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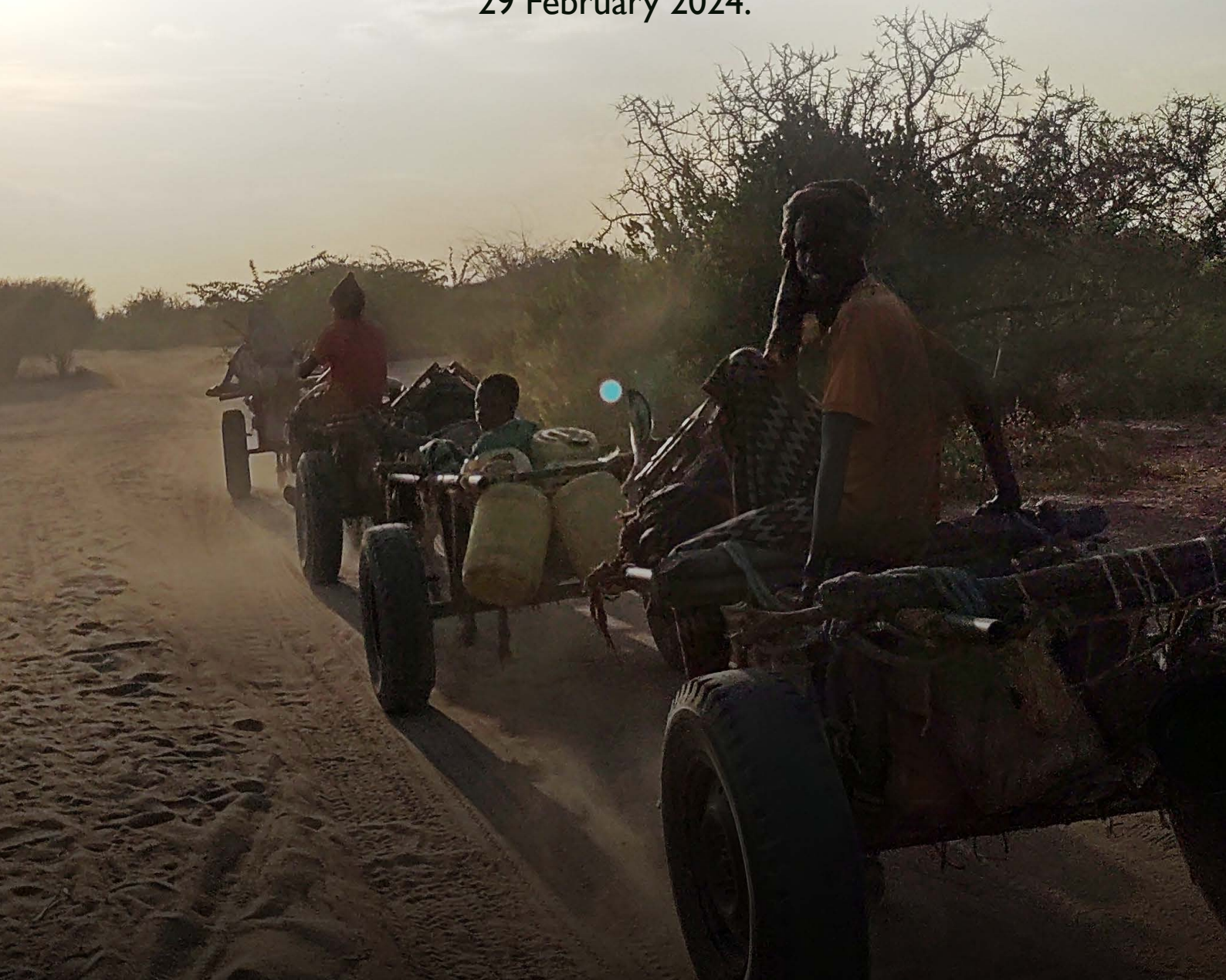


MILLENNIUM WATER
ALLIANCE



**DROUGHT RESILIENCE IMPACT PLATFORM:
FIXING UPTIME NOW AND DECISION IMPROVEMENT
(DRIP-FUNDI) BASELINE REPORT.**

29 February 2024.





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EXECUTIVE SUMMARY

One of the core challenges facing rural water supply in many parts of sub-Saharan Africa is the issue of extended downtimes following system breakdowns. Delayed response to broken boreholes often stems from unstructured or non-existent response systems, inadequate and unskilled human resources, and inadequate finances to resolve repairs. The issue is amplified in the Arid and Semi-Arid Lands (ASALs) of Northern Kenya where the twin challenges of insecurity and recurrent floods and droughts make it even more challenging to ensure rapid borehole repair and reliable water supply for communities. In cognizance of this, the Millennium Water Alliance (MWA) and Virridy LLC have been attempting to deploy solutions to improve borehole repair response across five ASAL counties in Northern Kenya since 2016. One key measure both organizations took was to install borehole functionality sensors across more than 400 borehole systems in the five counties with the aim of providing real-time alerts to county water managers. It was expected that the rapid detection of breakdowns would facilitate timely repair of systems. However, challenges around financing hampered timely borehole repair.

The Drought Resilience Impact Platform- Fixing Uptime Now and Decision Improvement (DRIP-FUNDI) program is an enhanced iteration of the work described above by MWA and Virridy. The program seeks to not only ensure the rapid detection of breakdowns but also to provide an avenue for sustainably financing borehole repairs. DRIP-FUNDI is a USD two million program supported through United States Agency for International Development's (USAID's) Bureau for Humanitarian Assistance (BHA). The primary goal of DRIP-FUNDI is to provide sustainable access to water for domestic uses for One Hundred and Twenty Thousand (120,000) people in five Arid and Semi-Arid (ASAL) counties in Kenya, specifically Garissa, Isiolo, Turkana, Wajir and Marsabit. The program strives to increase the operational uptime of the boreholes - defined as the percentage of days when a borehole is operational within a year - to an average of 90% annually.

This document describes the DRIP FUNDI baseline assessment that was conducted to determine key metrics for the program and to shortlist the boreholes where DRIP FUNDI will be implemented. The baseline assessment was conducted between November 2023 and February 2024. A three-phase methodological approach was adopted while carrying out the assessment involving an inception and preparation phase, a fieldwork phase, and a synthesis and data analysis phase. Core activities carried out during the inception phase included reviewing relevant literature, long-listing boreholes to be visited in the field, preparing and coding data collection tools and planning field logistics. During the field work phase, the data collection tools were administered to relevant stakeholders to gather data that would inform the baseline metrics and help refine program implementation. Data was gathered using various tools including Key Informant Interview and Focus Group Discussion Guides, Observation Checklists and Household Questionnaires. The collected data was synthesized and analyzed, and outputs summarized in this baseline report.

A total of 264 boreholes were visited during the baseline assessment. However, only data for 259 of the systems was analyzed because five of the boreholes were diesel powered. Data for 454 households was also assessed to triangulate information received from the borehole water operators. In terms of water quality testing, 240 tests were conducted at the boreholes while 228 water quality tests were administered at household level. Notable findings from the assessment center around the borehole uptime, water quality findings and the water treatment metrics.

Borehole uptime for the 259 boreholes was 84.4% meaning that the systems are operational for ten out of 12 months of the year. This was a significantly high uptime given that sources of literature initially placed uptime in the region at 77%. The high uptime was attributed to the type of boreholes selected for the assessment which were largely functional systems.

The assessment also revealed the widespread prevalence of microbiological contamination across both households and boreholes. The water quality test results for boreholes revealed that 50.4% or 121 out of 240 boreholes tested positive for E-coli. The figure was much higher for households where 74.56% or 170 out of 228 boreholes tested positive for E-coli. The household microbiological contamination was expected and is indicative of the need for improved water handling and storage at the household level. The high borehole contamination figures were unforeseen and pointed to potential contamination at the water storage unit and possible cross-contamination from animal feces at water points. In terms of water treatment, only 13% of households reported treating their water. This corroborates with anecdotal evidence that households in the region rarely treat their water. The baseline determined that the pre-dominant mode of water treatment is through chlorination or use of Aqua tabs. This contextual information and other data points were used to fill out baseline metrics which are summarized in the table below.



Borehole pump house in Garissa County with borehole operator.



Borehole and pump house with key informant interview in Garissa County.

Summarised indicator tracking table.

Indicator	Result Measured by Indicator	Baseline		Target	
		Date	Value	Date	Value
Number of individuals directly utilizing improved water services provided with BHA funding	<i>Utilization of the improved water services</i>	02/2024	0	03/2025	120,000
Percent of target boreholes reporting 90% uptime	<i>Uptime improvement of the boreholes,</i>	02/2024	0	03/2025	100%
Number of reported breakdowns that are responded to as a result of available borehole technical data	<i>Responsiveness to breakdowns of the boreholes</i>	02/2024	0	03/2025	TBD
Number of borehole assets inventory/ repository developed at the county level by BRRTs and Private Sector	<i>Availability of the crucial info on the boreholes</i>	02/2024	0	03/2025	I
Number of spare parts data repository developed and updated by BRRT and Private sector	<i>Availability of the fast-moving list of spare parts</i>	02/2024	0	03/2025	I
Number of boreholes repaired within 4 days of breakdown	<i>Timeliness of the repairs</i>	02/2024	0	03/2025	200
Number of people using climate information or implementing risk-reducing actions to improve resilience to climate change as supported by USG assistance (RiA)	<i>Utilization of climate information to combat climate risks</i>	02/2024	0	03/2025	TBD
Number of reported breakdowns that are responded to in a timely manner by the BRRT and Private Sector	<i>Responsiveness of the repairs team</i>	02/2024	0	03/2025	TBD
Percentage of persons reporting increased usage of remote borehole functionality monitoring approaches as a result of DRIP FUNDI	<i>Improved borehole functionality</i>	02/2024	0	03/2025	60%
Number of participants trained in the application of the proposed monitoring approaches reporting increased knowledge	<i>Increased knowledge of the participants</i>	02/2024	0	03/2025	100
Percent of water points developed, repaired, or rehabilitated with 0 fecal coliforms per 100 ml sample	<i>Improved water quality</i>	02/2024	0	03/2025	100%
Percent of water points developed, repaired, or rehabilitated with free residual chlorine (FRC) \geq 0.2 mg/L	<i>Improved water quality</i>	02/2024	0	03/2025	100%
Amount of carbon finance mobilized to support operations and maintenance	<i>Resources mobilization</i>	02/2024	0	03/2025	TBD
Amount of carbon credits generated from the target boreholes	<i>Resources mobilization</i>	02/2024	0	03/2025	TBD

The baseline was also used to shortlist 200 boreholes across the five counties based on certain criteria including the number of people living within a 1km radius around the borehole, the power source of the borehole, the borehole uptime, and the presence of microbial contamination. The spread of boreholes per county is captured in the table below.

Spread of boreholes per county

Counties	Selected Boreholes
Garissa	32
Isiolo	41
Marsabit	39
Turkana	48
Wajir	40
Total	200

Over and above indicator tracking and borehole shortlisting, findings from the baseline will be used to refine program implementation. In this regard, some of the key recommendations for enhanced program implementation are outlined below.

- i) Promote water treatment practices by providing accessible and affordable water treatment options and conducting awareness campaigns to educate households on the importance of water treatment to mitigate the risk of waterborne diseases and infections.
- ii) Enhance borehole operation and maintenance efforts by implementing regular maintenance schedules, involving private sector partners, building the capacity of Borehole Rapid Response Teams (BRRTs), and ensuring adequate resources to improve borehole uptime.
- iii) Reduce the distance to alternative water sources by establishing more communal water points which will help discourage reliance on potentially contaminated surface water.
- iv) Develop mechanisms to integrate climate information into water management strategies across all Counties which includes creating decision-support tools.
- v) Conduct test pumping for all the boreholes under the DRIP FUNDI program to improve on the accuracy of the borehole asset inventory.
- vi) Telemetric measurement of borehole non-functionality needs to be upscaled to diagnose the causes of borehole breakdown to reduce the turn-around time for repairs.

I. INTRODUCTION

I.1 Background

Frequent borehole breakdown continues to contribute significantly to the severity of drought emergencies in Kenya's Arid and Semi-Arid Lands (ASALs). Over the past decade, the government and donors have spent millions of dollars in installing thousands of groundwater pumping stations or boreholes, with the hope of mitigating drought emergencies. Unfortunately, these investments have not yielded the desired improvement in the situation. This is largely because the boreholes often break down during the periods of greatest need.^{1 2} Recent efforts have focused on enhancing the monitoring of boreholes to improve their functionality. However, evidence suggests that, despite more accurate and timely diagnostics of water point breakdowns, local communities and regional governments still face challenges in effectively managing the operations, maintenance, and service delivery in these regions.^{3 4}

To tackle the issue of insufficient data on borehole functionality, The Millennium Water Alliance (MWA), in partnership with county governments and the National Drought Management Authority (NDMA), identified over 200 boreholes across five ASAL counties in Northern Kenya - Turkana, Marsabit, Isiolo, Garissa, and Wajir - that were fitted with sensors. This initiative aimed to enhance monitoring capabilities and facilitate timely decision-making during breakdowns. These installations, carried out between 2017 and 2022 were part of the Kenya Resilient Arid Lands Partnership for Integrated Development (RAPID) program, funded by the United States Agency for International Development (USAID) and the Swiss Agency for Development and Cooperation (SDC). SweetSense Inc., now operating as Virridy, was responsible for installing the sensors, which are currently maintained by MWA and its partners under the Kenya Resilient Arid Lands Partnership for Integrated Development (RAPID+) program. The sensors systematically gather and transmit data daily via satellite, detailing each borehole's functionality and pumping hours. The data is displayed on a dashboard, providing the county Borehole Rapid Response Teams (BRRTs) with immediate access to the vital information.

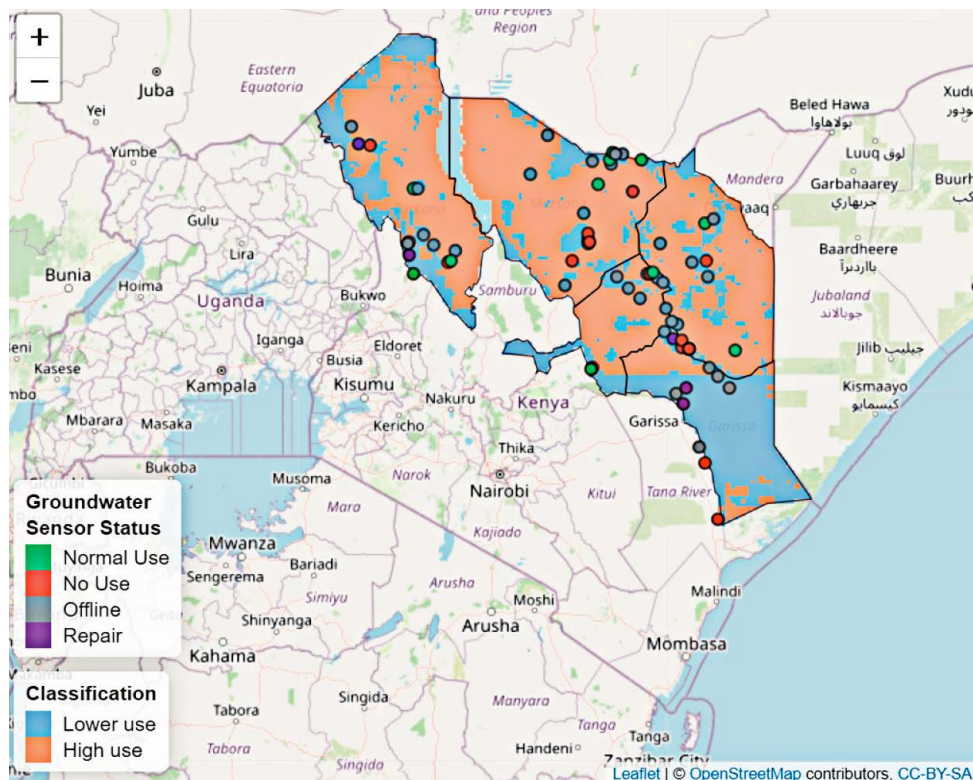


Figure 1: Map of Installed Sensor Status in 2023: Source Virridy - DRIP)

Millennium Water Alliance (MWA) has been actively advocating for the BRRT to leverage data received from the borehole functionality sensors to initiate repairs. Despite these efforts, the BRRTs have struggled to use the sensor data effectively to complete the decision loop and ensure timely repair of non-functional boreholes.

¹ Foster, T., Willetts, J., Lane, M., Thomson, P., Katuva, J., & Hope, R. (2018). Risk factors associated with rural water supply failure: A 30-year retrospective study of handpumps on the south coast of Kenya. *Science of The Total Environment*, 626, 156-164. <https://doi.org/10.1016/j.scitotenv.2017.12.302>

² Nagel, C., Beach, J., Iribagiza, C., Thomas, E.A., 2015. Evaluating Cellular Instrumentation on Rural Handpumps to Improve Service Delivery-A Longitudinal Study in Rural Rwanda. *Environ. Sci. Technol.* 49, 14292–14300. <https://doi.org/10.1021/acs.est.5b04077>

³ Butterworth, J.; Warner, J.; Moriarty, P.; Smits, S. and Batchelor, C. 2010. Finding practical approaches to Integrated Water Resources Management. *Water Alternatives* 3(1): 68-81

⁴ Moriarty, P.; Smits, S.; Butterworth, J. and Franceys, R. 2013. Trends in rural water supply: Towards a service delivery approach. *Water Alternatives* 6(3): 329-349

A primary obstacle to action on the data is the delayed disbursement of funds from the national government to the counties during the first quarter of the fiscal year, spanning July - September. This delay leads to significant setbacks in addressing borehole malfunctions during the critical drought season, which typically extends from August to October. Moreover, the counties encounter difficulties in prioritizing and allocating the disbursed funds for borehole repairs, as they juggle competing priorities, including the urgent need for food aid during drought periods. The recurrent issue of unpaid bills being carried over from one financial year to the next consumes a substantial portion of the budgets allocated for such essential services. Furthermore, the creation of supplementary budgets to adjust budgetary allocations mid-year fails to resolve the fundamental problem of underfunding.

An impact evaluation funded by USAID on the utilization of sensors for borehole monitoring within the Kenya RAPID program highlighted a critical shortfall: the absence of dedicated funds specifically for borehole repairs as a key barrier to improved functionality. Furthermore, local water managers indicated they lacked essential borehole spare parts for boreholes. The report underscored the necessity for establishing dedicated and sustainable funding mechanisms for the maintenance and repair of water systems⁵. It emphasized that the continuous requirement for reliable funding to maintain boreholes services in the five targeted counties cannot be met solely through donor or government funding. This approach has proven inadequate and is unlikely to succeed without the integration of additional funding streams.

The Millennium Water Alliance, through its sustained work in the region, has recognized the significant challenge in the general availability of spare parts necessary for borehole repairs. This issue, in conjunction with the previously mentioned funding constraints, significantly hinders timely repair of borehole systems, particularly during drought emergencies, thereby increasing the humanitarian case load. It was not until 2019 that major suppliers of equipment and spare parts established branches in selected counties in Northern Kenya. Despite this development, procuring certain required spare parts swiftly continues to be a struggle. The lack of comprehensive asset inventories for boreholes complicates the process of determining the specific spare parts to be stocked. Consequently, repair teams and private operators and maintenance service providers often have to source for spare parts from Nairobi, Kenya's capital, which is located a considerable distance from the affected areas.

1.2 The DRIP FUNDI Program

Acknowledging the borehole repair and maintenance challenges outlined above, Millennium Water Alliance (MWA) and Virridy have initiated efforts to secure sustainability of borehole repairs in the region. With support from the United States Agency for International Development's (USAID's) Bureau for Humanitarian Assistance (BHA), these two organizations have developed and are now implementing the Drought Resilience Impact Platform- Fixing Uptime Now and Decision Improvement (DRIP FUNDI) program. The primary goal of DRIP-FUNDI is to provide sustainable access to water for domestic uses for one hundred and twenty thousand (120,000) people in five ASAL counties in Kenya, specifically Garissa, Isiolo, Turkana, Wajir and Marsabit. The program is striving to enhance the operational uptime of boreholes - defined as the percentage of months when a borehole is operational within a year - from the current baseline of 77%⁶ to a targeted 90%⁷ annually. This baseline figure was determined through an analysis of borehole sensor data by Virridy, while the target uptime has been established based on insights from peer-reviewed research. The Theory of Change for DRIP FUNDI is detailed in Box 1 below and visually illustrated in Figure 2.

Box 1: DRIP - FUNDI Theory of Change

IF remote borehole monitoring data is utilized for timely decision-making on repair and maintenance, repair teams are supported to respond to borehole breakdown to improve borehole functionality, and carbon financing generated to sustain repairs then communities in Arid and Semi-Arid Lands will have sustainable access to water for domestic uses.

⁵ Dickinson, K. & Patterson-Stein, J. (2021). Final evaluation report - impact evaluation of the Kenya Resilient Arid Lands Partnership for Integrated Development activity.

⁶ Thomas, E., Wilson, D., Kathuni, S., Libey, A., Chintalapati, P., & Coyle, J. (2021). A contribution to drought resilience in East Africa through groundwater pump monitoring informed by in-situ instrumentation, remote sensing, and ensemble machine learning. *Science of The Total Environment*, 780, 146486. <https://doi.org/10.1016/j.scitotenv.2021.146486>

⁷ Brown, J., & Clasen, T. (2012). High adherence is necessary to realize health gains from water quality interventions. *PloS one*, 7(5), e36735.

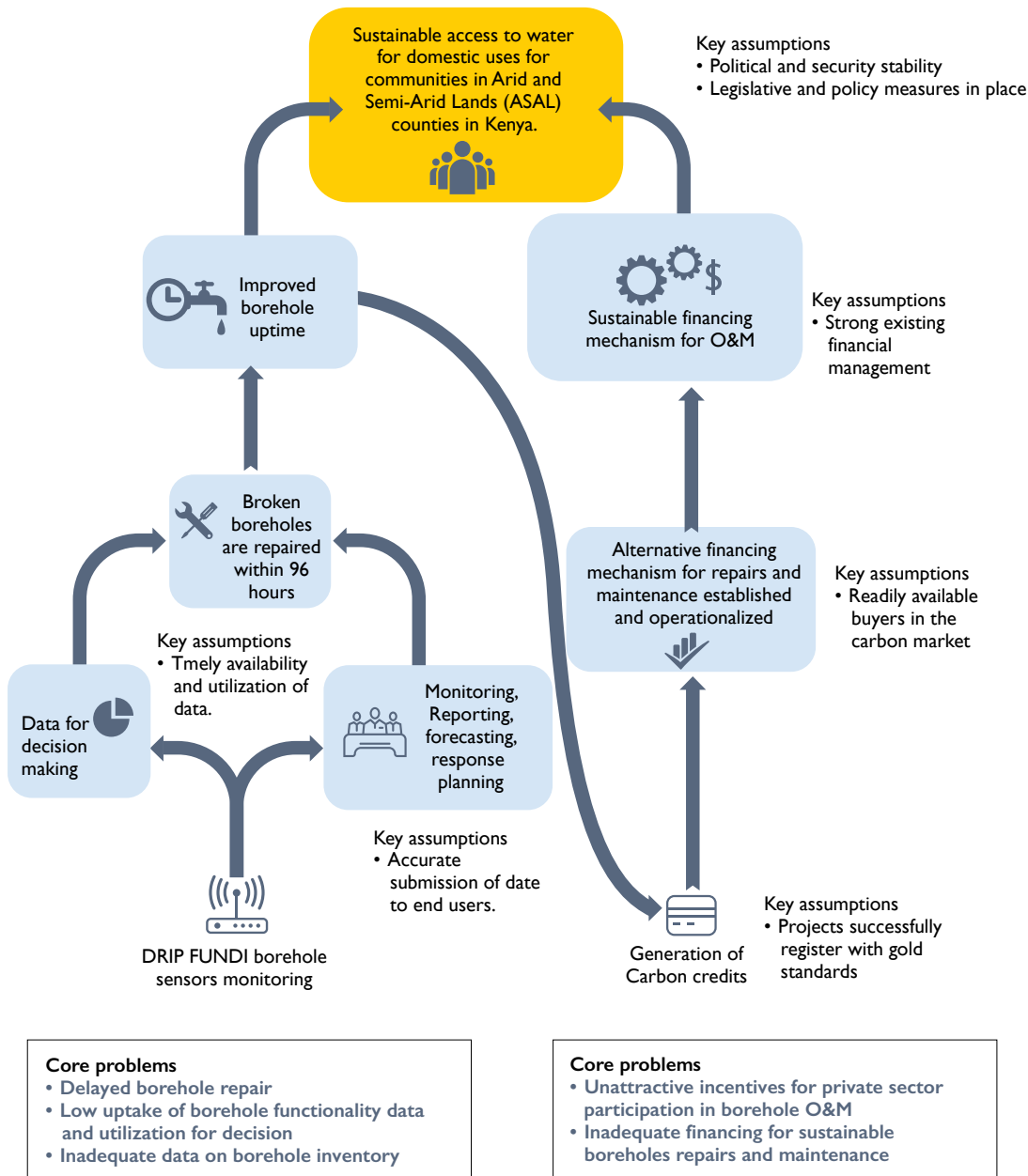


Figure 2: DRIP FUNDI Theory of Change

The purpose will be attained through the four intermediate outcomes below.

- a) **Intermediate Outcome 1: Borehole data for decision-making availed** – This will be realized through collecting county-specific data on barriers and solutions for timely borehole repairs. Additionally, the creation of a borehole asset inventory will also be developed to support quick decision-making processes for the boreholes in focus, enhancing the efficiency of addressing reported breakdowns.
- b) **Intermediate Outcome 2: Broken boreholes are repaired within 96 hours (4 days)** – This will be accomplished by leveraging data from borehole sensors and facilitating:
 - i. Timely access to spare parts necessary for repairs and maintenance and
 - ii. Supporting the Borehole Rapid Response Teams (BRRT) to acquire tools and logistics. A tripartite borehole repair agreement involving MWA, the county administration, and a private sector partner will be signed, alongside a transparent, verifiable, and accountable payment system for borehole repair works, guaranteeing accountability to MWA and stakeholders involved.

- c) Intermediate Outcome 3: Borehole functionality monitoring efforts strengthened** - MWA is committed to enhancing knowledge and practices related to borehole response planning and monitoring using information and communication technologies. This includes:
- Developing and strengthening capacities of BRRTs and private sector partners in accessing and interpreting borehole sensor dashboards, as well as utilizing mobile phone data collection tools for continuous monitoring,
 - Collaborating with RAPID+ for the maintenance of borehole sensors to minimize disruptions in the remote monitoring system; and
 - Sensitization of communities and stakeholders on the DRIP FUNDI model.
- d) Intermediate Outcome 4: Alternative financing mechanism for repairs and maintenance established and operationalized** - MWA and Virridy intend to register the project with the Gold Standard for Global Goals Carbon Registry. This move aims to facilitate the generation of carbon credits from the project's activities. These credits will then be sold in the carbon markets. The revenue obtained from these transactions is designated for financing the repair and maintenance of boreholes. This innovative financial mechanism is envisioned to bolster the project's sustainability and ensure continuous access to water in the targeted communities.

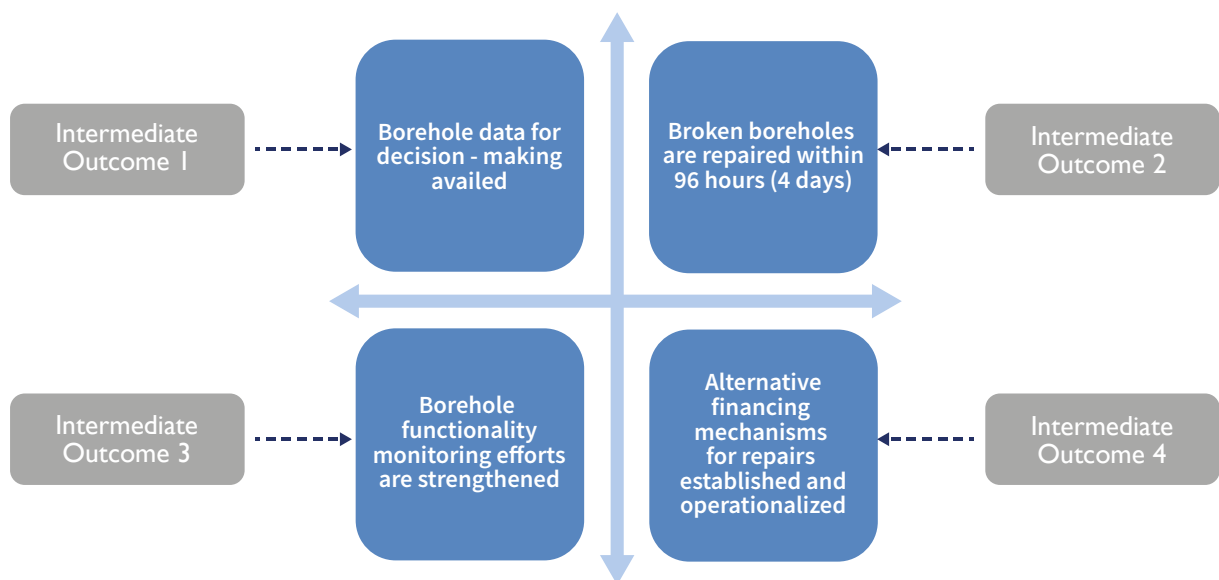


Figure 3: DRIP FUNDI Intermediate Outcomes

1.3 Situational Context of the DRIP FUNDI Counties

Garissa, Marsabit, Turkana, Wajir and Isiolo Counties are located in the ASALs of Northern Kenya (see map in Figure 4 below). Collectively, these counties span nearly 45% of Kenya's land area, underscoring their vast geographical extent. Despite their significant coverage, they are home to approximately 7% of the population in Kenya⁸. Historically, these regions have faced economic marginalization, a legacy that dates to colonial times and has persisted into the post-colonial era. This context has shaped the socio-economic landscape of the counties, presenting unique challenges and opportunities for development initiatives.



Figure 4: Location of the Five DRIP FUNDI Counties: Source Millennium Water Alliance

Access to water is a significant challenge that hinders the accelerated development of these counties. Given their classification as ASALs, they feature very few natural surface water sources, a consequence of harsh climatic conditions marked by elevated temperatures and highly variable rainfall. The region's several seasonal rivers, or 'laggas,' have become unreliable due to the increasingly scarce rainfall. The development of large-scale dams is challenging due to the scarcity of permanent surface bodies with adequate volumes. Consequently, the five counties have resorted to constructing a multitude of smaller, temporary dams and water pans.

Despite these challenges, the region is endowed with adequate ground water resources. The British Geological Survey⁹ has categorized the aquifers in the region as having moderate to high productivity. Notable among these aquifers are the Lotikipi and Lodwar Aquifers in Turkana County and the Merti Aquifer beneath Wajir County, which present viable solutions to the water scarcity issue.

As per the 2019 census, the average water access coverage across the DRIP FUNDI counties stands at 52.3%, which falls below the national water access coverage of 64.8%¹⁰. This low water access coverage in the DRIP FUNDI counties is attributed to both physical and economic water scarcity. Physical scarcity primarily stems from the lack of adequate surface water resources in Northern Kenya. The region's arid climate and erratic rainfall patterns exacerbate the challenge of securing reliable water sources. Economic scarcity, on the other hand, is linked to the inadequate water infrastructure present in the area, which fails to meet the needs of the growing population. Moreover, the economic water constraints are compounded by the poor operation and maintenance of existing reticulation systems, both in urban and rural settings within the DRIP FUNDI counties. Consequently, despite the presence of substantial ground water resources, it is still difficult to ensure that people are receiving at least basic water supply.

⁸ KNBS. (2019). 2019 Kenya Population and Housing Census: Volume IV- Distribution of Population by Socio-Economic Characteristics

⁹ British Geological Survey (2022). Africa Ground Water Atlas

¹⁰ BS. (2019). 2019 Kenya Population and Housing Census: Volume IV- Distribution of Population by Socio-Economic Characteristics.

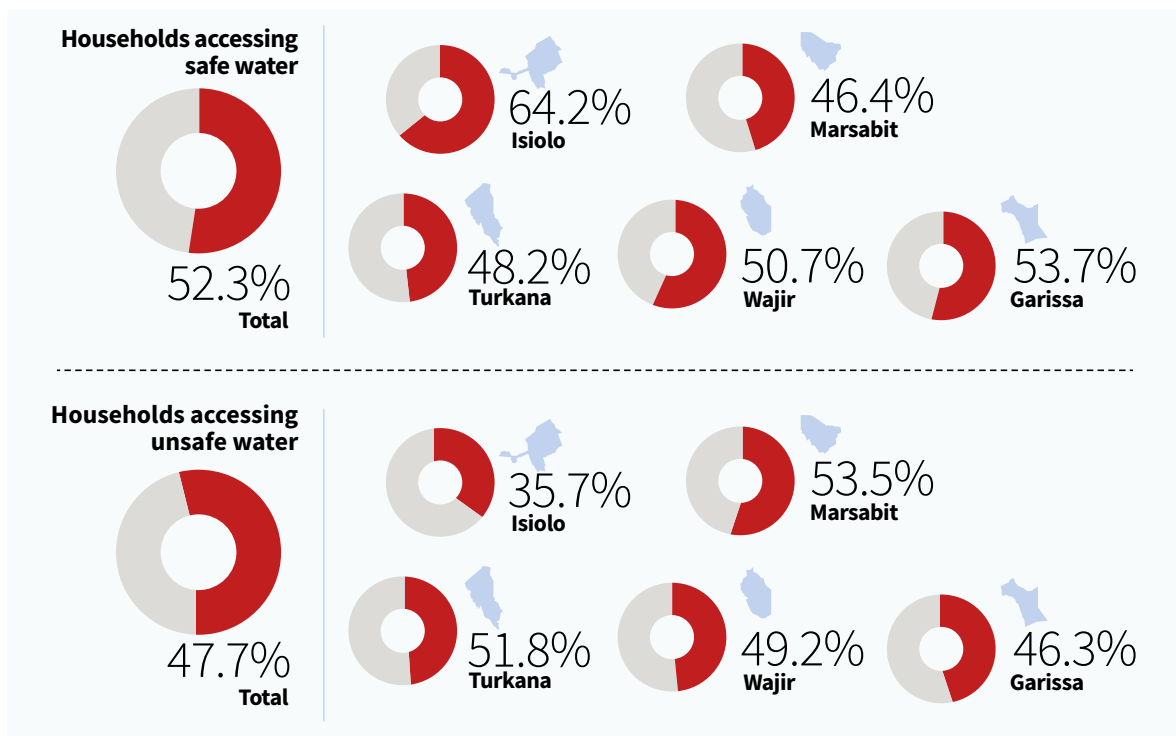


Figure 5: Household Water Access in the DRIP FUNDI Counties: Source RAPID+ Private Sector Assessment Report

1.4 Why Carbon Finance for Water?

Traditional methods of funding such as taxes and transfers have proven insufficient in overcoming the challenges associated with the repair and maintenance of water systems. As a result, there is a pressing need to identify new funding sources, including carbon finance, to address these financial shortfalls. Water insecurity is among of the most tangible consequences of climate change, making it imperative that funds aimed at repairing the climate are channeled into addressing the adverse effects of climate change on water supply systems.

The advent of carbon markets opens new avenues for funding, offering a viable solution to the budgetary constraints faced by the counties in Kenya. Water, considered a form of natural capital, presents unique challenges in terms of valuation and management due to its mobility, weight, non-exclusivity, multiplicity of uses, and varying values across different contexts. These characteristics have traditionally hindered the establishment of effective markets for water management. Nonetheless, targeted climate financing, derived from a mix of national governments, international donors, inter-government agencies, and increasingly from corporations through Environment, Social, and Governance (ESG) commitments towards achieving “net zero,” presents a significant opportunity to channel investment into climate reparative infrastructure. This includes the development of dependable, sustainable, and affordable water supplies. This approach is underpinned by the undeniable connection between climate change and water security, highlighting the critical role of carbon finance in bolstering water infrastructure against the backdrop of a changing climate.

One practical application of leveraging carbon finance for water systems involves using the revenue generated from carbon credits, earned through the provision of safe water services, to finance and sustain water access. The carbon finance markets are instrumental in reducing global greenhouse gas emissions worldwide by offering economic incentives for cleaner economic development. A carbon credit acts as a financial instrument, valued between \$1 to \$20, and represents a ton of carbon dioxide that has been either sequestered from the atmosphere or prevented from being emitted.

Today’s carbon credit market is rapidly growing, representing a multibillion-dollar industry. The principle behind carbon credits is effective because of the atmospheric mixing of gases, meaning that reducing emissions in one location can legitimately compensate for energy use elsewhere. Despite various debates surrounding responsibility, equity, opportunity, and the complexities of measurement, the fundamental math of carbon trading stands solid, offering a viable pathway to both address climate change and support the maintenance and expansion of water access initiatives through financial means.

MWA and Virridy have successfully secured formal approval from the Gold Standard for Global Goals, achieving a significant milestone in adapting the water treatment/carbon credit methodology to the unique context of the Arid and Semi-Arid Lands (ASALs).

This approval by the Gold Standard specifically recognizes MWA's and Virridy's request to:

- a) Credit an improvement in water pump functionality in contrast to only crediting new installations or complete rehabilitations, and
- b) To use the telemetry-based system as the primary tool for monitoring credits earned.

I.5 Objectives of the DRIP-FUNDI Baseline Evaluation

Prior to commencing the program, MWA and Virridy conducted an evaluation to ascertain key baseline figures for the program's indicators. This baseline was aimed at guiding program planning and setting benchmarks for assessing the impact and outcomes of the program at both its commencement and conclusion. The study established reference points on service coverage, levels of service, operation and maintenance practices, water use patterns and key service delivery gaps at the 200 boreholes. Additionally, some of these reference points will also feed into carbon metrics that will be used to determine emission reductions generated from program activities.

The six objectives of the baseline assessment were to;

- i) Prepare a narrative baseline report through the collection of primary data on the pre-intervention situation.
- ii) Fill out baseline values on the DRIP-FUNDI Indicator Tracking Table (ITT).
- iii) Support the selection of the 200 boreholes based on pre-set criteria.
- iv) Determine the uptime (number of months a borehole is functional annually) for each of the boreholes.
- v) Conduct an asset inventory at each of the 200 boreholes to determine the various parts and equipment installed at the systems.
- vi) Develop a list of fast-moving spare parts for the 200 water systems.

MWA contracted Losai Management Limited, a Kenyan-based consulting firm, to conduct the DRIP FUNDI baseline assessment between November 2023 and February 2024.

2. METHODOLOGICAL APPROACH

The baseline evaluation was conducted in three phases involving a desk review, field data collection and a data analysis and synthesis phase as captured in Figure 6 below. The evaluation adopted a non-experimental research design that focused on collecting qualitative data from key informant interviews and focus group discussions, as well as secondary data from literature reviews. Observational checklists were also utilized during the baseline evaluation to develop the borehole asset inventories and to shortlist the two hundred boreholes.

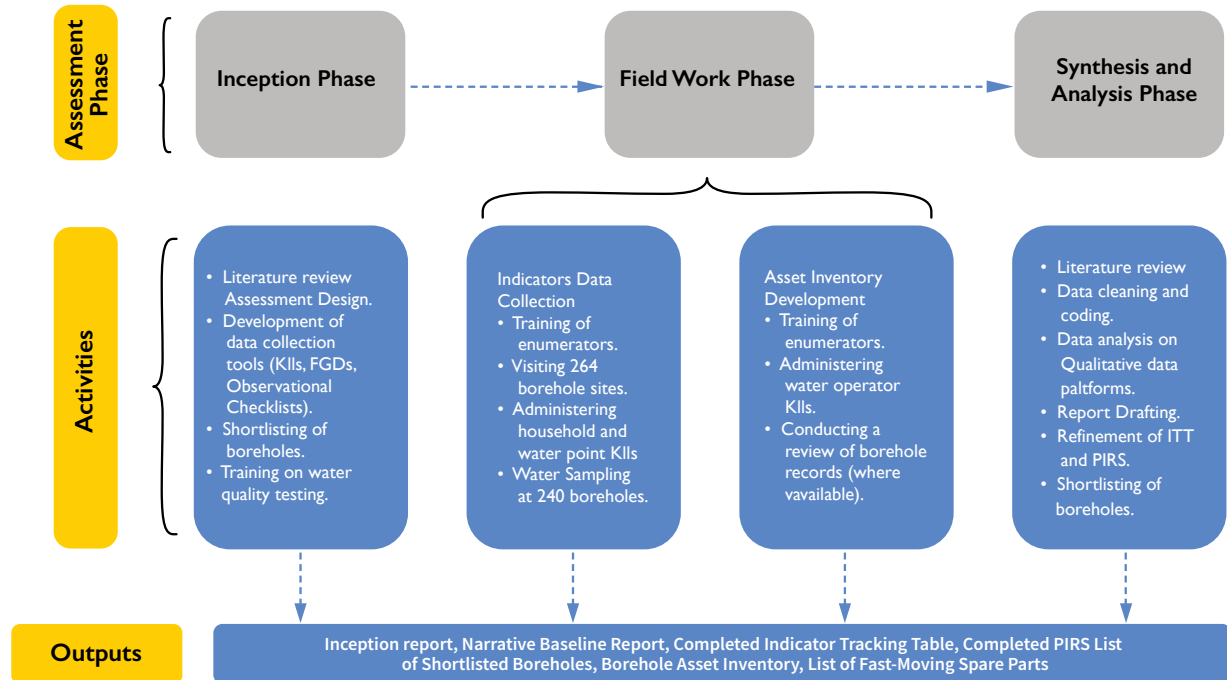


Figure 6: Illustration of the assessment approach.

2.1. Inception Phase

The desk review phase commenced with a kick-off meeting between MWA and Losai Management on Tuesday 28th November 2023. During the meeting MWA clarified communication protocols with the consultancy team and addressed any outstanding questions regarding the approach to the baseline assessment. Furthermore, MWA provided guidance on the project deliverables, expected outcomes, quality standards, and any specific requirements necessary to assist Losai Management in conducting the assessment effectively.

2.1.1. Preliminary Document Review

Following the kick-off meeting, the consulting firm interrogated both peer-reviewed and grey literature. This comprehensive literature review aimed to inform the approach to the assignment and assist in the development of tools for field data collection. The table below outlines some of the key documents the team consulted while conducting the literature review.

Table 1: Non-Exhaustive List of Reviewed Literature

#	Year	Document Title	Author
1.	2022	RAPID+ Baseline Evaluation Report	Millennium Water Alliance
2.	2023	DRIP-FUNDI Technical Narrative	Millennium Water Alliance
3.	2018	Risk factors associated with rural water supply failure:A 30-year retrospective study of handpumps on the south coast of Kenya. <i>Science of The Total Environment</i> , 626, 156-164. https://doi.org/10.1016/j.scitotenv.2017.12.302	Foster, T., Willetts, J., Lane, M., Thomson, P., Katuva, J., & Hope, R. (2018).
4.	2015	Evaluating Cellular Instrumentation on Rural Handpumps to Improve Service Delivery-A Longitudinal Study in Rural Rwanda. <i>Environ. Sci. Technol.</i> 49, 14292–14300. https://doi.org/10.1021/acs.est.5b04077	Nagel, C., Beach, J., Iribagiza, C., Thomas, E.A., 2015
5.	2010	Finding practical approaches to Integrated Water Resources Management. <i>Water Alternatives</i> 3(1): 68-81	Butterworth, J.; Warner, J.; Moriarty, P.; Smits, S. and Batchelor, C.
6.	2013	Trends in rural water supply: Towards a service delivery approach. <i>Water Alternatives</i> 6(3): 329-349	Moriarty, P.; Smits, S.; Butterworth, J. and Franceys, R.
7.	2021	Final evaluation report - impact evaluation of the Kenya Resilient Arid Lands Partnership for Integrated Development activity.	Dickinson, K. & Patterson-Stein, J
8.	2020	Rethinking the economics of water: An assessment. <i>Oxford Review of Economic Policy</i> , 36(1), 1-23	Garrick, D. E., Hanemann, M., & Hepburn, C.
9.	2022	Financing reparative climate infrastructures: capital switching, repair, and decommodification. <i>Antipode</i> , 54(3), 934-958.	Webber, S., Nelson, S., Millington, N., Bryant, G., & Bigger, P. (2022).
10.	2023	Applying climate reparative finance toward water security. <i>Science of The Total Environment</i> , 875, 162506.	Thomas, E., Ntazinda, J., & Kathuni, S.
11.	2022	Turn up the Dial: System Dynamics Modeling of Resource Allocations toward Rural Water Supply	Anna Libey; Pranav Chintalapati, Styvers Kathuni, Bernard Amadei and Evan Thomas.
12.	2021	Emission Reductions from Safe Drinking Water Supply	Gold Standard for Global Goals
13.	2021	Kenya Resilient Arid Lands Partnership for Integrated Development Plus (RAPID+) Proposal Document	Millennium Water Alliance
14.	2022	Private Sector Participation in the Water and Rangeland Markets	Millennium Water Alliance

2.1.2. Assessment Design and Preparation of Data Collection Tools

To respond effectively to the objectives of the baseline, the team elected to utilize a mixed- methods study design comprising of household questionnaires, Key Informant Interviews (KIIs), Focused Group Discussions (FGDs) and observation checklists to gather data. The baseline approach involved visiting all boreholes that were pre-listed (see section 2.1.4 below) prior to the baseline and conducting KIIs and FGDs with relevant stakeholders. Procedures that took place at each of the boreholes involved administering two household questionnaires, conducting an interview with the borehole operators, filling out an observation checklist on the mechanical and electrical components of the borehole, and conducting a water quality test at the point of water collection (the borehole) and the point of water use (the household).

The reviewed literature formed the basis for developing the first draft of the data collection tools. These were then iteratively refined ahead of field data collection. A total of six data collection tools were developed to facilitate field data collection including i) a household questionnaire, ii) a borehole operator questionnaire, iii) a water quality testing questionnaire, iv) a spare part providers KII guide, v) a guide for interviewing county department officials and members of the BRRT, and vi) an FGD guide. The three questionnaires were then coded on the mWater platform and subjected to several pre-tests to ensure the accuracy of skip patterns and logical flows. Virridy LLC supported the development and review of the coded tools and particularly the household questionnaire.

The data collection instruments were crafted to explore a comprehensive range of issues pertaining to water supply and management.

The objective was to gather data that would not only provide insights into the current state of water services but also inform strategies for improvement and sustainability. The areas of inquiry included:

- **Access to Water Supply:** Investigating the availability and reliability of water supply sources, particularly boreholes, within the community.
- **Current Charges for Water Services:** Examining the fees being charged for water access and whether these costs were aligned with the services provided.
- **Consumers' Willingness and Ability to Pay:** Assessing the community's willingness to pay for water services and their financial capacity to do so.
- **Preferred Charges for Water Services:** Seeking community input on what they considered to be fair and affordable charges for water services.
- **Consumers' Water Consumption Patterns:** Analyzing how water is used within households, including daily consumption rates and purposes for which water is used.
- **Sufficiency of the Water Supply:** Evaluating whether the current water supply meets the needs of the community.
- **Accessibility of Alternative Water Services:** Exploring the availability and use of alternative sources of water beyond the primary service.
- **Threats to Water Provision:** Identifying potential risks or challenges that could jeopardize the sustainability of water services in the area.
- **Frequency of Borehole Breakdown:** Assessing the reliability of borehole infrastructure and the commonality of operational issues.
- **Materials Required for Borehole Repair:** Cataloging the types of materials typically needed for maintenance and repair of boreholes.
- **Turnaround Time of Borehole Repair:** Investigating the efficiency of response to borehole breakdowns, including the average time taken to complete repairs.
- **Frequency of Spare Part Supply:** Looking into the regularity of spare part deliveries and how it affects maintenance schedules.
- **Challenges:** Identifying any additional challenges faced by the community in accessing and maintaining a reliable water supply.
- **Other Issues:** Providing an opportunity to capture any other relevant information or concerns not specifically addressed in the predefined questions.

The final data collection tools have been included as attachments to this baseline report (See Appendix I).

2.1.3. Field Preparation

In addition to preparing the tools, the consultant collaboratively with MWA conducted logistical planning for fieldwork during the inception phase. Given the vastness of the DRIP FUNDI counties and potential concerns around insecurity, field logistics were given keen attention. The consultants developed movement plans based on clustering boreholes across the counties. These movement plans were refined during the county entry meetings. The consultant, through the assistance of MWA, recruited four suitable well-trained enumerators in each of the DRIP FUNDI counties to administer the household and water-quality testing questionnaires. During this period MWA also administered training to the consultants on conducting water quality testing using the Aquagenx Compartment Bag Test (CBT) for detecting the presence of E. coli and Total Coliforms. The water quality testing kits were procured directly from Aquagenx LLC, an American organization that provides water quality test kits to simplify field testing of water samples.

2.1.4. Borehole Longlisting and Shortlisting

The boreholes to be visited in the field were shortlisted from a list of over 400 boreholes. MWA developed the long-list of boreholes in the five DRIP FUNDI counties based on information from its on-ground implementing partners in the RAPID+ program.

It also contacted various development entities working in the region to further develop the long list. These included Oxfam Kenya

and Save the Children. The National Government of Kenya through the National Steering Committee on Drought Response (NSCDR) also shared names of boreholes in the five counties.

A screening survey was conducted through Computer Aided Telephone Interviews (CATI) to whittle down the boreholes to 226 boreholes that were to be visited during the field work. The shortlisting exercise was extremely important because it ensured that only boreholes that are relevant to the program are visited. MWA solicited the support of the county water officers during the county entry meetings to further refine and expand the list (see section 2.2.1 below).

2.1.5. Submission of the Inception Report

The inception phase culminated with the preparation of an inception report detailing the agreed upon assessment approach, the field data collection tools, the assignment workplan and the staffing from the consultant’s team.

2.2. Field Work Phase

The fieldwork phase of the baseline assessment commenced on Monday, 22nd January 2024 and concluded on Friday, 2nd February 2024. It included four primary data collection activities: the administration of Key Informant Interviews (KIIs), conducting Focus Group Discussions (FGDs) in each of the counties, carrying out water quality tests at each borehole, and administering an observation checklist for each borehole system.

2.2.1. Borehole Listing Refinement

One of the key activities conducted during the county entry meetings was the refinement and expansion of the borehole longlist prior to commencing fieldwork. In cognizance of the need for inputs by relevant county stakeholders, MWA field teams held a one-day meeting with sub-county water officers and BRRTs to review the borehole list and to include any additional boreholes missing from the list. Resultingly, the number of boreholes to be visited in the field increased from 226 to 302. The county borehole breakdowns are provided in Table 2. Involvement of county water officials in borehole selection was a key move in ensuring acceptance of the DRIP FUNDI program.

Table 2: Number of boreholes visited.

County	Initial Number of Boreholes	Refined Borehole Number
Garissa	38	58
Wajir	31	67
Isiolo	43	55
Marsabit	58	60
Turkana	56	62
Total No of Boreholes	226	302

2.2.2. Enumerator Training

Locally selected enumerators in each county were trained in administering the Key Informant Interviews (KIIs) for households and conducting water quality tests. The training encompassed a comprehensive review of the program objectives, the baseline assessment process, and the household KII guide. This approach was aimed at providing the enumerators with a deep understanding of the baseline’s context. Following this, the enumerators were guided through the interview form on the mWater platform (see Figure 7 below), ensuring their proficiency with the program’s procedures. To validate their understanding and the effectiveness of the tool, the enumerators administered two to three pre-test interviews in areas close to the training location. These initial interviews served as a practical test of both the tool and the enumerators’ grasp of the instrument. The feedback from these pre-tests was reviewed by the trainers in each county, confirming the enumerators’ competency with the mWater platform and the KII guidelines. The enumerators were also trained on how to conduct field water quality tests and to interpret the results.

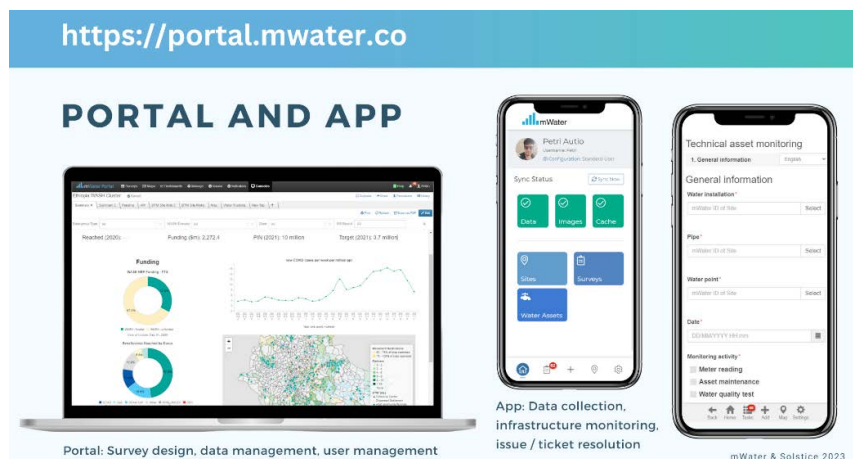


Figure 7: mWater portal and application interface: Source mWater.

2.2.3. Key Informant Interviews

The consultant developed a total of five KII scripts tailored for distinct groups: borehole water point operators, household key informants, county water department officials, technicians in the Borehole Rapid Response Teams (BRRT), and private sector suppliers of equipment, as detailed in Appendix I, which contains the final tools.

The KII guide for borehole operators was particularly critical, as it enabled the team to assess the operational uptime of each visited borehole. Households were identified as key informants, with two purposively selected households visited at each borehole. The information gathered from these visits was used to corroborate the data obtained through the borehole operator KIIs. Furthermore, the KIIs conducted with county water department officials and the BRRTs were instrumental in gathering data on the number of individuals utilizing climate information or engaging in actions to mitigate risks and enhance resilience to climate change, supported by United States Government (USG) assistance under the Resilience in Action (RiA) initiative.

Table 3: List of KIIs conducted.

Counties	The target number of KIIs (County, Water Department, BRRT, Climate Change Dept, Private Sector Partners, Borehole Operators)	Number of KIIs conducted
Garissa	5	9
Isiolo	5	11
Marsabit	5	9
Turkana	5	12
Wajir	5	5
Total	20	46

2.2.4. Focused Group Discussions

Focused Group Discussions (FGDs) were conducted to triangulate the information gathered on the frequency of borehole breakdowns and their repair methods. Each focus group consisted of 8 to 12 participants, ensuring a diverse mix of genders and ages, including male, female, older, and younger participants. The discussions were led by a dedicated facilitator accompanied by a note-taker to ensure all insights were accurately captured.

During the assessment, ten Focus Group Discussions (FGDs) were conducted with private representatives, community groups, and stakeholders across the water sector. These discussions were held across the five counties, facilitating the collection of a wide range of perspectives and experiences. This inclusive approach significantly enhanced the comprehension of the prevailing issues, offering a comprehensive outlook on the challenges and potential solutions associated with borehole maintenance and repair.

Table 4: Number of FGDs Conducted

Counties	The target number of FGDs	Number of FGDs conducted
Garissa	1	2
Isiolo	1	3
Marsabit	1	2
Turkana	1	4
Wajir	1	4
Total	5	15

2.2.5. Water Quality Testing

Water quality testing was conducted at each of the boreholes visited during the baseline assessment. This testing contributed critical baseline data for two indicators and aided in the shortlisting of boreholes for further analysis or intervention. The focus of the water quality testing was on identifying microbiological contamination, specifically targeting the presence of E. coli as a primary indicator of water safety.

The testing protocol was developed in accordance with World Health Organization (WHO) standards, which mandate that water intended for direct consumption should not contain detectable levels of E. coli in any 100 ml sample, specifically, less than 1 Colony Forming Unit (CFU) of E. coli per 100 ml.

These criteria align with the Gold Standard's methodology requirements for ensuring safe drinking water. The Aquagenx Compartment Bag Test (CBT) was employed to detect the presence or absence of *E. coli* and total coliforms in the water samples. This method was chosen for its reliability and alignment with international standards for water safety, as illustrated in Figure 9.

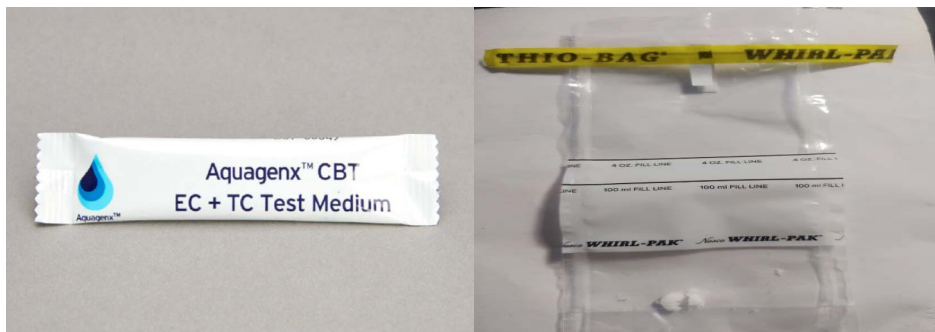


Figure 8: Aquagenx compartment bag test: Source Aquagenx

Procedure for Utilizing the Aquagenx Compartment Bag Test (CBT)

The following steps outline the procedure used with the CBT kit:

1. **Work Area Preparation:** The work area was sanitized using a disinfectant cleaning solution, to prevent contamination of samples.
2. **Sample Collection:** A 100ml water sample was collected in a Whirl-Pak Thio-Bag, specifically designed for water sampling.
3. **Growth Medium Addition:** The Aquagenx EC+TC growth medium was added to the water sample within the Thio-Bag, initiating the testing process.
4. **Incubation:** After mixing, the sample underwent an incubation period ranging from 20 to 48 hours, depending on the ambient temperature conditions. The recommended incubation periods were as follows:
 - At 35-37°C, samples were incubated for 20 hours.
 - At 31-34°C, the incubation period extended to 24-30 hours.
 - For temperatures between 25-30°C, samples were incubated for 40-48 hours.
 - For temperatures below 25°C, samples were either incubated at 35-37°C for 24 hours or placed near a heat source for up to 48 hours.

It was noted that temperatures exceeding 40°C might inhibit some Total Coliforms, potentially affecting the accuracy of results for these bacteria.

Result Interpretation:

***E. coli* Detection:** The presence of *E. coli* was determined by viewing the color change in the Thio-Bag under ambient light. A transition to blue or blue green indicated a positive result, while yellow or yellow brown signified a negative outcome.

Total Coliform Detection: The assessment for Total Coliforms required shining a UV light (365nm) on the Thio-Bag in a dark environment. Samples that fluoresced blue under UV light were considered positive for Total Coliforms.

Sample Decontamination: Post-analysis, the samples were decontaminated to ensure no environmental contamination. The table below shows how the colour-change test results of the Aquagenx Compartment Bag Test (CBT) were interpreted.

Table 5: Water Quality Test Result Interpretation Table

Color in Thio-Bag	Yellow/Yellow Brown in ambient light and does not fluoresce blue under UV light	Yellow/Yellow Brown that ... fluoresces blue under UV light	Blue/Blue Green in ambient light	Blue/Blue Green that... fluoresces blue under UV light
	E. coli	Negative	Negative	Positive
Total Coliforms	Negative	Positive	Positive	Positive

2.3. Synthesis and Analysis Phase

The data collected during the field work phase and, especially from the Key Informant Interviews (KIIs) conducted with households and borehole operators, was subjected to a thorough cleaning process before analysis. This process included filling in missing values, removing outliers, and ensuring the consistency of questions with their respective options, thereby preparing the dataset for detailed examination and interpretation.

Quantitative methods were applied to the analysis of data collected through the 487 household KIIs and the 259-borehole operator KIIs. This analysis was conducted using advanced excel techniques and was predominantly descriptive, with inferential analysis utilized as needed. The data derived from the borehole operator questionnaire was deemed representative, as it encompassed the entire population of systems under review. For the KIIs with county officials, BRRTs, and private sector operators, a qualitative analytical approach was adopted using the NVivo platform. This involved the coding and thematic organization of the interview transcripts into relevant themes and concepts. Additionally, literature review played a crucial role in validating and enriching the insights gained from the field data.

This narrative report was developed and finalized based on the results from the analyzed field data. The Indicator Tracking Table (ITT) and Performance Indicator Reference Sheets (PIRS) were also completed in line with the field data analysis outcomes.

2.3.1. Analysis of Key Baseline Indicators

A critical aspect of the analysis was the evaluation of key baseline indicators, notably the percentage of target boreholes achieving at least 90% uptime and the number of people using climate information.

a. Percentage of target boreholes reporting 90% uptime

Borehole uptime was determined by the ratio of days a borehole remained operational within a given month against the total days in that month. A functional borehole system was defined by its capacity to extract water and make it accessible to users, otherwise it was categorized as non-functional. Data on functionality cross referenced with records of breakdown frequency and repair timelines provided a robust mechanism for validation. Data on borehole functionality was obtained for the months of January 2023 to December 2023 and used to compute borehole uptime at each system visited.

$$Uptime = \frac{\frac{functional\ days(Jan)}{total\ no.\ of\ days(Jan)} + \frac{functional\ days(Feb)}{total\ no.\ of\ days(Feb)} + \dots + \frac{functional\ days(Dec)}{total\ no.\ of\ days(Dec)}}{12\ months} \times 100\%$$

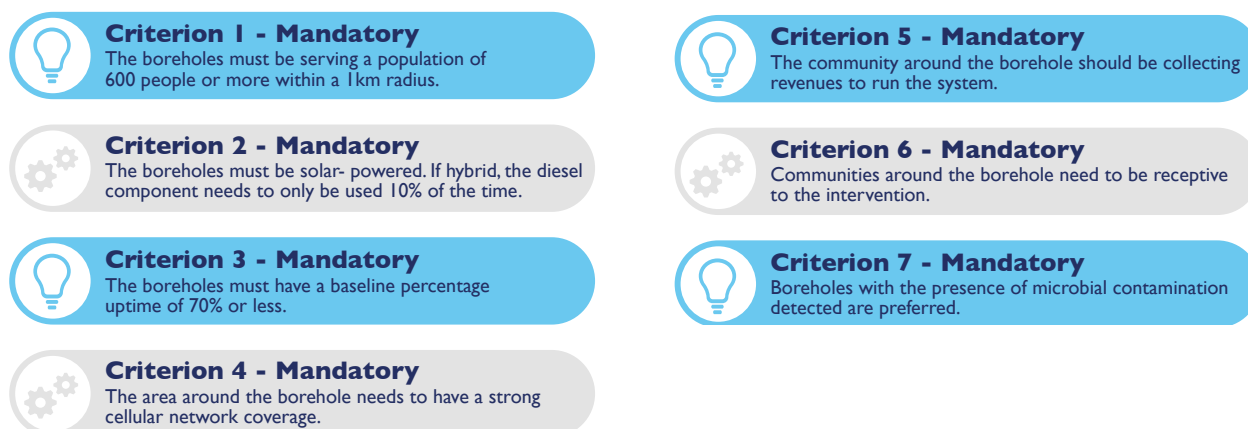
b. Number of people using climate information or implementing risk-reducing actions to improve resilience to climate change as supported by United States Government (USG) assistance Resilience in Action (RiA)

Within the scope of the DRIP FUNDI program, climate information has been defined as the repair response plans developed and adhered to by the BRRTs, county water officials, and borehole water operators. These plans are considered crucial strategies for adaptation and resilience, primarily focusing on enhancing the reliability of water supply during drought conditions. At the inception of the program, it was posited that these stakeholders might not have established repair response plans, potentially leading to significant delays in repairing borehole systems.

This hypothesis was explored during the baseline assessment through Key Informant Interviews (KIIs) conducted with representatives from the county water departments and the BRRTs. The total number of individuals anticipated to utilize these repair response plans to bolster community resilience against climate change encompasses all members of the BRRTs, officials from the county water departments, and operators of the 200 boreholes targeted by the program.

2.3.2. Final Borehole Shortlisting Procedure

The shortlisting of the final 200 boreholes was done from a pool of 259 boreholes that underwent evaluation during the baseline assessment. This shortlisting process was conducted in Microsoft Excel through a weighted ranking system. The selection criterion for the DRIP FUNDI boreholes was rigorously defined and applied to ensure that the boreholes chosen met the program's objectives and requirements, as depicted in Figure 10.

Figure 9: Borehole Selection Criteria.

The steps undertaken during the shortlisting are elaborated below:

Step 1: Data Compilation

A comprehensive spreadsheet was developed to include all 265 boreholes assessed during the baseline survey. This spreadsheet was organized with columns for each criterion such as population served, baseline uptime, power source, cellular network coverage, presence of microbial contaminants, revenue collection, community receptiveness, and boreholes serving large communities with microbial contamination.

Step 2: Scoring Mandatory Criteria

Scores were then assigned to each borehole based on whether they met the mandatory criteria (see Figure 10). Binary categorization “(met/not met)” was used where boreholes received **two** points for each of the mandatory criterion met and boreholes failing to meet mandatory criteria scored zero.

Step 3: Scoring Preferable Criteria

Scores were then assigned to each borehole based on whether they met the preferable criteria (see Figure 10). Binary categorization “(met/not met)” was used where boreholes received **one** point for each of the preferable criterion met and boreholes failing to meet preferable criteria scored zero.

Step 4: Calculating Total Scores, Ranking and Selection.

The points assigned for both mandatory and preferable criteria were summed to derive total scores for each borehole. These boreholes were then ranked based on their total scores, with priority given to those scoring higher, to identify the top candidates for selection.

Step 5: Final Selection

The highest-ranking 200 boreholes were selected for inclusion in the DRIP FUNDI program. A manual review was subsequently conducted on these selected boreholes to confirm their alignment with the program’s geographical impact goals and overarching objectives, ensuring a balanced and effective implementation strategy.

2.4. Data collection limitations and challenges

The baseline assessment encountered several challenges and limitations throughout its various phases, from inception to fieldwork. These included.

- i. The onset of El Niño-induced rains and subsequent flooding caused significant delays in the commencement of the data collection process. These adverse weather conditions made access to certain borehole sites difficult, hindering the timely gathering of necessary data.
- ii. The process of long-listing boreholes for evaluation was complicated by the receipt of incorrect or inaccurate data regarding the boreholes’ locations and specifications. This misinformation necessitated additional time and resources to verify and correct the data, delaying subsequent phases of the assessment.
- iii. There was a noticeable lack of comprehensive field data regarding the electro-mechanical components of the boreholes. This gap in information made it challenging to accurately populate the borehole asset inventory, a crucial element for planning maintenance and repair interventions.
- iv. The unavailability of the borehole operators and members of water management committees during data collection added to the time spent per borehole. This led to more time being spent in the field than was envisaged during the planning phase.

In response to the challenges encountered during the baseline assessment, MWA and the consulting team implemented several strategic measures to mitigate the impact of these issues and enhance the effectiveness of the data collection process:

1. **Postponement of Baseline Fieldwork:** To address the delays caused by the El Niño rains and flooding, MWA and the Consultant elected to postpone the commencement of the baseline fieldwork. USAID BHA was notified of this request in good time and sanctioned the postponement. This decision allowed for the floodwaters to recede and the roads to become passable, facilitating safer and more accessible conditions for the field teams to conduct their work.
2. **Verification of Borehole Long-list During County Entry Meetings:** Recognizing the importance of accurate borehole data, MWA allocated additional time during the county entry meetings specifically for the verification of the borehole long-list. This step was crucial in improving the accuracy of the borehole information, ensuring that all relevant boreholes were included in the assessment and subsequent program activities.
3. **Filling in Missing Information During Program Implementation:** To compensate for the inadequate field data on the electro-mechanical components of the boreholes, MWA plans to enrich the borehole asset inventory with additional information that will be gathered throughout the program's implementation. This may involve conducting test pumping activities, continuous interviews with county water department officials, and leveraging insights from private sector partners involved in the program.
4. **Informing community leaders within the villages:** To reduce the time taken looking for the borehole operators and members of the water management committees, the teams through the sub county water officers, contacted community leaders in advance to have the required interview respondents present.



The boreholes must be serving a population of 600 people or more within a 1km radius.

3. RESULTS AND DISCUSSION

This section expounds on the results of the analyzed household and Borehole Operator KII data. It also features observations drawn from the KIIs with the BRRTs and the county water officials. The chapter commences with an overview of the boreholes visited, followed by a description of demographic information. It provides an in-depth review of water supply metrics across the visited boreholes in all counties culminating in the establishment of the program baseline indicators.

3.1. Overview

A total of 265 (87.74%) boreholes were visited against 302 boreholes that were targeted for the baseline study. Figure 11 shows the disaggregation of the boreholes per county. 38 of the targeted boreholes were not visited either due to logistical constraints or because upon re-evaluation they did not meet the primary selection criteria. Analysis was conducted on 259 out of the 265 boreholes visited because five of the boreholes were powered using only diesel engines and this fell outside the borehole selection criteria.

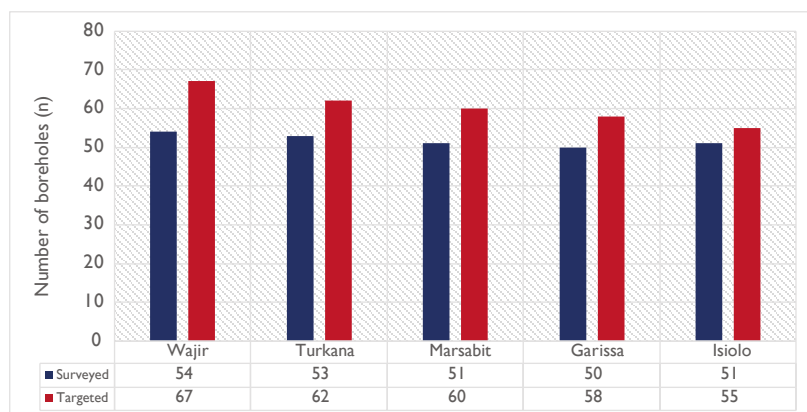


Figure 10: Total number of boreholes visited vs boreholes targeted.

A total of 487 households were visited, falling short of the target of 604, as detailed in Figure 12. The shortfall of 76 households resulted from 38 of the targeted boreholes not being visited. Additionally, ten households were excluded because they were associated with diesel-powered boreholes. After the process of data cleaning, 31 household records were omitted due to incompleteness.

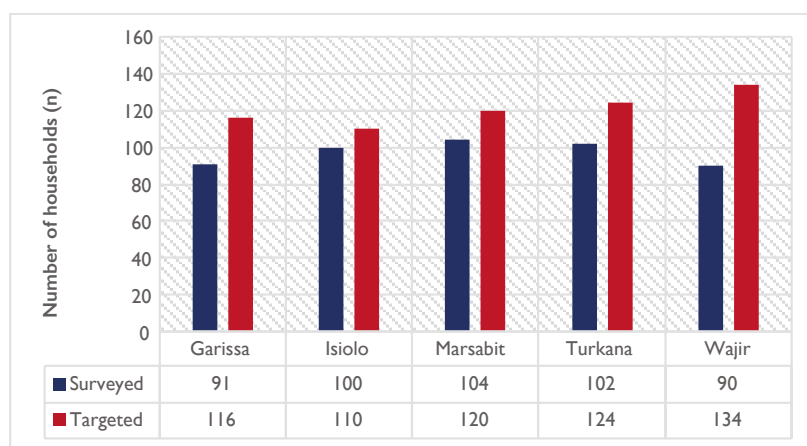


Figure 11: Total number of households visited versus households targeted.

3.2. Demographic Information

3.2.1. Gender and age of respondents

The data revealed that 98% of borehole operators were male, while 73% of the respondents to the household questionnaire were female, as depicted in Figures 13 and 14. This disparity highlights a significant trend: although women predominantly manage water-related tasks at the household level, their participation in the management of water infrastructure remains comparatively limited. This finding aligns with the results from the final gender assessment of a previous program carried out by the Millennium Water Alliance (MVA) in these five counties. It further illustrates the patriarchal dynamics of the region, where societal norms often assign women to domestic roles while men are more likely to hold technical and leadership positions within the community. In Wajir and Garissa counties, the proportion of female respondents was notably lower; attributed to cultural norms that restrict interactions between females and male enumerators. As a result, male household members often undertook the responsibility of answering the Key Informant Interviews (KIIs).

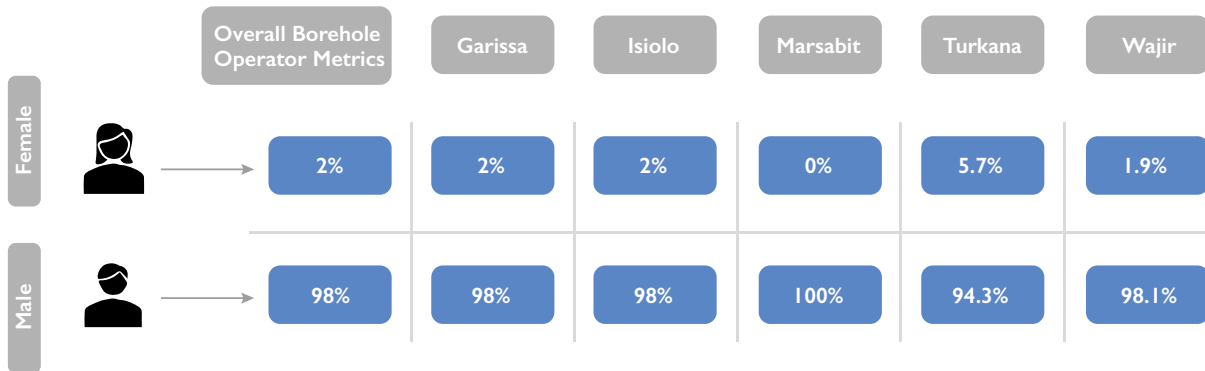


Figure 12: Borehole operator gender across the counties.

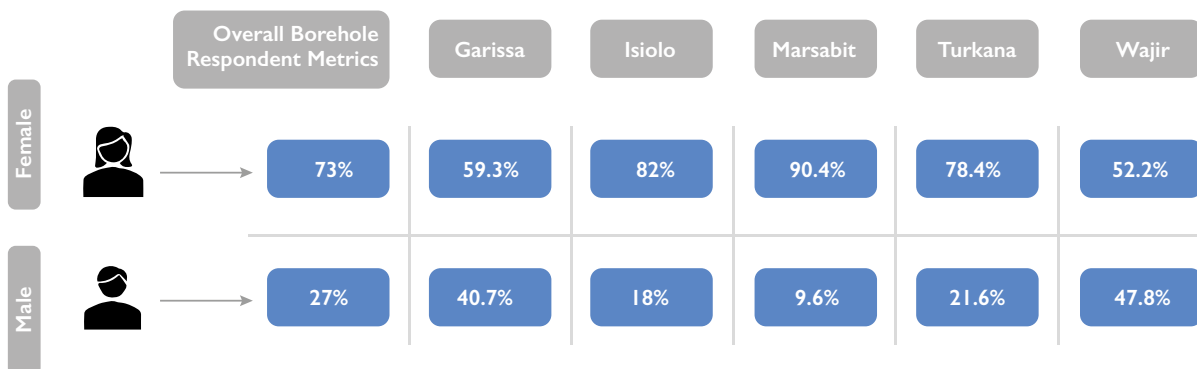


Figure 13: Household respondent gender across the counties.

The results also reveal that a significant proportion of water operators are aged between 40-50 years comprising 32.8% of the all the water operators’ interviews. Anecdotal evidence indicates that this is the pre-dominant scenario across the DRIP FUNDI counties. Only 1.2% of the operators were aged between 18-24 years. Figure 15 provides a summary of the age distribution among borehole operators surveyed. There is a need to advocate for increased participation of the youth in the operation of the boreholes to create a larger workforce for the management of water systems. These youth could also potentially be absorbed by operation and maintenance institutions.

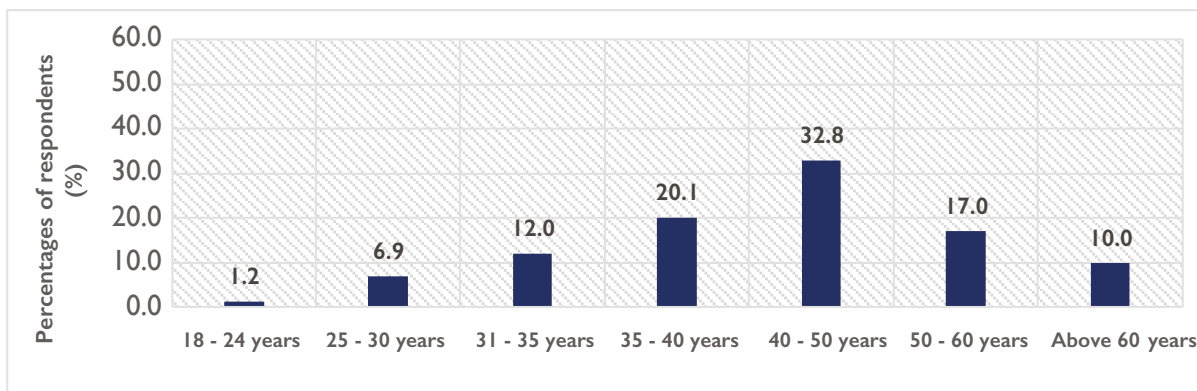


Figure 14: Age Distribution of the borehole water operators.

3.2.2. Average household size and number of people served.

According to the baseline assessment, average household sizes across all the five counties were higher than values captured in the 2019 Kenya National Bureau of Statistics census (Figure 16 below). The main reason for this variance was that households were purposively rather representatively selected. There may also have been incidences of recall bias by the respondents as well as exaggeration bias whereby respondents provided inflated values of household sizes in anticipation of receiving aid. Consequently, DRIP FUNDI will utilize the more conservative household sizes captured in the 2019 census.

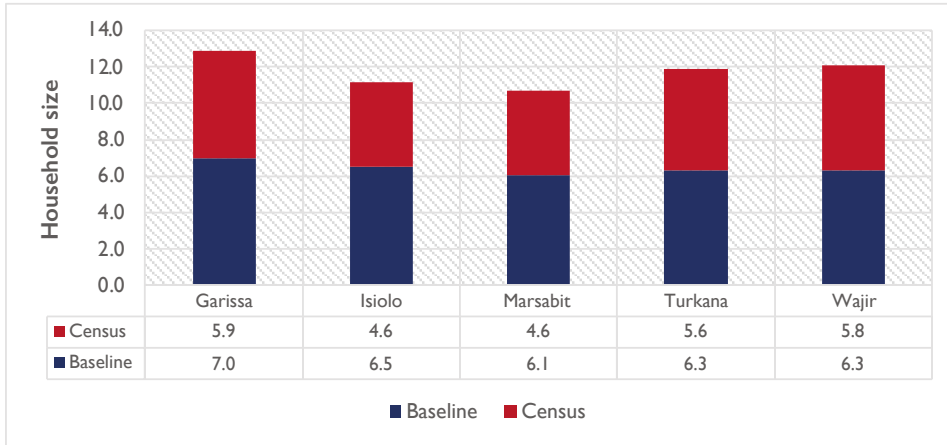


Figure 15: Average household size.

The boreholes enumerated serve an average of 410 households within a one-kilometer radius as per Figure 16.

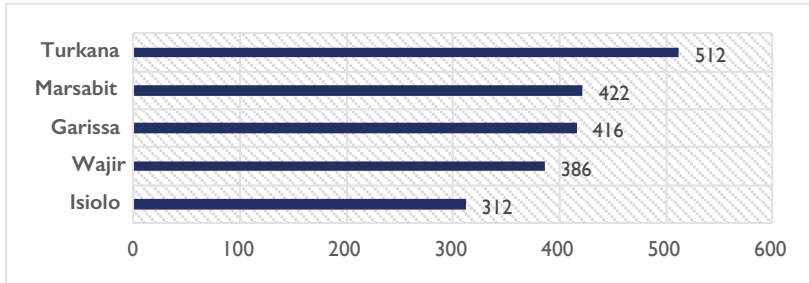


Figure 16: Average number of households served within a 1km radius of the borehole.

3.2.3. Borehole power sources

Due to the carbon financing component of DRIP FUNDI, the program is targeting boreholes powered using renewable energy sources. The Methodology for Emission reductions from Safe Drinking Water Supply under the Gold Standard for Global Goals allows for the use of a hybrid diesel-renewable energy arrangement but only if the diesel power is used for 10% of time. According to the baseline assessment, 53% of the visited systems or 137 boreholes are hybrid systems, 42% or 109 boreholes are powered using only solar, 4% or 10 boreholes are solar- electric hybrid systems while 1% or 3 boreholes are electric-diesel hybrid systems. The per county breakdowns are captured in the graph below.

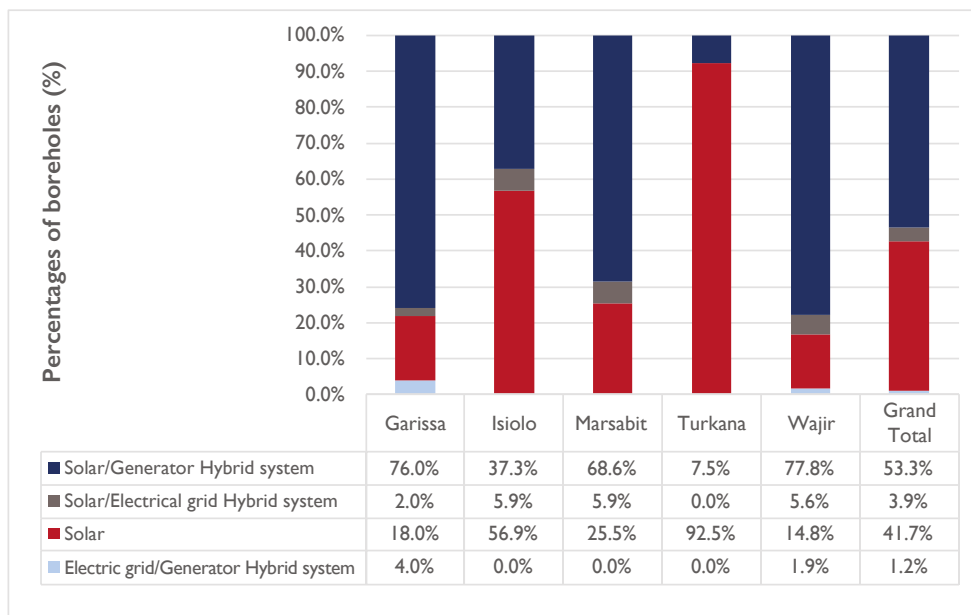


Figure 17: Power Source of the Boreholes

3.3. Water access in the DRIP FUNDI Counties

3.3.1. Water Sources

Analysis of data for 487 households across the five counties indicates that 93.2% of the interviewed households rely on the visited boreholes, as shown in the table below. Further analysis was conducted to determine why 33 households were not utilizing borehole water at the time of the survey. It was revealed that the systems were either broken down, or households opted to use alternative sources like dams because it was the rainy season.

Table 6: Utilization of the borehole

Counties	Not Utilizing Borehole at the time of the survey	Utilizing the borehole at the time of the survey
Garissa	1	90
Isiolo	5	95
Marsabit	13	91
Turkana	6	96
Wajir	8	82
Total	33	454

Analysis was conducted for the 454 households to determine seasonal variations in water sources. Of these households, 62.1% or 282 reported using the same source during dry and wet seasons, while 37.8% or 172 households varied their sources of water per season. Marsabit and Wajir Counties had the highest percentage of households reporting using different water sources in dry and wet seasons at 67.8% and 65.2% respectively, while Isiolo and Garissa Counties had the lowest percentage of households reporting the utilization of different water sources across different seasons at 27.4%.

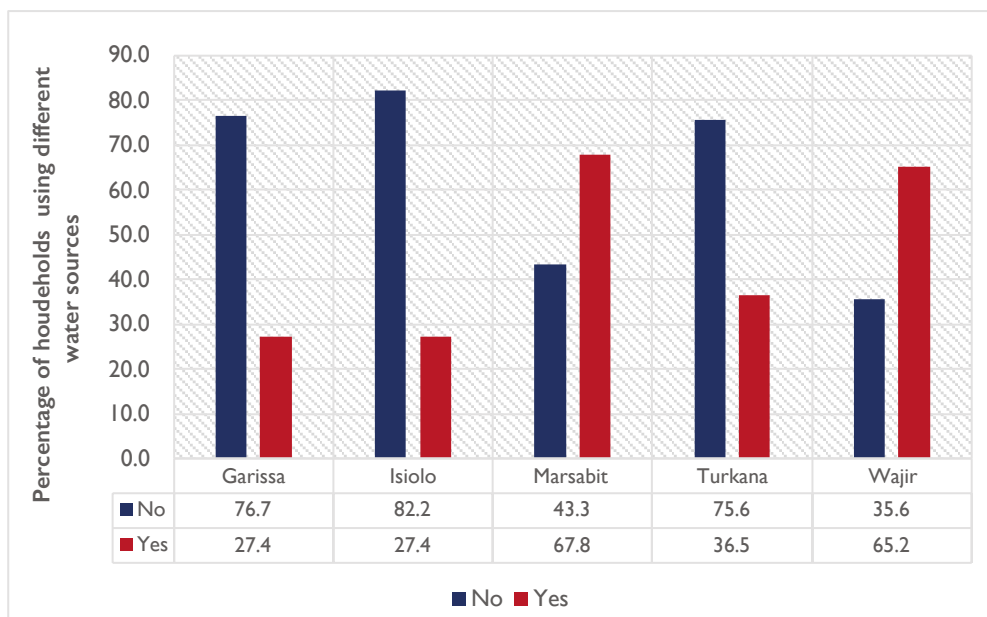


Figure 18: Percentage of households that vary their water sources seasonally.

To assess variations in source during the dry and wet season, the 172 households that reported varying their water source seasonally were queried on the different sources used during the dry and wet season. Analysis indicates that these households rely on water kiosks (23.3%), protected wells (20.3%), water piped into compound, yard, or plot (15.1%) and public taps/standpipes (8.7%) during the dry season. Water from the water kiosks, water piped into compounds, yards or plots and water from public taps/standpipes is supplied through boreholes which form the major supply (52.3%) during dry seasons. Alternatively, during the wet season, the households predominantly rely on surface water and rainwater harvesting. Of importance is that there is still significant reliance on water kiosks during the wet season as per Figure 19 below.

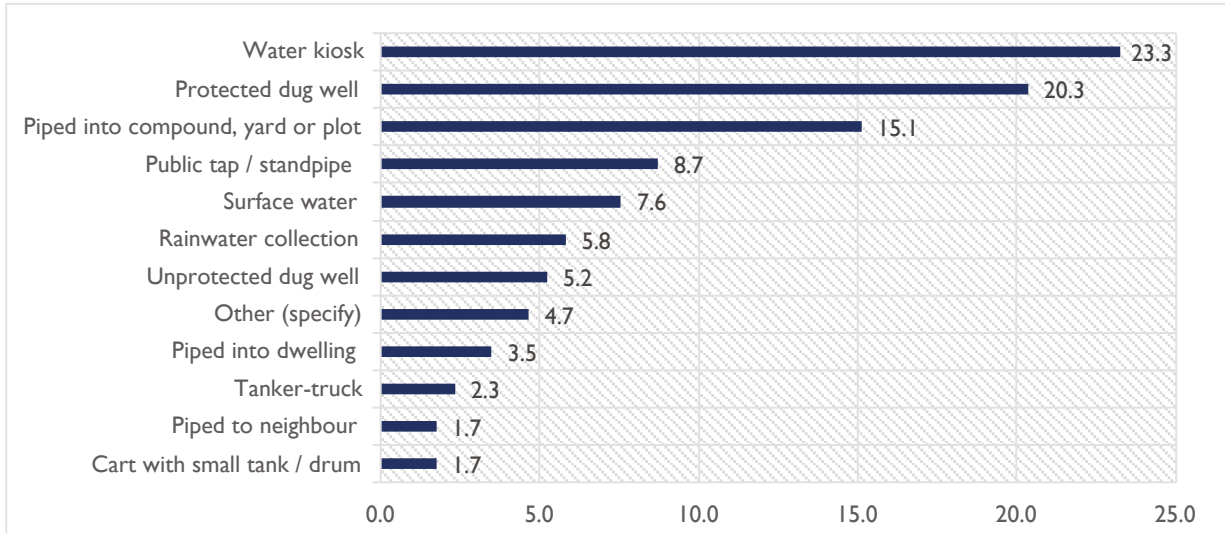


Figure 19: Main source of drinking water for household members in the dry season.

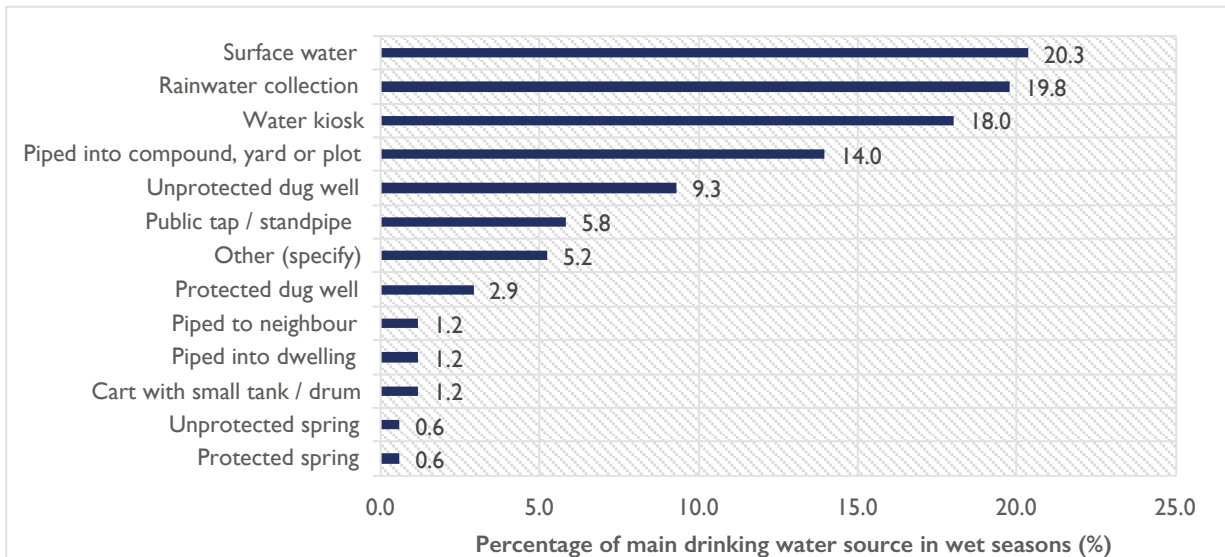


Figure 20: Main source of drinking water for household members in the wet seasons.

As discussed above, it is clear that the primary sources of drinking and domestic water vary with rainfall seasonality. Previous studies have shown that pastoral and agropastoral households typically in ASAL regions use a mix of groundwater (boreholes) and surface water to meet their needs but have an increased reliance on ground water during dry seasons or in times of drought.¹¹

For the 282 households that reported using the same water source across the seasons, further analysis was conducted to understand how they collect their water from the source or how water is conveyed to their households. The main means of conveyance was through water kiosks, followed by water that was piped directly to the household. Water was sourced from the boreholes, for households receiving water through water kiosks, public standpipes, piped compound and dwelling connections, and piped connections from the neighbors. The respondents were not sure where the water from carts with small tanks/drums was conveyed from.

¹¹ Katie Fankhauser, Denis Macharia, Jeremy Coyle, Styvers Kathuni, Amy McNally, Kimberly Sliniski, Evan Thomas, Estimating groundwater use and demand in arid Kenya through assimilation of satellite data and in-situ sensors with machine learning toward drought early action, Science of The Total Environment

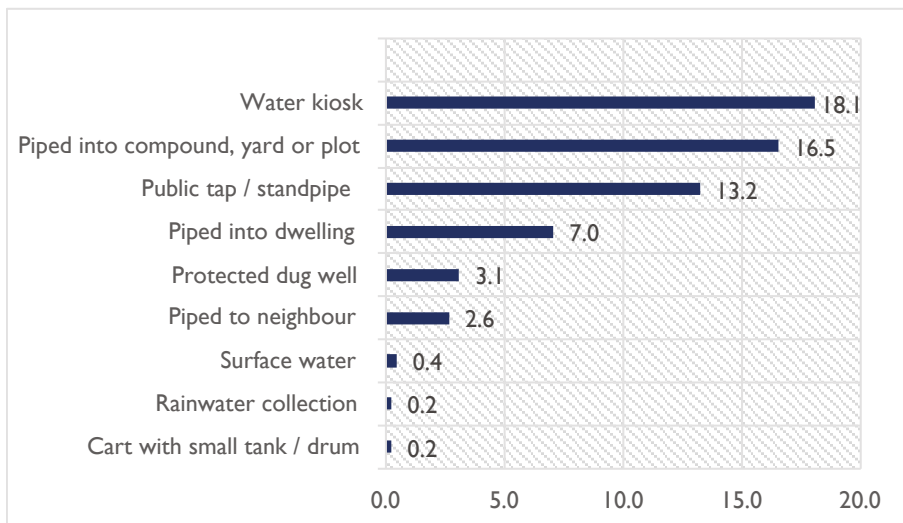


Figure 21: Type of Water Source

Alternative water sources

About 50.4% of the 454 households have alternative sources of water that they can visit when the main water source is not working. Marsabit County has the highest number of households with alternative water sources at 72.5% while Turkana County has the lowest number of households with alternative water sources at 35.4%. The disaggregation of the access to alternative sources of water per county is illustrated in Figure 22.

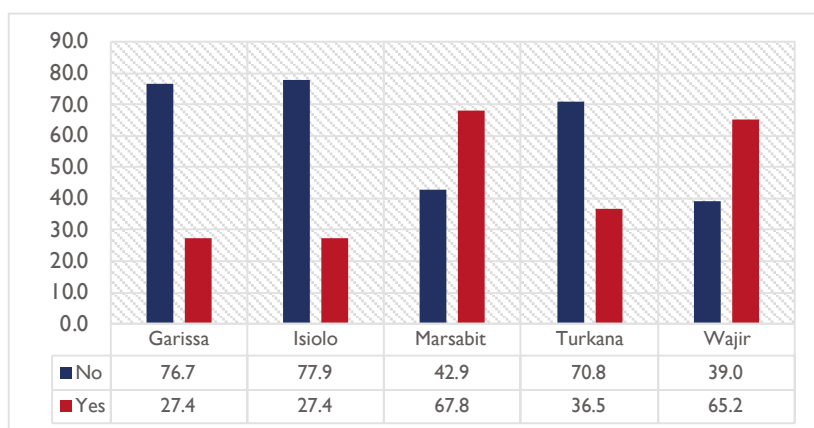


Figure 22: Households with alternative sources of water.

Surface water and unprotected wells account for the highest percentage of alternative water sources at 29% followed by unprotected dug wells at 24%, implying that households resort to unsafe water sources when the primary source is non-functional. Figure 23 provides a summary of alternative water sources.

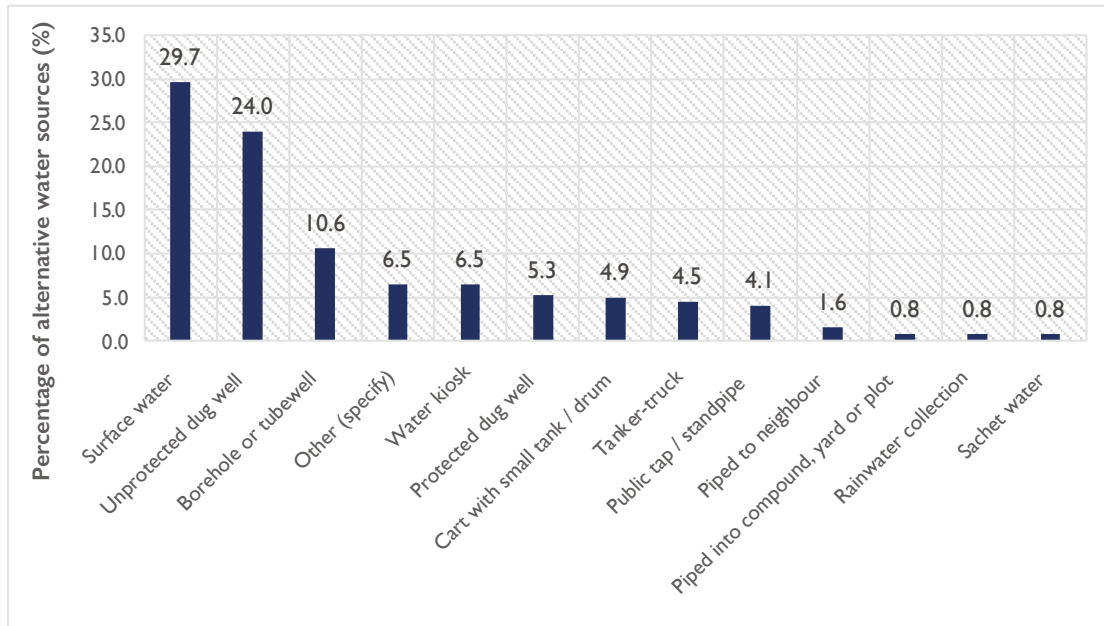


Figure 23: Break down of alternative water sources.

Distance to water sources.

The average distance to the primary water source is about 356m while the average distance to the alternative water sources is 6.8 kilometers for the households interviewed under the assessment. A round trip to the primary water source takes approximately 28.5 minutes including queuing. This time increases almost threefold to 92 minutes for alternative water sources. This is caused by the long distances to the alternative sources. About 86% of household members who collect water walk to the source, 3% use animal transport while 2% use carts. Only 9% use other means of transport comprising wheelbarrows that are either owned by the households or shared among neighbors as shown in figure 24 below.

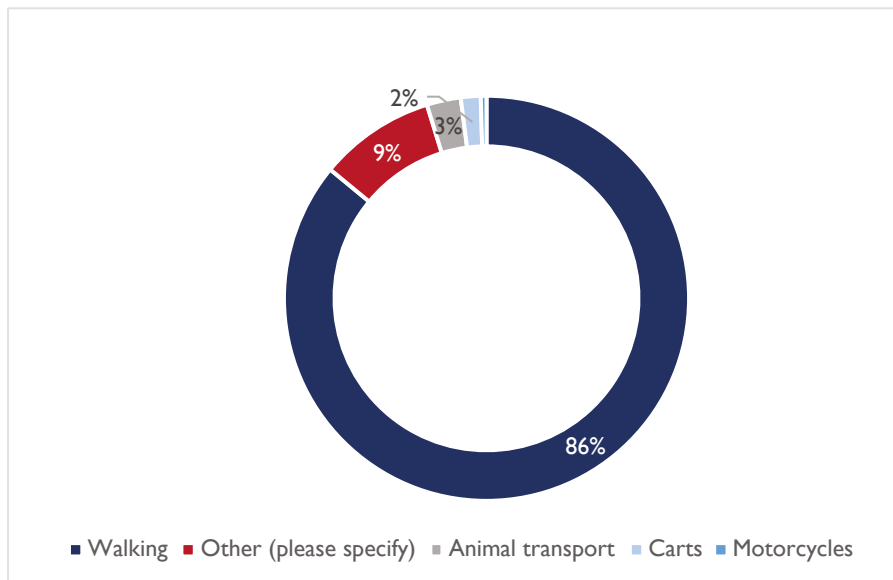


Figure 24: Means of transport to the water point.

Across all counties it is pre-dominantly adult women who fetch water for the household followed by girls. A per county breakdown is provided in Figure 25 below.

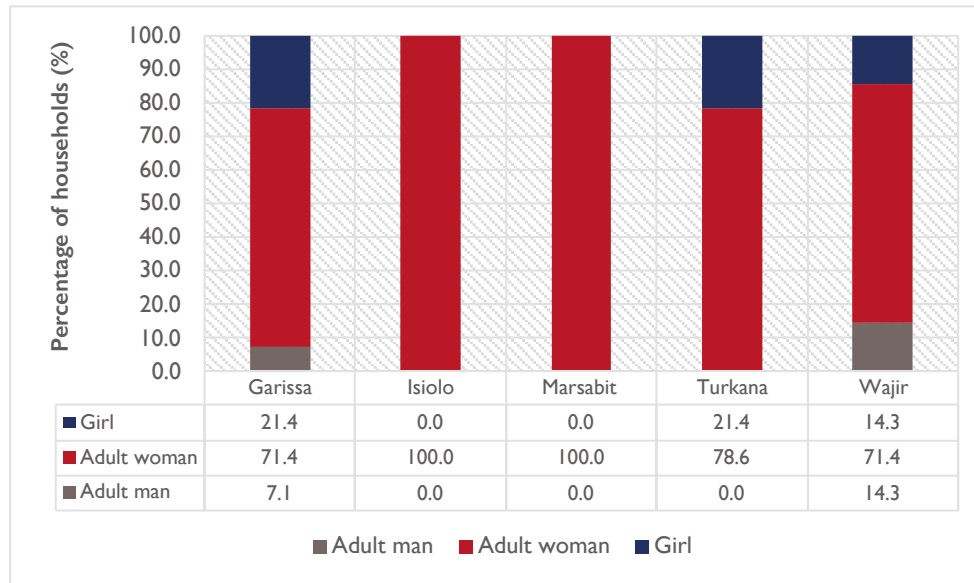


Figure 25: Household members who fetch water.

3.3.2. Ability and willingness to pay for water.

Out of the 454 households surveyed in the study, 76% pay for water services, with Garissa having the highest number of households paying for water at 88.9%. The majority of households (68.3%) pay for water on a weekly or monthly basis while 31.7% of households pay for water every time they collect it. Households who pay for water weekly or monthly pay an average of KES 75 and KES 302 respectively, while those that pay every time they collect water pay about KES 5.25 per 20-liter jerrycan. 97% of households pay for water through cash as illustrated below.

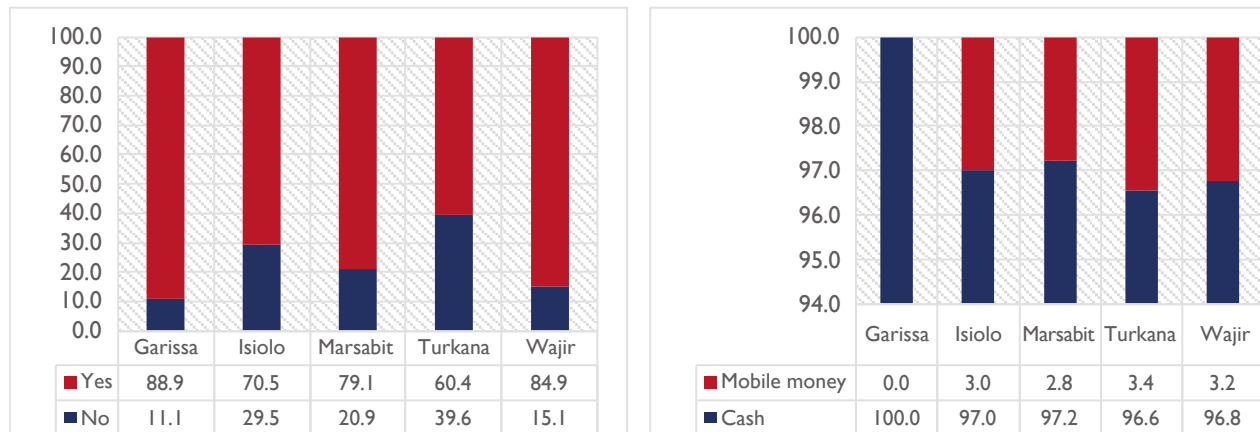


Figure 26: Number of households paying for water and methods of payment.

The overall cost of water for those who pay for water every time they collect is higher compared to those who pay weekly or monthly.

Of households that do not pay for water (24%), 70.5% express willingness to pay for improved water services as illustrated in figure 27, implying that unreliability of current water services may be a significant factor in their reluctance to pay. In the context of DRIP FUNDI, the fact that majority of the enumerated households (69.3%) are already paying for water services and 70.5% are willing to pay for improved services means that if proper processes are put in place to guarantee reliable supply, the more revenues can be generated to support the maintenance of the boreholes. This could complement revenue generated from carbon credits, aiding in borehole maintenance efforts.

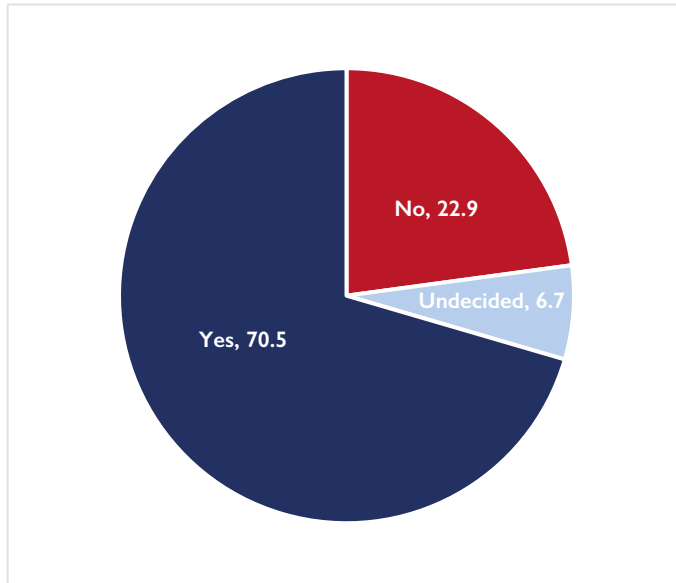


Figure 27: Percentage of people willing to pay for water.

3.3.3. Borehole breakdown and repair

Borehole breakdown or non-functionality refers to a situation where the borehole system is unable to pump water from the borehole to a suitable waterpoint for users to fetch water. This can result from various issues, including motor failure, submersible pump failure, sedimentation, casing/draw pipes issues, and solar power/diesel generator failure, among others. Insights from the borehole operator questionnaire highlight pump and motor failure as the most prevalent cause of borehole breakdowns. Table 7 shows the main causes of borehole breakdowns:

Table 7: Major causes of borehole non-functionality

Causes of borehole non-functionality	Percentage %
Casing failure	2.65%
Distribution pipeline failure	2.12%
Generator failure	8.47%
Grid power failure	0.53%
Insufficient water at source	2.12%
Motor Failure	40.21%
Sediment and/scale build up	0.53%
Sensor failure	0.53%
Solar power failure	8.99%
Storage facility	0.53%
Submersible pump failure	26.46%
Switchboard failure	6.88%

Borehole non-functionality is mainly caused by motor and submersible pump failure, accounting for 40.21% and 26.46% of borehole failures respectively. Solar power failure contributes 8.99%, while generator failure and switchboard failure contribute 8.99% and 8.47% respectively. Other notable causes of borehole failure include casing failures (2.65%), distribution pipeline failure (2.12%), insufficient water at source (2.12%), grid power failure, sediment buildup, storage facility failure and sensor failure all which account for 0.53% of breakdowns.

The high instances of motor and pump failure could be associated with motors and pumps being overworked, especially during the dry season. In the context of DRIP-FUNDI, motors and pumps would be one of the key spare parts to stock especially in the dry season when most of the boreholes are working full time. The capacity building of borehole operators will also be key in the overall operation and maintenance of the boreholes on issues such as nominal working hours for pumps and generators and timelines for servicing of borehole parts such as the generator.

Borehole breakdowns are reported using various mechanisms. Table 8 illustrates the preferred reporting and response mechanisms disaggregated by county. According to the interviewed borehole operators, “Calling the county water department” is the preferred reporting mechanism likely because water user committees are conversant with the Borehole Rapid Response Teams (BRRTs). The second most common method is calling of Non-Governmental Organizations that are prevalent in ASALs of Northern Kenya and are known to support water user committees during system breakdowns.

Table 8: Breakdown Reporting Methods.

County	Call a local technician to repair	Call an NGO	Call the area MCA/MP/Women Rep	Call the county water department/BRRT	None	Committee
Garissa	20.0%	4.0%	14.0%	60.0%	2.0%	0.0%
Isiolo	3.9%	15.7%	0.0%	76.5%	3.9%	0.0%
Marsabit	3.9%	11.8%	2.0%	74.5%	3.9%	3.9%
Turkana	0.0%	5.7%	0.0%	90.6%	3.8%	0.0%
Wajir	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%

For boreholes where revenue is collected through water users’ associations or similar outfits, some repairs and regular service of components can be funded. However, for cost-heavy parts such as pumps, motors, inverters etc., the communities reach out to the county government, development partners or NGOs to facilitate the repair. Figure 28 below illustrates the entities that meet the cost of repairing broken boreholes. It is encouraging to note that charges paid on water rank highly among the methods for funding the repair of boreholes.

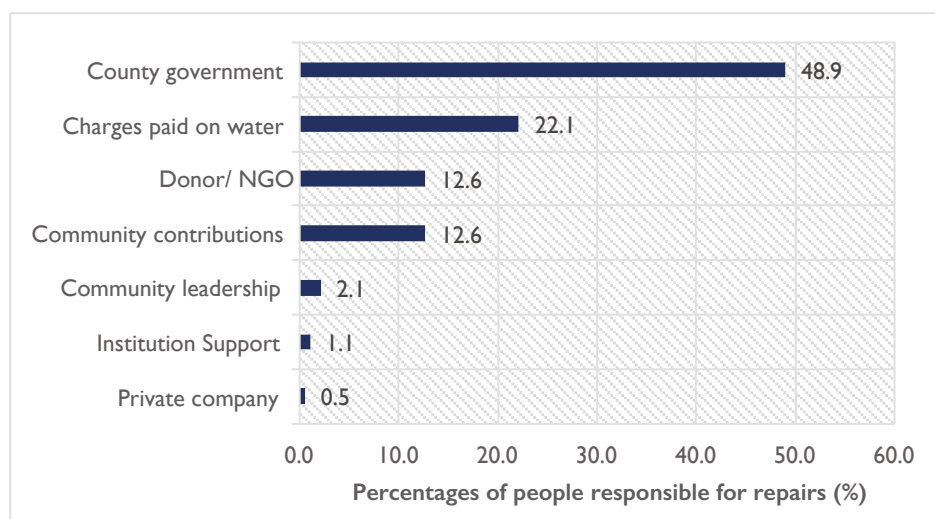


Figure 28: Who meets the costs of borehole repairs.

From the KIIs and FGDs, 33% of the respondents indicated that the average response time to address reported issues was less than 7 days whilst 67% reported the response time to range between 7 – 30 days. This response time is affected by several issues with the main one being the limited availability of spare parts (41%) and limited financial capacity (19%) of the entities that meet the cost of repairing boreholes.

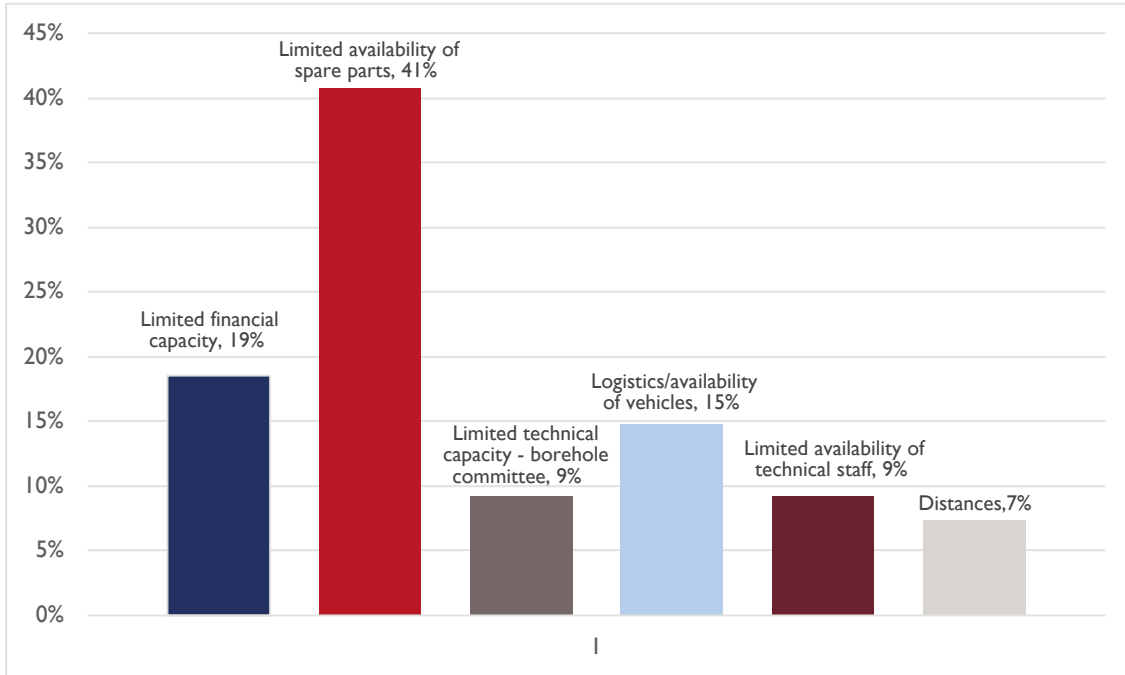


Figure 29: Factors affecting response time from KIIs and FGDs

3.3.4. Borehole Uptime

Borehole uptime is calculated as the number of days the borehole was functional within a month divided by the total number of days in the month. Borehole functionality is defined as the ability of the borehole pump to draw water from the borehole to a collection point, that is, if the system can draw water, then it is categorized as functional otherwise it is categorized as non-functional. Using the borehole operator questionnaire to obtain the number of days that a borehole was functional within a month, the formula below was used to calculate the borehole uptime:

$$Uptime = \frac{\frac{funtional\ days(Jan)}{total\ no.\ of\ days(Jan)} + \frac{funtional\ days(Feb)}{total\ no.\ of\ days(Feb)} + \dots + \frac{funtional\ days(Dec)}{total\ no.\ of\ days(Dec)}}{12months}$$

From the study, the average borehole uptime across the five counties is 84.4 %. Figure 30 illustrates the average borehole uptime per county.

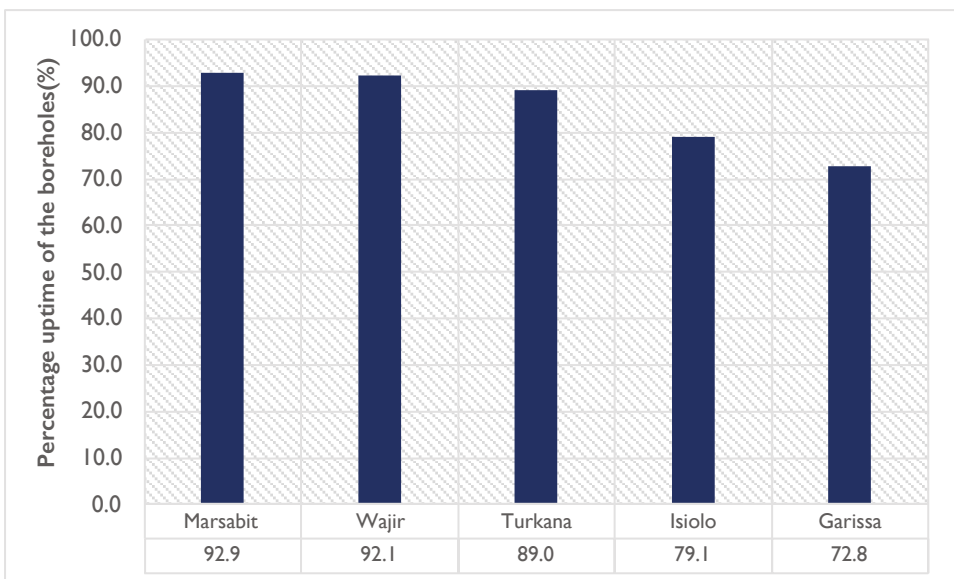


Figure 30: Borehole uptime per county.

The average borehole uptime fluctuates throughout the year, reaching its lowest points in November and May, which align with the October-November-December (OND) short rains and March-April-May (MAM) long rains seasons, respectively. Conversely, borehole uptime peaks during the driest months of September and January-February. The observed patterns may be attributed to the presence of alternative surface water sources during the rainy seasons which may minimize the urgency for repairing boreholes. The increased functionality of boreholes during dry seasons could be because of collaborative endeavors by stakeholders to activate boreholes, which serve as primary water sources during periods of drought.

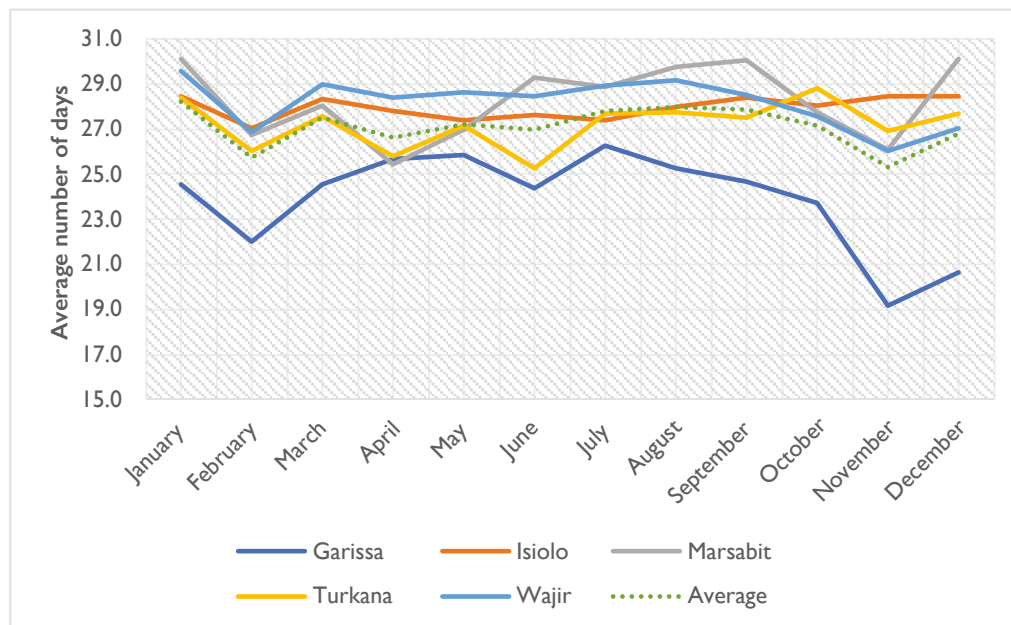


Figure 31: Borehole uptime per month.

The table below shows the average number of borehole breakdowns in the past year per County with Wajir and Garissa registering the highest number of breakdowns in 2023.

Table 9: Frequency of borehole breakdown – 2023

Counties	Average Number of Times the Borehole Breaks Down Annually	How long did it take to repair the last breakdown on average (Days)
Garissa	2	57
Isiolo	1	60.3
Marsabit	1	46.8
Turkana	1	75
Wajir	2	16.6

To triangulate the uptime value, data from the borehole questionnaire revealed that it takes an average of 51.14 days to repair a borehole when it breaks down (Table 9). Using a calendar year of 365 days, and the data above showing that on average a borehole breaks down once a year, then it means that the borehole is operational for 309 days in a year which is about 85.9% uptime. This data corroborates the calculated uptime in Figure 30.

Figure 32 illustrates the frequency of borehole breakdowns as described by respondents from the KIs. The majority (32%) of respondents noted that boreholes break down 0-1 times in a year, which corroborates the data from the borehole operator questionnaires.

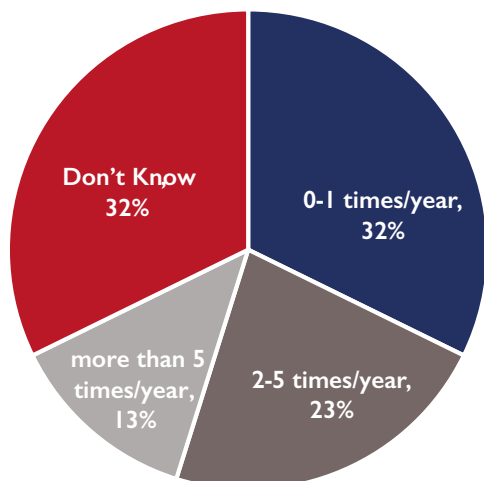


Figure 32: Frequency of borehole breakdown from KIIs and FGDs

The uptime value determined by the study surpasses the program proposal design uptime of 77% (derived from secondary sources of data). This variance could be attributed to the sampling method employed, which may have favored primarily functional boreholes. Moreover, the data used to compute borehole uptime heavily relied on the recollection of borehole operators for the 2023 period, potentially introducing inaccuracies compared to relying on physical records. The timing of data collection, occurring after a notably abundant rainy season, might have influenced the data provided by the respondents. Additionally, anecdotal evidence indicates that more development entities have been channeling funding towards the rapid repair of boreholes which could have improved the overall uptime of boreholes.

3.3.5. Water Quality and Treatment

Water Quality

Water quality testing was done at a total of 241 boreholes but only 240 boreholes had complete results while tests were conducted at 230 households but only 228 had complete results. For the households only one test was being conducted at each borehole¹². The test was focused on microbiological contamination based on WHO standards which state that water directly intended for drinking must not have detectable E. coli in any 100ml sample i.e., less than 1 Colony Forming Unit (CFU) of E. coli /100 ml. Testing was not conducted for chemical parameters. Figure 33 shows the distribution of the total number of tests done across the counties for both households and boreholes/water points.

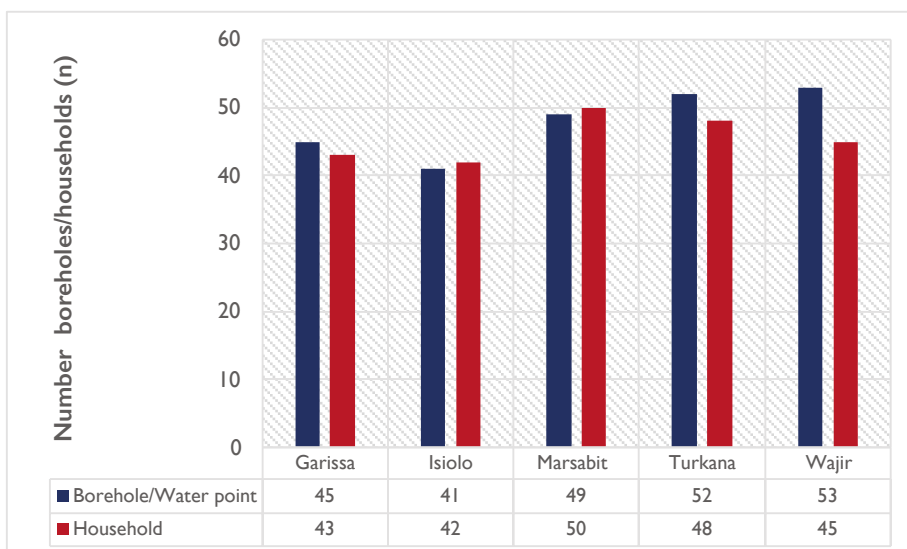


Figure 33: Number of boreholes and households where water quality treatment was conducted.

¹² Water Quality tests were not done for all 259 boreholes because the testing kits ran out in some of the counties. Boreholes where water quality testing has not been conducted have been flagged for water quality testing later during program implementation.

Analysis was only conducted for E-coli due to failure of the UV backlights in Turkana and Marsabit Counties during the field data collection. This rendered it impossible to finalize the testing for Total Coliforms. Boreholes and households with E-coli automatically have total coliforms. However, it would have been difficult to detect additional samples with total coliform contamination hence the decision to omit these results.

The water quality test results for boreholes revealed that 50.4% or 121 out of 240 boreholes tested positive for E-coli. The figure was much higher for households where 74.56% or 170 out of 228 boreholes tested positive for E-coli. This shows that the storage methods of water in the households play a role in the contamination of drinking water once fetched from the borehole. The contamination could also have come from cross-contamination of water from different sources as the household also collected water from water pans during the rainy season.

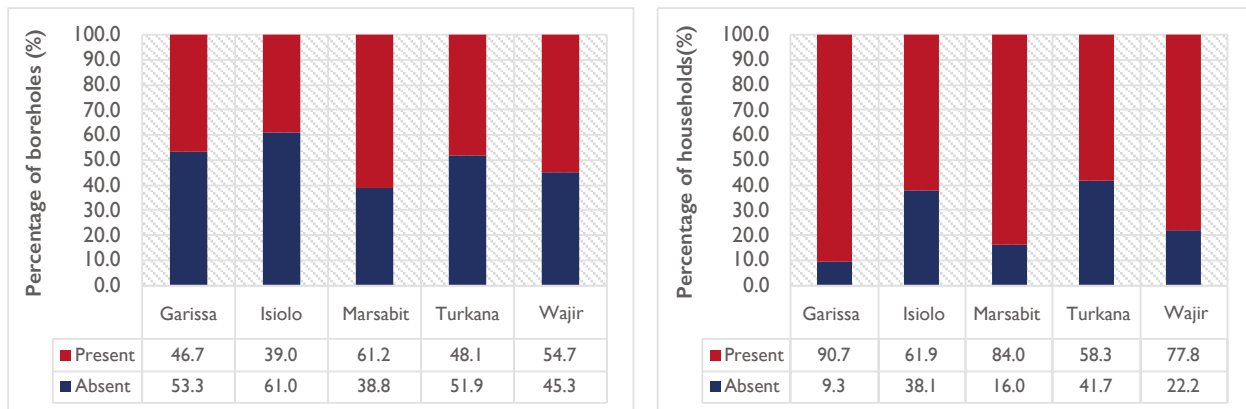


Figure 34: Presence/Absence of E. coli in Borehole and Household Water Samples

Water Treatment

It was noted from the data that most households queried on water treatment (n=386) do not treat their water.

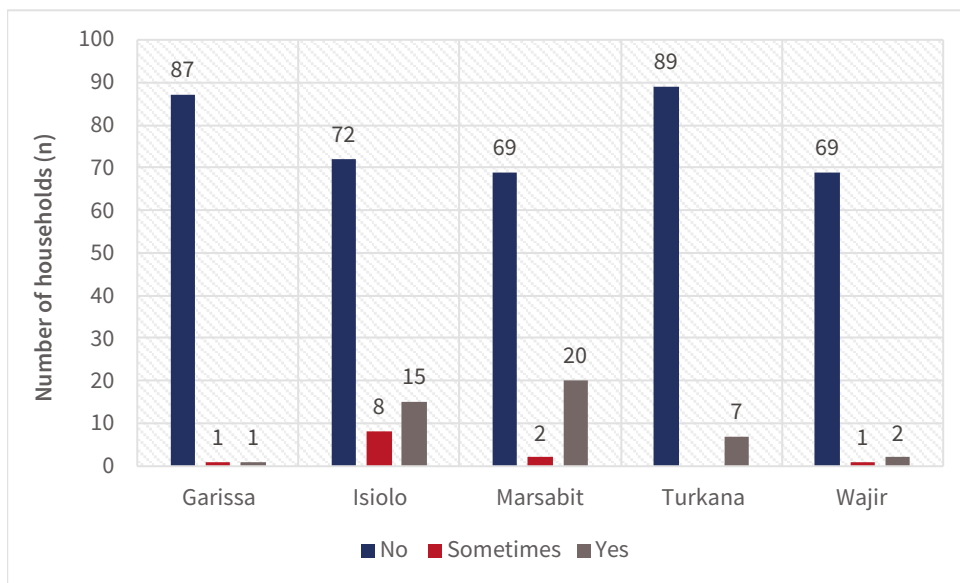


Figure 35: Household Water Treatment

For households that reported treating their water (n=57), the main mode of treatment was through the addition of chlorine/bleach or Aqua tabs. The second most common treatment method was boiling of untreated water practiced by 15 households or by 26% of the households treating water. This information is captured in table 10 below. It is essential to note that households were purposively selected and therefore the data is not representative. However, the findings corroborate evidence of low water treatment prevalence in the region.

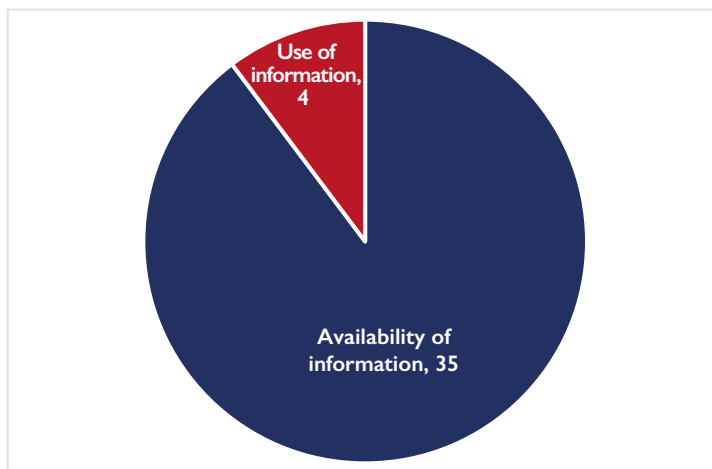
Table 10: Treatment Methods

Treatment Methods	Garissa	Isiolo	Marsabit	Wajir	Turkana	Grand Total
Adding Bleach/Chlorine/Aqua tabs	1	15	9	3	4	38
Boiling	1	8	6		2	15
Let it stand and settle	1		1		1	3
Solar disinfection	1		1			1
Grand Total	n=2	n=23	n=17	n=3	n=7	n=57

3.3.6. Data management and use

Most of the borehole operators do not have any logs or records of the boreholes they maintain. Only 9.5% (n= 25) borehole operators reported that they kept some form of borehole records. Key informant interviews (KIIs) with various stakeholders also revealed that county water departments only have records on the location of the boreholes, the staff members assigned to repair the boreholes and the materials used for repair but lack information on the nature of repair undertaken. The officials repairing the systems do not compile reports that can be followed up or accessed by external parties. The sharing of data across institutions, such as between water utilities, non-governmental organizations (NGOs), and county water departments, was found to be limited, thereby impeding timely repair of systems.

When questioned, the borehole operators, water users' associations and management committees confirmed limited to no access to climate information nor were they implementing any water related risk-reducing actions to improve resilience to climate change. Interviews with county water department officials and the BRRTs reveal slightly different metrics. From figure 36 the interviewees confirm that they are aware of climate information being available (90%) but due to the limited access only 10% (n=4) use the information. According to one of the interviewees, the information is not well shared, and exists in too many places, thus there is need to enhance coordination across the different institutions. One of the representatives from the National Drought Management Authority (NDMA) who was interviewed indicated that they undertake flood and drought assessments twice a year thus confirming the existence of climate information.

**Figure 36: Access to climate information.**

Below are some of the activities that the 10% who use climate information undertake:

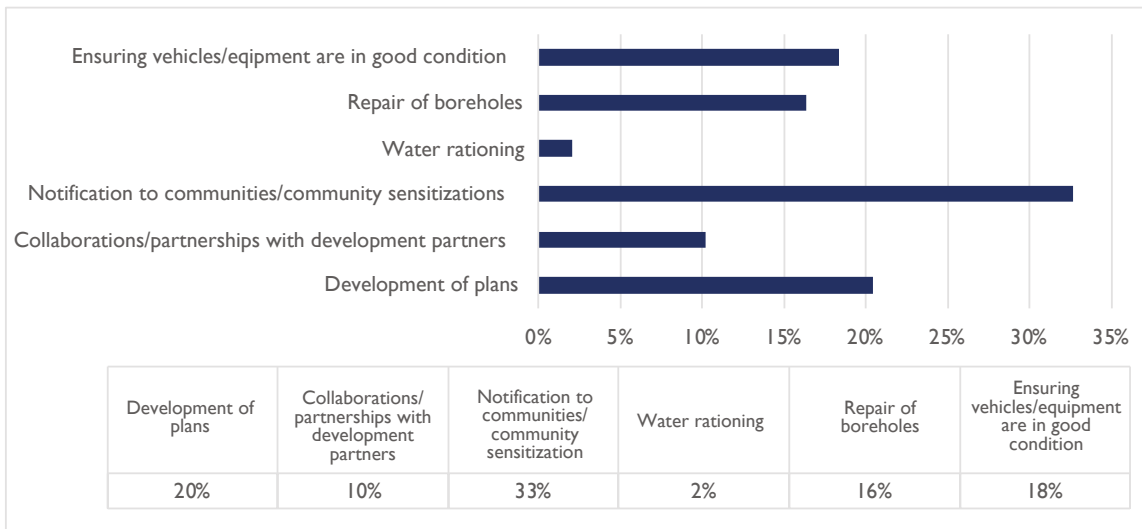


Figure 37: Activities undertaken because of climate information.

Water rationing is mainly done by the water service providers within the counties. The majority (33%) of the activities are centered around community sensitization and notification of impending floods or drought.

3.3.7. Technical, Human and Financial capacity of BRRT Teams

From the KIIs and the FGDs, the borehole operators expressed confidence in the technical capacity of the BRRTs as they had undertaken multiple repairs of their boreholes to full functionality. The interviewees offered that the BRRT members were well-trained (88%) with only 12% noting that they would require additional capacity building.

In terms of availability of human personnel to undertake borehole repair and maintenance works, 21% of respondents noted that there was limited availability while 24% indicated that the human personnel were available. This shows that the mobilization of the BRRT teams could be skewed to certain areas due to other factors such as distance and transport logistics. Figure 38 illustrates the availability of resources as described by the KIIs.

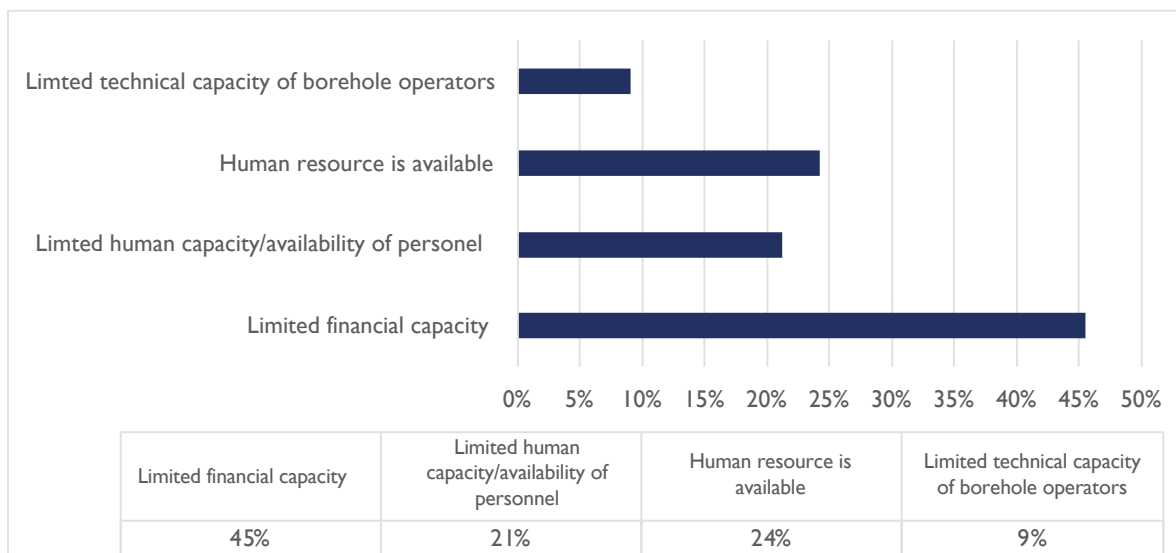


Figure 38: Availability of resources from key informant interviews.

The most significant limiting factor hampering BRRTs from repairing borehole systems was lack of financial resources to purchase spare parts and to travel to the boreholes. The county governments can leverage NGOs and other development partners to facilitate the repair of boreholes as well as undertake rehabilitation works through proposals. However, the process is long and lengthens the delay in repairing the borehole. More importantly, it is not sustainable. Some of the water users’ associations and management committees collect revenue from borehole users and use the money to repair boreholes. The financial capacity of the water associations and committees is not enough to fund the replacement of submersible pumps, motors, and other cost-heavy repairs.

3.3.8. Spare parts providers

Spare part providers in the DRIP FUNDI counties mainly deal in borehole equipping, solarization, irrigation equipment supply and installation. Some of the spare part providers that were interviewed include Davis & Shirtliff, Epicenter Africa, Solargen Technologies, Jatim Engineering and Kataboi Hardware. The Key Informant Interviews (KIIs) revealed that the most requested spare parts are motors and borehole pumps corroborating evidence on borehole components that frequently breakdown. This is captured in figure 40 below.

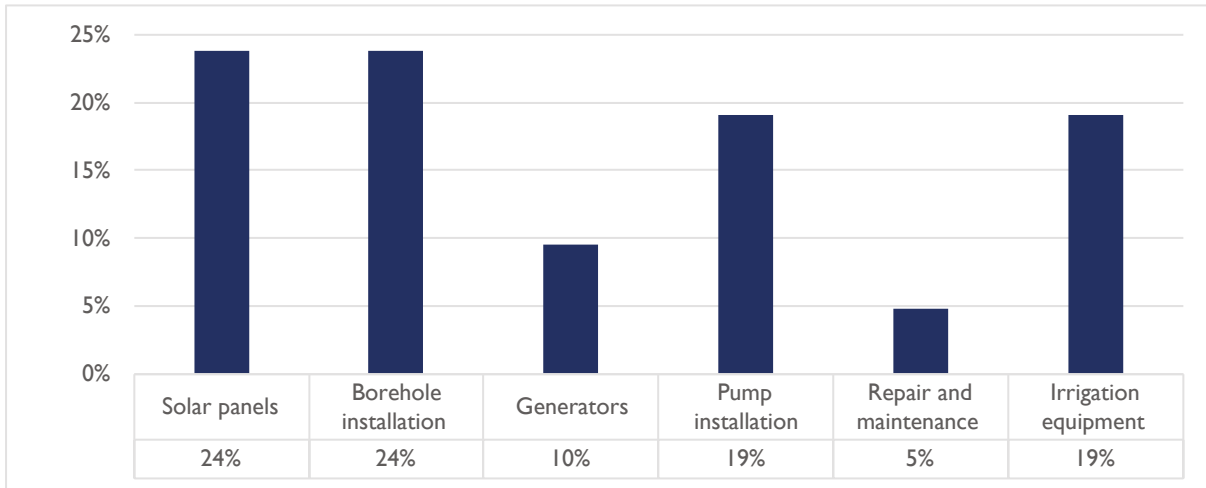


Figure 39: Items interviewed spare parts providers deal in.

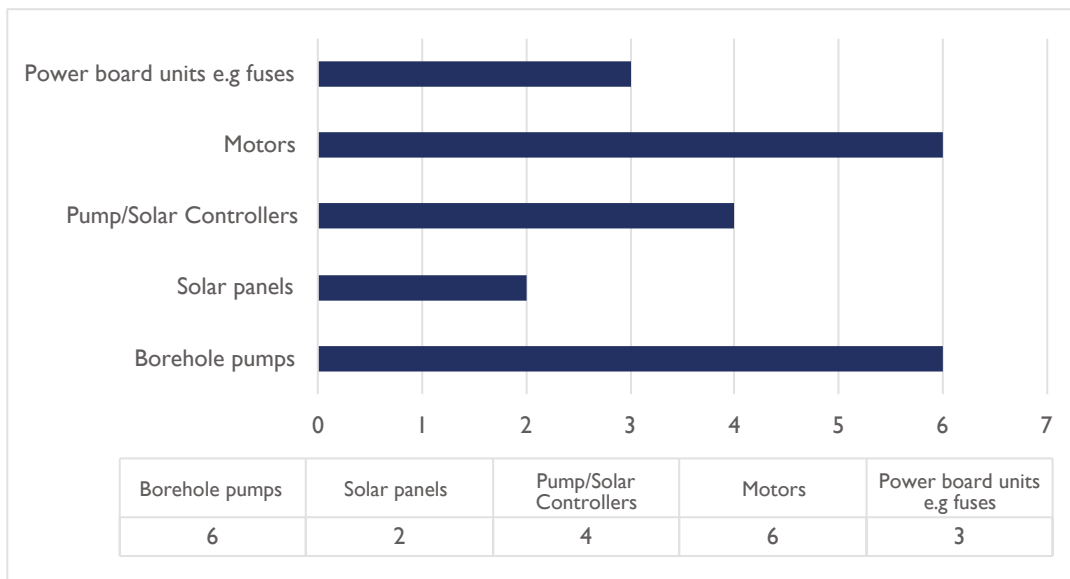


Figure 40: Most commonly requested spare parts.

From figure 41, it is evident that the most common clients for the spare parts providers are individual/private entities (31%) followed by non-governmental organizations (30%). The spare parts providers interviewed also work with contractors who have been employed by either the county government or the water service providers. The spare parts providers prefer to work with the contractors rather than working directly with the county government due to the long procurement process at the county level and delayed payments during implementation of projects.

Some of the non-governmental organizations and development partners that the spare parts providers have worked with include:

- Save The Children
- World Vision
- Aqua for All
- Action Aid
- Rotary
- Well Aware
- World Bank
- USAID
- UNDP
- Novartis
- PACIDA
- Child Fund
- Practical Action
- SOS Children's Village

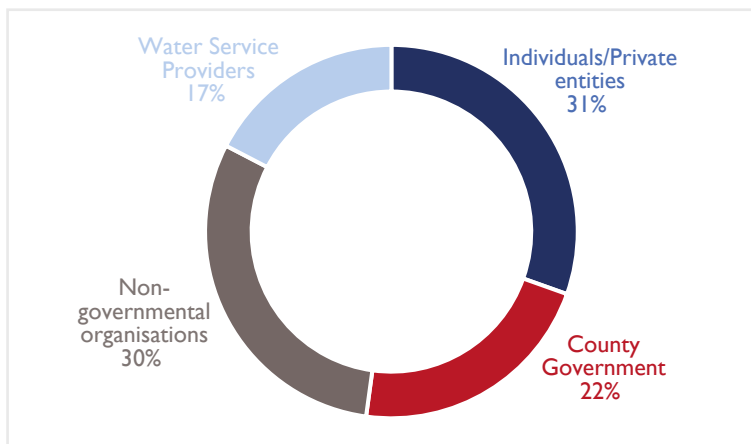


Figure 41: Spare parts providers' clients.

All the spare parts providers that were interviewed have a good relationship with their suppliers and manufacturers with most of them having multiple partnerships with several suppliers. Below is a list of suppliers and manufacturers that the spare parts operators work with:

- General Electric (USA)
- Grundfos (Denmark)
- Solar Water Solutions (Finland)
- Jinko Solar (China)
- Yingu Solar (China)
- Ennos (Switzerland)
- Hidro-Tek (China)
- Leoch International Technology (China)
- Lister Petter (UK)
- Lorentz (Germany)
- Perkins (UK)
- Pedrollo

The main challenges that the spare parts providers face in the sourcing of spare parts include:

- a) **Customization of spare parts** – Some of the spare parts requested by the clients are specific to a borehole and need to be customized. This requires the team to go on-site and assess the borehole and request for the part to be custom made or modifications to be made to available parts once delivered.
- b) **Low client technical capacity** – Due to limited capacity in borehole maintenance some of the clients are usually unsure of what has broken down and thus request the wrong part.
- c) **Cost** – Due to the location of some of the boreholes, the cost of purchasing the spare part is sometimes lower than the cost of delivery and installation.
- d) **Phasing out of some spare parts** – Some of the spare parts have been phased out and thus are a challenge to source from the suppliers.

In terms of delivering spare parts within the county, the main challenges faced by the spare parts providers are insecurity (46%) and bad road networks (31%). Regardless of this, all the spare parts providers that were interviewed stated that they are able to deliver the needed spare parts within two days to the boreholes, provided payment is made on time.

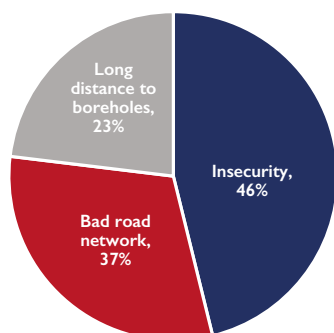


Figure 42: Challenges to delivery of borehole spare parts.

The spare parts providers are well versed with the repair of borehole systems having gone through capacity building by their suppliers. Six of the spare parts providers that were interviewed have qualified engineers in the fields of electrical and mechanical engineering while the rest confirmed they have qualified technicians in the electro-mechanical field. Some of the technicians have also undergone extra training from tertiary institutions such as the Kenya Water Institute (KEWI). Spare parts providers such as Davis and Shirtliff and Epicenter even offer training to the county government operators.

The spare parts providers also noted that there is increased trust in spare parts from China as long as they have warranties. There has also been greater demand for solar power components. All the spare parts providers that were interviewed confirmed that there is always higher demand for spare parts during the dry season as the boreholes are operated continuously.

The spare parts providers stated that the implementation of DRIP-FUNDI would not affect the supply chain. One of the spare parts providers mentioned that it would provide a credible interface with borehole owners and management committees while another postulated that it would provide a much better framework for Public-Private Partnerships (PPP) especially where the borehole has already been drilled. The spare parts providers were all willing to partner with DRIP-FUNDI in borehole operations, maintenance, and monitoring.

3.4. Indicator Baseline Values

Based on the results of the baseline, MWA was able to complete baseline values in the Indicator Tracking Table (see summary below):

Table 11: Summarized Indicator Tracking Table

Indicator	Result Measured by Indicator	Type of Indicator	Data Source	Frequency	Unit of Measure	PPR (Y/N)	Baseline		Target	
							Date	Value	Date	Value
Number of individuals directly utilizing improved water services provided with BHA funding	Utilization of the improved water services	Performance	Population-based endline survey	Annually	Number	Y	02/2024	0	03/2025	120,000
Percent of target boreholes reporting 95% uptime	Uptime improvement of the boreholes,	Performance	Dashboard analytics	Quarterly	Percentage	Y	02/2024	0	03/2025	100%
Number of reported breakdowns that are responded to as a result of available borehole technical data	Responsiveness to breakdowns of the boreholes	Performance	Outcome monitoring and participant-based sample survey	Quarterly	Number	Y	02/2024	0	03/2025	TBD ¹³
Number of borehole assets inventory/ repository developed at the county level by BRRTs and Private Sector	Availability of the crucial info on the boreholes	Performance	Routine monitoring	Baseline	Number	Y	02/2024	0	03/2025	1
Number of spare parts data repository developed and updated by BRRT and Private sector	Availability of the fast-moving list of spare parts	Performance	Routine monitoring	Baseline	Number	Y	02/2024	0	03/2025	1

¹³ The number will be hard to determine right now, as one cannot tell the number of breakdowns that will be responded to during the program implementation period. This will be computed during the program endline, when all breakdowns that have occurred are summed up.

³ The program is aiming at enhancing the use of sensor data to inform the implementation of risk reducing action. This will be computed during the program endline.

Indicator	Result Measured by Indicator	Type of Indicator	Data Source	Frequency	Unit of Measure	PPR (Y/N)	Baseline		Target	
							Date	Value	Date	Value
Number of boreholes repaired within 4 days of breakdown	Timeliness of the repairs	Performance	Outcome monitoring and participant-based sample survey	Quarterly	Number	Y	02/2024	0	03/2025	200
Number of people using climate information or implementing risk-reducing actions to improve resilience to climate change as supported by USG assistance (RiA)	Utilization of climate information to combat climate risks	Performance	Routine monitoring or participant-based sample survey	Quarterly	Number	Y	02/2024	0	03/2025	TBD ³
Number of reported breakdowns that are responded to in a timely manner by the BRRT and Private Sector	Responsiveness of the repairs team	Performance	Routine monitoring	Quarterly	Number	Y	02/2024	0	03/2025	TBD ¹⁴
Percentage of persons reporting increased usage of remote borehole functionality monitoring approaches as a result of DRIP FUNDI	Improved borehole functionality	Performance	Participant based survey	Annually	percentage	Y	02/2024	0	03/2025	60%
Number of participants trained in the application of the proposed monitoring approaches reporting increased knowledge	Increased knowledge of the participants	Performance	Pre- and post-survey	Quarterly	Number	Y	02/2024	0	03/2025	100
Percent of water points developed, repaired, or rehabilitated with zero fecal coliforms per 100 ml sample	Improved water quality	Performance	Census of all water points repaired	Annually	Percentage	Y	02/2024	0	03/2025	100%
Percent of water points developed, repaired, or rehabilitated with free residual chlorine (FRC) ≥ 0.2 mg/L	Improved water quality	Performance	Census of all water points repaired	Annually	Percentage	Y	02/2024	0	03/2025	100%
Amount of carbon finance mobilized to support operations and maintenance	Resources mobilization	Performance	Outcome monitoring	Annually	Currency	Y	02/2024	0	03/2025	TBD ¹⁵
Amount of carbon credits generated from the target boreholes	Resources mobilization	Performance	Outcome monitoring	Annually	Number	Y	02/2024	0	03/2025	TBD ¹⁶

¹⁴ At this stage of the program, determining the exact number will be challenging as we cannot project the breakdowns that will occur during the implementation period. This will be computed during the program endline, when all breakdowns that have occurred are summed up.

¹⁵ This is dependent on the amount of verified emission reductions that the program will accrue that can only be reasonably estimated after the first visit by the validation and verification body in June 2024.

¹⁶ This is dependent on the amount of verified emission reductions that the program will accrue that can only be reasonably estimated after the first visit by the validation and verification body in June 2024.

3.5. Selected Boreholes under DRIP FUNDI

Following the baseline assessment, 200 boreholes have been shortlisted from across the five counties for the DRIP FUNDI program. The spread of boreholes per county is captured in table 12 below.

Table 12: Spread of selected boreholes per county.

Counties	Selected Boreholes
Garissa	32
Isiolo	41
Marsabit	39
Turkana	48
Wajir	40
Total	200

4. CONCLUSIONS AND RECOMMENDATIONS

The baseline study identified that the borehole uptime for the surveyed boreholes was averagely high compared with the program design uptime. This could be due to either enhanced operational and maintenance efforts in recent years, potential lapses in recall by operators, or the timing of the survey, notably conducted after an above-normal rainfall season. Further, the assessment indicates poor water quality across most boreholes and households. This could be attributed to the cross-contamination of borehole water with water from water pans collected in the same containers in the households. Despite this, most households do not treat their drinking water thus potentially increasing the risk of water related diseases and infections. The poor water quality from the samples taken from borehole water can be linked to the state of the storage tanks which are not cleaned regularly.

Alternative water sources are mostly surface water sources whose quality cannot be guaranteed. The distance to alternative water sources was also generally longer than distances to the primary sources. This emphasizes the need for increasing borehole uptime to reduce instances of households resorting to unsafe alternative water sources. Climate information was not being utilized to improve resilience to climate change across all the counties.

Recommendations to address these shortcomings identified in the study are captured below.

- i) Promote water treatment practices by providing accessible and affordable water treatment options and conducting awareness campaigns to educate households on the importance of water treatment. This will mitigate the risk of waterborne diseases and infections.
- ii) Enhance borehole operation and maintenance efforts by implementing regular maintenance schedules, involving private sector partners, building the capacity of Borehole Rapid Response Teams (BRRTs), and ensuring adequate resources to improve borehole uptime.
- iii) Reduce the distance to alternative water sources by establishing more communal water points which will help discourage reliance on potentially contaminated surface water.
- iv) Develop mechanisms to integrate climate information into water management strategies across all counties which includes creating decision-support tools.
- v) Conduct test pumping for all the boreholes under the DRIP FUNDI program to improve on the accuracy of the borehole asset inventory.
- vi) Telemetric measurement of borehole non-functionality needs to be upscaled to diagnose the causes of borehole breakdown to reduce the turn-around time for repairs.

APPENDICES

Appendix I:

- DRIP FUNDI Baseline Household Questionnaire
- DRIP FUNDI Baseline Borehole Operator Questionnaire
- DRIP FUNDI Water Quality Questionnaire
- DRIP FUNDI Borehole Asset Inventory
- DRIP FUNDI FGD Guide
- DRIP FUNDI County BRRT KII Guide
- DRIP FUNDI Spare Parts Providers KII Guide

DRIP FUNDI - Household Questionnaire

INTRODUCTION

Please state your name?

Phone Number

Gender

- Male
 Female

Please state your age

- 18 - 24 years
 25 - 30 years
 31 - 35 years
 35 - 40 years
 40 - 50 years
 50 - 60 years

County: State the name of the county.

- Marsabit
 Wajir
 Isiolo
 Turkana
 Garissa

If State the name of the county, is Garissa:

Select your sub - county

- Balambala
 Dadaab
 Fafi
 Garissa
 Hulugho
 Ijara
 Lagdera

If State the name of the county, is Isiolo:

Select your sub - county

- Garbatulla
 Isiolo
 Merti

If State the name of the county. is Wajir:

Select your sub-county

- Eldas
- Tarbaj
- Wajir East
- Wajir North
- Wajir South
- Wajir West

If State the name of the county. is Turkana:

Select your sub - county

- Turkana Central
- Turkana North
- Turkana South
- Turkana East
- Turkana West
- Kibish
- Loima

If State the name of the county. is Marsabit:

Select your sub - county

- Loiyangalani
- Moyale
- North Horr
- Sololo
- Marsabit Central
- Marsabit North
- Marsabit South

State the name of your village.

Hint: Which this household is a part of

Please record the GPS location of the household

Don't Know

State the size of this (your) household.

Hint: Number of persons who live in the Household/Compound

Water Source Information

W1: What is the main source of drinking water for members of your household?

Definition of sources of drinking water:

- **Piped into dwelling:** also called a 'household connection', is a piped water supply connected with in-house plumbing to one or more taps (for example in the kitchen or bathroom).
- **Public tap or standpipe:** also known as a public fountain, is a public water point from which people can collect water.
- **Borehole or tubewell:** is a deep hole that has been driven, bored or drilled, in order to reach groundwater. Boreholes/tubewells are constructed with casing, or pipes, which prevent the small diameter hole from caving in and protect the water source from infiltration by run-off water. Water is delivered through a pump which may be powered by human, animal, wind, electric, diesel or solar means.
- **Protected well:** is a dug well that is protected from runoff water by a well lining or casing that is raised above ground level to form a headwall and an apron that diverts spilled water away from the well. A protected well is also covered so that contaminated materials (including bird droppings and small animals) cannot enter the well. Water is delivered through a pump or manual lifting device.
- **Unprotected well:** is a dug well that lacks any of the following: a lining or casing that is raised above ground level to form a headwall; an apron that diverts spilled water away from the well; a cover which prevents contaminated materials (including bird droppings and small animals) from entering the well; or a pump or manual lifting device.
- **Protected spring:** is a natural spring protected by a "spring box", made of brick, masonry, or concrete, that is built around the spring so that water flows directly out of the box into a pipe or cistern, without being exposed to runoff or other sources of contamination.
- **Unprotected spring:** is a natural spring that lacks a "spring box" to protect against run off and other sources of contamination (including bird droppings and animals).
- **Rainwater collection:** refers to a system whereby rain is collected or harvested from large surfaces (by roof or ground catchment) and stored in a container, tank or cistern until used.
- **Tanker-truck:** refers to water sold or distributed by a provider who transports large quantities of water into a community using a motorized truck with a tank.
- **Cart with small tank/drum:** refers to water sold or distributed by a provider who transports a tank or drum with small quantities of water into a community using donkey carts, small motorized vehicles and other means.
- **Water kiosk:** refers to a water point from which water is sold in small quantities. Households typically bring their own containers to be filled.
- **Bottled water:** is sold by commercial providers in small or large bottles or refillable containers. This does not include water from other sources stored in plastic bottles.
- **Sachet water:** is similar to bottled water but is packaged in a plastic bag rather than a bottle.
- **Surface water:** refers to open water sources located above ground including rivers, reservoirs, lakes, ponds, streams, canals, and irrigation channels.

Note: W1 refers to the main source only. See expanded questions on use of multiple sources.

Note: Drinking water refers to the accessibility, availability and quality of the main source used by households for all usual domestic purposes, including drinking, food preparation and personal hygiene

Notes on classification:

1. The term **drinking water source** refers to the point from which water is collected (for example the tap or borehole/well/spring) and not the origin of the water supplied (for example surface water or groundwater).
2. **Improved drinking water sources** are those which by nature of their design and construction have the potential to deliver safe water. Improved sources include: piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater and packaged or delivered water.
3. **Packaged and delivered water** can potentially deliver safe water but were previously treated as unimproved due to lack of data on accessibility, availability and quality. For SDG monitoring the JMP will treat them as **'improved'** and classify them as limited, basic or safely managed based on the new SDG criteria.
4. **Public taps or standpipes** can have one or more taps. They are typically made of brickwork, masonry or concrete and located in public spaces. Households using privately owned taps in a neighbour's yard should be classified as **'piped to neighbour'**.
5. **Boreholes** from which water is pumped into an overhead tank which supplies households in the same compound, should be classified as **'borehole or tubewell'**. However, boreholes delivering water to an overhead tank which supplies multiple compounds through a reticulated piped system should be classified as one of the types of **'piped water'**, depending on where the household collects the water.
6. **Protected wells** may be fitted with a range of lifting devices (for example motorized pumps, hand pumps, ropes and windlasses with buckets) but if the well lacks a cover then it should be classified as **'unprotected well'**.
7. **Rainwater collection** comprises a range of different technologies designed to capture and store rainwater for drinking. Groundwater catchments require filtration and unfiltered surface water should be classified as **'surface water'**.
8. **Water kiosks** are similar to public standpipes, but with a more commercial approach to collecting fees. **Water refill stations** are similar to water kiosks, but operators typically provide households with dedicated containers that are then sanitized before being refilled. These should be classified as **'bottled water'**.
9. **Unimproved drinking water sources** are those which by nature of their design and construction are unlikely to deliver safe water. Unimproved sources include: unprotected dug wells, unprotected springs, and surface water.

- Piped into dwelling
- Public tap / standpipe
- Borehole or tubewell
- Protected dug well
- Unprotected dug well
- Protected spring
- Unprotected spring
- Rainwater collection
- Tanker-truck
- Cart with small tank / drum
- Water kiosk
- Bottled water
- Sachet water
- Surface water - (river, stream, dam, lake, pond, canal, irrigation channel)
- Other (specify)

What is the main source of drinking water for members of your household? is one of Public tap / standpipe, borehole or tubewell, Water kiosk:

Enter name of the water point

If What is the main source of drinking water for members of your household? is one of Bottled water, Sachet water:

W2: What is the main source of water used by members of your household for other purposes, such as cooking and hand washing?

Hint: If this question is answered then W3 and W4 should be answered in reference to this water source

Definition of sources of drinking water:

- **Piped into dwelling:** also called a 'household connection', is a piped water supply connected with in-house plumbing to one or more taps (for example in the kitchen or bathroom).
- **Piped into compound, yard or plot:** also called a 'yard tap', is a piped water supply connected to a tap in the compound, yard or plot outside the house.
- **Piped to neighbour:** refers to a household obtaining drinking water from a neighbour's piped water supply (household connection or yard tap).
- **Public tap or standpipe:** also known as a public fountain, is a public water point from which people can collect water.
- **Borehole or tubewell:** is a deep hole that has been driven, bored or drilled, in order to reach groundwater. Boreholes/tubewells are constructed with casing, or pipes, which prevent the small diameter hole from caving in and protect the water source from infiltration by run-off water. Water is delivered through a pump which may be powered by human, animal, wind, electric, diesel or solar means.
- **Protected well:** is a dug well that is protected from runoff water by a well lining or casing that is raised above ground level to form a headwall and an apron that diverts spilled water away from the well. A protected well is also covered so that contaminated materials (including bird droppings and small animals) cannot enter the well. Water is delivered through a pump or manual lifting device.
- **Unprotected well:** is a dug well that lacks any of the following: a lining or casing that is raised above ground level to form a headwall; an apron that diverts spilled water away from the well; a cover which prevents contaminated materials (including bird droppings and small animals) from entering the well; or a pump or manual lifting device.
- **Protected spring:** is a natural spring protected by a "spring box", made of brick, masonry, or concrete, that is built around the spring so that water flows directly out of the box into a pipe or cistern, without being exposed to runoff or other sources of contamination.
- **Unprotected spring:** is a natural spring that lacks a "spring box" to protect against run off and other sources of contamination (including bird droppings and animals).
- **Rainwater collection:** refers to a system whereby rain is collected or harvested from large surfaces (by roof or ground catchment) and stored in a container, tank or cistern until used.
- **Tanker-truck:** refers to water sold or distributed by a provider who transports large quantities of water into a community using a motorized truck with a tank.
- **Cart with small tank/drum:** refers to water sold or distributed by a provider who transports a tank or drum with small quantities of water into a community using donkey carts, small motorized vehicles and other means.
- **Water kiosk:** refers to a water point from which water is sold in small quantities. Households typically bring their own containers to be filled.
- **Bottled water:** is sold by commercial providers in small or large bottles or refillable containers. This does not include water from other sources stored in plastic bottles.

- **Sachet water:** is similar to bottled water but is packaged in a plastic bag rather than a bottle.
- **Surface water:** refers to open water sources located above ground including rivers, reservoirs, lakes, ponds, streams, canals, and irrigation channels.

Note: W1 refers to the main source only. See expanded questions on use of multiple sources.

Note: Drinking water refers to the accessibility, availability and quality of the main source used by households for all usual domestic purposes, including drinking, food preparation and personal hygiene

Notes on classification:

1. The term **drinking water source** refers to the point from which water is collected (for example the tap or borehole/well/spring) and not the origin of the water supplied (for example surface water or groundwater).
2. **Improved drinking water sources** are those which by nature of their design and construction have the potential to deliver safe water. Improved sources include: piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater and packaged or delivered water.
3. **Packaged and delivered water** can potentially deliver safe water but were previously treated as unimproved due to lack of data on accessibility, availability and quality. For SDG monitoring the JMP will treat them as **'improved'** and classify them as limited, basic or safely managed based on the new SDG criteria.
4. **Public taps or standpipes** can have one or more taps. They are typically made of brickwork, masonry or concrete and located in public spaces. Households using privately owned taps in a neighbour's yard should be classified as **'piped to neighbour'**.
5. **Boreholes** from which water is pumped into an overhead tank which supplies households in the same compound, should be classified as **'borehole or tubewell'**. However, boreholes delivering water to an overhead tank which supplies multiple compounds through a reticulated piped system should be classified as one of the types of **'piped water'**, depending on where the household collects the water.
6. **Protected wells** may be fitted with a range of lifting devices (for example motorized pumps, hand pumps, ropes and windlasses with buckets) but if the well lacks a cover then it should be classified as **'unprotected well'**.
7. **Rainwater collection** comprises a range of different technologies designed to capture and store rainwater for drinking. Groundwater catchments require filtration and unfiltered surface water should be classified as **'surface water'**.
8. **Water kiosks** are similar to public standpipes, but with a more commercial approach to collecting fees. **Water refill stations** are similar to water kiosks, but operators typically provide households with dedicated containers that are then sanitized before being refilled. These should be classified as **'bottled water'**.
9. **Unimproved drinking water sources** are those which by nature of their design and construction are unlikely to deliver safe water. Unimproved sources include: unprotected dug wells, unprotected springs, and surface water.

- Piped into dwelling
- Public tap / standpipe
- Borehole or tubewell
- Protected dug well
- Unprotected dug well
- Protected spring
- Unprotected spring
- Rainwater collection
- Tanker-truck
- Cart with small tank / drum
- Water kiosk

- Surface water - (river, stream, dam, lake, pond, canal, irrigation channel)
- Bottled water
- Sachet water
- Other (specify)

If What is the main source of drinking water for members of your household? is not Piped into dwelling or What the main source of drinking water for members of your household? is not None or What is the main source of water used by members of your household for other purposes, such as cooking and hand washing? is not Piped into dwelling or What is the main source of water used by members of your household for other purposes, such as cooking and hand washing? is not None:

W3: Where is that water source located?

If What is the distance to your primary drinking water source? was answered:

Which means of transport do you use to get to the water point?

- Walking
- Animal transport
- Motorcycles
- Bicycles
- Tractors
- Cars, Pick-ups
- Carts
- Other (please specify)

W4: How long does it take to go there, get water, and come back?

Hint: If household members do not move to fetch water then select Not Applicable

Note: Record the total time taken for a single round trip including queuing.

Not Applicable

Do you have an alternative source of drinking water that you use when your main source is not functioning?

- Yes
- No

If Do you have an alternative source of drinking water that you use when your main source is not functioning? is Yes:

Alternative water source information

State the alternative water source you use when your main source is not functioning

Definition of sources of drinking water:

- **Piped into dwelling:** also called a 'household connection', is a piped water supply connected to the compound or in-house plumbing to one or more taps (for example in the kitchen or bathroom).
- **Piped to neighbour:** refers to a household obtaining drinking water from a neighbour's piped water supply (household connection or yard tap).
- **Public tap or standpipe:** also known as a public fountain, is a public water point from which people can collect water.
- **Borehole or tubewell:** is a deep hole that has been driven, bored or drilled, in order to reach groundwater. Boreholes/tubewells are constructed with casing, or pipes, which prevent the small diameter hole from caving in and protect the water source from infiltration by run-off water. Water is delivered through a pump which may be powered by human, animal, wind, electric, diesel or solar means.
- **Protected well:** is a dug well that is protected from runoff water by a well lining or casing that is raised above ground level to form a headwall and an apron that diverts spilled water away from the well. A protected well is also covered so that contaminated materials (including bird droppings and small animals) cannot enter the well. Water is delivered through a pump or manual lifting device.
- **Unprotected well:** is a dug well that lacks any of the following: a lining or casing that is raised above ground level to form a headwall; an apron that diverts spilled water away from the well; a cover which prevents contaminated materials (including bird droppings and small animals) from entering the well; or a pump or manual lifting device.
- **Protected spring:** is a natural spring protected by a "spring box", made of brick, masonry, or concrete, that is built around the spring so that water flows directly out of the box into a pipe or cistern, without being exposed to runoff or other sources of contamination.
- **Unprotected spring:** is a natural spring that lacks a "spring box" to protect against run off and other sources of contamination (including bird droppings and animals).
- **Rainwater collection:** refers to a system whereby rain is collected or harvested from large surfaces (by roof or ground catchment) and stored in a container, tank or cistern until used.
- **Tanker-truck:** refers to water sold or distributed by a provider who transports large quantities of water into a community using a motorized truck with a tank.
- **Cart with small tank/drum:** refers to water sold or distributed by a provider who transports a tank or drum with small quantities of water into a community using donkey carts, small motorized vehicles and other means.
- **Water kiosk:** refers to a water point from which water is sold in small quantities. Households typically bring their own containers to be filled.
- **Bottled water:** is sold by commercial providers in small or large bottles or refillable containers. This does not include water from other sources stored in plastic bottles.
- **Sachet water:** is similar to bottled water but is packaged in a plastic bag rather than a bottle.
- **Surface water:** refers to open water sources located above ground including rivers, reservoirs, lakes, ponds, streams, canals, and irrigation channels.

Note: W1 refers to the main source only. See expanded questions on use of multiple sources.

Note: Drinking water refers to the accessibility, availability and quality of the main source used by households for all usual domestic purposes, including drinking, food preparation and personal hygiene

Notes on classification:

1. The term **drinking water source** refers to the point from which water is collected (for example the tap or borehole/well/spring) and not the origin of the water supplied (for example surface water or groundwater).
2. **Improved drinking water sources** are those which by nature of their design and construction have the potential to deliver safe water. Improved sources include: piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater and packaged or delivered water.
3. **Packaged and delivered water** can potentially deliver safe water but were previously treated as unimproved due to lack of data on accessibility, availability and quality. For SDG monitoring the JMP will treat them as '**improved**' and classify them as limited, basic or safely managed based on the new SDG criteria.
4. **Public taps or standpipes** can have one or more taps. They are typically made of brickwork, masonry or concrete and located in public spaces. Households using privately owned taps in a neighbour's yard should be classified as '**pipled to neighbour**'.
5. **Boreholes** from which water is pumped into an overhead tank which supplies households in the same compound, should be classified as '**borehole or tubewell**'. However, boreholes delivering water to an overhead tank which supplies multiple compounds through a reticulated piped system should be classified as one of the types of '**pipled water**', depending on where the household collects the water.
6. **Protected wells** may be fitted with a range of lifting devices (for example motorized pumps, hand pumps, ropes and windlasses with buckets) but if the well lacks a cover then it should be classified as '**unprotected well**'.
7. **Rainwater collection** comprises a range of different technologies designed to capture and store rainwater for drinking. Groundwater catchments require filtration and unfiltered surface water should be classified as '**surface water**'.
8. **Water kiosks** are similar to public standpipes, but with a more commercial approach to collecting fees. **Water refill stations** are similar to water kiosks, but operators typically provide households with dedicated containers that are then sanitized before being refilled. These should be classified as '**bottled water**'.
9. **Unimproved drinking water sources** are those which by nature of their design and construction are unlikely to deliver safe water. Unimproved sources include: unprotected dug wells, unprotected springs, and surface water.

- Piped into dwelling
- Piped to neighbour
- Public tap / standpipe
- Borehole or tubewell
- Protected dug well
- Unprotected dug well

- Protected spring
- Unprotected spring
- Rainwater collection
- Tanker-truck
- Cart with small tank / drum
- Water kiosk
- Bottled water
- Sachet water
- Surface water - (river, stream, dam, lake, pond, canal, irrigation channel)
- Other (specify)

If State the alternative water source you use when your main source is not functioning isn't one of Piped into dwelling, Piped to neighbour, Rainwater collection, Tanker-truck, Cart with small tank / drum:

How far is your alternative source of water?

If How far is your alternative source of water? was answered:

Which means of transport do you use to get to the alternative source of water?

- Walking
- Animal transport
- Motorcycles
- Bicycles
- Tractors
- Cars, Pick-ups
- Carts
- Other (please specify)

If Which means of transport do you use to get to the alternative source of water? was answered:

How long does it take to go there, get water, and come back from the alternative source of water?

Hint:

Note: Record the total time taken for a single round trip including queuing.

Don't Know

r Usage

State approximate number of 20-litre jerricans used per day

Hint:

What are your main uses of water? (Check all that apply)

- Domestic use
- Agriculture
- Animal use
- Other (please specify)

If What is the main source of drinking water for members of your household? is one of Public tap / standpipe, Borehole or tubewell, Water kiosk:

Frequency of Borehole Breakdowns**When was the last time the borehole broke down?**

Has it been repaired?

- YES
- NO

If Has it been repaired? is YES:

During this last borehole breakdown how long did it take before the borehole was repaired?

Hint: if more than a month, use 1 month = 30days

How many times has the borehole broken down in the past month?

Don't Know

How many times has the borehole broken down in the past year?

Don't Know

On average how long does it take to repair the borehole when it breaks down?(Number of days)

Hint: if more than 1 month, 1 month = 30 days

Who repairs the borehole when it breaks down?

- County government
- Borehole management
- Community
- I don't know
- Other (please specify)

In a day, when the borehole is functional, how many hours does it operate?

On average how many days in a month does the borehole operate?

Hint: Number of days active in a month

Water Quality - Perception of Water Quality from Borehole

Which of the following best describes the color of water from the borehole?

- Clear
- Milky/ cloudy
- Green coloration
- Brown coloration

Which of the following best describes the smell of water from the borehole?

- Odorless
- Chlorine
- Smelly (rotten eggs)
- Other unpleasant smell

Which of the following best describes the taste of water from the borehole?

- Tasteless
- Chlorine
- Salty
- Metallic taste
- Other unpleasant taste

If Do you have an alternative source of drinking water that you use when your main source is not functioning? is
Yes:

Perception of Water Quality from Alternative Source

Which of the following best describes the color of water from the alternative source?

- Clear
- Milky/ cloudy
- Green coloration
- Brown coloration

Which of the following best describes the smell of water from the alternative source?

- Odorless
- Chlorine
- Smelly (rotten eggs)
- Other unpleasant smell

Which of the following best describes the taste of water from the alternative source?

- Tasteless
- Chlorine
- Salty
- Metallic taste
- Other unpleasant taste

Water Treatment Practices

Do you treat water before consumption?

- Always
- Sometimes
- No

If Do you treat water before consumption? is one of Sometimes, Always:

If Yes, how do you treat it?

- Boiling
- Adding bleach/ adding chlorine
- Strain through a cloth
- Use a water filter (Ceramic, sand, composite, reverse osmosis, etc)
- Solar disinfection
- Let it stand and settle
- Other (please specify)

If Do you treat water before consumption? is Sometimes:

If sometimes, have you treated your water in the last 3 months?

- Yes
- No

If Do you treat water before consumption? isn't No:

If possible, please take a photo capturing treatment method used.

If If Yes, how do you treat it? is Boiling:

Stove Use

Which kind of stove do you **MAINLY** use for boiling water?

- Three-stone fire or a conventional system for woody biomass lacking improved combustion air supply mechanism and flue gas ventilation system
- Other conventional systems using woody biomass
- Improved cookstove
- Liquid petroleum gas cooker (LPG)
- Other fossil fuel combusting systems
- Electric cooker
- Other (please specify)

Which other of types of stoves do you frequently use for boiling water? (Check all that apply)

- Three-stone fire or a conventional system for woody biomass lacking improved combustion air supply mechanism and flue gas ventilation system
- Other conventional systems using woody biomass
- Improved cookstove
- Liquid petroleum gas (LPG) cookers
- Other fossil fuel combusting systems
- Electric cooker
- Other (please specify)

If Which other of types of stoves do you frequently use for boiling water? (Check all that apply) was answered:

How often do you use the main stove?

- Always
- Very often
- more than half the time
- about half the time

If Which kind of stove do you MAINLY use for boiling water? is Improved cookstove:

How did you acquire the improved cookstove?

- I bought it
- I received it as part of a project.
- I made it myself
- Other (please specify)

If How did you acquire the improved cookstove? is I received it as part of a project.:

Which project provided you with the improved cookstove?

Don't Know

If If Yes, how do you treat it? is Boiling:

Fuel

What is the main type of fuel you use for boiling water in the dry seasons?

- Wood
- Charcoal
- Liquid petroleum gas (LPG)
- Electricity
- Agricultural waste
- Solar
- Other (please specify)

What is the main type of fuel you use for boiling water in the rainy seasons?

- Wood
- Charcoal
- Liquid petroleum gas (LPG)
- Electricity
- Agricultural waste
- Solar
- Other (please specify)

What is the secondary type of fuel you use for boiling water in the dry and rainy seasons?

- Wood
- Charcoal
- Liquid petroleum gas (LPG)
- Electricity
- Agricultural waste
- Solar
- Other (please specify)

How often do you use the main type of fuel?

- Always
- Very often
- Sometimes
- More than half the time
- About half the time

If What is the main source of drinking water for members of your household? is one of Public tap / standpipe, Borehole or tubewell:

Water-related Health Issues

Have you experienced any health issues related to water?

- Yes
- No

If Have you experienced any health issues related to water? is Yes:

If yes, select the issues you have encountered..

- Typhoid
- Cholera
- Diarrhoea
- Dysentery
- Hepatitis A
- Polio
- Other (please specify)

Modes of Payment for Water

Do you pay for water?

- Yes
 No

If Do you pay for water? is Yes:

How do you usually make payments for water services?

- Cash
 Mobile money
 Cheques
 Other (please specify)

If Do you pay for water? is Yes:

How often do you make payments for water from your main source?

- Every time you collect water
 Weekly
 Monthly
 Other (please specify)

If How often do you make payments for water from your main source? is Every time you collect water:

If “Every time you collect water” how much do you pay per jerrican?

Hint: in Keyan Shillings

If How often do you make payments for water from your main source? is one of Weekly, Monthly:

State your current tariff for Water Services for weekly and monthly payments

Hint: Specify the charges for water services in Ksh.

If Do you pay for water? is Yes:

Who do you make payments to?

- Water point operator
 Water service provider
 Community leader
 Private individual

If Do you pay for water? is Yes:

Do the prices fluctuate between the dry and wet season?

- Yes
 No

If Do the prices fluctuate between the dry and wet season? is Yes:

If “Yes”, what are the prices during dry season?

Hint: in Ksh per 20-Litre jerrican

Willingness and Ability to Pay for Water Services

Preferred Charges for Water Services

If How often do you make payments for water from your main source? is Monthly:

What charges would you find reasonable for water services?

Hint: State your preferred charges in Ksh/ month

If How often do you make payments for water from your main source? is Weekly:

What charges would you find reasonable for water services?

Hint: State your preferred charges in Ksh/ week

If How often do you make payments for water from your main source? is Every time you collect water:

What charges would you find reasonable for water services?

Hint: State your preferred charges in Ksh/ 20-litre jerrican

Willingness and Ability to Pay

Are you willing and able to pay for improved water services?

- Yes
 No
 Undecided

If Are you willing and able to pay for improved water services? is Yes:

How frequently would you be willing and able to pay for water services?

- Weekly
 Monthly
 Every time I go to collect water
 Other (please specify)

If How frequently would you be willing and able to pay for water services? is Every time I go to collect water:

If yes, select the amount you are Willing/ Able to pay per 20-Litre jerrican for improved water services (In Ksh.)

- Less than Ksh. 5
- Ksh. 5 - 10
- Ksh. 11 - 15
- Ksh. 16 - 20
- Ksh. 20 - 25
- Above Ksh. 25

If How frequently would you be willing and able to pay for water services? is Weekly:

If yes, state the amount you are Willing/ Able to pay per unit (1000 cubic meters) per week for improved water services (In Ksh.)

If How frequently would you be willing and able to pay for water services? is Monthly:

If yes, state the amount you are Willing/ Able to pay per unit (1,000 cubic meters) per month for improved water services (In Ksh.)

If Do you pay for water? is Yes:

Payment Practices

What is your most preferred mode of payment?

- Cash
- Mobile money
- Cheque
- Other (please specify)

DRIP FUNDI - Borehole Operator Questionnaire

INTRODUCTION

Please state your name?

Hint: Full name of the operator.

Phone Number

Not Applicable

Sex of Operator

- Male
 Female

Please state your age

- 18 - 24 years
 25 - 30 years
 31 - 35 years
 35 - 40 years
 40 - 50 years
 50 - 60 years
 Above 60 years

How long have you been manning the borehole

Administrative Region

Location

County

Subcounty

Ward

State the name of the village

How do the water consumers receive water?

- Piped network to household
 Communal water points/public stand pipes

If How do the water consumers receive water? is one of Piped network to household:

How many piped water connections are connected to the borehole?

If How do the water consumers receive water? is one of Communal water points/public stand pipes:

Number of water points served by the borehole

If Number of water points served by the borehole is greater than 0 and How do the water consumers receive water? includes Communal water points/public stand pipes:

Is the closest water point more than 1 km from the borehole?

Yes

No

Don't Know

If Is the closest water point more than 1 km from the borehole? is Yes:

Please take a photo of the water point

State the average number of households which are served by the water points within a radius of 1 km.

Borehole Information

Select Borehole ID and Name

County

Subcounty

Borehole Name

Borehole ID

Does the borehole have a Virridy/SweetSense sensor?

- Yes
 No

State the date of installation of the borehole.

Hint: If month unknown, enter January

Don't Know

Take a clear landscape photo of the borehole.

Take clear landscape photos of the borehole.

State the average number of people who fetch water from the borehole every day

Hint: From all water points

Don't Know

Operational Status

Is the borehole currently functional?

This question is used to assess whether a water system is working as designed or if some failure is impacting performance. The dictionary definition of *functional* is "working properly." A water system may be working properly but not actually providing water at the time of a visit due to rationing, opening hours, or limited aquifer capacity. The availability or reliability of water should be assessed separately using other questions.

Definitions of functional status:

- **Functional:** Water system is in good working condition and regularly provides water according to the specifications in the original design.
- **Partially functional but in need of repair:** Water system provides water on a regular basis (possibly in a reduced capacity) but repairs are needed due to some maintenance issue or change in conditions at the site.
- **Not functional:** Water system is no longer providing water on a regular basis. This could be due to maintenance issues or changes in water availability or quality.
- **No longer exists:** The water point can no longer be found at the original site or has been de-commissioned.

Special considerations

- Water may not be available at the time of the visit due to rationing. If users are still able to access enough water during the expected service hours, you might still report such a water system as functional.
- If the water system does not provide water at certain times of the year due to scarcity, please address this in the following questions regarding accessibility and reliability.

- Functional
 Partially functional but in need of repair
 Not functional
 Abandoned or no longer exists
- Don't Know

How saline is the water?

- Very saline
 Mildly saline
 Not saline
- Don't Know

Does the borehole have working flow meters?

- Yes
 No

If Is the borehole currently functional? is one of Partially functional but in need of repair, Not functional:

Please take clear pictures illustrating the non-functionality or partial functionality

- Not Applicable

If Is the borehole currently functional? is one of Partially functional but in need of repair, Not functional:

Why is the borehole partially functional or non-functional currently?

- Insufficient water at source - Dry Well/Borehole
 Distribution pipeline failure
 Taps broken
 Generator failure - Lack of power from Generator
 Grid power failure - Lack of power from grid
 Solar power failure - Lack of power from Solar
 Submersible pump failure - Broken Pump
 Motor failure
 Switchboard failure - Electronics
 Casing failure
 Well screen or gravel pack issues
 Sediment and/scale build up
 Biological/bacterial/chemical contamination
 Vandalism
 Other (please specify)

If Is the borehole currently functional? is one of Partially functional but in need of repair, Not functional:

What are usually the main causes of non-functionality or partial functionality for this borehole?

- Insufficient water at source - Dry Well/Borehole
- Distribution pipeline failure
- Taps broken
- Generator failure - Lack of power from Generator
- Grid power failure - Lack of power from grid
- Solar power failure - Lack of power from Solar
- Submersible pump failure - Broken Pump
- Switchboard failure - Electronics
- Vandalism
- Other (please specify)

If Is the borehole currently functional? is one of Not functional, Partially functional but in need of repair:

Describe the functionality problem/s

Hint:

If Is the borehole currently functional? is one of Partially functional but in need of repair, Not functional:

Number of days since partially functional or non-functional

Don't Know

If Is the borehole currently functional? is one of Partially functional but in need of repair, Not functional:

Are there any plans to rehabilitate/ repair the borehole?

- Yes
- No

Don't Know

If Are there any plans to rehabilitate/ repair the borehole? is Yes:

When is the borehole supposed to be repaired?

Hint: If day unknown, enter the 1st.

Don't Know

If Is the borehole currently functional? is one of Functional, Partially functional but in need of repair:

How many days in a week does the borehole operate?

- Sunday
- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday

If Is the borehole currently functional? is Functional:

While functional, does the water system have any emerging problems that might lead to non-functionality in the near future

- Yes
- No
- Don't Know

If While functional, does the water system have any emerging problems that might lead to non-functionality in the near future is Yes:

Please describe the problems that might lead to non-functionality in the near future

Are there any borehole operator logs/records?

- Yes
- No

How many days per month was the borehole operational

	Days Operational
January	
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	

Downtime in case of Borehole Breakdown

Has the borehole ever broken down?

- Yes
 No
 Never

Don't Know

If Has the borehole ever broken down? is Yes:

When was the last time the borehole broke down?

Hint: If day unknown, enter the 1st

If Has the borehole ever broken down? is Yes:

Has the borehole been repaired?

- Yes
 No

If Has the borehole been repaired? is Yes:

How long did it take to repair or fix the problem?

Don't Know

If Has the borehole ever broken down? is Yes:

What mainly caused the borehole to fail the last time it ceased to function?

- Insufficient water at source - Dry Well/Borehole
 Distribution pipeline failure
 Taps broken
 Generator failure - Lack of power from Generator
 Grid power failure - Lack of power from grid
 Solar power failure - Lack of power from Solar
 Submersible pump failure - Broken Pump
 Motor Failure
 Switchboard failure - Electronics
 Casing failure
 Well screen or gravel pack issues
 Sediment and/scale build up
 Contamination - Biological, Bacterial, Chemical, etc.
 Other (please specify)

If Has the borehole ever broken down? is Yes:

If the problem remains unrepaired, what is usually the main reason?

- Lack of spare part
- Lack of specialized technician
- No funds for repair
- County/ management delay in repairing
- Other (please specify)

If Has the borehole ever broken down? is Yes:

Who meets the cost of repairing when the borehole fails?

- Charges paid on water
- Community contributions
- Community leadership
- Donor/ NGO
- Private owner
- County government
- Private company
- Other (please specify)

If Who meets the cost of repairing when the borehole fails? is Private company:

Which private company meets the cost of repairs?

If Who meets the cost of repairing when the borehole fails? is Donor/ NGO:

Which NGOs repair the boreholes?

If Who meets the cost of repairing when the borehole fails? is Donor/ NGO:

Please help us with the phone number of the NGO/Donor

If Has the borehole ever broken down? is Yes:

In which months does the borehole usually breakdown?

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December

If Has the borehole ever broken down? is Yes:

How many times has the borehole broken down in the past 12 months?

Don't Know

Select the main reporting and response mechanism for breakdowns that are currently in place

- Call the county water department/BRRT
- Call the area MCA/MP/Women Rep
- Call a private company to repair
- Call an NGO
- Call a local technician to repair
- Other (please specify)

What would be your preferred reporting and response mechanism for quicker turn around

- Call the county water department/BRRT
- Call the area MCA/MP/Women Rep
- Call a private company to repair
- Call an NGO
- Call a local technician to repair
- Other (please specify)

Why is that the preferred reporting and response mechanism?

Most Affected Parts, Causes of Borehole Failure

If Has the borehole ever broken down? is Yes:

Which part of this borehole is most problematic and results in failure?

- Borehole casing and liner
- Well screen and gravel packs
- Pump
- Motor
- Wellhead components
- Pipes and tubing
- Seals
- Monitoring and control systems
- Electrical components - Generators, Solar, Etc.
- Other (please specify)

If Has the borehole ever broken down? is Yes:

Which other parts of this borehole are prone to failure?

- Casing and liner
- Well screen and gravel pack
- Pump and motor
- Wellhead components
- Pipes and tubing
- Seal and packers
- Monitoring and control systems - Sensors
- Geological structure of the area
- Other (please specify)

Factors Influencing/Causing Failure

If Has the borehole ever broken down? is Yes:

List factors that contribute to failure of this particular borehole

State the borehole's source of power

- Hand-pump
- Solar
- Generator
- Electricity
- Solar/Generator Hybrid system
- Solar/Electrical grid Hybrid system
- Electric grid/Generator Hybrid system
- Other (please specify)

If possible, please take a clear photograph of the power supply.

If possible, please take clear photographs of the power supply.

Other Characteristics of the Borehole

State the number of pumping hours per Day

Does the borehole have a storage facility?

- Yes
 No

Select the type of storage facilities available

- Elevated steel tank
 Elevated carbon fibre tank
 Elevated plastic tank
 Ground Masonry tank
 Ground plastic tank
 Other (please specify)

If Does the borehole have a storage facility? is Yes:

State the type of the storage facility

- Elevated steel tank
 Elevated Carbon fiber tank
 Elevated plastic tank
 Underground masonry tank
 Ground masonry tank
 Ground plastic tank
 Other (please specify)

If Does the borehole have a storage facility? is Yes:

State the capacity of the storage facility in cubic meters(m3)

If Does the borehole have a storage facility? is Yes:

Describe the condition of the storage facility

- The storage is in good condition and functioning properly
- The storage is a bit damaged but functioning
- The storage is damaged and not functional
- Other (please specify)

If Does the borehole have a storage facility? is Yes:

Take a clear landscape photo of the storage facility

If Does the borehole have a storage facility? is Yes:

Take clear landscape photos of the storage facility/facilities

Vulnerabilities the Borehole is Exposed to

Please assess the surroundings of the borehole and determine if it is exposed to any kind of risks such as vandalism, destruction by floods, drought etc.

- The borehole is exposed to risk(s)
- The borehole is NOT exposed to any notable risk at the moment

If Please assess the surroundings of the borehole and determine if it is exposed to any kind of risks such as vandalism, destruction by floods, drought etc. is The borehole is exposed to risk(s):

What kind of risks is the borehole exposed to?

- Destruction by floods
- Vandalism
- Drying up due to drought
- Other (please specify)

If Please assess the surroundings of the borehole and determine if it is exposed to any kind of risks such as vandalism, destruction by floods, drought etc. is The borehole is exposed to risk(s):

How is the risk likely to affect the functionality of the borehole?

Yield (Flow Rate)

Production of system: yield or discharge (m3/hr)

Don't Know

Which tools do you have for aquifer monitoring?

- Sonar
- Manual/Dip-meters
- None
- Other (please specify)

Water Treatment

Do you treat the water from this borehole at any point?

- Yes
- No

If Do you treat the water from this borehole at any point? is Yes:

Which methods are used in treating water from this borehole?

- Chlorination
- Filtration
- Sedimentation
- Other (please specify)

What is the status of borehole water in terms of the salinity?

- No salinity
- Low salinity
- Moderate salinity
- High salinity

Water Testing

Has a water sample been taken for testing?

- Yes
- No

Comments on issues not addressed in the survey

DRIP FUNDI - Water Quality Questionnaire

Water Quality

Is this a household or a borehole/water point

- Household
 Borehole/Water point

State the county name?

- Garissa
 Turkana
 Marsabit
 Isiolo
 Wajir

Do you have a blacklight/UV light?

- Yes
 No

If Is this a household or a borehole/water point is Household:

Select Borehole name and ID of the borehole linked to the household

County

Subcounty

Borehole Name

Borehole ID

If Is this a household or a borehole/water point is Household:

Borehole name and ID of the borehole linked to the household

County

Subcounty

Borehole Name

Borehole ID

If Is this a household or a borehole/water point is Household:

Borehole ID linked to the household

If Is this a household or a borehole/water point is Borehole/Water point:

Borehole name and ID

County

Subcounty

Borehole Name

Borehole ID

If Is this a household or a borehole/water point is Borehole/Water point:

Select Borehole ID and Name

County

Subcounty

Borehole Name

Borehole ID

If Is this a household or a borehole/water point is Borehole/Water point:

Borehole ID

If Is this a household or a borehole/water point is Household:

Can you please show me where the members of your household collect drinking water so that I can test the water quality?

- Yes
 No (please specify the reason)

Has the water quality been tested for bacteriological contamination?

- Yes
 No

If Is this a household or a borehole/water point is Borehole/Water point:

Where was the water quality tested?

Hint: Only water quality for the point of collection / water source will feed into the service level calculation

- At borehole
- Both
- Before tank
- After tank
- At water point

If Is this a household or a borehole/water point is Household:

Where was the water quality tested?

Hint: Only water quality for the point of collection / water source will feed into the service level calculation

- Point of consumption - From Household drinking water storarage
- Both

If Is this a household or a borehole/water point is Borehole/Water point:

Water Quality - Point of collection/ source

What parameter(s) have been tested and with what methodologies?

- E. coli risk - Aquagenx compartment bag test
- E. coli - other method
- E.coli / TTC - Presence/absence
- TTC - other method

If What parameter(s) have been tested and with what methodologies? is one of E. coli risk - Aquagenx compartment bag test, E.coli / TTC - Presence/absence:

Please record the results of the compartment bag test using this question

- Compartment 1
- Compartment 2
- Compartment 3
- Compartment 4
- Compartment 5

If What parameter(s) have been tested and with what methodologies? is E. coli - other method:

E. coli

If What parameter(s) have been tested and with what methodologies? is E.coli / TTC - Presence/absence:

Did the test indicate whether Ecoli contamination was present or absent?

- Present
- Absent

If What parameter(s) have been tested and with what methodologies? is E.coli / TTC - Presence/absence and Did the test indicate whether Ecoli contamination was present or absent? is Absent:

Did the test indicate whether TTC contamination was present or absent?

- Present
- Absent

If What parameter(s) have been tested and with what methodologies? is E.coli / TTC - Presence/absence:

What was the volume tested?

If What parameter(s) have been tested and with what methodologies? is TTC - other method:

TTC

If Is this a household or a borehole/water point is Household:

Water Quality - Point of consumption

Which parameter(s) have been tested and with what methodologies?c

- E. coli risk - Aquagenx compartment bag test
- E. coli - other method
- E.coli / TTC - Presence/absence
- TTC - other method

If Which parameter(s) have been tested and with what methodologies?c is one of E. coli risk - Aquagenx compartment bag test, E.coli / TTC - Presence/absence:

Please record the results of the compartment bag test using this question

- Compartment 1
- Compartment 2
- Compartment 3
- Compartment 4
- Compartment 5

If Which parameter(s) have been tested and with what methodologies?c is E. coli - other method:

E. coli

If Which parameter(s) have been tested and with what methodologies?c is E.coli / TTC - Presence/absence:

Did the test indicate whether Ecoli contamination was present or absent?

- Present
- Absent

If Did the test indicate whether Ecoli contamination was present or absent? is Absent:

Did the test indicate whether TTC contamination was present or absent?

- Present
- Absent

If Which parameter(s) have been tested and with what methodologies?c is E.coli / TTC - Presence/absence:

What was the volume tested?

If Which parameter(s) have been tested and with what methodologies?c is TTC - other method:

TTC

DRIP FUNDI - Borehole Asset Inventory

Basic Borehole Details

Select Borehole ID and Name

County

Subcounty

Borehole Name

Borehole ID

Borehole name and ID

County

Subcounty

Borehole Name

Borehole ID

Borehole ID

Borehole name

Location

County

Subcounty

Ward

Borehole location**Borehole depth(m)****Drilling date** Don't Know**Name of the drilling company** Don't Know**Borehole equipping date** Don't Know**Borehole Motor and Pump details****Pump type***Hint:*

- Submersible pump
 Hand Pump
 Other (please specify)

Pump capacity in m3/hour Don't Know**Pumping head(m)** Don't Know**Pump Manufacturer** Don't Know**Motor power type**

- Alternating current (AC)
 Direct current (DC)

 Don't Know

Motor power supply

- Single phase motor
- Three phase motor
- Don't Know

Motor type

- Fixed speed motor
- Variable speed motor
- Other (please specify)

- Don't Know

Motor Manufacturer

- Don't Know

Motor capacity (kW)

- Don't Know

Borehole Power**What is the source of power?**

- Electrical grid
- Solar Panels
- Diesel Generator
- Solar/Electrical grid Hybrid
- Solar/Generator hybrid
- Electrical grid with back up generator
- Other (please specify)

If What is the source of power? is one of Diesel Generator, Electrical grid with back up generator, Solar/Generator hybrid:

Generator capacity (kVA)

If What is the source of power? is one of Diesel Generator, Solar/Generator hybrid, Electrical grid with back up generator:

What is the fuel capacity of the generator?

	Liters
Main Tank	
Reserve Tank	

- Don't Know

If What is the source of power? is one of Diesel Generator, Solar/Generator hybrid, Electrical grid with back up generator:

Generator Manufacturer

Don't Know

If What is the source of power? is one of Solar Panels, Solar/Generator hybrid, Solar/Electrical grid Hybrid:

Number of solar panels

Don't Know

If What is the source of power? is one of Solar Panels, Solar/Electrical grid Hybrid, Solar/Generator hybrid:

Total Solar power capacity (W)

Don't Know

If What is the source of power? is one of Solar Panels, Solar/Electrical grid Hybrid, Solar/Generator hybrid:

Solar panels manufacturer

Don't Know

If What is the source of power? is one of Solar Panels, Solar/Electrical grid Hybrid, Solar/Generator hybrid:

When were the solar panels installed?

Don't Know

Type of controller

Don't Know

Controller manufacturer

Don't Know

If What is the source of power? is one of Solar Panels, Solar/Electrical grid Hybrid, Solar/Generator hybrid:

Does the system use battery storage?

- Yes
 No

If What is the source of power? is one of Solar Panels, Solar/Electrical grid Hybrid, Solar/Generator hybrid and Does the system use battery storage? is Yes:

What is the type of battery?

- Lead-Acid
 Lithium ion
 Nickel cadmium
 Flow batteries

Don't Know

If Does the system use battery storage? is Yes:

Individual Battery Capacity (Ah)

If What is the source of power? is one of Solar Panels, Solar/Generator hybrid, Solar/Electrical grid Hybrid and Does the system use battery storage? is Yes:

Number of batteries

Extra information

Has the borehole undergone major rehabilitation/upgrades?

Yes

No

Don't Know

If Has the borehole undergone major rehabilitation/upgrades? is Yes:

When was the rehabilitation/upgrade?

Don't Know

If Has the borehole undergone major rehabilitation/upgrades? is Yes:

What major rehabilitation was done?

Don't Know

If Has the borehole undergone major rehabilitation/upgrades? is Yes:

Which institution did the rehabilitation?

Focus Group Discussion Guide (Water Management Committees, Water Users Associations)

A. Introduction

Hello, my name is _____. I am working with Losai Management Limited, and with Millennium Water Alliance We are doing a baseline study for Drought Resilience Impact Platform- Fixing Uptime Now and Decision Improvement (DRIP FUNDI) Program which is supported by USAID to enhance sustainable access to water for domestic use for communities in Arid and Semi-Arid Lands (ASAL) counties in Kenya.

Study Procedure

We are interested in learning about how boreholes are managed for water service delivery in this area, especially during times of drought. If you agree to participate in this study, we will conduct a focus group discussion with you for about 1hr .

Study Objective

The objective of this study is to learn about borehole management in arid and semi-arid lands in Kenya. There are no right or wrong answers, but we do want to understand your perceptions and experiences around borehole management. DRIP-FUNDI's objective is to jump-start sustainable and adequately funded operation and maintenance of water supply systems. Ensuring these systems remain functional during periods of drought will improve the ability of households and communities to cope with recurrent climatic shocks such as drought.

Voluntariness

Taking part of this study is completely voluntary. You have every right to refuse to participate. If you should refuse, you will not suffer any consequences.

Withdrawal

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Questions

If you have any questions concerning the study, you can contact [Consultant's representative name]

Oral Consent Of Participant

Do you agree to participate in this study?

- a) YES b) NO

Participant Introductions: Allow the participants to briefly introduce themselves and their roles in borehole management.

A. Existing Technical Capacity

- i. How would you describe the current technical capacity within the community for borehole management?
- ii. How would you describe the current technical capacity within the county for borehole management?
- iii. Are there skilled personnel available for borehole repairs and maintenance (both at county, community private sector level)?

(Let the participants describe the nature of technical capacity, relevant to operation and maintenance of boreholes. The description should also include the number of active and available technical staff)

Training and Skill Development

- i. Have you invested in training programs for borehole technicians and other technical staff within the WMC/WUA?
- ii. Has the county provided any training programs for borehole technicians and other technical staff within the WMC/WUA? *(Discussions under this question should be driven towards ascertaining if there are efforts to equip technical staff with up-to-date knowledge in borehole technology, to match today's technological advancement in the water sector. Are they conversant with borehole sensors? Do they know advanced borehole parts? Do they know the current market cost of these parts etc.)*
- iii. Are there any ongoing efforts to enhance technical skills in borehole management? *(Let the participants specify if there are any plans for capacity building of the technical staff and list the areas where this would be done)*
- iv. State the technical constraints you face with operations and maintenance of the borehole
- v. Is there external support or aid (technical) for borehole management in the county?
- vi. How has this technical support contributed to improved borehole functionality?
- vii. What challenges, if any, have been faced in acquiring external support for borehole management?

B. Borehole Breakdown

- i. How often do the boreholes break down?
- ii. Which parts of the borehole cause the break down?
- iii. How long does it take to repair a borehole after a breakdown?
- iv. What reporting and response mechanism do you use in case of a breakdown?
- v. If you need support from the BRRT, how do you reach out to them?

C. Existing Financial Capacity

- i. What is the average amount of money you spend per borehole repair?
- ii. Is the money usually enough for the repairs or do you face challenges acquiring spare parts?
- iii. State the financial constraints you face with operations and maintenance of the borehole
- iv. What is your source of funding for borehole management?
- v. Are there partnerships or collaborations with external organizations for financial support?
- vi. Is there external support or aid (financial) for borehole management in the county?
- vii. What challenges, if any, have been faced in acquiring external financial support for borehole management?
- viii. How has this support contributed to improved borehole functionality?
- ix. Do you experience any squabbles with other key stakeholders in the water sector that hinder operations and maintenance of boreholes?
- x. What is the annual budget or expenditure dedicated to repairing and maintaining boreholes in the county?

D. Borehole Spare Parts Acquisition

Challenges Faced with Borehole Parts Acquisition

- i. Are there challenges in acquiring necessary parts for borehole repairs?
- ii. How is the procurement process for borehole parts managed in the county?

Most Problematic and Fast-moving Borehole Parts

- i. In your experience, which borehole parts pose the most significant challenges in terms of availability or cost?
- ii. In your experience, which borehole parts have the highest turnover rate?
- iii. Kindly give your recommendations to work around the said challenges

E. General Challenges in Borehole Management:

- i. Identify and discuss any general challenges faced in managing boreholes within the county.
- ii. Do you have access to any climate information to manage the boreholes?
- iii. Do you have any contingency plans for calamities that pose a risk to the boreholes?
- iv. What recommendations do you have for improving the county's capacity to manage boreholes effectively?

Key Informant Interview Guide: County Department Officers / Borehole Rapid Response Teams

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Study Procedure

We are interested in learning about how boreholes are managed for water service delivery in this area, especially during times of drought. If you agree to participate in this study, we conduct an interview with you that will take about one hour .

Study Objective

The objective of this study is to learn about borehole management in arid and semi-arid lands in Kenya. There are no right or wrong answers, but we do want to understand your perceptions and experiences around borehole management. DRIP-FUNDI's objective is to jump-start sustainable and adequately funded operation and maintenance of water supply systems. Ensuring these systems remain functional during periods of drought will improve the ability of households and communities to cope with recurrent climatic shocks such as drought.

Recording

With your permission, I will audiotape and my colleague will take notes during the discussion. The recording is to accurately capture the information you provide and will be used for transcription purposes only. Excerpts from the recordings/transcripts may be used to illustrate the research findings. This will always be done in a way to protect your identity (that is, your name will not be used).

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Questions

If you have any questions concerning the study, you can contact [Consultant's representative name]

Oral Consent Of Participant

Do you agree to participate in this study?

- a) YES b) NO

A. Position and responsibilities

- i. Request information about their role within the county water department or rapid response team.
- ii. Inquire about their specific responsibilities related to borehole management.

B. Borehole Management and Rapid Response:

Borehole Monitoring:

- i. Inquire about the current methods used to monitor boreholes within the county.
- ii. Discuss the frequency of monitoring and data collection practices.

C. Rapid Response Protocols:

- iii. Explore the existing protocols for responding to borehole breakdowns.
- iv. Inquire about the average response time to address reported issues. (Explore how this response time is affected by other factors such as financial and human resource available)

D. Climate change information

- i. Do you have access to climate change information?
- ii. How do you use this information to plan for responses or draw contingency plans should the calamities pose risk to the boreholes, that is, drought bulletins or predictions of drought or flood

E. Coordination with Communities:

- i. Discuss the level of coordination with communities when addressing borehole-related concerns.
- ii. Explore communication strategies for informing communities about the status of borehole repairs.

F. Challenges and Opportunities:Identifying Challenges:

- i. Ask about challenges faced by the county water department or rapid response teams in maintaining borehole uptime.
- ii. Explore any recurring issues or patterns in borehole breakdowns.

Resource Availability:

- i. Inquire about the availability of resources (financial, human, technical) for rapid response activities.
- ii. Discuss any constraints faced in acquiring necessary resources.

G. Technical Capacity and Training:Technical Expertise:

- i. Assess the technical expertise of the rapid response team members.
- ii. Inquire about any ongoing training programs to enhance technical skills.

Training Needs:

- i. Discuss identified training needs for rapid response teams.
- ii. Explore potential sources of technical training or support.

H. Collaboration and Partnerships:Stakeholder Collaboration:

- i. Inquire about existing collaborations with other government agencies, NGOs, or private sector entities in borehole maintenance.
- ii. Explore opportunities for enhancing collaboration to improve borehole uptime.

Community Engagement:

- i. Discuss strategies for engaging communities in the maintenance and monitoring of boreholes.
- ii. Explore the role of community feedback in the rapid response process.

I. Data Management and Analysis:Data Collection and Analysis:

- i. Inquire about the methods used to collect and analyze data related to borehole functionality.
- ii. Inquire about how the BRRT stores or keeps track of responses, parts, expenditure and other data.
- iii. Discuss any challenges or improvements needed in data management.

J. Future Planning:Improvement Strategies:

- i. Inquire about any planned strategies or initiatives to improve the overall uptime of boreholes.
- ii. Discuss potential innovations or technologies that could enhance the rapid response process.

K. Conclusion:Feedback and Additional Insights:

- i. Allow informants to provide any additional insights or feedback not covered in the questions.
- ii. Express gratitude for their time and dedication to maintaining water infrastructure.

Encourage open-ended responses to capture the diverse perspectives and experiences of county water department officers and borehole rapid response teams.

Key Informant Interview Guide: Spare Parts Providers

A. Introduction

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Questions

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Oral Consent Of Participant

Do you agree to participate in this study?

- a) YES b) NO

B. Background information

- i. Request a brief overview of their business: types of spare parts sold, other locations in the county etc.
- ii. Please provide a description of your customer base
- iii. Inquire about their experience in supplying spare parts for boreholes and water systems.
- iv. Do you have other shops in Isiolo, Marsabit, Garissa, Turkana and Wajir? (Leave out the host county when asking this question)

C. Borehole Spare Parts Supply:*Inventory and Availability:*

- i. Ask about the range of spare parts they keep in stock.
- ii. Inquire about the most commonly requested spare parts for boreholes.
- iii. Explore how they manage inventory to meet the demands.

D. Suppliers and Manufacturers:

- i. Discuss their relationships with suppliers and manufacturers of borehole spare parts.
- ii. Inquire about any challenges faced in sourcing high-quality spare parts.
- iii. Do you have any experiences with development partners?

E. Challenges and Opportunities:*Identifying Challenges:*

- i. Ask about common challenges faced by borehole owners in sourcing spare parts.
- ii. Inquire about the time taken to supply spare parts to far off parts of the counties
- iii. Explore any specific challenges they face in supplying spare parts to the water system maintenance sector.

F. Improvement Suggestions:

- i. Discuss potential improvements to the current spare parts supply chain.
- ii. Inquire about ideas for enhancing the efficiency of spare parts distribution.

G. Knowledge and Training:*Technical Knowledge:*

- i. Assess the technical knowledge of the spare parts sellers about borehole systems. (Look into the capacity of staff, academic background, training levels)
- ii. Inquire about any training or support they receive from suppliers.

H. Training Needs:

- i. Ask if there are areas where additional training or information could enhance their ability to serve borehole owners better.

I. Market Dynamics:*Market Trends:*

- i. Discuss any observed trends in the demand for borehole spare parts.
- ii. What are your experiences working with the county government, if you have them as a customer?
- iii. Inquire about changes in customer preferences or emerging technologies.
- iv. Discuss how the project may affect the supply chain.
- v. Discuss any arrangement they would be open to with a development partner.

J. Conclusion:*Feedback and Additional Insights:*

Allow the informant to provide any additional insights or feedback not covered in the questions.
Express gratitude for their time and willingness to contribute to the study.

