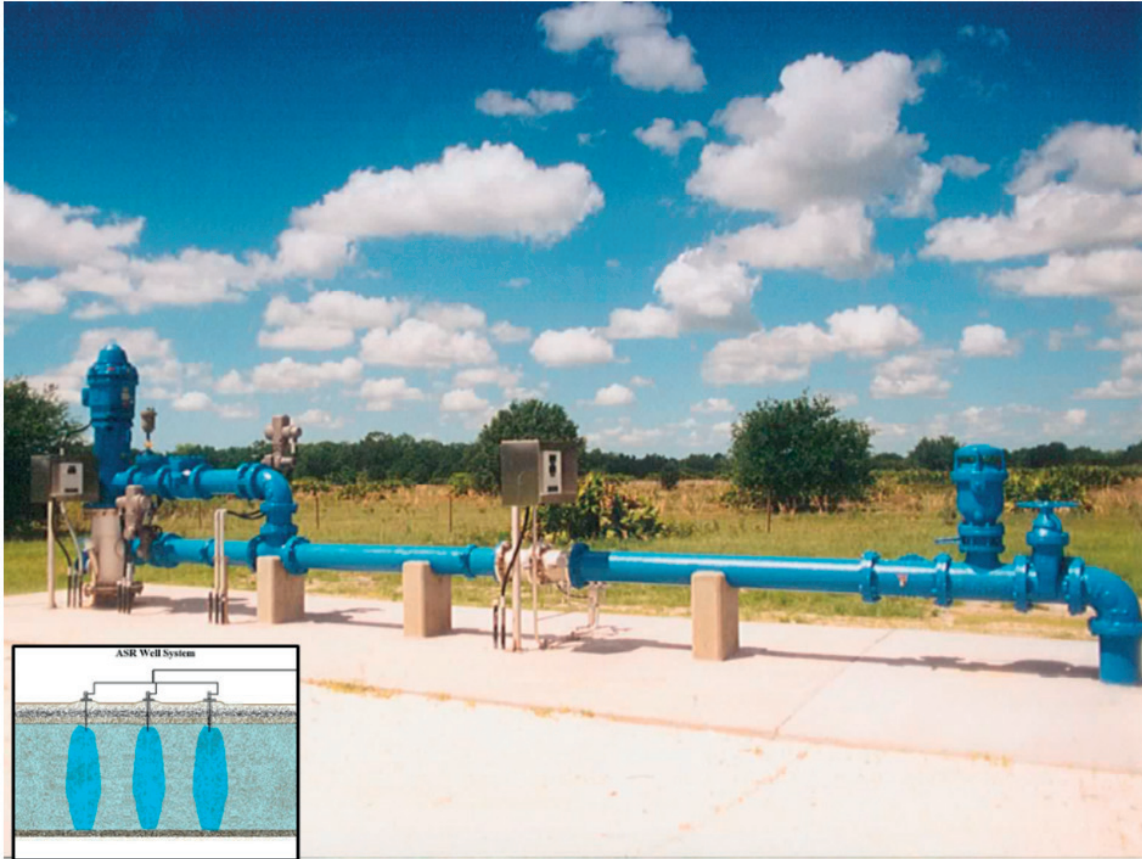


Figure Box 1. Aquifer Storage and Recovery (ASR) system example in Southwest Florida with a capacity of 30 million M3 consisting of 21 wells.

We are aware of within year utilization of ASR (injecting and recovering) implemented by water supply utilities around the world. This technology cannot be prescribed to all kinds of situations and in every locality. While we see potential for Addis Ababa to put in place this technology, it needs to be verified through careful studies including identifying suitable pockets of deep aquifers for storage, extent and potential water quality issues that need to be studied. Its technical viability needs to be checked.

Can Aquifer Storage and Recovery (ASR) system help Addis Ababa water issue? Yes. As much as about half to one-third of the current Addis Ababa above ground storage could potentially be stored underground for use in the drier season of the year, increasing the overall storage available for water.

1.4 Invest in water use efficiency improvement including the reduction of non-revenue water and encourage “Fit for Purpose” use

Given Addis Ababa’s highly seasonal rainfall, expansive area coverage, small decentralized ASR wellfield storage and their feasibility should be carefully studied. This will also save significant cost of transmission and delivery distribution systems that traverse in challenging topographical conditions.

Invest in water use efficiency improvement including the reduction of non-revenue water and encourage “fit for purpose” use

In the lexicon of water utilities, non-revenue water encompasses many factors beyond water leakage and wastage that most people think of. While it's important to recognize that non-revenue water can never be eliminated, global best practices offer effective methods to reduce it. For the case of Addis Ababa, it is essential to dispel the misconception that minimizing non-revenue water alone will (entirely) solve the city's water shortage problems. That is because there is a significant gap in supply and demand today, with only 40% of demand being delivered.

Unfortunately, the chronic water supply shortage has forced AAWSA to operate with frequent interruptions, leading to system pressure build-up that can result in pipe damage, further contributing to non-revenue water. Regardless of the reason for water use, whether it's for activities like parks, firefighting, flushing due to interruptions, or theft through illegal connections that jeopardize the system, all these fall under the category of non-revenue water use. The estimates for non-revenue water in Addis Ababa are alarmingly high, around 50%. Best practices in the water utility sector aim to reduce this figure to more manageable 10% to 20%. Various approaches, including inter-departmental water accounting and auditing methods, followed by pressure management tools, have proven successful in addressing this issue. Above all, addressing the major causes of pipe breaks, stemming from intermittent operations and poorly managed utility conflicts, such as uncoordinated major construction projects that damage transmission mains, must be a priority.

Embracing the concept of "fit-for-purpose" water usage, which involves using different water qualities for different purposes, is another valuable strategy. The approach allows the use of lower-quality water (e.g., from on-site recycling) for toilet flushing, gardening, car washing, and other

uses, reducing the demand for treated drinking water for all purposes. The same water that is treated to a drinking water standard does not need to be used for all purposes. Implementing organized campaigns and incentivized initiatives can help promote this approach, offering an excellent opportunity to engage the private sector and innovators in the water sector while effectively managing water use and demand.



2. Proper pricing, private sector involvement and affordable hydroelectricity key to improving operations in Addis Ababa water supply

The operations of Addis Ababa's Water supply are severely inefficient and as such operational costs are a huge challenge in financing repairs and replacements and bringing new infrastructures. First, the low revenues generated through water sales mean that AAWSA is unable to raise sufficient capital from customers. Second, despite the difficulties in raising sufficient finances for new infrastructures from development financing and global markets, current arrangements do not involve the local private sector beyond bottled water provision and illegal water sales via trucks. Third, the deep groundwater sources make up most of the Addis water resources and incur large costs in pumping; the pumping stations also use costly and dirty diesel generators in periods of power interruptions, which is often. To address the issue of financing, we outline how to address the issue of proper tariffs, private sector involvement and leveraging affordable hydropower from GERD and other projects.

2.1 Consider proper pricing for cost recovery, fairness and to encourage efficient water use

Addressing the huge water gap in Addis requires significant capital to be raised to maintain the efficient operation of existing infrastructures (i.e. repair and replacement) and to invest in new water supply infrastructures, including interbasin transfer. Although African initiatives are now underway to mobilize significant debt financing from the more favorable domestic capital markets, a large part of the investment will still likely need to come from concessional loans from the Bretton Woods Institutions or global private market investment, which come with stringent requirements on cost recovery for water utilities. While these options offer financial assistance, they can lead to increased pressure on governments and utilities to raise tariffs, potentially impacting vulnerable communities' access to affordable water services. Unfortunately, raising capital on the global capital markets is also excessively expensive for many African states and utilities, which are often deemed to have poor creditworthiness with only a few exceptions. National water and sewerage corporation (NWSC, Uganda) has had the highest ever long-term credit rating for water utilities in Africa (AA), which has allowed it to raise low-cost capital to fuel its rapid increase in service coverage of urban water supply over the last decade or more. This (AA credit rating and the rapid increases in piped water access) has been possible because NWSC achieved significant cost-recovery (all O&M costs and part of investment costs) and increased user financing through much higher tariffs (Ref-1¹, Ref-2²).

1. Joffe, M., Hoffman, R., & Brown, M. (2008). African water utilities regional comparative utility creditworthiness assessment report. Washington DC: Global Credit Rating Co. <https://thedocs.worldbank.org/en/doc/197501544810224462-0090022018/related/Session0100Cre0Water0Services0Board.pdf>

2. Banerjee, Sudeshna Ghosh and Foster, Vivien and Ying, Yvonne and Skilling, Heather and Wodon, Quentin T., Cost Recovery, Equity, and Efficiency in Water Tariffs: Evidence from African Utilities (July 1, 2010). World Bank Policy Research Working Paper No. 5384, Available at SSRN: <https://ssrn.com/abstract=1650475>

Table 1. Comparison of selected pricing Tariffs of AAWSA (Ethiopia) and NWSC (Uganda)

In Kampala, households typically pay around 1.15 USD /m³ and 0.29 USD/m³, respectively, for use through domestic on-premises piped access and a public standpipe, respectively. In Addis Ababa, the rates are much less (a factor of 10-20 less) but are planned to be increased by as much as 10 times in the next four years.

| Customer Category | AAWSA today (2023) Price in local currency (USD cents) per m ³ | AAWSA plan for 2027 | NWSC today (Kampala) |
|-------------------------|--|---------------------|----------------------|
| Public Standpipe (ባገ) | 2.4 (4.3) | 22.17 (39.9) | 1060 (29,68) |
| Domestic Customer | 2.4 - 14.7 (4.3 - 26,2) | 22.2 (40-280) | 4148 (114,8) |
| Non-Domestic Customer** | 2.4 - 14.7 (4.3 - 26,2) | 22-177 (40-320) | 4920 (137,76) |

AAWSA: Addis Ababa Water and Sewage Authority
NWSC: National Water & Sewerage Corporation

Chart by weASPIRE

As illustrated in the price comparison (Table 1), AAWSA's current tariffs for Addis Ababa are notably low in relation to cost recovery (roughly 20 times less than Kampala, where NWSC nearly achieves cost recovery). However, this doesn't translate to affordable water access in Addis Ababa. Many households' resort to alternative water sources (e.g., truck deliveries) to cope with inconsistent and unreliable supply. The existing structure actually results in significantly higher costs for Addis Ababa residents, particularly compared to those in Kampala who can purchase water more affordably. AAWSA's tariff stands at 7.25 Birr/1000 liters for up to 5,000 liters as of 2023. Residents pay close to 100 times more in street trading to get the same quantity to fill their storage tanks. Complaints have been received from customers across all economic segments, including "well-to-do" individuals who have reported spending up to 6000 Birr/month on water from parallel markets due to AAWSA's unreliable supply to their area. Considering an average monthly income for employees at approximately 5,106 Birr and a corresponding median income of 2,640 Birr in Addis Ababa, it's evident that few can afford such parallel market water prices. A significant quantity of bottled water is also being sold in the city to meet drinking water demands since stored water quality in households deteriorates and household treatment is not widely adopted in Addis. Moreover, the cost of truck-delivered water for businesses in the city is also increasing at an alarming rate. These factors contribute to the rising expenses and challenges associated with accessing clean and affordable water in the city. The existing supply shortage and intermittency therefore significantly affect households across the whole socio-economic spectrum, irrespective of their financial capacity, thereby hindering the city's development.

Although significant household expenditures are spent to access water in Addis Ababa, most of this expenditure doesn't come to AAWSA. By employing effective pricing strategies, AAWSA has the potential to generate substantial revenue to fund new infrastructures and effectively tackle the Repair and Replacement (R&R) fund shortfall, a pressing need for the agency to address intermittency of supply. Increasing cost recovery through this revenue could improve borrowing capacity for necessary infrastructure endeavors. Allocating funds to R&R initiatives can

Trucks excel at collecting and hauling waste in the absence of a sanitation drainage system; but they are not a good choice for distributing water! Inefficiency, sustainability concerns, impracticality (illegal profiteering from public water), and traffic jams call for a smarter solution.

enhance supply reliability, ultimately diminishing the reliance on parallel markets. Implementing usage-based pricing that considers the socio-economic circumstances of residents could even lead to very low costs for those in the lower income brackets. The intermittent AAWSA delivery, unfortunately, has tilted the benefit of relatively cheap water to the few who are able to store large quantities of water in their premises using storage tankers. Many utilities worldwide, including in developed countries, prioritize equitable pricing structures that cater to economically disadvantaged populations. However, a thorough examination and implementation of a robust tariff are essential. Balancing cost recovery with targeted subsidies for low-income households (e.g. through affordable community managed access points like public stands (bono) for the poorest) and strict regulation of private water trade, should be considered as policy. We also believe that participatory approaches that effectively communicate the need for cost recovery to the city's population and assess the willingness to pay by customers from all socio-economic backgrounds should be carried out.

2.2 Consider leveraging and bringing in the private sector into the mix

Water access is a human right and water is a social good. As such, most water utilities operate under the ownership of municipalities, regional administrations, interstate bodies, and similar entities, often aligned with non-profit objectives. In the US, about 90% of the urban water supply is under such arrangements. But this does not mean there is no place for the private sector to participate and play a significant role. A typical Design Build Operate (DBO) framework for getting infrastructures such as treatment plants constructed has been widely used by public institutions.

As an example, the prompt construction of a specialized treatment facility could be achieved through the involvement of the private sector. This can be facilitated through a public-private partnership (PPP) model, wherein a non-profit element can also be incorporated. Under this framework, the overall project can be managed by the government or a board comprising stakeholders from both the public and private sectors. Such an approach enables faster project execution while allowing water supply authorities like AAWSA to assess the timing and eventual transfer of completed projects back into their management. This collaboration can expedite the implementation of vital water infrastructure projects and improve overall efficiency in addressing the water supply challenges.

Regular cost-benefit assessments of such arrangements allow internal staff development and project viability evaluation. In addition, it gives the overall sector the ability to catch up to providing service to residents. This will also give the authorities enough time to make sure expensive projects have the required time to demonstrate their viability. This risk management approach is essential for addressing the chronic water supply issue with substantial private investment, ensuring a sustainable solution for Addis Ababa's water challenges.

Leverage Ethiopia's ability to produce significant energy production through GERD and other ongoing hydropower projects

Addis Ababa is located at the intersection of a major watershed and located at high altitude. It is one of the top three high altitude capital cities in the world with a dramatic topographical change, great for visualization but a formidable challenge for water supply utility. AAWSA service area covers an elevation that ranges from 2000 meter to 3000 meter in elevation above sea level considering source to delivery points, a whopping 1000 meters of topographical hydraulic difference! This is before accounting for system loss that major pumps have to accommodate to push water from one point to another.

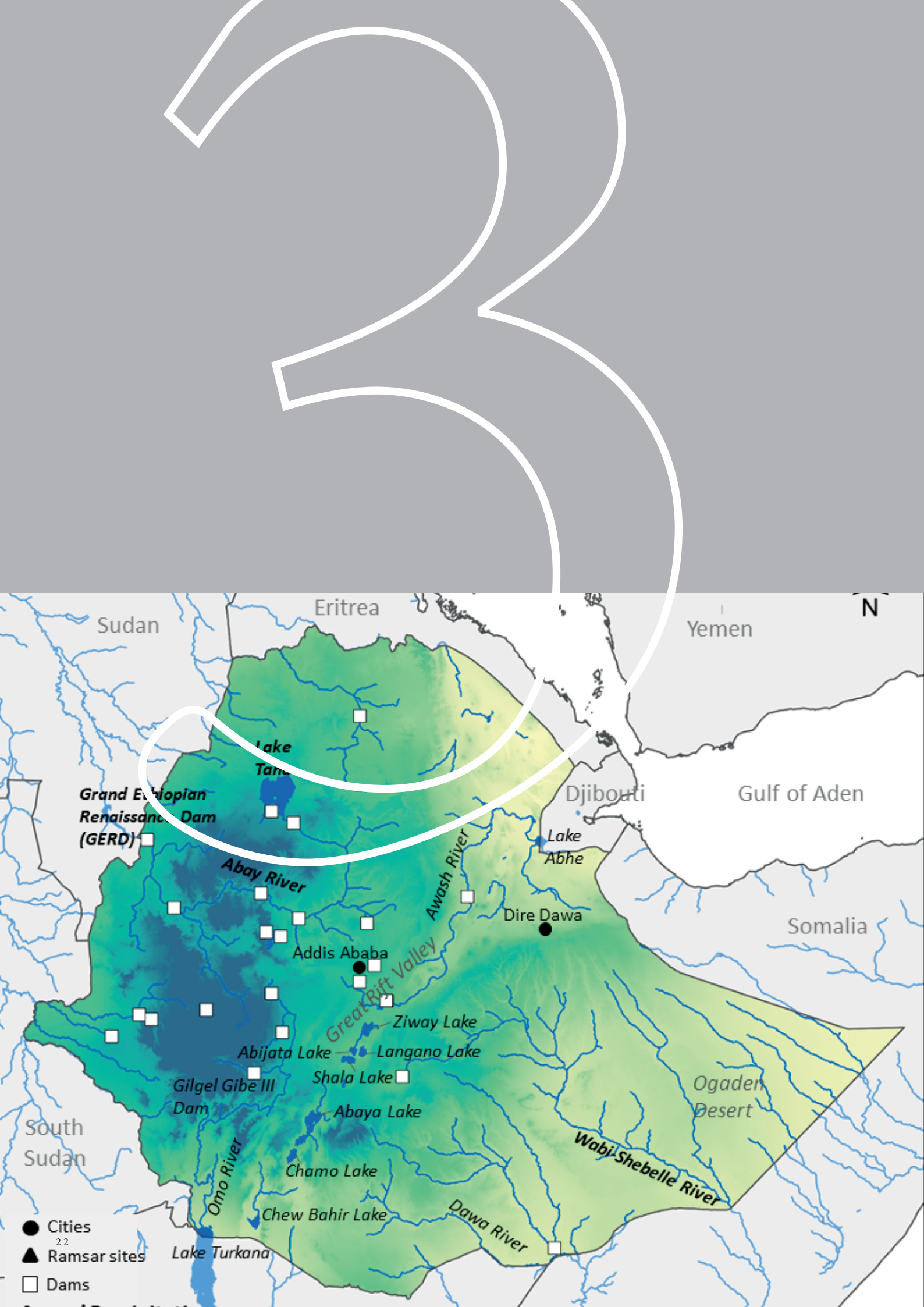
Only a handful of capital cities in the world encounter the need for multiple pressure zones to deliver water, as is the case with Addis Ababa, due to its unique topographical challenges within the AAWSA service area. For instance, AAWSA has established seven booster stations as part of the current operational setup to deliver water to some of the service areas - an outcome of incremental development in the city. The presence of these booster stations means that any power interruption at one of them poses a significant challenge to water delivery in that area. The complex topography of Addis Ababa necessitates careful planning and management to ensure a reliable and uninterrupted water supply to all parts of the city. For example, re-sectorisation of the supply-distribution network can be done to accommodate the current need to effectively schedule intermittent as well as optimal use of the pumping stations, among other objectives like leak reduction.

Operational expenses for utilities worldwide are largely influenced by chemical and electricity usage. In some regions, even in areas without challenging topography like Addis Ababa, the cost of electricity for moving large quantities of water through extensive transmission mains can outweigh the entire water treatment infrastructure and chemical expenses. Past projects that have examined the cost of supplying water to Addis Ababa through long transmission mains, supported by a series

of booster stations that need significant energy. Fortunately, Ethiopia's current state benefits from ample energy production, creating a more favorable situation for such projects. Reassessing these projects that were once deemed costly due to energy consumption is essential now, considering the improved energy conditions.

Moreover, numerous water interruptions in the City have been attributed to electric power shortage and interruptions. Addressing and optimizing the energy aspect of water supply infrastructure is crucial to ensure reliable and uninterrupted water delivery to the residents of Addis Ababa.

Recently, AAWSA revealed that they have been heavily relying on 100 high powered diesel generators to sustain their day-to-day water delivery operations. Although generators serve as backup plans during emergencies, using them regularly for an extended period is not cost-effective and has a high CO₂ footprint compared to hydro generated renewable electricity. Ethiopia's substantial hydropower capacity, together with a reliable electricity grid operation, can strategically address this issue by providing a more sustainable energy source for water utilities. Implementing energy-efficient measures and leveraging the abundant hydropower resources can lead to a more economically viable and environmentally friendly water supply operation for Addis Ababa. This approach will not only enhance the utility's resilience during emergencies but also optimize its regular day-to-day operations.



3. Build an institutional setup that addresses concerns for water use: Source to delivery

Addis Ababa Water and Sewage Authority (AAWSA) has managed to significantly expand services despite many capacity and financial limitations. Over the past several years we have worked with many professionals at AAWSA and other governmental institutions. Given our collective experiences, we want to give credit to the teams (at AAWSA) for managing the ongoing crisis in water management, despite the daily “firefighting” mode of operation. The different teams have taken on the task of managing an “interruption” based water supply system that was not designed to be operated as such. The Addis Ababa water system was not designed for intermittent operations and the result of intermittent operations is significant damage to infrastructure, including pipe breakage due to large pressure changes and potential water quality deterioration given this unusual operations. Addis Ababa’s population has outgrown AAWSA’s capability to supply. An intermittent electricity supply, utility conflicts such as the uncoordinated ongoing construction projects that end up breaking transmission mains are a few of the challenges that we frequently see and AAWSA reports. To the best of our understanding, there is no regulatory framework that forces and/or requires builders and construction companies to clear a potential “utility conflict” ahead of time, resulting in conditions that are costly for all parties in repair costs and customers without service.

Inconsistencies between the city’s growth plan and infrastructure development have created a daunting challenge for AAWSA, making it virtually impossible to manage the situation. The current water supply system has numerous vulnerabilities, and complaints from the residents about significant service degradation are growing daily. AAWSA’s capability to address these complex issues lags significantly, also influenced by various factors beyond the control and current mandate of AAWSA. Managing the responsibility of wholesale water development (i.e. developing reservoirs and groundwater resources) and retail services (i.e. delivery to customers throughout the city) adds further complexity to AAWSA’s demanding tasks.

The growing pressure from the city’s expansion, combined with the mounting service complaints, underscores the urgent need for comprehensive solutions. Collaboration among stakeholders and enhanced planning and coordination are essential to bridge the gap between the city’s growth and infrastructure development, ensuring a more reliable and efficient water supply system for the residents of Addis Ababa.

What is the solution then?

Consider separating wholesale vs. retail businesses. The institutional setup of separating wholesale water delivery from retail delivery, allowing both to complement each other, is the most widely successful approach that we know of in the water utility business. In such an arrangement, the wholesale business function typically deals with long-term demand forecasts, the development of several major supply projects that would oversee bulk water productions and delivery to major population centers, and across the board water efficiency and conservation projects implementations.

Considering the execution of major supply projects that Addis Ababa is about to embark on, this business function will be able to laser focus on the big picture, ultimately solving the chronic demand-supply issue the city is facing. These projects span multi-jurisdictions, necessitating a different approach than what a typical retail utility can provide.

Operations, R&R, and management of retail and wholesale delivery are quite different and such an arrangement will create an opportunity to leverage the strength of both business functions and take advantage of each of these business functions' strengths while distributing accountability to different entities. By adopting this model, Addis Ababa can optimize its water supply system, improving efficiency, and ensuring a more sustainable solution to its water challenges.

The significant growth of Addis Ababa over several decades, unlike many cities in developing countries, necessitates a new way of thinking and exploring innovative ways of delivering basic services with equity and accountability at its core. This allows a self-sustaining water supply agency that can react in a timely manner to water shortages. Several large regional water supplies in the US are set up as such: from the Metropolitan Water District of Southern California in the west coast, which supplies water to an estimated 20 million people for 26 municipalities including Los Angeles county, to Tampa Bay Water in the south east, which provides water to people over an expansive area similar to Addis Ababa with an estimated 2.6 million population. While we cannot recommend a specific “regional water authority set up” for Addis Ababa at this stage, we recommend that relevant authorities in Ethiopia (MOWE, the Addis Ababa government, AAWSA, and others) conduct a landscape assessment and inventory of best practices from around the world. By adapting a specific approach that is appropriate for Addis Ababa's unique circumstances, the city can establish an efficient and sustainable water supply system to meet its growing demands and ensure equitable and accountable service delivery over the coming decades.

Consider putting a comprehensive groundwater use regulation mechanism. Addressing the current uncoordinated groundwater usage in Addis Ababa will be essential to avoid prolonged hardships for the population and government. Without a clear overview of sustainable groundwater extraction and allocation, the risk of groundwater decline and depletion looms large. Currently, there is no proper monitoring of who extracts how much groundwater, leading to potential unsustainable exploitations and conflicts. In a previous article, we discussed how businesses have begun to promise potential investors in real estate, for example, “their own” uninterrupted water supply through local groundwater development. Despite AAWSA’s warnings about the illegality of such practices, parallel markets have emerged, where individuals develop “their own” groundwater beyond their needs and sell water to other parts of the city.

To tackle this issue effectively, prevent potential conflicts and ensure equitable water distribution, a robust regulatory framework must be established to govern groundwater use. Adequate monitoring and documentation of groundwater usage are imperative to safeguard Addis Ababa’s water resources and ensure the city’s long-term water security. The unaccounted and unregulated groundwater use in Addis Ababa poses significant risks for potential future litigations. As groundwater sources are exploited without clear documentation and oversight, conflicts may arise among various stakeholders over well drying and its impacts on communities and businesses. While leaving private businesses and individuals to develop groundwater by themselves may offer temporary relief, providing AAWSA with additional time to address the current chronic water shortage and search for a long-term solution, it also raises concerns. Such an approach undoubtedly exacerbates the gap in water access and equity among Addis residents. Those with better financial capabilities will have better access to private groundwater sources, further marginalizing vulnerable communities with limited resources. One solution could be to mandate the Water (Resources) Commission that we suggested above to also facilitate the task of creating an institution that would monitor and manage resources. This could also be from AAWSA, MOWE or other institutions. A proper regulation mechanism will enable proper monitoring and management of groundwater use while safeguarding the interests of all residents and promoting sustainable and equitable water resource management for the future. To manage resources, at a minimum, groundwater development license granting institutions need to have a comprehensive database of installed wells, their use and permits. In addition, such an institution is required to have reliable resource assessment capability (to determine the sustainable extraction level at a specific locality and identify existing permittees) and take into consideration whether the quantities the regulator approves are consistent with what the underground aquifer can support over the long term.

We are currently unaware of such a mechanism, and it should be implemented as soon as possible to prevent future challenges. To achieve this, investment in resource exploration and assessment, along with the establishment of a robust regulatory framework is necessary. Such a proactive approach will ensure responsible and sustainable water resource management, helping to avoid potential issues in the future.

The Urgency of Now: Recommendations

- The chronic water shortage problem in Addis Ababa demands a permanent Big and Bold Fix (BBF). Ethiopians are no strangers to ambitious solutions, as seen with projects like the GERD:
 - Given Addis Ababa's 29% GDP contribution, neglecting to address this issue will inevitably impede the city's exemplary progress and growth, which has been remarkable among sub-Saharan cities.
 - Embrace a comprehensive "all-of-the-above" strategy, incorporating inter-basin surface water transfer, conjunctive water use, efficiency improvement, and the implementation of innovative technologies and optimized decentralized solutions, to effectively address Addis Ababa's water challenges.
- Leverage Ethiopia's significant power generation capability, particularly with the completion of the Grand Ethiopian Renaissance Dam (GERD), which could provide the substantial amount of energy required to transport water from surrounding basins to Addis Ababa's higher location. The energy used to push water could also be recovered in Addis, thereby recouping some of the costs associated with water transportation.
- We cannot stress enough to the leaders of Addis Ababa, Oromia Region, and the Federal authorities that the current crisis of water shortages can only be solved through bold, collaborative, and committed engagement at the highest levels of government.
- We strongly recommend the creation of a task force dedicated to finding long-lasting solutions to address the water needs of the dynamic and growing city of Addis Ababa and its surrounding areas. The task force should begin by exploring the comprehensive solutions outlined above, encompassing both technical and institutional aspects.

This task force should be responsible for creating a Water Commission or a similar institution with the primary objective of facilitating major project executions, including those involving inter-basin water transfer, as well as ensuring equitable distribution across the entire service area of the water supply authority. By taking a holistic and collaborative approach, the task force can pave the way for sustainable water management, ensuring a reliable and accessible water supply for the city's continued development and prosperity.

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