Strengthening Water Security for Nutrition Resilience in Kenya's ASALs

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LESSONS AND INSIGHTS FROM NAWIRI

Water insecurity remains a primary and persistent driver of acute malnutrition in Kenya's Arid and Semi-Arid Lands (ASAL) counties. Nawiri's 2021 base line study revealed that only 6.8% of households in Samburu and Turkana had consistent access to safe drinking water, underscoring the structural nature of the crisis and its links to diseases and malnutrition. Global evidence highlights high rural water system failure rates, which, alongside recurrent droughts and floods, continues to strain the water infrastructure and governance systems. Nawiri's water interventions were designed to combine infrastructure investments, governance strengthening and social behavior change, intending to address the links between water, nutrition, livelihoods and inequalities between men, women, boys and girls, improving sustainable, holistic wellbeing.

Results demonstrate meaningful progress with over 290,296 people having gained sustainable access to safe water through 57 Multiple-Use Water Systems serving households and institutions. More than 1,529 households have adopted micro-irrigation practices to strengthen food production and dietary diversity. The program has also led to stronger water governance structures, including 81 Water Users Associations and 9 Water Resources Users Associations, which have improved maintenance, cost recovery, and accountability, while county co-investment and private sector partnerships have enhanced sustainability. By embedding climate-smart design, inclusive governance, and livelihood linkages, Nawiri's water interventions are contributing to improved nutrition, reduced disease burden, and more resilient pastoralist communities. However, to ensure these results are sustained, increased efforts on private sector water financing and service delivery is critical for long term reliable operations of strategic water systems.

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INTRODUCTION

Reliable access to safe water for multiple use including drinking water, food preparation, hygiene, livestock production, and small-scale agriculture is fundamental to household health, nutrition, and livelihoods. However, repeated climate shocks; including prolonged droughts and recurrent flooding, have weakened already fragile water infrastructure, undermining year-round service delivery. Water insecurity is directly linked to poor health, and with only 6.8% of households in Nawiri program areas having access to safe drinking water in 2021, it is unsurprising that malnutrition was widespread and health was poor.

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Globally, high failure rates of rural water systems continue to pose a significant development challenge, particularly in contexts facing climate stress and limited institutional capacity (World Bank, 2024). In northern Kenya, these challenges are compounded by the disproportionate burden placed on women and girls, who spend substantial time collecting water, limiting income generation, childcare, and participation in community decision-making. Recognizing that sustainable water security requires more than infrastructure alone, Nawiri has adopted an integrated, systems-oriented approach. By combining climate-smart investments, strengthened local governance, and social and behavior change strategies, the program aims to expand reliable access to safe water, reduce disease burden, improve nutrition outcomes, strengthen livelihoods, and alleviate gender-based time poverty. This learning brief highlights emerging findings and results from implementation in Samburu and Turkana counties.

THE CHALLENGE

Despite decades of investment in water infrastructure development, rural water systems in ASAL areas continue to experience frequent operational breakdowns that the communities and county governments do not have capacity to address due to inadequate financing, limited technical capacity, fragile maintenance systems, and weak spare-parts supply chains. Many systems either operate sub-optimally or become fully non-functional within a few years of commissioning, while climate shocks, floods that damage infrastructure, droughts that reduce borehole yields, and large irrigations sites without adequate soil and water conservation measures further strain fragile service systems (World Bank Group, 2024).

Research conducted during USAID Nawiri's inception phase (2019–2021) also identified low willingness and ability to pay for safe water, driven by household poverty, perceptions of water as a communal good, and reliance on "free" but unsafe sources such as seasonal sandy riverbeds (lagga). Limited awareness of contamination risks and common open defecation compounds these challenges. As a result, water insecurity remains closely linked to declining livestock productivity and persistently high Global Acute Malnutrition (GAM) rates—above 19% in both counties.

NAWIRI'S APPROACH

Nawiri's water systems intervention is anchored in two strategic pillars: improving access to safe water as a driver of nutrition resilience and livelihoods, and strengthening governance and climate adaptation to ensure long-term sustainability in ASAL contexts.

Photo: Mercy Corps, Kenya/2025

Water systems are implemented through the following components:

1. Integrated Multiple-Use Water Systems (MUS) Design

Nawiri constructed water infrastructure following a Multiple-Use Systems model that serves domestic, livestock, irrigation, and institutional needs within a single scheme. Designs are based on hydrogeological assessments, safe yield analysis, and demand forecasting, with abstraction capped at 70–75% of borehole capacity. Infrastructure typically included source improvements (boreholes, shallow wells, dams, river intakes, springs), elevated storage, distribution networks, human and livestock access points, and connection to agri-nutrition farms for fresh vegetable production. Solar-powered pumping and gravity-fed systems were prioritized to reduce costs and environmental impact.

Environmental safeguarding was fundamental to the design of Nawiri's water systems designs. All infrastructure upgrades integrated rigorous climate-risk screening, groundwater abstraction controls, and comprehensive environmental mitigation measures to prevent overextraction, ensure infrastructural integrity, and mitigate risks of contamination or ecosystem degradation. By embedding these safeguards at the inception phase, the program ensured that expanded water access did not compromise long-term resource sustainability.

2. Climate-Resilient Engineering and Monitoring

Nawiri water system placement and design began through a participatory, community led process. Climate risk screening was conducted across all sites to ensure that inherent climate shocks, such as floods, informed designs. The program considered appropriate siting, reinforced and elevated components where necessary, solar optimization, recharge zone protection, and soil and water conservation measures—such as berms, fencing, and controlled livestock access— to enhance environmental integrity and long-term system sustainability.

All Nawiri water systems then integrated the appropriate form of climate proofing to strengthen resilience to drought, flooding, wind and temperature extremes. For example, solar pumping, borehole monitoring sensors, and prepaid metering were included to enhance efficiency, accountability, and preventive maintenance. Where water systems were located close to seasonal rivers, alternative community management practices were utilised to ensure protection of the infrastructure. For example, communities constructed gabions or established farms, in order to reduce the velocity of water and reduce soil erosion.

The program collaborated closely with the National Drought Management Authority and the Kenya Meteorological Department to support integration of early warning and seasonal forecast information into local water management structures.

3. Water Quality and Public Health Integration

Nawiri water site selection commenced with water quality testing to determine whether the borehole water met the country and donor regulations and was fit for human consumption. The infrastructure design then incorporated specific measures to improve water quality.

All Nawiri water systems included in-line chlorination at water collection points providing residual disinfection, reducing bacterial contamination risks during transport and storage. In-line chlorination was intended to reduce the burden of household water treatment on women, ensuring that more time was available for caregiving and other responsibilities. However, the program's Faecal Oral study identified that the most frequent contamination point was at the point of use by animal and human faeces in the household. To address this, Nawiri introduced water, sanitation, and hygiene (WASH) behavior change efforts to improve child health and nutrition outcomes. Community health promoters were trained to conduct household level dialogues and distribute water treatment tablets to the communities with the highest incidences of diarrhoea.

To ensure these improvements were sustained, the program trained Water User Associations (WUA) on how to manage chlorination and provided them with water testing kits for ongoing water quality assessments. Nawiri developed its own quality standards, based on reasonable expectations within these contexts, and is currently supporting the County Governments to align with these standards, in collaboration with other local partners.

4. Governance systems and pro-poor revenue generation

In line with the 2016 Water Act, Water User Associations (WUAs) and Water Resource User Associations (WRUAs) are critical community-based structures for day-to-day operations of water systems and their sustainability. Nawiri identified, established and trained 81 WUAs and 7 Water Resource User Associations (WRUAs) in fundamental practices required to improve the governance, operation and maintenance, and revenue generation of the water systems. A large part of this was supporting on equitable membership practices, conflict resolution and accurate record keeping. In addition, the program trained WRUAs on developing sub-catchment management plans to better manage water resources, protect catchments, ensure soil and water conservation and groundwater recharge.

Photo: Mercy Corps, Kenya/2025

Nawiri supported the WUAs to facilitate community led decision making processes on how to generate revenue from the water system, which would be essential to reinvest for maintenance and upgrades. A number of different types of payment models were established, depending on the community's unique needs. However, across all systems,

WUAs and community groups collectively identified ultra poor families who could not afford to pay for water. These families were given free access to a specific quantity of water per day, reinforcing the message that water is a human right and shoud be accessible to all.

Photo: Mercy Corps, Kenya/2025

In more urban communities, automated pre-paid water meters with pro-poor tariffs were introduced, particularly in Samburu where the program partnered with Maji Milele (a social enterprise offering prepaid water metering solutions across East Africa) to introduce prepaid automatic water vending machines at community kiosks. However, in more rural villages, the approach differed greatly. In some cases, households contributed a standard amount (usually around KES 100) per month, irrespective of the quantity of water used. In more pastoralist, last mile villages, such as Long'olemwa in Turkana North, the monetary contribution was substituted by one goat per year. These goats are kept by members of the WUA and monetized when required. The program made efforts to centralize revenue collection and establish shared bank accounts with signatories requiring multiple Association members, in an attempt to increase transparency and improve buy in from the community.

5. Maintenance Supply Chain

Operation and Maintenance is key to sustaining improved and rehabilitated water systems. In the ASALs, historic challenges with limited availability of parts, lack of skilled tradespeople and scarce financing or insurance mechanisms led to many improved water systems degrading or rendered unusable after a few years of establishment.

To address this, the program worked with the WUAs to identify varied solutions. For basic repairs, the program trained members of the WUA on how to identify and repair common and simple issues such as replacement and fixing broken taps, basic wiring, and maintenance of solar systems and water kiosks. For more technical operational repairs, the program linked the WUAs with local graduates of Technical and Vocational Education Institutions (TVETs). The program supported 2,371 young people in Samburu and Turkana to study alternative employment pathways, many of whom were trained as local plumbers, masonry and electricians.

In Turkana County, where the Dioceses of Lodwar developed water system insurance systems, Nawiri linked 18 WUAs with water insurance brokers. The WUAs pay $78 per solarized borehole and $49 per hand pump annually, and the Diocese will then be available to conduct immediate repairs in case of any breakdown. Whilst this model has proven to be effective and reduces reliance on county governments and non-qualified technicians, it is limited in geography and only available for simple electro-mechanical and plumbing works.

The program also worked closely with the County Departments of Water in Samburu and Turkana to carry out routine water systems maintenance and address major repairs required, such as replacement of submersible pumps, solar panels, invertors, changeover switches and replacement of and fixing of borehole pipes. By ensuring this practice was carried out regularly, challenges were detected early and resolved swiftly. After project close-out, the governments in both counties have taken ownership of these water systems and the maintenance required.

EMERGING EVIDENCE OF SUSTAINED RESULTS

Increased access to water for domestic use

Nawiri has constructed 110 kms of pipeline, 51 tanks, 1.2 kilometers of irrigation canal lining, and 34 livestock watering points as part of 57 Multi-Use Water Systems in Samburu and Turkana. By the end of FY 2025, 290,296 individuals benefited from improved water services. [1] This was first measured at 6.8% at baseline in 2021, rising by over double to 14% in Year 4.

Increased access to water for productive use

Nawiri helped 1,528 participants adopt improved agricultural and water management practices, with a 300% increase in uptake reported in FY25. Approximately 768 Acres were placed under irrigation, reinforcing resilience to drought. Improved water reliability catalyzed diversification into irrigated crop production and strengthened livestock productivity. Nawiri's provision of storage and irrigation infrastructure enabled a shift from rain-fed to year-round crop production in a number of villages. Communities previously dependent on seasonal rainfall began cultivating vegetables consistently, supporting household food supply and income generation. This stability is reflected in the Recurrent Monitoring System (RMS) Wave 1 findings (Oct 2025), which show that households receiving high-intensity program interventions—including water infrastructure improvements—had four times higher odds of engaging in crop production compared to those in low-intensity areas (36.1% vs. 11.8%). In targeted agropastoral zones, 63.4% of households are now actively involved in crop cultivation. One farmer in Long'olemwar, Turkana, observed that *"This time around, our water system will not be washed away by floods. I feel safe and encouraged to engage in farming since I am sure of year-round water availability, and my efforts will not be washed away by floods—unlike before, where such was the order of the day."* This demonstrates the clear link between improved water infrastructure and food security, providing the stability of resources required for increased agricultural investment in those drought-prone geographies.

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Improved health and nutrition

The Nawiri program is a multisectoral programme encompassing support to health systems, markets, food security and other sectors, in addition to the water interventions. Therefore, many of the results cannot solely be attributed to the water interventions alone, however are due to the combination of the different layered interventions.

Nutrition trends in intervention areas are encouraging. In Samburu, Global Acute Malnutrition (GAM) declined from 21.8% in 2022 to 17.1% in 2024, while in Turkana, GAM rates declined by 13 percentage points from 34.8% in 2022 to 21.8% in 2024. This downwards trend is even more pronounced when considering locations that had extreme rates of child malnutrition and where the program focused intensive efforts. For example, Kaaleng ward in Turkana county, where population level child malnutrition was recorded at 68% in 2021, decreasing to 31% in 2025 after three years of Nawiri interventions.

These nutritional gains are underpinned by significant shifts in public health behaviors at the household level. From the program's baseline to 2025, the percentage of households adopting proper water treatment technologies surged from 9% to 57%, while access to basic sanitation services grew from 4% to 35%. Furthermore, households observed with soap and water at handwashing stations

1 defined as accessing 20 litres of safe water per day located within a 30 min walk of the household

increased from just 4% at baseline to 35%. This improved hygiene environment directly influenced disease burdens, with diarrheal disease occurrences among children under five dropping to 20.6% in 2024 from 25.5% the prior year. Additionally, care-seeking behaviors have vastly improved, with 97% of all community-level referrals for childhood illnesses and malnutrition now successfully linked to clinical treatment. These findings demonstrate that while provision of safe water is fundamental, investments must be made in hygiene behaviours and education to catalyse health improvements.

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This data is complemented by qualitative observations from community members. In Elelea village, in Turkana, one mother described the clear health improvements resulting from increased water access. She said, *"Our children used to fall sick frequently due to using water from the irrigation canals. We were trained on hygiene and sanitation practices during household visioning and action planning trainings on the dangers of drinking water from the canals. Nawiri has also solarized additional borehole and installed pipeline; bringing water closer to our houses. The diarrhea cases have since gone down."*

Environmental benefits

The environmental analyses worked into the design of Nawiri have led to measurable improvements in soil and water conservation, with 290,930 hectares of land now under improved management practices and 78,300 hectares of degraded land suceesfuly reclaimed for productive use. The transition to solar pumping, including the rehabilitation of systems at sites like Lorian, Mugur, Morijoi, and Lowamara, has significantly reduced reliance on diesel generators, lowering both emissions and operational costs. Furthermore, rigorous infrastructure climate-proofing, such as raised platforms, reinforced headwalls on the boreholes, overhead bridges of pipeline bridges to avoid washouts across lagga bed, flood diversions, and embankment stabilization, has reduced repeated system failure caused by flash floods. To protect fragile groundwater resources, the program enforced regulated abstraction, installing submersible pumps calibrated

Photo: Mercy Corps, Kenya/2025

to extract at only 70% of tested water yields to ensure long-term aquifer sustainability. This physical infrastructure is backed by improved local governance, including the finalization of five decade-long Sub-Catchment Management Plans (SCMPs) in Samburu County, which together reduce pressure on local ecosystems and support long-term water security

Photo: Mercy Corps, Kenya/2025

Water governance

Nawiri supported the promulgation of the Water Act in both Samburu and Turkana. This ensures stronger water governance by establishing urban and rural water companies who can support professionalisation and management of existing water utilities. The bill also introduced water systems insurance and provisioned for sustainable operations and maintenance practices, as well as enshrined the rights and responsibilities of the WUAs and WRUAs into law. Nawiri's additional capacity development support to the WUAs has led to empowered local water governance, with the Associations being able to make decisions that are responsive to their own communities. In a milestone example from Turkana, one WUA successfully handed over management of its water system to a Rural Water Company (RWC), with all members of the WUA seamlessly absorbed into the RWC workforce. This transition demonstrates how targeted capacity-building, combined with supportive investment, can transform local management structures into sustainable, professionalized water service delivery systems while ensuring communities remain actively engaged in the stewardship of their resources.

Photo: Mercy Corps, Kenya/2025

Increased water revenue

Improved water governance practices and investment into increased transparency and participatory tariff setting with the community has increased water revenue collected by WUAs through tariffs. By adopting tariff payment mechanisms (e.g. in kind, cash) and setting the quantity and frequency of payments with the community, this has increased adherence to these payments. However, willingness to pay for water services still remains low: only 18% in 2025. Even though community members are currently paying, they remain reluctant to do so. Many express the expectation that payment for water provision is the responsibility of the County Governments.

Automated revenue collection in particular, such as through the prepaid vending machines in partnership with Maji Milele, has increased the revenue and

allowed greater investment back into the system for regular operation and maintenance. In prepaid kiosks, revenue collection has increased from 60% to 100%, while non-revenue water has dropped from 25% to just 5%. This can partly be accredited to the automated payment system being easy to use (and only accepting payment from cards that have credit), and how it strengthened accountability around water tariffs and payment for water. However, there was also initial skepticism from community members, questioning the new technology and cashless payments. To address this, the program invested significant efforts in behaviour change interventions, working with the local administration and the WUAs and WRUAs to build community trust in the automated system. This involved explaining the importance of paying for water and proactively sharing the tariff reinvestment strategy.

LESSONS LEARNED AND RECOMMENDATIONS

Revenue Generation

Whilst the Nawiri program made significant headway towards increasing revenue generation and willingness to pay in communities that historically have never paid for water, more efforts are needed to ensure a sustainable tariff system. The current tariff system allows community members to contribute an amount they can afford in order to install the practice of regular payments for water services. However, it is unknown if the overall revenue generated using this payment method covers the standard operating costs of the systems or if the funds insufficient to maintain and improve the functioning of the system. Future programming in these areas, or efforts by the newly established water companies, must consider tariff setting based on operational costs and in regards to criteria such as quantity used and income level of the community member or user profile (e.g. discounts for disabled, widows etc) to ensure that the revenue is sufficient to maintain and improve the systems.

Furthermore, increased economic and livelihood investments by county governments or development actors in these communities will increase the available resources that households have and, from Nawiri's experience, increase the willingness to pay for water.

Photo: Mercy Corps, Kenya/2025

Private sector investment and professional service delivery

The work Nawiri has done with the local community based WUAs and WRUAs has been very effective to improve water service delivery at scale in these last mile villages and make progress in restoring community member trust in water system management, however, increased private sector investment is required for fuller sustainability. The establishment of rural and urban water companies in both counties has been a strong start; now county and national governments

must increase efforts to incentivise more risk-informed, economically viable water business investments, particularly to encourage expansion of the network, coverage, and cost recovery of water payments. However, despite privatization, the role of community based organizations should not be undermined. Local, transparent decision makers, who are responsible for the community feedback loop and provide a trusted face to community members will remain an important asset, particularly with efforts to increase willingness to pay.

Water system value chain

Enhancing locally available supplies and skilled tradespeople is essential for ensuring sustained operation and maintenance, infrastructure functionality and ultimately, water provision. County Governments and development actors should make efforts to increase investment in suppliers of quality materials, strengthening local value chains, and training programs for tradespeople, increasing timely repairs and supporting local economies. This will lead to greater system functionality, more trust in the water service delivery operators, and ultimately increase the likelihood of payment for water.

Weather resilient infrastructure and environmental protection

Climate-smart water infrastructure–designed to withstand droughts, floods, and other recurrent shocks–plays an essential role in ensuring water security and the continuation of water supply. These design elements ensure infrastructure can be properly maintained and investments are protected from climate shocks. This must be combined with real time monitoring including both modern and traditional systems of forecasting, protecting rural populations from the adverse effects of water shortages and sustaining acccess to water during crisis.

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Nawiri is an eight-year (2019 – 2027) US State Department funded Resilience Food Security Activity (RFSA) implemented by a Mercy Corps-led consortium of international, national, and local implementing partners. The goal of Nawiri is to sustainably reduce persistent acute malnutrition (PAM) in Kenya's arid and semi-arid lands (ASALs), specifically across Turkana and Samburu counties. Nawiri aims to reach 598,475 participants with a set of sequenced, layered and integrated (SLI) interventions, and reduce PAM to 12% by 2027.

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