A process-based evaluation of the IWRM Performance of water supply interventions

Investigating the Nexus of water supply intervention initiatives and IWRM: A case study of the Tana Sub-basin in the Amhara National Regional State

Millennium Water Alliance

World Resources Institute

Acacia Water

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Executive summary

This report presents the findings of a study conducted in the Tana sub-basin to assess how well Integrated Water Resources Management (IWRM) principles align with Water Supply Interventions (WSI). The study identified major water-related challenges, including contamination, scarcity, droughts, and floods, driven by climate variability, land use changes, and pollution. Utilizing systematic sampling, the study gathered stakeholder insights through Key Informant Interviews (KII) and Focus Group Discussions (FGD). An IWRM Evaluation Tool was developed for the analysis of this study based on the main principles of IWRM Equity and stakeholder participation, Environmental and functional sustainability, and Governance and capacity building.

The IWRM Evaluation Tool was used to evaluate 12 water interventions selected for the study in Dera, Farta, and North Mecha districts. The findings revealed inconsistencies in policy implementation, stakeholder participation, and water quality management, with notable gaps in environmental monitoring and conflict resolution.Key areas for improvement include stakeholder involvement, climate resilience, functional sustainability, financial viability, capacity building, and environmental monitoring. Despite the existence of a robust legal framework for water management, better implementation is needed. Recommendations include promoting cross-sector collaboration, enhancing climate resilience through land-use planning, establishing a formal maintenance tariff system, building local capacity for management, and improving environmental monitoring.

Colophon

Client
Millennium Water Alliance (MWA)
World Resources Institute (WRI)

Status
Final Rapport

Date
September 19, 2024

Reference number
2315000

Author(s)
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Reviewed by
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Released by
Tine Te Winkel

Detailed Summary

This report presents the final findings of a study conducted in the Tana sub-basin, assessing the alignment of Integrated Water Resources Management (IWRM) principles with Water Supply Interventions (WSI) in 12 water points across three woredas. The study began with a comprehensive literature review, utilizing secondary data to assess the current state of the sub-basin, the role of governmental institutions and various stakeholders, and the legal frameworks in place. The review highlighted several key water-related challenges in the sub-basin:

- **Water Contamination**: The water quality in the basin is severely affected by agricultural runoff, industrial discharge, and improper waste management. This contamination has led to nutrient pollution, harmful algal blooms, and waterborne diseases, especially in Lake Tana.
- **Water Scarcity and Droughts**: Seasonal rainfall variability causes extended dry periods, reducing inflows to Lake Tana, and negatively affecting agricultural productivity, water supply, and hydropower generation.
- **Floods**: Heavy rainfall events cause flooding, resulting in soil erosion, infrastructure damage, and the disruption of economic activities. Effective flood management strategies are essential to mitigate these impacts.

The main drivers contributing to these challenges include:

- **Climate (precipitation variability)**: There is an imbalance between excessive water during the rainy season and a shortage during the dry season.
- **Land use and land cover change**: Rapid population growth, expansion of crop production, and deforestation reduce soil infiltration capacity, leading to lower groundwater recharge and increased water contamination from agricultural runoff.
- **Pollution**: Industrial discharge, agricultural activities, and urban runoff contribute to the contamination of water bodies in the basin.

The Land Use and Land Cover map developed for the sub-basin shows that intensive agriculture dominates the area, causing land degradation and deforestation. Approximately 72.7% of the land is used for crop production, while other significant covers include tree cover, shrubland, and grassland. Sustainable land management practices are required to mitigate the environmental impacts on water resources.

The legal and institutional framework review revealed that Ethiopia has a well-structured system for water resource management. This system is grounded in the Federal Democratic Republic of Ethiopia (FDRE) Constitution and the Ethiopian Water Resources Management Proclamation. According to the Water Management Proclamation, all interventions must align with IWRM principles and the national IWRM program. Although Ethiopia's water management policies emphasize a centralized approach with room for decentralized decision-making involving regional states and basin authorities, the implementation of these frameworks requires significant improvement.

Methodology

The study utilized a systematic sampling process to select stakeholders for interviews and an IWRM Monitoring, Evaluation, and Learning (MEL) tool developed by Acacia Water to

analyze the data collected. The stakeholder mapping employed an influence vs. interest matrix and institutional assessment to identify relevant Water Resource Management (WRM) and Water, Sanitation, and Hygiene (WASH) interventions.

Sampling process

Stakeholder Analysis, Interviewee and WSI Selection

The selection of interventions for primary data collection was conducted in consultation with project stakeholders, including representatives from the World Resources Institute (WRI), Millennium Water Alliance (MWA), and local authorities. The final intervention selection was based on the predefined criteria established at the outset of the study, with a focus on maintaining representation across key characteristics such as technology, community size, and water source type.

To identify key stakeholders a detailed stakeholder mapping using influence vs interest and institutional assessment for the WRM-WASH interventions was conducted. The stakeholder analysis prioritized stakeholders for participation in Key Informant Interviews (KII) and Focus Group Discussions (FGD). Interviewees included implementers, governmental workers, Water Management Committees (WMC), and water users.

- **Key Informant Interviews (KII)**: A total of 36 participants, including governmental workers, implementers, and water management committee members from each selected water point, were involved.
    - Implementer Interviews: Provided comprehensive insights into the operation of water supply interventions, for evaluating IWRM performance.
    - Governmental Worker Interviews: Focused on assessing the impact of policies on IWRM performance, covering equity, stakeholder participation, governance, and capacity building.
    - Water Management Committees (WMC): WMC members were interviewed to gather perspectives from both water users and committee members to avoid groupthink.
- **Focus Group Discussions (FGD)**: Conducted with community members, the FGDs explored the community's perspectives on water supply interventions and IWRM principles. A total of 12 FGDs were conducted with 126 participants, 37% of whom were women.

Interventions were selected using purposive sampling (Criterion Sampling) based on predefined criteria such as technology, water source type, implementer type, and accessibility. This approach ensured a targeted selection of interventions that aligned with the study's objectives.

Analysis Tools

An IWRM Evaluation Tool, specifically developed for this study, was used to assess the performance of interventions against IWRM principles like inclusivity, scalability, stakeholder engagement, and environmental consequences. The tool facilitated the identification of areas of alignment and potential gaps in IWRM practices. The results of this analysis are presented in subsequent chapters.

Results

The study identified several findings from different groups:

- **Governmental Workers**: There was consistency in responses related to stakeholder identification, capacity building, and conflict resolution. However, there was variability in indicators like water balance, suggesting differences in policy implementation.
- **Implementers**: They generally rated water supply interventions positively, though indicators such as Environmental Assessment and Monitoring, Water Balance and Conservation Measures, and Policy Alignment scored lower, with Policy Alignment being notably deficient.
- **Community and WMCs**: Communities in Dera scored higher on water quality preservation and functionality than Farta and North Mecha, with WMCs in North Mecha reporting better conflict resolution but lower scores in other areas. Significant discrepancies were observed between community and WMC responses regarding conflict resolution and water quality management.

Gaps Identified and Recommendations

The assessment of water supply interventions in Dera, Farta, and North Mecha districts reveals significant gaps when evaluated against IWRM principles. These gaps highlight critical areas requiring attention to ensure the sustainability and effectiveness of these interventions. Recommendations are offered to address each identified gap:

1. **Stakeholder Involvement and Institutional Responsibility**
   IWRM emphasizes the importance of equity and social participation in ensuring the sustainability of interventions. However, it was observed that while there is strong involvement from stakeholders during the planning and construction phases, this diminishes during the operation, maintenance, and management stages. WASHCOs are often left as the sole entities managing water points, without a clear allocation of responsibilities among other institutions.
   Recommendation: To ensure sustainability, multi-sector stakeholder collaboration must be fostered throughout the project lifecycle, particularly during the post-project phase. Clearly defined roles and responsibilities for all stakeholders are crucial to maintaining long-term project success.
2. **Climate Resilience**
   Water points in these districts are increasingly affected by environmental factors, including floods and droughts exacerbated by climate change. Current water supply interventions lack adaptation measures for climate resilience.
   Recommendation: Integrating land-use planning and implementing soil and water conservation (SWC) measures will enhance the climate resilience of water points and the broader catchment area. This dual approach can mitigate both flooding and drought risks.
3. **Functional Sustainability and Financial Viability**
   A gap in functional sustainability was identified, as many water supply interventions break down due to a lack of maintenance and a formal tariff system.
   Recommendation: Introducing a standard tariff payment system would ensure resources are available for the maintenance of water supply systems, aligning functional and financial sustainability with IWRM principles.
4. **Capacity Building for WASHCOs**
   WASHCOs, responsible for maintaining water points, have received insufficient training to manage these systems effectively.
   Recommendation: Strengthening local capacity through ongoing training

programs is essential for the long-term sustainability of water supply interventions. This approach has the added benefit of enhancing the local labor force's skill set.

5. **Water Quality and Environmental Monitoring**
   While community members may not perceive water quality as a concern, implementers and government workers indicated otherwise. Poor water quality remains an issue, partly due to a lack of environmental monitoring.
   Recommendation: Effective environmental monitoring, including regular water quality assessments, is critical. Understanding the catchment dynamics, both biophysical and socio-economic, will allow for more comprehensive solutions to water quality challenges.

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List of abbreviations

ABAO	Abbay Basin Administration Office
CBO	Community-Based Organization
CMP CoWASH	Community management project
FDRE	Federal Democratic Republic of Ethiopia
FGD	Focus Group Discussion
GWP	Global Water Partnership
Gov't	Government
IRC	International Water and Sanitation Centre
IWRM	Integrated Water Resources Management
KII	Key Informant Interviews
MWA	Millennium Water Alliance
MoA	Ministry of Agriculture
MoWE	Ministry of Water and Energy
MoWR	Ministry of Water Resources (Now MoWE)
MoWIE	Ministry of Water, Irrigation, and Energy (Now MoWE)
NGO(s)	Non-Governmental Organizations
OECD	Organisation for Economic Co-operation and Development
RWSEP	Rural water supply and environmental program
SWC	Soil and Water Conservation
TASBO	Tana Sub-Basin Branch Office
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation, and Hygiene
WASHCO	Water, Sanitation, and Hygiene Committee
WMC	Water Management Committees

WRM	Water Resource Management
WRI	World Resources Institute
WHO	World Health Organization
Woreda	Administrative district in Ethiopia
Kebele	Local administrative unit in Ethiopia
MASL	Meters Above Sea Level
°	Degree symbol for slope angle
3R	Recharge, Reuse, and Retain

1 Introduction and Background

1.1 Background

Water supply interventions and IWRM are meant to address complex global water challenges. Water supply interventions focus on ensuring universal access to safe drinking water (WHO/UNICEF, 2020). Simultaneously, Integrated Water Resources Management (IWRM) promotes the coordinated development and management of water, land, and related resources to maximize economic and social welfare in an equitable manner, without compromising the sustainability of vital ecosystems (GWP, 2021), including natural habitats and landscapes critical to the supply of freshwater.

The nexus IWRM and WASH highlights the benefits of a holistic and system approach to water management. While WASH focuses on delivering the important and immediate needed safe drinking water, sanitation, and hygiene, IWRM expands this perspective by considering water use within a wider environmental, landscape, governance, and socio-economic context (see Figure 1). IWRM takes into account the dynamics of entire catchment areas, including the governance layers (such as stakeholder collaborations and inclusive policies), bio-physical layers (like water flows, land cover, and ecosystem health), and structural layers (infrastructure and urban planning).

By aligning WASH interventions with IWRM principles, synergies can be unlocked that contribute to a broad range of outcomes. These include optimizing water use efficiency, enhancing water security (including flood protection), social cohesion, cross-sectoral cooperation, and promoting ecosystem health. This integrated approach ensures that interventions address not only immediate water access needs but also the long-term sustainability of water resources and resilience of affected livelihoods.

IWRM acknowledges the multi-purpose productivity of as catchment which can be captured in ecosystem services, that include provision services (water for food and drinking, energy, and materials), regulating services (climate and flood regulation), and supporting services (soil formation and nutrient cycling). These directly impact human well-being (MEA, 2015). Therefore, improving the health and governance of catchments through IWRM ultimately supports and complements the goals of WASH by ensuring reliable and sustainable water for human consumption, sanitation, and hygiene.
In a world increasingly affected by environmental degradation and climate change, an IWRM approach is crucial for ensuring sustainable water sources. It focuses on promoting environmental sustainability, maintaining catchment health, and protecting water resources, all of which are essential for achieving resilient WASH services, while including governance and stakeholders' aspects. By embedding WASH within the broader IWRM frameworks, projects move beyond isolated solutions, transforming into more positive, system-wide changes that contribute to long-term sustainability and resilience.

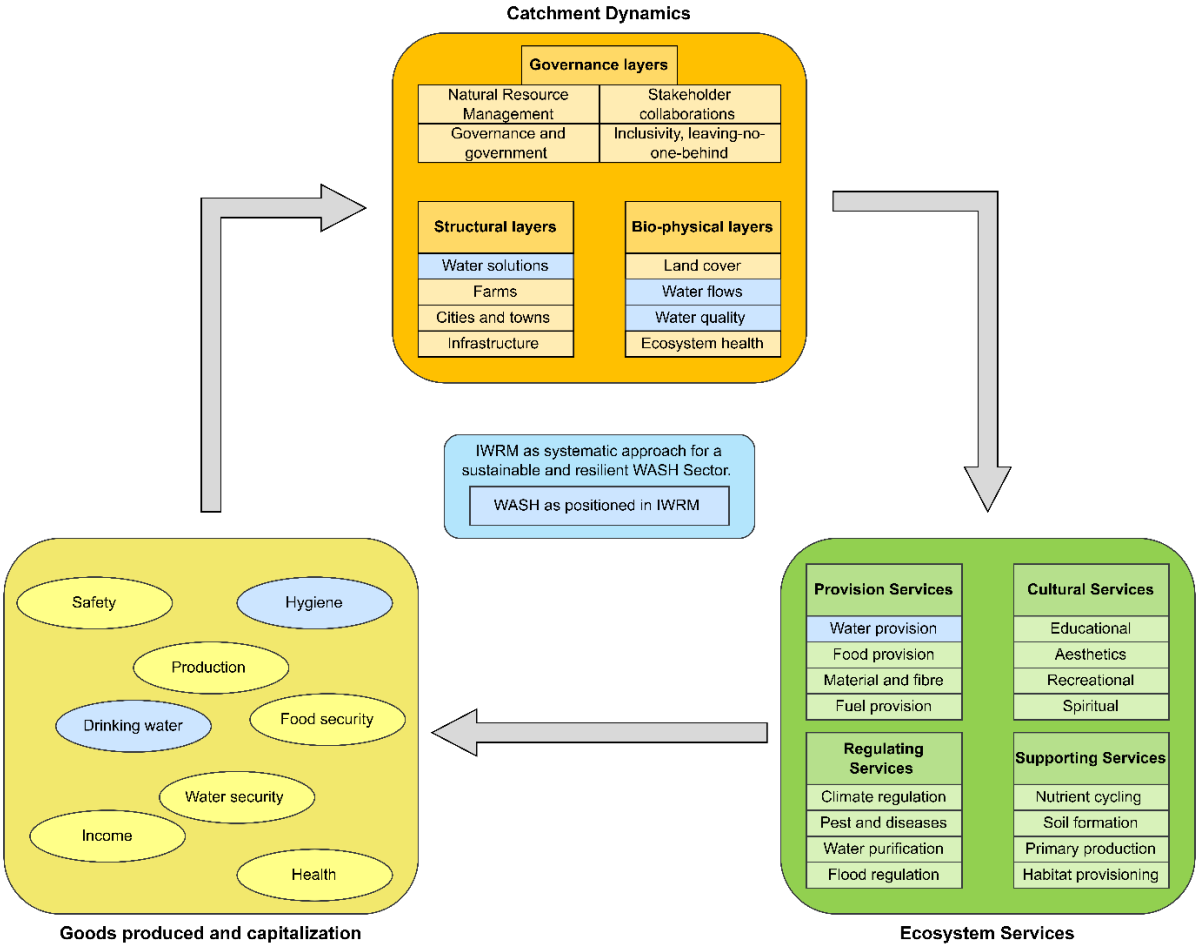

Figure 1. System approach flowchart – WASH as positioned in IWRM

In Ethiopia, integrating water supply intervention with IWRM is essential due to diverse water resource challenges. The Amhara region, where the Tana Subbasin is found, faces periodic droughts, inadequate infrastructure, and uneven access to sanitation, affecting both urban and rural areas.[1] Efforts in the Amhara region include projects to improve water supply and sanitation infrastructure, promote community-led sanitation, watershed management, and enhance water management practices. For instance, World Resources Institute (WRI) and Millennium Water Alliance (MWA), along with other partners, are working on developing water systems, improving quality, promoting catchment protection, and building local management. [2]

[1] https://www.wri.org/update/new-project-promotes-integrated-water-resources-management-ethiopias-tana-sub-basinmanagement-ethiopias-tana-sub-basin, July 5, 2022.

[2] https://mwawater.org/promoting-integrated-water-resourcesmanagement-and-environmentalsustainability-to-enhance-water-availabilityand-livelihoods-in-ethiopia-wale-tana-sub-basin/environmentalsustainability-to-enhance-water-availabilityand-livelihoods-in-ethiopiahttps://mwawater.org/promoting-integrated-water-resourcesmanagement-and-environmentalsustainability-to-enhance-water-

Acacia Water, MWA and WRI conducted a study to investigate the current alignment of local water supply intervention initiatives with IWRM principles, and better understand how to improve this nexus approach going forward. This report summarizes the findings, analysis, and recommendations of the study, aiming to guide future project designs and developments of donors, implementing agencies, and policymakers.

1.2 Objectives

The objective of this study is to evaluate the effectiveness and alignment of water supply intervention in the Tana Sub-Basin with Integrated Water Resources Management (IWRM) principles. By conducting stakeholder mapping, interviews, and a process-based IWRM evaluation, the study aims to identify strengths and weaknesses in current water management practices.

It also seeks to:

- Investigate and gain an understanding of how current water supply interventions either align with or contradict the principles of IWRM in the Tana Subbasin.
- Evaluate existing regulations, policies, and funding mechanisms to determine the extent to which they support or hinder the integration of water supply interventions with IWRM.
- Identify any gaps in data systems that have an impact on decision-making in water resource management and provide recommendations to bridge these gaps.
- Produce a comprehensive report that summarizes the findings, analysis, and recommendations of the study. This report can be used to inform future project designs and offer guidance to donors, implementing agencies, and policymakers.

The goal is to provide actionable recommendations for enhancing the sustainability and resilience of water supply interventions in the area while addressing the unique challenges posed by the local biophysical and hydrological conditions.

1.3 Conceptual Framework: IWRM

The objective of this assignment is to evaluate the performance of water supply intervention regarding IWRM. Performance refers to how well a water supply interventions are aligned with IWRM principles Therefore, it is essential to first define the concept of IWRM. According to several publications, IWRM can be defined as:

IWRM promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.
(UN, 2014; GWP, 2000; OECD, 2005, IWRM-action-hub).

availabilityand-livelihoods-in-ethiopia-wale-tana-sub-basin/wale-tana-sub-basin/, July 13, 2023.

As this commonly accepted definition suggests, IWRM is a holistic and multi-disciplinary approach. Accordingly, the following principles can be used as a basis IWRM for water supply intervention in the Tana Sub-Basin.

Equity and stakeholder participation

In successful IWRM, stakeholders from upstream and downstream catchment areas, the private and public sectors, as well as women and youth, are actively engaged in planning and decision-making. This inclusive approach fosters collective ownership of the interventions and aligns their activities for greater synergy.

One of the key principles of IWRM is that natural resources, such as water, create value for multiple stakeholders and are cross-sectoral issues, relevant to drinking water as much as agriculture, industry, energy, etc. Therefore, effective stakeholder participation and equity are essential for the success of IWRM and the sustainability of water supply interventions. Without positive collaboration, pressures and conflicts among stakeholders over water resources are likely to arise.

In stakeholder participation, we consider not only their role within the catchment area, such as upstream versus downstream positions, but also a broader perspective. Because for a vibrant economy and sustainable development, it is important to involve a diverse range of stakeholders—not just governmental or project-related entities, but also the private sector, local communities, and knowledge institutions. This ensures durability after the project and that interests are synergizing in-stead of contradicting.

Similarly, equity is as fundamental for IWRM. It focuses on ensuring that the added value derived from natural resources is fairly distributed across different groups. This includes adhering to principles such as "leaving no one behind" and promoting gender-responsive approaches to scaling. When water resources or project resources only increase inequality, it will lead to conflicts hence harming the sustainability of each intervention.

Environmental and functional sustainability

In successful IWRM, the use of water, land, and ecosystems is optimally balanced with regeneration to ensure environmental sustainability, while maintaining technically sound structures to guarantee reliable functionality.

Environmental degradation poses serious and increasing risks to freshwater availability. IWRM is fundamentally centred around sustainable natural resource management, making environmental considerations and ecological well-being inseparable from both IWRM, the continuity of water sources, and the sustainability of water supply interventions. This principle emphasizes the importance of water quantity, quality, and the overall functionality of interventions.

For an intervention to be sustainable, it is essential that water replenishment equals or exceeds the rate of water uptake. From a water management perspective, this means that, for example, the volume of water extracted by a pump must be compensated somewhere within the system, such as through upstream infiltration measures. Maintaining a balance between water use and available supplies and protecting the water cycle and its hydrological functions are key regarding sustainability.

Moreover, within IWRM, it is vital to ensure that water quality is preserved. Degraded water quality can harm downstream users and diminish the resource's potential to add value and improve safe access. Additionally, the functionality of interventions is closely related to environmental outcomes. When an intervention malfunctions, it can have significant consequences for both water quantity and quality. Similarly, functionality is related to the reliability of the source of water, for example, a water supply intervention would also have low functionality when the borehole works fine but the source is empty or too uncertain (i.e., discontinuous).

Governance and capacity building

In successful IWRM, strong policies combined with robust institutional capacity enable and facilitate informed decision-making, responsible resource use, and harmonious collaboration, minimizing the potential for conflicts.

The final principle embodies the governance and institutional capacity needed to align water supply interventions with IWRM principles. This involves critical aspects such as policy-making, decision-making processes, and conflict resolution. It is about translating the previously described principles into applicable governance structures, through effective governance and robust institutional frameworks.

For example, successful IWRM implementation requires clear policies that support integrated approaches to water management, ensuring that various sectors, such as agriculture, industry, and urban development, are coordinated. Moreover, it is important that local policies are aligned with national or regional policies or vice versa, in order to have a system that is synergizing instead of different authorities contradicting each other. At the same time, the implementation and enforcement of good policy is vital.

This principle also reflects the capacity required for effective governance, such as establishing basin management plans, aligning policies with practical implementation, and resolving conflicts. Ultimately, successful IWRM depends on strong institutions and strong, albeit complex, governance structures.

1.4 Security concerns

The security situation in the Amhara region during 2023-2024 posed significant challenges during the interview and Focus Group Discussion (FGD) processes at the regional, woreda, and kebele levels. The ongoing conflict made it difficult to establish contact with the proposed government officials, many of whom were unresponsive due to the instability. Additionally, conducting extended Key Informant Interviews (KIIs) with community beneficiaries proved challenging under these conditions. To mitigate these difficulties. Community KII interviewees and woreda water officials were cautiously mobilized to Bahir Dar, where a safer environment allowed for more effective communication. The team also prioritized repeated communication and scheduling interviews at the convenience of the respondents and also reviewed the initial stakeholder mapping to better align with the realities on the ground.

Key limitations of the study include:

- **Security Restrictions**: limited access to woreda and kebele levels, reducing the ability to gather on-site data.

- **Limited Government Participation**: Instability caused unresponsiveness from some officials.
- **Communication Delays**: Repeated attempts were required to secure interviews.
- **Time Constraints**: The conflict imposed tight schedules, reducing the time available for in-depth discussions.
- **Limited Access to Local Communities**: Direct contact with community beneficiaries in some areas was difficult.
- **Inconsistent Data Availability**: Data collection was hindered by unpredictable access to certain officials and respondents.

1.5 Report outline

The report is structured as follows:

- **Chapter 2** provides an overview of the Tana Sub-Basin, covering its biophysical and hydrological characteristics as well as the legal and institutional context. This chapter also examines the security challenges in the region, which have influenced the research process.
- **Chapter 3** explains the methodology used for the analysis, water supply intervention and participants for FDG and KII selected.
- **Chapter 4** explains the approach and rationale behind stakeholder mapping, presenting the results for the Tana Sub-Basin.
- **Chapter 5** formulates the conceptual framework of IWRM, resulting in three principles and twelve indicators. These IWRM principles and indicators form the foundation of Acacia Water's process-based IWRM evaluation tool. This tool uses interviews with various resource persons, including community focus groups, to assess the strengths and weaknesses of specific water supply interventions with respect to IWRM. Additionally, it provides recommendations for specific interventions on how to address these weaknesses.
- **Chapter 6** discusses the results of the interviews and IWRM evaluation. This chapter also includes two case studies that evaluate IWRM performance for water supply intervention in Farta and North Mecha districts. The case studies reveal varying perspectives on the same interventions, underscoring the importance of a nuanced approach to water management.
- **Chapter 7** offers several concrete recommendations on how to better integrate IWRM principles into water supply intervention for sustainable water management

2 The Tana Sub-Basin

This chapter provides context for this study, detailing the water situation in the Tana subbasin, the relevant legal and institutional frameworks, and the application of IWRM. Lastly, this chapter elaborates on the security concerns in the area, which had significant practical implications for the study

2.1 General

The Tana Sub-Basin, situated in northwest Ethiopia, consists of several Woredas and Kebeles (see Figure 2). The sub-basin is an important hydrological region due to its role as the source of the Blue Nile River, originating from Lake Tana. Lake Tana, the largest lake in Ethiopia, is essential in regulating the regional water cycle and influencing river flows downstream. The basin's water availability is highly seasonal, with significant variations in precipitation affecting water levels in the lake and the river's flow. Seasonal rainfall patterns play a key role in determining the amount of water available throughout the year, impacting both ecological systems and human activities (Melsew, 2022); (Gashaw, 2021).

Effective management of the Tana Sub-Basin's water resources is essential due to several challenges, including pollution, over-extraction, and the impacts of climate change. IWRM practices can be implemented to address these issues. These strategies can include rigorous monitoring of water quality, controlling water extraction rates, and adapting to changes in water availability due to climatic shifts. Such management practices are critical to ensure that water resources are used sustainably and equitably, meeting both agricultural and domestic needs (Ferede, 2022; Haile, 2020).

The socioeconomic dynamics of the Tana Sub-Basin are closely linked to its water resources. The livelihood of the community in the basin predominantly depends on agriculture, fishing, and small-scale trade. Agriculture is the primary source of income, with many residents engaged in farming and livestock rearing. The region faces socioeconomic challenges related to water management, particularly in balancing water use for irrigation with the needs of local communities and ecosystems. Effective water resource management is vital to sustaining these economic activities and improving the quality of life for the basin's inhabitants (Haile, 2020).

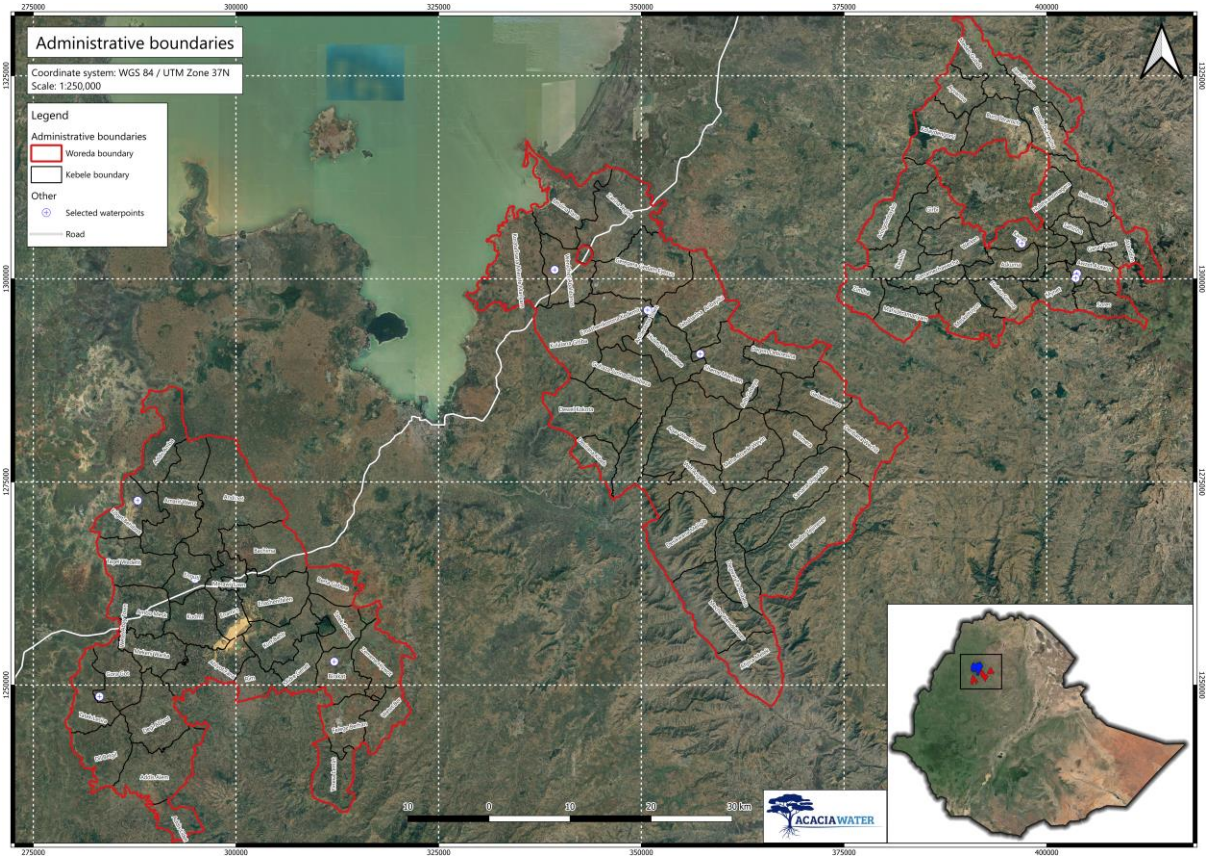

Figure 2. Administrative boundaries, showing the three target woredas (North Mecha, Dera, and Farta).

2.1.1 Current situation of water and land

The Tana Sub-Basin faces a range of complex water-related issues that impact its IWRM and water supply intervention efforts. These challenges include water contamination, droughts, and floods, each of which affects the region's water resources and overall socioeconomic stability.

The drainage network map (Figure 3) shows the streams around the three target woredas and the catchments they can be divided into. The Ribb (white), Gumara (green), and Gilgel Abay (orange) catchments are the most noteworthy catchments draining into Lake Tana in this area. The Infiranz and Gelda catchments (purple) consist of more local streams draining into the lake as well. Catchments containing streams that flow towards the opposite direction (not into the lake) are visualised in grey.

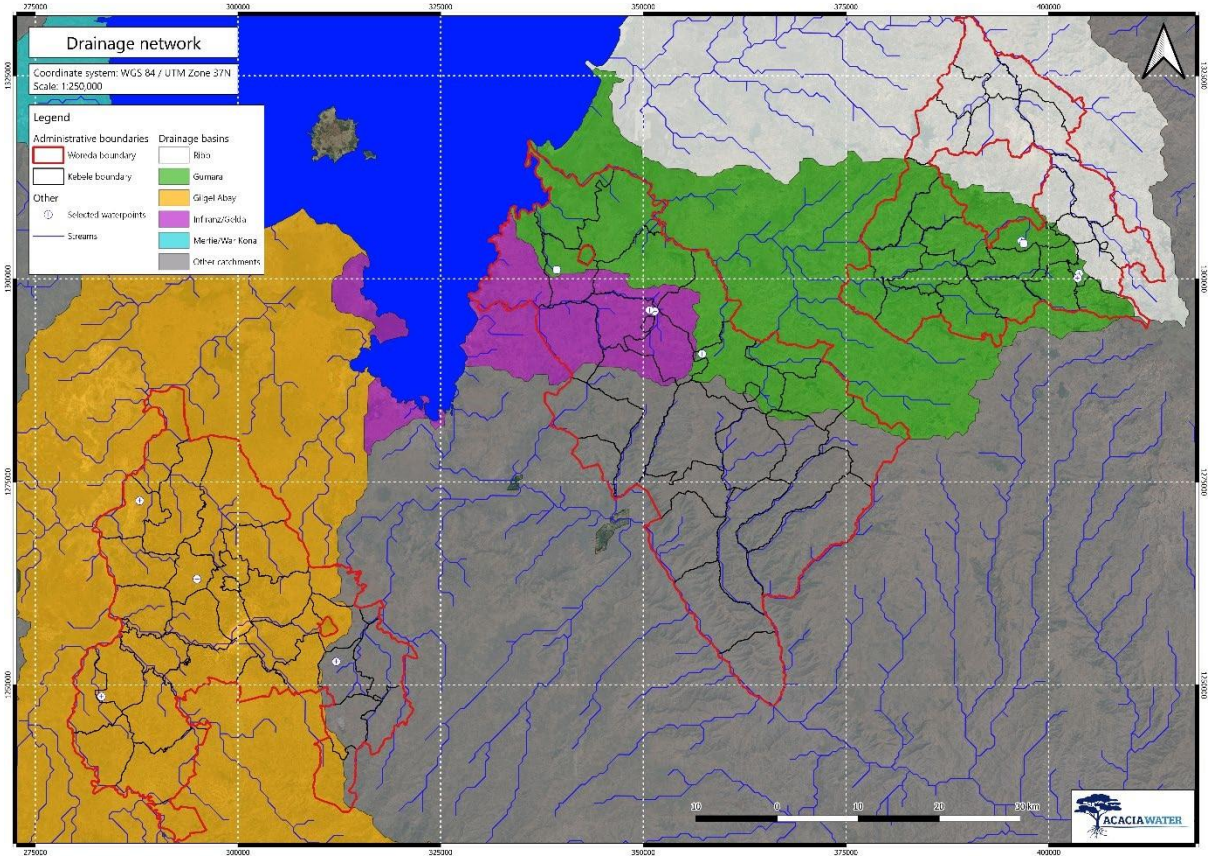

Figure 3. Draine network map. Showing het streams around the three target woredas and the catchments they are located in. The Ribb (white), Gumara (green), and Gilgel Abay (orange) catchments are the most noteworthy, draining into the lake.

Land use and land cover in the study areas

Land use within the Tana Sub-Basin is characterized by intensive agricultural activities, which significantly impact water resources. The region experiences issues such as land degradation and deforestation due to intensive farming practices. These activities put additional pressure on water resources, making sustainable management even more critical. For example, forests are known to have a positive impact on groundwater recharge and nutrient filtering, whereas intensive hillside agriculture is more prone to surface run-off containing nutrients. The water from Lake Tana supports irrigation, domestic needs, and hydropower generation. To address the challenges associated with land and water use, it is essential to implement effective management practices that promote sustainability and mitigate adverse environmental impacts (Assefa, 2023); (Mohammed, 2024).

The land use/land cover map shows that agricultural activities are very common in the target woredas, with roughly 72.7% (2,577 km2) of the total area covered by Cropland. Tree cover is second most prevalent at 9.5% (338 km2), and is most common in the North Mecha woreda.
Shrubland and Grassland make up 8.7% (309 km2) and 6.8% (240 km2), respectively. The map shows that Shrubland and Grassland prevail over Cropland in the extremely steep south of Dera woreda, as well as in some steeply sloped areas of Farta woreda. This indicates that the landscape is too rough for agriculture there.

Other land cover types of lesser importance in the area are Built-up (concentrated in the towns), Bare or sparsely vegetated land, Permanent water bodies, and Herbaceous wetlands. Together, these make up only 2.2% (79 km2) of the total area.

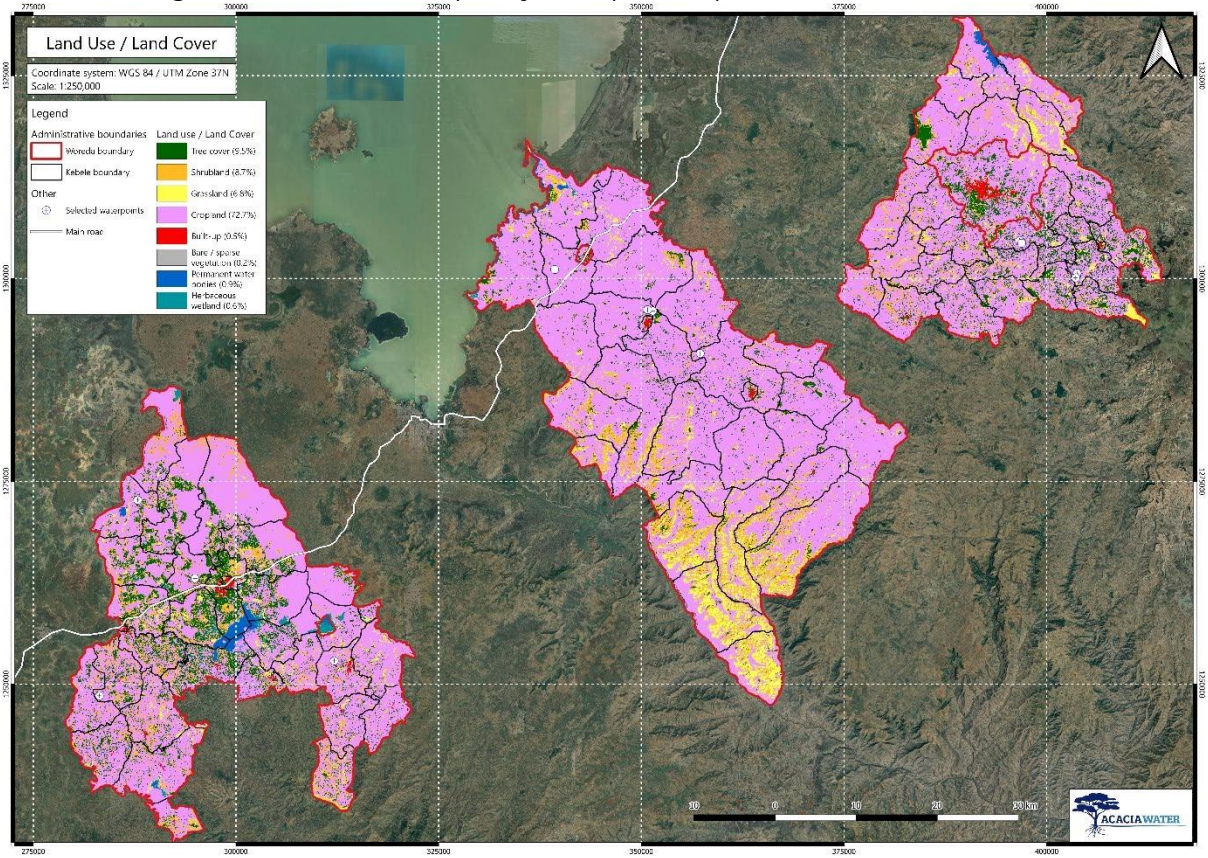

Figure 4. Land use/ Land cover map of Dera (left), Farta (center), and North Mecha (right) Woredas.

Water Contamination

Water contamination in the Tana Sub-Basin poses significant risks to both human health and the environment. The primary sources of contamination include agricultural runoff, industrial discharge, and improper waste management. Pesticides and fertilizers used in agriculture often leach into water bodies, leading to nutrient pollution and eutrophication in Lake Tana. This contamination affects water quality, leading to harmful algal blooms and reduced oxygen levels, which in turn impacts aquatic life and the safety of drinking water (Haile, 2020); (Ferede, 2022). Additionally, inadequate sanitation facilities contribute to the contamination of water sources, as improper disposal of human waste can lead to the spread of waterborne diseases such as cholera and dysentery (WorldBank, 2023).

Droughts and water scarcity

Droughts represent a major challenge in the Tana Sub-Basin, exacerbating water scarcity and affecting agricultural productivity. Seasonal variability in rainfall significantly influences water availability, with prolonged dry periods leading to reduced inflow into Lake Tana and lower river flows. Drought conditions increase the pressure on water resources, making it difficult to meet the demands for irrigation, drinking water, and hydropower. This variability in water supply has severe implications for food security and local livelihoods (Melsew, 2022); (Assefa, 2023).

Floods

Conversely, floods are another significant challenge in the Tana Sub-Basin considering the slope and elevation levels (see Figure 6 and Figure 5) Heavy rainfall and the resultant high inflow into Lake Tana can lead to flooding, which impacts both human settlements and agricultural lands. Floods cause soil erosion, damage infrastructure, and disrupt economic activities. The increased frequency and intensity of floods are linked to changes in precipitation patterns and land use changes in the basin. Effective flood management strategies are essential to mitigate the impacts and enhance resilience (Gashaw, 2021); (Mohammed, 2024).

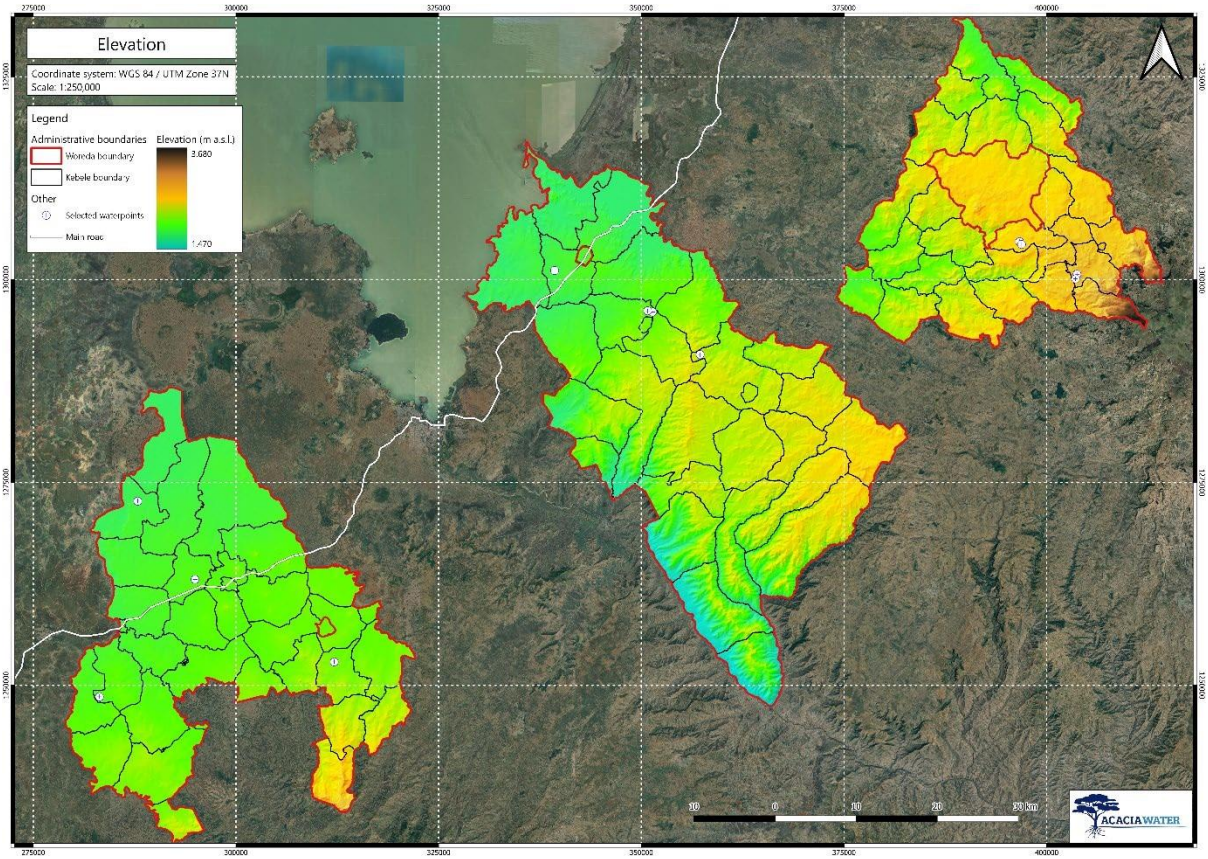

Figure 5. The elevation levels across the three target woredas.

Elevation across the three target woredas ranges from 3,680 m a.s.l. (in the easternmost point of Farta woreda) to1,470 m a.s.l. (in the south of Dera woreda). The elevation of North Mecha woreda is more constant, and the majority is located at an elevation of around 2,000 m. Only in the south-eastern point (Yinesa Lemirt kebele) the elevation goes up to more than 3,000 m.

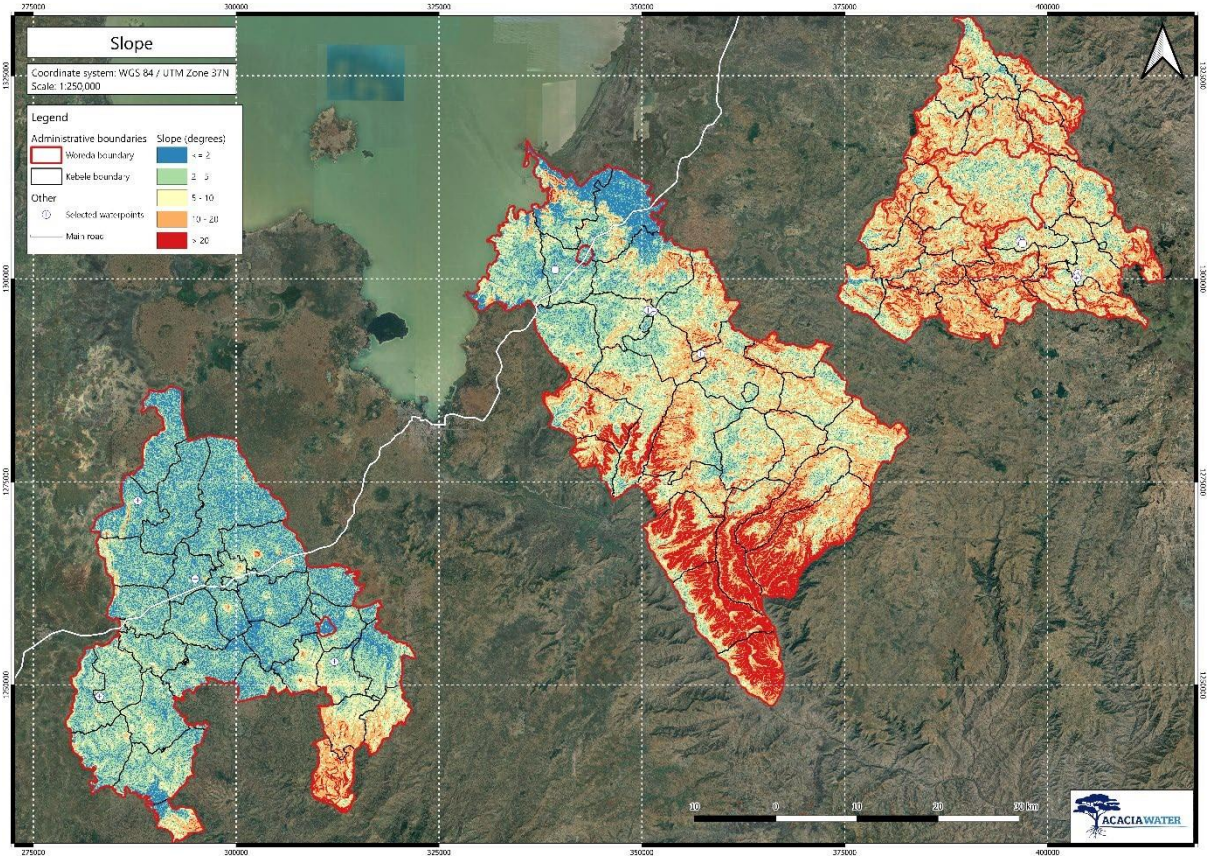

Figure 6. Slope map of the targeted woredas.

The slope map shows that North Mecha is the most flat out of the target woredas, consisting mostly of flat (0°-2°) and gentle (2°-5°) slopes (apart from the area surrounding the earlier mentioned Yinesa Lemirt kebele). Farta shows more relief, with moderate to steep slopes being common all over the woreda. However, the area most concentrated with extremely steep slopes (>20°) is the southern part of Dera woreda.

2.2 Legal and Institutional Framework

Ethiopia's legal and institutional frameworks provide a good foundation for implementing IWRM principles. From national policies and proclamations to basin-level management offices, the country has established a comprehensive approach to managing its water resources. Below the national laws, water management policies, and legal frameworks are reviewed in contrast with the IWRM principles.

2.2.1 Ethiopian water resource management policy and strategy

The administration, use, and preservation of Ethiopia's water resources are regulated under the Ethiopian Water Resources Management Proclamation No. 197/2000. The Proclamation stipulates that the Ethiopian Water Resource Management Policy, the Integrated Basin Master Plan Studies, and other water management and water resources regulations shall serve as the foundation for the management and administration of the nation's water resources. In accordance with Article 8 of the Proclamation, the MoWE is designated as the primary federal agency in charge of overseeing water management. The Ministry has the authority to choose how interstate water will be used and managed.

It is within its rights to transfer its authority to other organs, including regional states, if necessary (MOWE, 2000).

The country's policy, other water management laws, and water strategies have included IWRM's guiding principles. The fundamental tenets of IWRM, integration, and decentralization, call for the federal government to manage basins as a single integrated resource while also delegating authority to the Regional States and including them in decision-making processes. The Constitution implicitly but clearly expresses the possibility of transferring to the Regional States the authorities and responsibilities granted to the Federal government in terms of coordination and collaboration between the Federal government and the Regional States. However, it is not spelled out as a requirement; rather, it depends on the federal government's desire to cede control to the States or Basin Authorities. While Regional States and River Basin Organizations are not directly named, the Ethiopian Water Management Policy clearly adopts the river basin as the fundamental unit for the management of the nation's water resources. Subsequent legislation also provides for delegation to suitable institutions (MoWR, Ethiopian Water Resource management policy, 1999).

Overall, the Proclamation takes a centralized approach by delegating primary authority over the country's water resources to the MoWE (known as the MoWIE in the past) at the federal level. Two major policy guidelines have been developed for water management in Ethiopia: i) The Ethiopian Water Resources Management Policy, and ii) the Ethiopian Water Sector Strategy (MoWR, Ethiopian Water Resource management policy, 1999).

Water Resources Management Policy: Ethiopia's Water Resources Management Policy was created to ensure an equitable system for the distribution and use of water, as well as for the people to gain from socioeconomic growth and make proper and sustainable use of the country's limited water resources.
According to the policy, Ethiopia follows a decentralized strategy that ensures the participation of all stakeholders in decision-making in all aspects of water resource management. It emphasizes the importance of implementing an IWRM approach and treating all water-related issues, including the management of surface and groundwater resources, holistically. The policy document outlines the necessity of creating river basin organizations step-by-step in order to manage the nation's water resources in a sustainable and coordinated manner.

Water Sector Strategy: The Ethiopian Water Sector Strategy adopted a basin-based strategy, with the 'Integrated River Basin Development Master Plans', which treats each basin as a whole for the purposes of development and master plan studies, rather than project by project. The strategy for interstate waterways emphasizes that, in order to develop the institutional framework, it is necessary to create and implement the proper linkage mechanisms to ensure that water resources management plans at the federal and regional levels are coordinated (MoWR, Ethiopian Water Sector Strategy , 2001).

2.2.2 Roles and responsibilities of organization in IWRM

The Ministry of Water and Energy is the principal government body responsible for water management in Ethiopia. While the basin authorities and regional water offices are dedicated to managing and overseeing the basins and the water bodies in their own

territorial boundary. The basin authorities are tasked with implementing IWRM principles at the basin level. They are responsible for data collection, monitoring water quality, managing water allocations, and ensuring the sustainable use of water resources. The Abbay Basin Administration Office and the Tana Sub-basin Branch Office play fundamental roles in translating national IWRM policies into actionable strategies at the regional level, supporting Ethiopia's goals for sustainable water resource management.

Ministry of Water and Energy(MoWE)

MoWE is responsible for formulating and implementing national water policies, overseeing water management practices, and ensuring effective cross-sectoral coordination. The Ministry's efforts include integrating IWRM principles into national strategies and facilitating collaboration among various stakeholders to enhance water resource management across the country. MoWE's role is pivotal in advancing IWRM practices by addressing both policy formulation and on-ground implementation, aiming to achieve sustainable water management outcomes.

Abay Basin Administration Office (ABAO)

The Abbay Basin Administration Office (ABAO) is tasked with managing water resources within the Abbay Basin, which includes the upper Blue Nile basin and Tana sub-basin.. The MoWE oversees these activities, and due to recent organizational restructuring, there have been significant impacts on the frequency and quality of data collection. Despite these challenges, the ABAO continues to manage about 170 stations within the basin, focusing on critical tributaries like the Gilgel Abay, Gumara, and Ribb rivers.

Tana Sub-Basin Branch Office (TASBO)

The Tana Sub-Basin Branch Office (TASBO) was previously responsible for managing water resources within the Tana Sub-Basin. However, recent reports indicate that the TSBA is currently not operational. According to Tesfaye et al. (2023), the branch office, not being functional currently has implications for the management and coordination of water resources in the Tana Sub-Basin, potentially affecting the implementation of IWRM practices in the region. Management of the Tana Sub-basin now falls under the aegis of the ABAO.

Regional water administration and agriculture office

In addition to the responsibilities allocated by the MoWE, regional water bureaus are in charge of implementing federal policies, strategies, and action plans at the regional level by adapting them to the specific conditions of the region. There are additional irrigation offices at the regional level that implement federal policies and work on small-scale irrigation projects. The Federal Ministry of Agriculture (MoA) oversees such irrigation offices. Other than managing waters that are contained within their borders, regional states have no control over the inter-regional or transboundary water bodies. If a state has a river that flows through regional boundaries, it must wait for the establishment of a Basin Administration Office by the federal government.

2.3 Application of IWRM in Ethiopia

Ethiopia's efforts to IWRM principles into its water governance framework are evident in its policies, legislation, and development programs, which aim to promote sustainable water development. The Water Resources Management Policy sets out comprehensive

guidelines for managing the country's water resources, with support from institutions like the Ministry of Water and Energy, Regional Bureaus for Water Resources, and other governmental and environmental agencies (Cap-Net., 2005) & (Hailu, 2008).

Despite these efforts, challenges persist in the practical implementation of IWRM. According to (Gebremichael, 2023), ineffective institutional frameworks hinder coordination across various levels of government and stakeholders. For example, currently, only three basin authorities exist for Ethiopia's twelve major river basins. Additionally, limited financial resources constrain the capacity of institutions to enforce regulations and invest in necessary infrastructure. This is compounded by insufficient stakeholder engagement, particularly at the community level, which is critical for the success of IWRM initiatives.

(Jembere K., 2009) highlights that Ethiopia's water insecurity is linked to inadequate water resources management, arguing that existing policies require revision to address technical and capacity gaps among water users. He emphasizes the need to update the policy framework to accommodate increasing and competing water demands driven by population growth, agricultural expansion, and climate change. (Balcha, 2018) support this view, providing a case study of the Awash River Basin, demonstrating that IWRM, when applied effectively, can manage competing water demands and improve water security. By integrating surface water, groundwater, pollution control, and equitable water allocation, IWRM facilitates a more holistic approach to managing water resources in the region. This case shows the potential for IWRM to improve water governance across Ethiopia, provided that institutional, financial, and technical challenges are addressed.

3 Methodology

3.1 Sampling Process

The sampling process started with detailed stakeholder mapping using influence vs interest and institutional assessment for the WRM-WASH interventions. The next chapter includes a detailed report on this topic. The selection of interventions for primary data collection was conducted in consultation with project stakeholders, including representatives from the World Resources Institute (WRI), Millennium Water Alliance (MWA), and local authorities. The final intervention selection was based on the predefined criteria established at the outset of the study, with a focus on maintaining representation across key characteristics such as technology, community size, and water source type. Through this collaborative process, we aimed to ensure that the selected interventions were reflective of the diverse landscape of WASH interventions in the Tana Subbasin

3.1.1 Stakeholder analysis and interviewee selection

A detailed stakeholder mapping, analysis, and institutional assessment were conducted to identify key stakeholders that need to be included in the interviews. Prioritized stakeholders were selected for detailed engagement based on the analysis. These stakeholders were approached for Key Informant Interviews (KII) and Focus Group Discussions (FGD) In Chapter 4 detailed information about the stakeholder mapping can be found.

Implementer interview (KII)

The implementers or operators of water supply intervention provided most information, as illustrated in Figure 10 by the numerous lines connecting this informant to the majority of the questions. This focus was intentional, given that the primary aim is to evaluate the IWRM performance of water supply interventions. Understanding how these interventions are operated is therefore fundamental for assessing IWRM performance.

Implementers were interviewed through Key Informant Interviews (KIIs), which included a mix of open and closed questions. The closed questions utilized a similar 5-point metric as outlined in the Table 9. For the full questionnaire, please refer to the Annex 2.

Implementers were identified through the stakeholder analysis during the first step of the study and interviewed. These were involved in previous interventions by Finida, Water Aid, Millennium Water Alliance, Care Ethiopia, and Plan International were interviewed. For this survey, 36 KIIs were conducted at regional, woreda, and Kebele levels including implementers and governmental officials. The number of participants can be found in Table 1 while the list of all participants with full information can be found in Annex 1.

Governmental worker interview

Government workers were interviewed through KII, with a focus on the principles of equity, stakeholder participation, governance, and capacity building. The aim was to understand how government policies, training programs, and legislation either support or complicate the IWRM performance of water supply interventions. These interviews included both open and closed questions. For the full questionnaire, see the Annex 2.

Government workers were identified through the stakeholder analysis at the first stage of this study. At the region level respondents from the Amhara Water and Energy Bureau including the WASH program manager, at the woreda level the Farta and Dera water office heads. Experts and people who are involved in water supply intervention were included in these interviews. WASH coordinators and advisors, water resource management managers and experts, water and energy heads, and representatives of the water user were included. See Table 7.

Water Management Committees (WMC) and Water Sanitation and Hygiene Committee (WASHCO) (FGD)

To complement the FDG discussion with the community, we also interviewed water management committees (WMC) through the same procedure as the community i.e., the same questionnaire but in a KII setting. Two representatives of the WASHCO committee members per intervention were interviewed separately. This approach was chosen due to their dual roles as water users and WASHCO committee members, providing valuable insights. Additionally, interviewing them separately helps capture a diverse range of perspectives and reduces the likelihood of groupthink.

Table 1. Number of KII participants

KII participant categories	**Male**	**Female**	**Total**
Government Offices at region, basin, and woreda level	7		7
Implementers	5		5
Community/beneficiaries	17	7	24
Total KII			36

Community (FGD)

Lastly, the communities benefiting from the water supply intervention were engaged through Focus Group Discussions (FGDs). FGDs are particularly valuable for understanding social dimensions and gaining an in-depth view of the dynamics at play, making them more focused on the quality of insights rather than the quantity of questions (Nyumbaet, et al, 2017). As a result, we designed the questionnaire for the FGDs differently from the KIIs.

For the FGDs, we did not use open and closed questions. Instead, we presented statements related to IWRM principles and their associated indicators. This approach allowed the community or focus group to discuss whether they agreed or disagreed with the statements, to what degree, and the reasons behind their views. This method provides a more nuanced understanding of the impact of the water supply interventions, offering valuable insights into IWRM performance.

The FGDs were particularly indispensable for triangulation because, in our view, the community being the ones who experience the consequences or impact of a water supply intervention can effectively validate the claims made in other interviews. Their firsthand experiences provide a critical perspective, ensuring that the insights gathered are grounded in the real-world effects of the interventions. For example, one of the statements was whether the community felt that the water provided by the intervention

was safe to drink. For this study, this serves as a proxy for water quality preservation, a key indicator in the environmental and functional sustainability IWRM principle.

A group of 10-13 people (see Figure 7) with similar backgrounds participated per FGD. Participants were identified and invited to participate with the help of intervention water office experts. Experienced moderators who are experts of the woreda water office facilitated the FGDs. Open-ended questions were prepared by the consultant Acacia Water for the FDG. As presented in the table below, 12 FGDs were conducted with a total of 126 participants. From these number 37% are women.

Table 2. Number of FDGs participants

Woreda	**Kebeles covered**	**Number of FDGs**	**Male**	**Female**
North Mecha	Edigetbehibret	1	5	6
	Engutie	2	15	5
	Birakat	1	8	2
Dera	Huletu Wogedamie	1	7	4
	Wonchet	1	8	2
	Emashenkore	2	13	11
Farta	Awuzet	2	13	7
	Kanat	2	10	10
Total Number of FGDs participants		12	79	47

Figure 7. Photograph of a conducted focus group discussion in North Mecha.

3.1.2 Intervention selection

Representative WASH interventions that offer a comprehensive understanding of their alignment with IWRM principles within the Tana Subbasin are selected using purposive sampling (Criterion Sampling). Criterion Sampling is proposed as the sampling to utilize pre-established criteria for intervention selection, this sampling approach allows for a

targeted and purposeful selection of interventions that possess the identified qualities, ensuring that the study's focus is maintained, and the objectives are met. The criteria used for the selection of interventions for the assessment are the technology used, water source type, type of implementer (NGO, community, government), and security and accessibility

Table 3. Selected water supply interventions

woreda	kebele	Village	Water source	Technology	Implemented by	managed by	Functionality	X	Y
Dera	Huletu wegedamie	Dul bet	Drilled well (shallow)	Hand pump	World Vision	WASHCO	Functional	357254	1290762
Dera	Wonchet	Yntaba	Drilled well (shallow)	Solar	World Vision	WASHCO	Functional	339310	1301118
Dera	Ema Shenkoro	Derebet	Hand dug well	Hand rope	CMP (Community management project)	WASHCO	Functional	351387	1296012
Dera	Ema Shenkoro	Abalo	Hand dug well	Hand pump	ORDA	WASHCO	Functional	350770	1296154
Farta	Awozet	Gose	Spring Development	Solar	CMP/RWSEP	WASHCO	Non_functional/Needs major maintenance	403731	1300658
Farta	Awozet	nech hawaria	Hand dug well	Hand Pump	CMP	WASHCO	Functional	403563	1300096
Farta	Kanat	Zelan beret	Hand dug well	Hand Pump	Care Ethiopia	WASHCO	Functional	396654	1304682
Farta	Kanat	Dengit	Spring Development	Solar	RWSEP (Rural water supply and environmental program) /CMP	WASHCO	Not Functional	396907	1304345
North Mecha	Enguti	Engutie	Drilled well (shallow)	Hand pump	UNCEF	WASHCO	functional	294948	1263051
North Mecha	Birakat	Debr mender_Akali mnch	Spring	Gravity	Government/WASH & Community	CMP	functional	312124	1252887
North Mecha	Edget Behibiret	Birnie	Hand dug well	Hand pump	Government/WASH & Community	WASHCO	Functional	287880	1272704
North Mecha	Enguti	Chorka Mender	Drilled well (shallow)	Hand pump	UNCEF	WASHCO	Not Functional	283164	1248590

3.2 IWRM Evaluation Tool

For the analysis, an easy-to-use spreadsheet tool that evaluates IWRM principles of intervention projects and encourages learning was developed purposely for this study. The IWRM Evaluation Tool assesses principles of IWRM such as inclusivity, socioeconomics, scalability, stakeholder engagement, and environmental consequences. The tool is designed as a simple-to-use Excel file to ensure compatibility with a wide range of users, avoiding the need for them to learn a new application. The tool works as follows: the interviews with governmental workers, implementers, community members, and WMCs for a specific water supply intervention and location are analysed using the rubric (Table 9). These scores are then entered into the Excel tool, which calculates the average, minimum, and maximum values. Internal formulas analyse these values, producing a results sheet that displays the indicator score, principle scores, and overall result. Additionally, the tool automatically identifies bottlenecks in IWRM performance and suggests potential solutions to address them. A detailed explanation of how the tool works can be found in chapter 5.

In addition, two case studies are prepared based on the results found using the IWRM framework tool. In these case studies based on the gaps identified the tools also point out which indicators need more work and how to include them in the practices.

4 Stakeholder Mapping

This section outlines the process of identifying and analysing stakeholders for the assessment of water supply intervention and IWRM. The stakeholder identification began with a desk study and mapping exercise to categorize relevant entities. The focus was on determining stakeholders' roles, interests, and impact within the scope of water management and supply projects.

4.1 Stakeholder mapping and institutional assessment

The purpose of this stakeholder mapping and the institutional assessment is to identify and analyse key stakeholders and to evaluate the roles, responsibilities, and capacities of institutions involved in the implementation of water supply intervention and IWRM. This process is essential for determining who to interview and engage in Key Informant Interviews (KII) and Focus Group Discussions (FGD).
The stakeholder mapping covers various government administrative structures of the Amhara regional state, including region, Woreda, and kebele levels, as well as Basin Organizations. The mapping focuses on development project areas associated with ongoing projects by MWA and WRI, specifically:

- North Mecha Woreda
- Farta Woreda
- Dera Woreda

Additionally, the mapping includes project intervention kebeles within these woredas and considers NGOs, academic, and research institutions involved in capacity building and financial resource support.
This geographical scope ensures a comprehensive assessment of stakeholders involved in water supply and IWRM activities across the relevant administrative and project areas.

4.2 Methodology

The stakeholder mapping methodology involves several steps to ensure a thorough analysis:
The stakeholder mapping methodology employs an "Influence vs. Interest" approach to ensure a comprehensive analysis of stakeholders involved in IWRM and water supply projects/initiatives. This methodology helps in categorizing stakeholders based on their level of influence over and interest in the projects.
The steps involved in this methodology are:

1. Identifying Relevant Stakeholder Groups and Organizations: Conduct desk research to identify a broad range of stakeholders who have an impact on or interest in IWRM and water supply initiatives.
2. Analyzing Stakeholders: Assess each stakeholder's level of influence and interest in the projects. This involves gathering information through focus group discussions and consultations to understand their perspectives, interests, and potential impact.

3. Mapping Relationships: Use the "Influence vs. Interest" matrix to visualize the relationships between stakeholders.

   This matrix categorizes stakeholders into four groups:

   - High Influence, High Interest: Key stakeholders who should be actively engaged and consulted.
   - High Influence, Low Interest: Stakeholders who can influence the project but may need to be kept informed.
   - Low Influence, High Interest: Stakeholders who are interested but have limited influence; should be kept informed and involved as appropriate.
   - Low Influence, Low Interest: Stakeholders with minimal impact and interest; require minimal attention.

4. Prioritizing Stakeholders: Rank stakeholders based on their placement in the matrix to prioritize engagement and resource allocation for the nexus assessment.

4.3 Stakeholder Identification

Stakeholder identification involved categorizing various entities involved in or affected by water supply and IWRM initiatives. These categories include government organizations at different levels, basin-level organizations, non-governmental organizations (NGOs), academic and research institutions, and community-based organizations (CBOs). The identification process aimed to ensure a comprehensive inclusion of all relevant stakeholders. The table below provides a comprehensive list of potential stakeholders categorized by their roles and level of involvement. The inclusion of these stakeholders is key for the effective assessment of water supply intervention and IWRM.

Table 4. Possible List of Potential Stakeholders

Stakeholder Category	**Specific Stakeholders**
Regional Level Stakeholders	-Amhara Regional State Water and Energy Bureau
	- Amhara Region Environment Protection Authority
	- Amhara Region Tana and Other Water Bodies Agency
	- Amhara Agriculture Bureau
Basin Level Organizations	- Abbay Basin Administration Office
Woreda Level Stakeholders	- Woreda Water and Energy Development Offices (Farta, Dera, North Mecha)
Kebele Level Stakeholders	- Kebele Water Management Committees
Community/Beneficiaries	- Local communities impacted by water supply and IWRM interventions
Academic and Research Institutions	- Bahir Dar University
	- Debre Tabor University
Non-Governmental Organizations (NGOs)	- World Resources Institute
	- Millennium Water Alliance
	- Water Aid
	- IRC WATER SUPPLY INTERVENTIONS
	- World Vision
	- SNV
	- UNICEF

IWRM-WASH platform in Amhara region[3]	- Plan International - Relevant platforms integrating IWRM and WASH activities

4.4 Stakeholder analysis

The analysis of stakeholders focuses on understanding their relevance, importance, and role in water supply and IWRM initiatives. This analysis aids in prioritizing stakeholders for detailed engagement, including Key Informant Interviews (KII) and Focus Group Discussions (FGD). Figure 8 and Table 5 presents an analysis of stakeholders based on their relevance, importance, interest, and mandate related to water supply and IWRM initiatives. It provides insight into each stakeholder's role and impact on the projects.

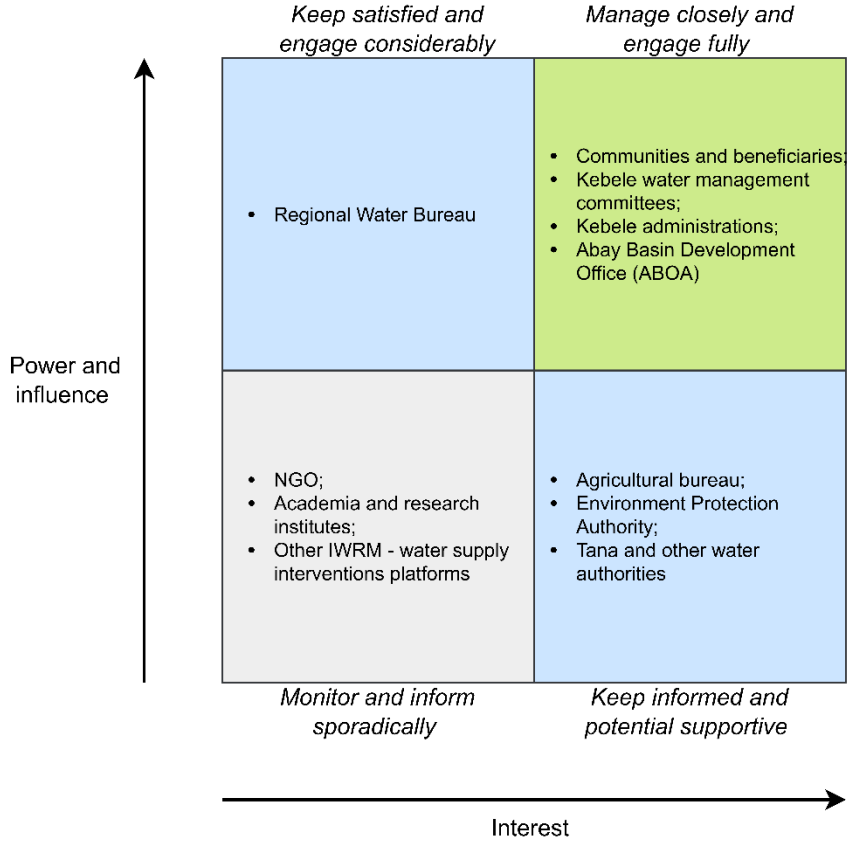

Figure 8. Water supply intervention and Integrated water resource management stakeholder's matrix

Table 5. Stakeholders' Analysis Matrix

Stakeholder Category	Relevance	Importance	Interest	Mandate
Regional Water Bureau	High	High	High	Oversight of water resources

[3] IWRM-WASH platform in Amhara region was established and launched in December 2023 with the support of a number of institutions, for the very purpose to improve IWRM-WASH alignment, under the auspices of the same project that initiated this study. https://www.wri.org/update/new-platform-will-promote-integrated-water-management-ethiopias-amhara-region

Communities/Beneficiaries	High	High	High	Directly affected by interventions
Kebele-Level Water Management Committees	Medium	High	High	Local management and implementation
NGOs	High	High	Medium	Support with finance and knowledge
Academic & Research Institutions	Medium	Medium	High	Research and capacity building
Other Government Bureaus	Medium	Medium	Medium	Related to water resource management

4.5 Institutional Assessment

Effective Water Resource Management (WRM) and water supply intervention require a comprehensive understanding of the institutional landscape. An institutional assessment is fundamental for identifying the roles, responsibilities, and capabilities of various organizations involved in WRM and water supply interventions. This assessment examines the structures, mandates, and interactions of these institutions to ensure coordinated and efficient implementation of water-related projects. By analysing institutional frameworks, strengths, and challenges, we can develop strategies to enhance collaboration and achieve sustainable water management goals.

Table 6. Institutional assessment for the WRM-Water supply intervention

Stakeholder Name	Stakeholder category	Mandate	Influence	Interest	Roles & responsibility
Amahar Water and Energy Bureau	Gov't organization	Mandated for the coordination and implementation and supervision of regional water and sanitation development programs	High influence in its decision making in WASH programs and coordination	Interested in sustainable water resource development and management issues	Develops, decides, guides and supports the WASH Program implementation and water administration at region level
Abbay Basin Administration Office	Regulatory body	Mandated for the implementation of IWRM at basin scale	High influence/Regulatory body for the water resource management at basin scale	Interested to ensure the inter-sectoral water resources management	Coordinate and communicate the IWRM implementation
The previous Tana Sub Basin Office	Regulatory body	Mandated for the implementation of IWRM at sub-basin scale	Regulatory body for the water resource management at sub basin scale	Interested to ensure the inter-sectoral water resources management	Coordinate and communicate the IWRM implementation, provide develop guidelines
Tana and other water bodies agency	Gov't organization	Mandated for the sustainable development and protection of the Tana & other water bodies in Amhara region	Technical advisory body to the regional government on the water bodies sustainable use and management	Interested in collaboration, awareness creation for the protection of Tana & other water bodies at Amhara	Implement water body protection activities
Woreda Administration Office(Farta, Dera & North Mecha)	Gov't structures	Mandated to implement gov't development programs	High influence as a decision making for woreda level interventions	Interested in for IWRM-WASH interventions, awareness creation and financial support	Coordinate, steer and implement the IWRM-WASH interventions
Woreda water and energy development office(at Frata, Dera & North Mecha)	Gov't structures	Mandated for the coordination and implementation of WASH Programs at woreda level	High influence in its role for the WASH Program coordination and implementation	Interested in IWRM-interventions, awareness creation and related capacity building	Water Offices at the woreda level manage the woreda's water programs; provide information for IWRM-WASH interventions. The Water Office assists communities by hiring local service providers to mobilize and assist beneficiaries in the kebeles.
Kebele Administration office	Gov't structures	-	High influence on IWRM-WASH interventions	High interest in WASH interventions	Mobilize the community and facilitate IWRM-WASH interventions
Kebele water management committee	Community water management institutions	-	High influence in the day to day supply, operation and maintenance of water supply schemes	At the community level there is a requirement that WASHCO should be formed to manage and maintain each	Manage the community water supply structures/schemes

				water scheme, interested for capacity building on scheme managment	
The community/beneficiaries	Beneficiaries	-	High influence in IWRM-WASH interventions	Interested for more equitable and reliable access to water as a result of improved development & management of water supply schemes, interested for extra awareness creation	Participate and cooperate in in IWRM-WASH interventions
World Resource Institute	Partners on IWRM	-	Low influence in directing IWRM-WASH interventions	Interested to cooperate in IWRM interventions, awareness creation and capacity building	Fund, capacity building, technology introduction
Millennium Water Alliance	Partners on WASH	-	-	Interested to cooperate in WASH interventions, awareness creation and capacity building	Fund, capacity building, technology introduction
Water Aid	Partners on WASH	-	-	Interested to cooperate in WASH interventions, awareness creation and capacity building	Fund, capacity building, technology introduction
IRC WASH	Partners on IWRM & WASH	-		Interested to cooperate in IWRM-WASH interventions, awareness creation and capacity building	Fund, capacity building, technology introduction, monitoring and evaluation of interventions
UNICEF	Partners on WASH	-	-	Interested partner for COWASH in Ethiopia	Fund, capacity building, technology introduction
Plan International	Partners on WASH	-	-	Interested to cooperate in water supply interventions, awareness creation	Fund, capacity building, technology introduction
The Amhara region IWRM-WASH Platform	Platform IWRM-WASH	-	-	Key regional platform on IWRM-WASH and interested to coordinate and cooperate on different capacity building activities	Platform for the IWRM-WASH interventions, facilitate knowledge sharing and capacity building activities. Launched in December 2023.
Universities/Bahir Dar & D/Tabor	Gov't	-	-	Universities and research centers , has capacity and interest for IWRM-WASH nexuses interventions	Conduct research and build capacity for interventions

4.6 Prioritized stakeholders

Prioritized stakeholders were selected for detailed engagement based on the analysis. These stakeholders were approached for Key Informant Interviews (KII) and Focus Group Discussions (FGD). However, some declined participation. A list of participants is provided in Annex 1. The table below lists the stakeholders prioritized for KII and FGD based on their relevance and significance in the assessment. It includes entities selected for detailed engagement and those who were approached but declined to participate.

Table 7. Prioritized Stakeholders for KII and FGD

Stakeholder Category	Specific Stakeholders
Community/Beneficiaries	Local communities impacted by water supply and IWRM
Woreda Level	Woreda Water and Energy Development Offices (Farta, Dera, North Mecha)
Kebele Level	Kebele Water Management Committees/WASHCO
Regional Level	Amhara Region Water Bureau and WASH Program Office
Basin Level	Abbay Basin Administration Office
NGOs	World Resources Institute/Focal person interviewed, Millennium Water Alliance, Water Aid, IRC WASH /FINIDA, Plan International
IWRM-WASH Platforms	Relevant platforms integrating IWRM and WASH activities

5 IWRM Framework and Tool

Acacia Water developed and tested a process-based tool to evaluate the IWRM performance of water supply and WASH interventions. Process-based evaluation implies that the process is evaluated rather than the result. This tool has been adapted to match the Tana subbasin context and to better fit the scope of this current assignment. It enabled to systematically evaluate each intervention's performance in relation to IWRM criteria, identifying areas of alignment and potential contradictions. By employing this tool, consistency in our analysis was ensured, ultimately leading to better findings and conclusions. The following paragraphs will go into the conceptual and analytical framework of the tool.

5.1 Operational framework

This section goes into the operationalization of the above set conceptual framework, moving from concept to application. To this end, we selected multiple indicators per IWRM principle in order to get a value. See Figure 9.

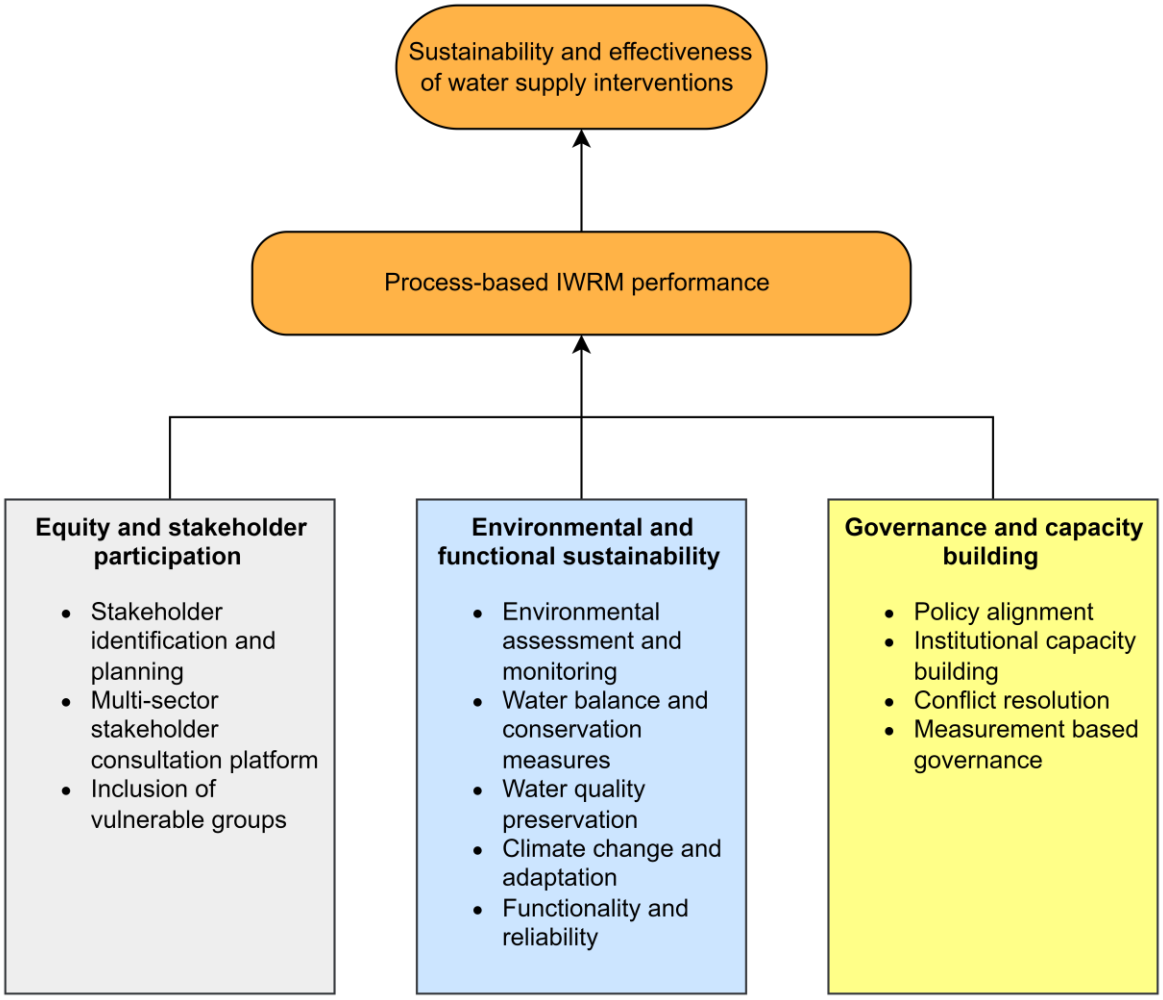

Figure 9. The objective and criteria structure of process-based IWRM evaluation

Indicators

Figure 9 shows the build-up of indicators towards the objective, namely, to improve the effectiveness and sustainability of water supply intervention through IWRM. With that in mind, Table 8 can be used to understand the individual indicator and how indicators differ from one-another.

Table 8. Elaboration on the use, aim, and description of IWRM and principle indicators.

IWRM Principle	#	Indicator name	Aim and Description
Equity and stakeholder participation	1	Stakeholder identification and planning	To understand to which degree different stakeholders are considered and included in the intervention. Stakeholders are different based on relation to catchment (e.g., upstream or downstream) and sector (e.g., private, knowledge institute, government).
	2	Multi-sector Stakeholder consultation platform	To understand how well stakeholders communicate with each other for proper intervention implementation and resource(s) management. This may depend on the frequency of meetings (e.g., once a month) as well as their nature (e.g., one-directional meeting, honest dialogues, merely advising, not being listened to, equal partner).
	3	Inclusion of vulnerable groups in project committee	To understand how well different stakeholders and different social groups are included in water management decision-making bodies.
Environmental and functional sustainability	4	Environmental assessment and monitoring	To understand how aware the intervention team is about the environmental consequences of the interventions, as well as the impact of the surrounding environment on the interventions. It will also help understand the ability of implementers on Environmental monitoring. Environmental consequences are related to land use and cover, water quantity and quality, erosion, and sedimentation.
	5	Water balance and conservation measures	To understand if the intervention and related team are aware of the water balance concept, and to what degree they consider and undertake action for water conservation to recharge the interventions' water usage.
	6	Water quality preservation	To understand the awareness about water quality and to what degree the interventions considers or ensures sufficient water quality.
	7	Climate change Adaptation	To understand if the implementation team is aware of changing climate and its effects (e.g., more floods/droughts), and how the intervention is adapted for changing climate.
	8	Functionality and reliability	To understand the reliability of fresh and sufficient water by the intervention, based on technological operations, breakdown, and repairs.
Governance and capacity building	9	Policy Alignment	To understand how well higher-level authorities' (e.g., basin or catchment management) policies and legal framework enable or hinder IWRM.
	10	Institutional Capacity building	To understand to what degree the intervention contributes to building the (local) institutional capacity based on frequency of trainings.
	11	Conflict Resolution	To understand if there are and how effective conflict resolution mechanisms are. Mechanisms can be various such as protocols, moderators, higher level authority, and water distribution methods.
	12	Measurement based Governance	To understand the degree to how water resources are managed based on water measurements.

5-point metric

The tool used is a process-based evaluation, which requires a specific framework for scoring interventions per indicator. While other frameworks

often involve highly detailed, complex, and often expensive modelling and data collection, we opted for a more pragmatic approach due to the challenging circumstances of this project and for potential out-scale of this methodology and tool. This led to the development of a simple, easy-to-use 5-rank metric This metric or rubric is presented in Table 9.

Table 9. The designed rubric to go from interviews to uniform and standardized indicator scores

IWRM Principle	Indicator	Scoring				
		1	2	3	4	5
Equity and stakeholder participation	**Stakeholder identification and planning**	Only one stakeholder included	Very basic, only some stakeholders included	Stakeholders are limited; not all stakeholder included. Not a good mix of upstream vs downstream, and different sectors	Different stakeholders are included. Sectors come from different sectors and different areas within the catchment	It includes a very detailed stakeholder list stating their links to the catchment and are form different sectors. Furthermore, it includes how synergies and limitions of the interaction between the stakeholders and the interventions.
	Stakeholder consultation platform	No meetings	Sporadic and basic meetings in which not all stakeholders or representatives are attending.	Frequent meeting (e.g., once a year) with several stakeholders represented	Majority of the stakeholders are attending the meetings that are held more than once per half a year. They can freely express their concerns and opinions	Majority of the stakeholders are attending. The meetings are held once a half-year or more. Stakeholder can freely discuss with the project team about their concerns and opinions. The project teams takes this into consideration and acts accordingly.
	Inclusion of vulnerable groups in project committee	No project committee exists	There is a project committee: however, there are no meetings/ discussions held with the committee to make decisions; or vulnerable groups are not well represented.	Some meetings were held but not frequently; major decisions were not made; well-diverse committee members but not fully representative	Good frequency of meetings and well-versed representatives; some documentation of the meetings	Frequently planned meeting and well-versed representatives/ documentation of discussions and desions made are well documented
Environmental and functional stability	**Environmental assessment and monitoring**	No report or report does not include environmental indicators	Report contains some information about the environment but not up to date data	The report clearly outlines what environmental conditions are and what the effect of the interventions.	The reports shows what the environmental conditions are and how the interventions affects them. This is includes some ongoing monitoring.	There is good monitoring in place that is kept up to data.
	Water balance and conservation measures	The project does not incorporate any water conservation measures or promotes practices that exacerbate water scarcity or environmental degradation.	The project inconsistently implements water conservation measures or only focuses on a few aspects of conservation; if there are some efforts to promote water-saving technologies but no comprehensive strategy for reducing water loss or to increase water recharge.	No specific strategy was designed and integrated into the project; but promotes/implements water conservation measures	The project has a strategic plan designed to integrate water conservation measures and adopts ecosystem-friendly technologies to reduce its ecological footprint; however, it lacks in some aspects in the implementation.	The project systematically integrates water conservation measures into its planning, design, and operations. This is not only to recharge the water but also to prevent flood
	Water quality preservation	Intervention lacks measures to safeguard water quality, potentially leading to increased pollution	Some efforts to minimize pollution, but lacks a comprehensive approach. Water quality may show slight improvements post-intervention, but issues remain unresolved.	Measures in place to preserve water quality, but implementation gaps exist. Moderate improvements in water quality post-intervention, with further efforts needed for full protection.	Adoption of sustainable practices effectively minimizes pollution, resulting in noticeable improvements in water quality post-intervention.	Systematic integration of sustainable practices leads to significant improvements in water quality post-intervention
	Climate change Adaptation	The intervention does not incorporate any measures to adapt to climate change impacts on water availability and demand. Climate change considerations are entirely absent from the intervention's design and planning processes.	Climate change considerations are inconsistently integrated into the intervention's design and planning processes. While some efforts may be made to address climate resilience, they are not comprehensive or effectively implemented.	The intervention includes measures to adapt to climate change impacts, but there are gaps in integration or effectiveness. Some aspects of climate resilience may be addressed, but further efforts are needed to fully incorporate climate change considerations.	Climate change considerations are effectively integrated into the intervention's design and planning processes. The intervention adopts measures to adapt to climate change impacts on water availability and demand, demonstrating a proactive approach to building climate resilience.	The intervention systematically integrates climate resilience measures into its design, planning, and implementation phases. It effectively addresses climate change impacts on water availability and demand, setting a high standard for climate-resilient water supply interventions.
	Functionality and reliability	High rate of system breakdowns and repairs, indicating poor reliability; Persistent issues compromise water supply availability and quality.	Moderate rate of breakdowns and repairs, suggesting some reliability challenges; Efforts to address issues are inconsistent.	Low to moderate rate of breakdowns and repairs, ensuring satisfactory reliability; Occasional maintenance issues are promptly resolved	Low rate of breakdowns and repairs, demonstrating excellent reliability; Proactive maintenance minimizes disruptions to water supply.	Minimal to no breakdowns or repairs, showcasing excellent reliability; excellent infrastructure and proactive management ensure uninterrupted water supply.
Governance and capacity building	**Policy Alignment**	Intervention does not comply with relevant legal frameworks and policies, indicating poor alignment with national and regional water policies and regulations.	Partial compliance with legal frameworks and policies, with some alignment but significant gaps or inconsistencies.	Substantial compliance with legal frameworks and policies, indicating satisfactory alignment with national and regional water policies and regulations.	Strong compliance with legal frameworks and policies, demonstrating good alignment and consistent adherence to requirements.	Full compliance with legal frameworks and policies, showcasing exceptional alignment and serving as a model for effective policy implementation.
	Institutional Capacity building	No training or capacity-building activities conducted for local water management institutions, indicating a lack of investment in building institutional capacity.	Limited training or capacity-building activities conducted for local water management institutions, with inadequate support for enhancing institutional capacity.	Some training and capacity-building activities conducted for local water management institutions, indicating efforts to strengthen institutional capacity, but additional support may be needed.	Regular training and capacity-building activities conducted for local water management institutions, demonstrating a commitment to enhancing institutional capacity and sustainability.	Comprehensive and ongoing training and capacity-building activities conducted for local water management institutions, showcasing strong institutional capacity and readiness to manage and sustain water interventions effectively.
	Conflict Resolution	No effective mechanisms in place to address conflicts related to water allocation and management, leading to unresolved disputes and potential escalation of tensions.	No effective mechanisms in place to address conflicts related to water allocation and management, but no conflicts arise.	There are mechanisms in place but they are not used, nor respected.	There are mechanisms in place and they are occasionally used, but not everyone agrees or respects the outcomes.	strongly effective conflict resolution mechanisms, with nearly all water-related disputes resolved through formal or informal processes, fostering a harmonious and cooperative environment for water allocation and management.
	Measurement based Governance	Decision are not grounded on measurements	No measurement done but intervention governance does consider quantity somewhat (e.g., pay per jerry can)	Governance is based on measurements, but measurements are limited (e.g., no functioning water meter)	Decisions are based on measurements, but measurements could be improved (e.g., more data, validation)	Decisions are based on measurements and measurements are accurate, abudant, timely, and validated.

5.2 Use of interviews

Interviews were the main data source for this evaluation. It is important to highlight that the conceptual and operational frameworks can also be complemented with modelling and measurements.

5.2.1 Organization and set-up of the interviews

We relied on three different informants or data sources, each approached with a slightly different formulation. The three sources were selected to cross-check one another, ensuring that an indicator score is not based on a single source but is instead the result of triangulation. In addition to using multiple sources, we also optimized the process by linking each indicator to several questions, allowing for cross-verification of responses. These interrelationships are illustrated in the accompanying Figure 10.

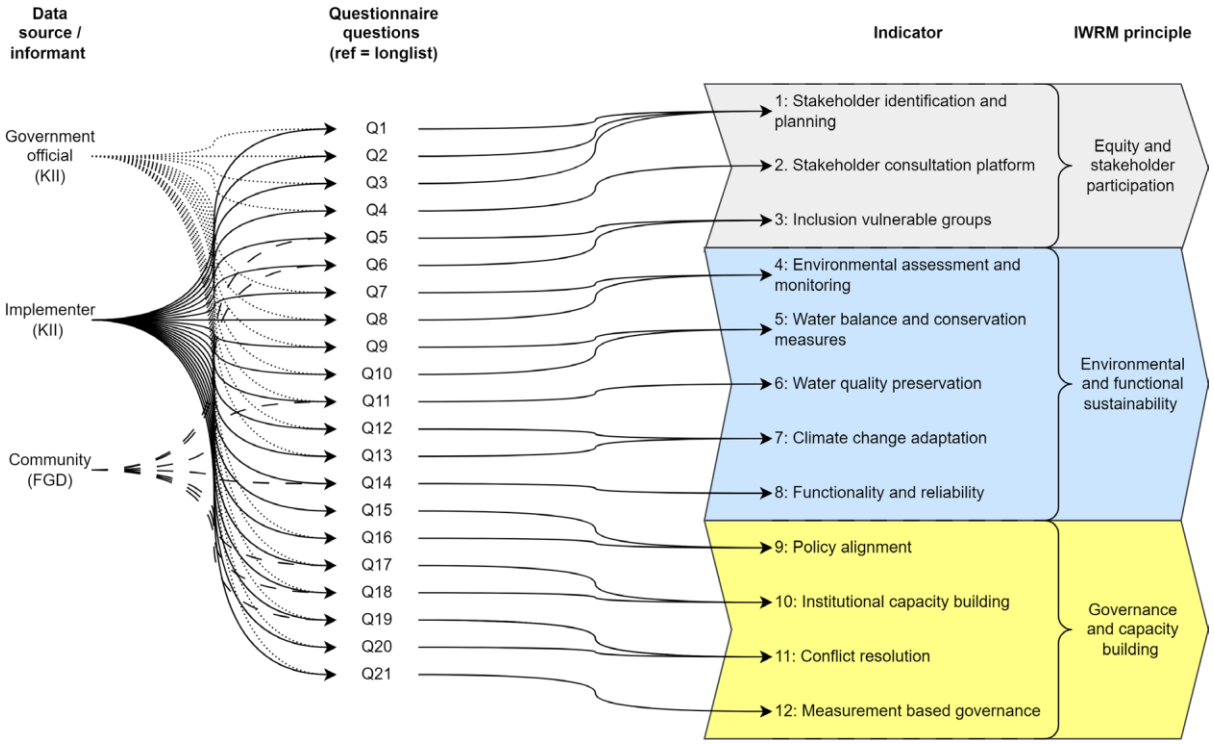

Figure 10. The relation between data source, interview questions, indicators and IWRM principles.

6 Results

Firstly, we present the overall results of the interview. After that two case studies are presented.

6.1 Interview results

6.1.1 Governmental workers

Government workers are key informants for understanding the effectiveness of water management policies and interventions, particularly in relation to the IWRM principles. It was hypothesized that their responses would be relatively uniform across interviews and, given that the same policies and frameworks apply to all of them. However, analysis of the interview responses and subsequent scoring, as illustrated through box plots (Figure 11), revealed otherwise. The following observations were made:

- In areas such as stakeholder identification and planning, institutional capacity building, and conflict resolution, the responses and scores were relatively consistent. This suggests that these policies have similar perceived effects across different governmental workers, with only a few outliers.
    - Many interviewees highlighted that meetings with stakeholders were often held.
- For other IWRM indicators, a wider spread in the responses was observed, indicating that the impact of policies may vary depending on the location and the individual government worker.
    - For example, one interviewee recalled that water balance was often considered only in the planning phase and not in the implementation phase. Whereas another interviewee highlighted that their experts consider the water balance during licensing as well.

It is important to note that only eight government workers were interviewed, and they were spread across three different areas. This limited sample size makes it difficult to establish statistical significance, but the findings are still valuable as a potential starting point for further research.

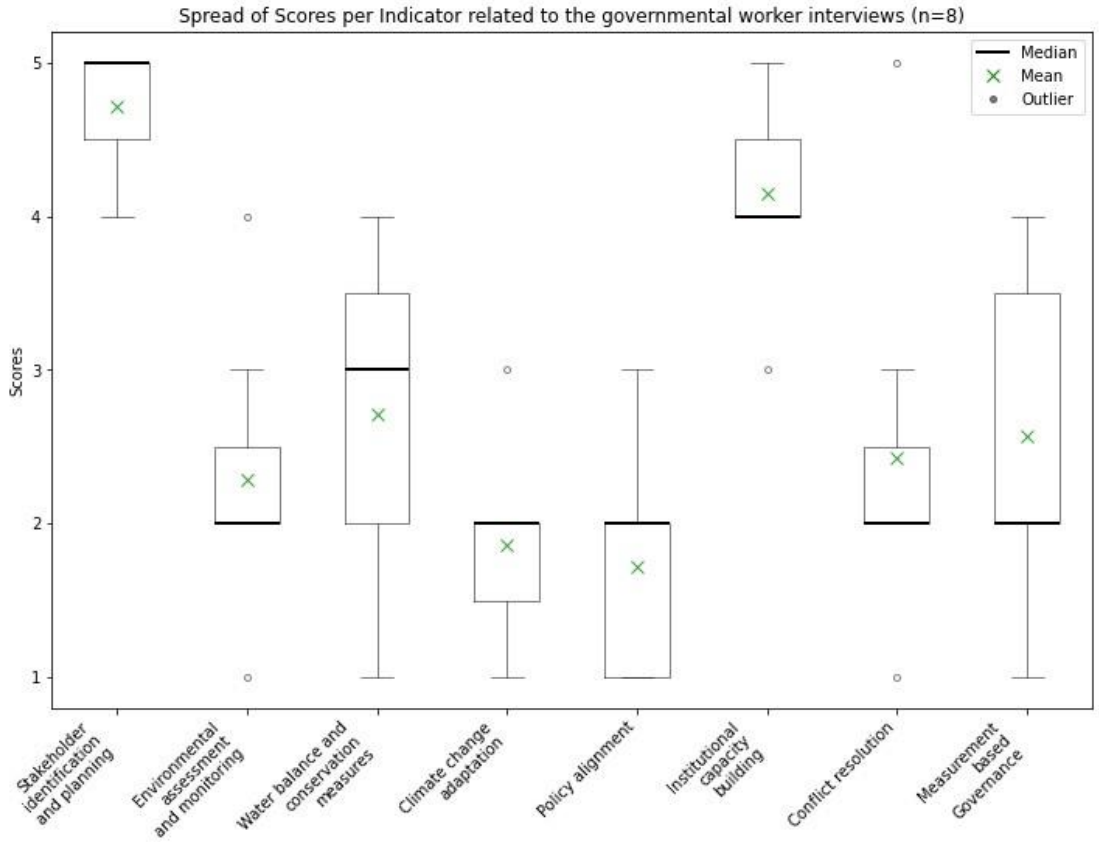

Figure 11. A boxplot graph of the scores derived from the interviews of governmental workers.[4]

6.1.2 Implementers

The implementers provided input for all indicators. Their interviews were analyzed using the rubric (Table 9). The results of this analysis are shown as a bar chart in Figure 12. It is interesting to note from this graph that, according to the implementers, water supply intervention generally scores well on most indicators, achieving a score of 3 or higher. However, the indicators for Environmental Assessment and Monitoring, Water Balance and Conservation Measures, and Policy Alignment scored relatively lower. The low score in Policy Alignment is particularly noteworthy when considered alongside the variability in responses discussed in the previous paragraph.

[4] See Annex 4 for a guide on how to interpretate boxplots

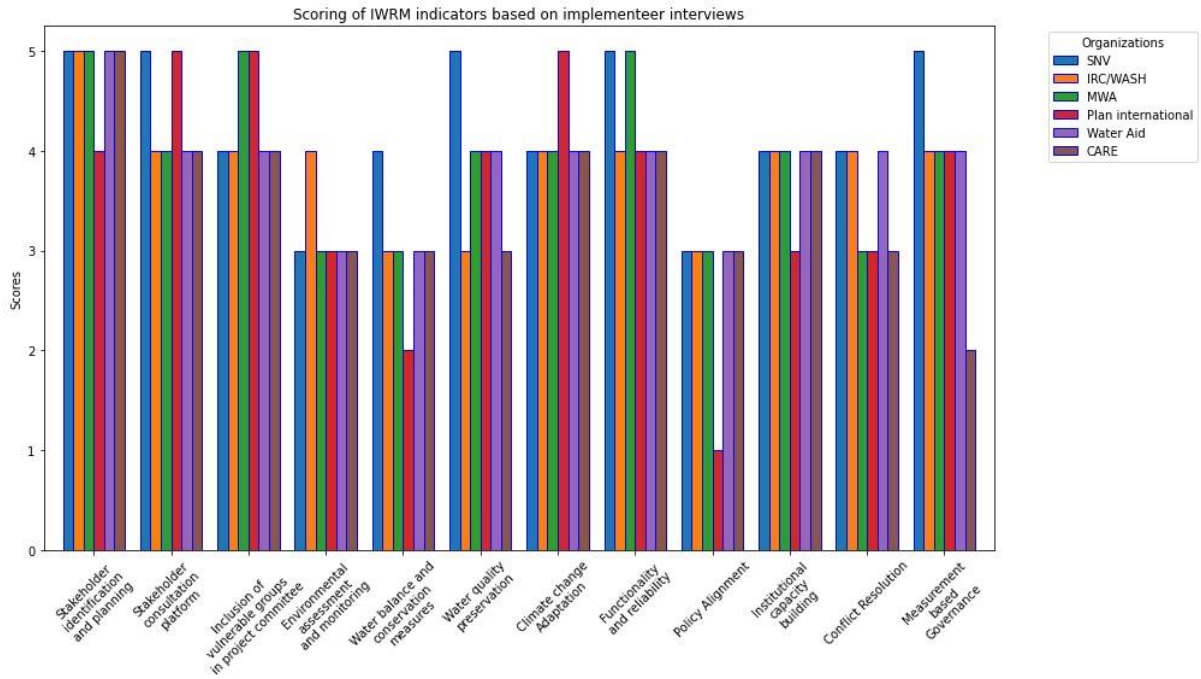

Figure 12. Bar chart presenting and summarizing the results of scores derived from the implementer interviews.

6.1.3 Community and WASHCO / WMCs

Specific indicators were cross-checked using Focus Group Discussions (FGDs) with the communities and Water Management Committees (WMCs) or WASHCO. The scores for these indicators are presented in Figure 13 for the communities and Figure 14 for the WMCs. Additionally, the results were grouped by region. The following observations can be made:

- For the communities, Dera consistently scores higher in areas such as water quality preservation, functionality and reliability, and institutional capacity building compared to Ferta and North Mecha.
    - Based on the interview and scoring rubric, higher implies that for example the water supply intervention in Dera is more often cleaned and no pollution is observed by the respondents whereas in the other areas, some concerns regarding pollution were raised.
- Regarding the WMC responses, North Mecha generally scores lower than the other two regions, with the exception of conflict resolution.
    - The interviews with the WMC/WASHCO in North Mecha highlighted several times the successful implementation and enforcement of the by-law.
    - The same interview also stated that water supply interventions were often broken and not maintained, explaining the relatively lower scores for the other indicators.
- A noticeable discrepancy exists between the community and WMC responses concerning conflict resolution.
    - One of the community members highlighted the fact there is often conflict with local youth who wash their clothes and take showers at the fetching place.

These differences highlight the varying perspectives between communities and WMCs on certain aspects of IWRM. This contrast is also visible when comparing these responses with those of governmental workers and implementers discussed in the previous paragraphs.

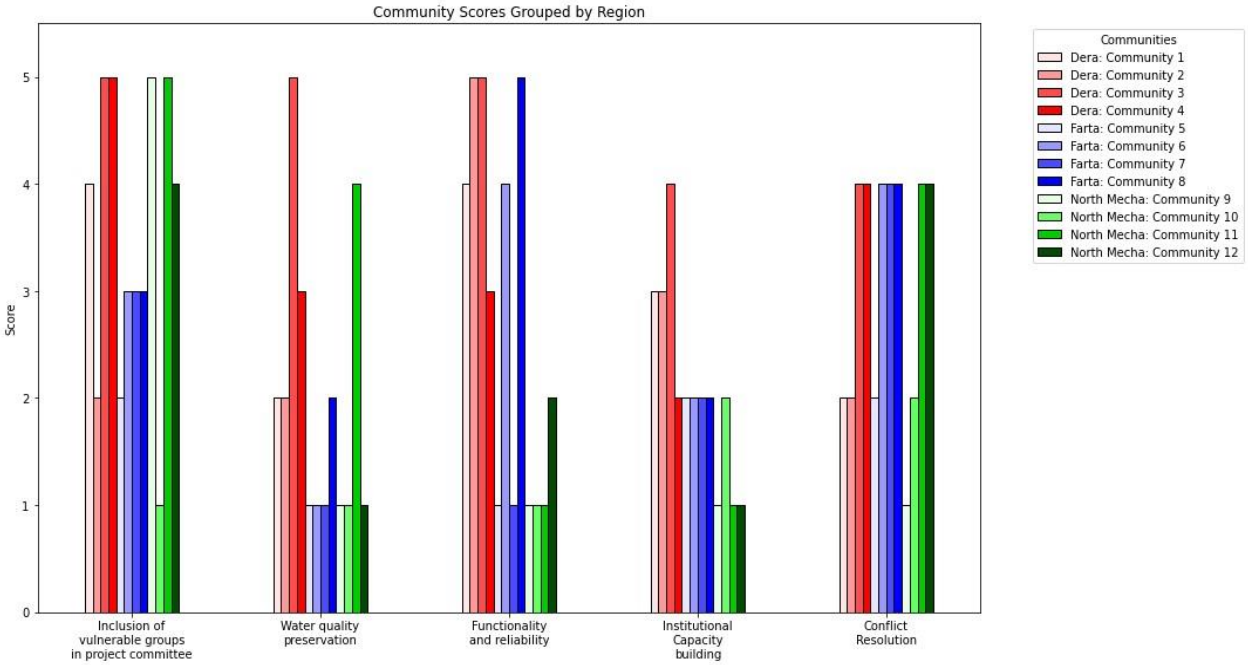

Figure 13. The scores derived from the community focus group discussion

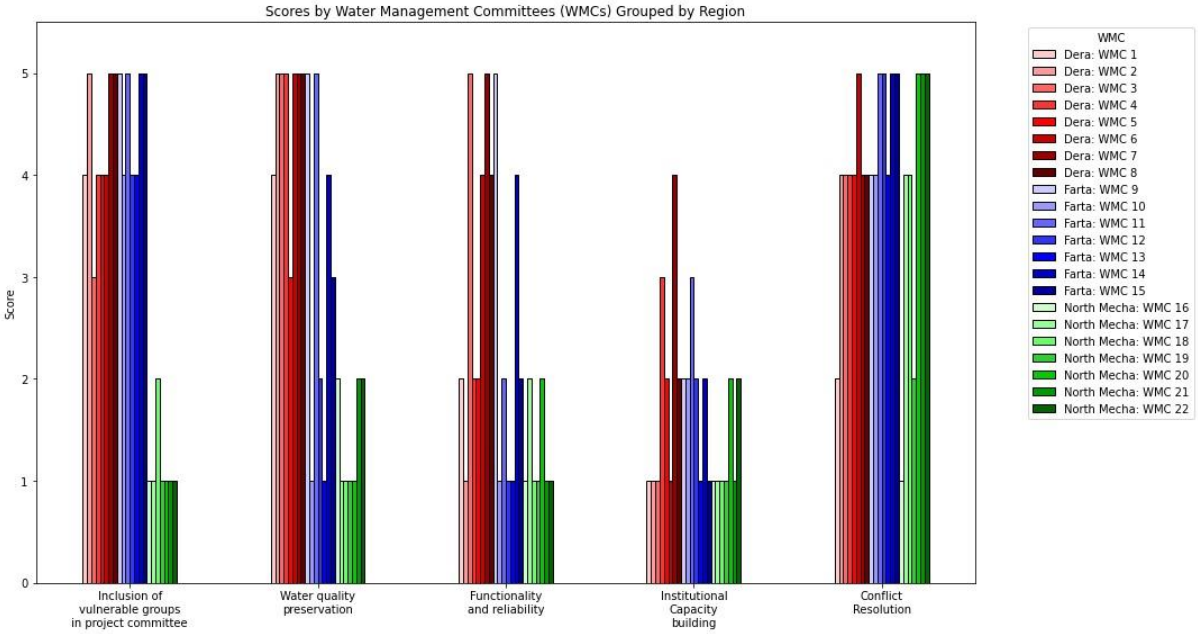

Figure 14. The scores derived from the interview with the WASHCO (water management committees) members

6.2 Case studies

The interview results presented earlier already showed substantial differences across data sources. To show these variations, the evaluation tool incorporates not only the average

score but also the minimum and maximum scores for each question. The maximum score represents the highest rating provided by different interviewees for the same question, while the minimum score reflects the lowest. This tool is designed primarily to assess the performance of individual water supply interventions, rather than to compare responses across different communities or implementers. The following two case studies are provided to illustrate this approach

6.2.1 Farta (water supply intervention #7)

In Figure 15, the result sheet for a water supply intervention in the Fara region is displayed. The overall result is deemed sufficient, with the primary bottleneck identified in the Governance and Capacity principle, where the average score of 2 is most frequent. Based on this, the tool highlights three low-scoring indicators and provides suggestions on how these can be improved.

As noted in the previous paragraphs, there is a significant contrast between informants' perspectives. For instance, in the case of functionality and reliability, one informant assigned the lowest possible score of 1, while another gave the highest score of 5. This suggests that there are two very different perspectives on the functionality and reliability of the same water supply intervention.

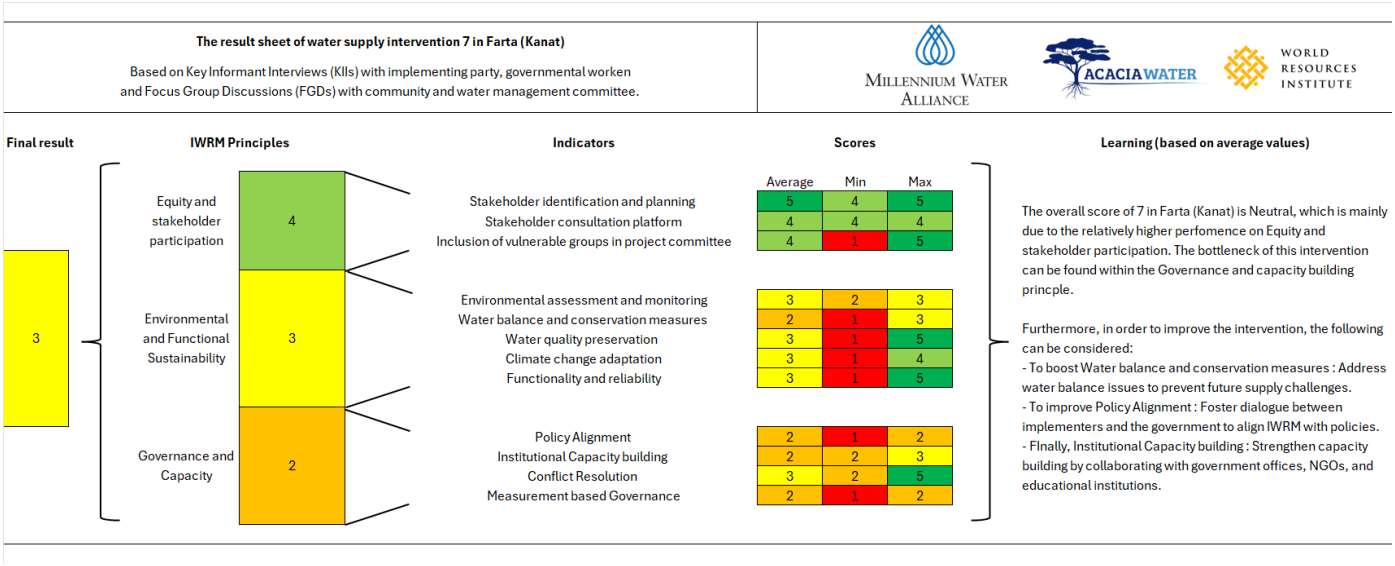

Figure 15. Result sheet of the IWRM evaluation tool of Acacia Water for water supply intervention 7 in Ferta

6.2.2North Mecha (water supply intervention #11)

Figure 16 displays the results of Water Supply Intervention 11 in North Mecha. Similar to the previous example, although to a lesser extent, a discrepancy is observed. For instance, the inclusion of vulnerable groups received an average score of 2, with individual scores ranging from 1 to 4, indicating differing perspectives on the same intervention. On the other hand, we also see uniform responses in areas such as stakeholder identification, environmental assessment and monitoring, and measurement-based governance.

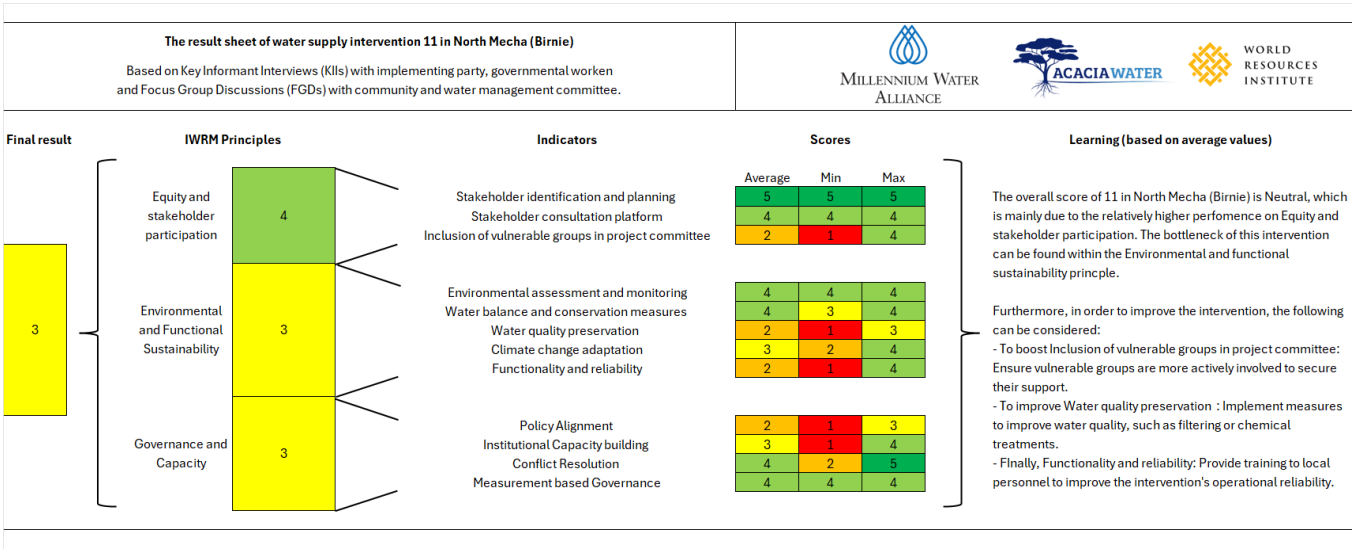

Figure 16. Result sheet of the IWRM evaluation tool of Acacia Water for water supply intervention 11 in North Mecha

7 Final Remarks

This study researched the nexus of water supply interventions, also known as WASH interventions and IWRM. To this end, IWRM was conceptualized based on three main principles consisting of several indicators. This was based on an existing tool and methodology developed by Acacia Water. The data was collected through interviews. In order to understand who should be interviewed a stakeholder mapping exercise was done. Based on this study the following gaps were identified between water supply interventions and IWRM in the Dera, Farta, and North Mecha. Based on these gaps, several recommendations are drawn. Lastly, suggestions are made for expanding the presented methodology.

7.1 Gaps identified and recommendations

The assessment of water supply interventions in Dera, Farta, and North Mecha districts reveals gaps when aligned with IWRM principles. These gaps highlight areas that require attention to ensure the sustainability and effectiveness of water supply interventions in these districts. Per gap, recommendations are formulated.

1. In IWRM, equity and social participation are essential for ensuring the sustainability of interventions. When stakeholders and institutions are inadequately involved, ownership of the intervention tends to be suboptimal and unequal. Potentially more importantly, water supply interventions are inherently linked to the broader catchment dynamics and hydrology, meaning that they depend on upstream users and impact downstream stakeholders. **Effective multi-sector stakeholder** collaboration and clearly defined **institutional responsibilities** are therefore crucial for sustainable water supply.
   From stakeholder mapping and interviews, it was noted that during the planning and construction phases of water supply projects in these districts, there is strong involvement from implementers, government bodies, and the community. However, this participation diminishes significantly once the projects reach the operation, maintenance, and management stages. While WASHCOs are tasked with managing water points, there is no clear allocation of responsibilities among other institutions. This lack of ongoing support and shared responsibility leaves a substantial gap in the effective management and sustainability of water supply systems in Dera, Farta, and North Mecha. Bridging this gap requires a more integrated approach with clearly defined roles for all stakeholders throughout the project lifecycle.
   - ➔ After projects conclude, the absence of a clear division of roles can create a vacuum, during which water supply interventions may deteriorate or stakeholders may inadvertently make conflicting decisions. To mitigate this risk, we recommend that during both the planning and implementation phases, significant resources be allocated to fostering multi-sector stakeholder collaboration throughout the watershed, with a particular focus on post-project responsibilities. Key questions to address include: How to/ What will ensure a minimum baseflow for the water supply intervention? Who will be responsible for maintaining the interventions

and monitoring water quality? Equally important is defining the consequences if a stakeholder fails to fulfil their responsibilities.

2. Catchments and watersheds are directly dependent on climate and land conditions, and climate change exacerbates rainfall variability, leading to more frequent and severe floods and droughts. Therefore, the sustainability of water points is increasingly threatened by environmental and climatic factors such as flooding and hydrological droughts. A core principle of IWRM is using catchment and watershed management both its biophysical and socioeconomic aspects to build landscape and **climate resilience**.
   Respondents noted that water points are often damaged or filled with sediment during floods, while droughts cause a drop in the water table, leading to shortages. These issues are becoming more prevalent in Dera, Farta, and North Mecha, highlighting the urgent need to integrate conservation and climate resilience into water supply interventions. Results from the interview show that there is a lack of adaptation measures for climate change and inadequate attention to the water balance and conservation practices. This represents a significant gap in current water supply with regard to climate resilience.
   - ➔ Integrated land-use planning, when combined with water supply interventions, can significantly enhance the climate resilience of both the interventions and the broader catchment area. Implementing soil and water conservation measures—such as reforestation, sustainable farming practices, and water harvesting—helps improve long-term sustainability. SWC increase the capacity of the land to retain water, which not only increases the availability of water over extended periods but also mitigates the risk of peak runoff events. This dual benefit means that while water resources are sustained for longer during dry periods, the risk of flooding is simultaneously reduced.
   - ➔ Community-Based Water Management Solutions: Empower local communities to take charge of water resources by forming water user associations, providing training, and promoting participatory decision-making, ensuring sustainable water use and management.
   - ➔ Rainwater Harvesting Systems: Implement systems to collect and store rainwater during wet seasons. Improve these systems with filtration technologies and increased storage capacities to ensure water quality and availability during dry periods.
   - ➔ Smart Water Management Systems: Utilize technology to monitor water levels, usage patterns, and quality in real-time. These systems enable better decision-making and timely interventions during periods of scarcity or contamination.
   - ➔ Drought-Resistant and Climate-Adapted Infrastructure: Design water supply infrastructure such as pipes, storage tanks, and distribution systems that can withstand extreme weather events, ensuring consistent water supply in the face of climate change.

3. A key objective of IWRM is to achieve lasting and sustainable impact through a systems approach. However, this study identified a gap in **functional sustainability**, as many water supply interventions break down, are not maintained, or are not able to produce the promised discharge. This could be explained by the observed disconnect

between this and the community's willingness to pay for water services. Respondents noted that while they are willing to pay, no formal tariff payment system is in place, hence no resources to do maintenance, leading to the deterioration of interventions over time.

- ➔ Introducing a standard tariff payment system could improve the quality and maintenance of water supply interventions, ensuring a balance between water demand and supply for sustainability. This approach aligns closely with the holistic perspective of IWRM, addressing functional sustainability through financial sustainability.

4. Another gap identified relates to (**local) capacity building**. In a systems approach like IWRM, effective capacity building is critical to creating resilience within the (socio-economic) spheres and ensuring the functional sustainability of water supply interventions. WASHCOs play a key role in maintaining these interventions. However, while some training has been provided to WASHCOs, respondents indicated that the capacity-building efforts have not been sufficient to equip these committees with the necessary skills and knowledge to further maintain or repair the interventions
   This shortfall limits WASHCOs' ability to manage water points effectively, jeopardizing sustainability of these.
   - ➔ To address this, there is a need for enhanced and ongoing training programs tailored to the specific needs and challenges that WASHCOs face in these districts. Strengthening local capacity is essential for the long-term sustainability of water supply interventions. In addition, this capacity building has co-benefits such as a more skilled labour force, which can eventually benefit the whole system.

5. Although community interviews indicated that **water quality** is not a concern, interviews with implementers and government workers present a different perspective. This discrepancy arises mainly because community members may lack a comprehensive understanding of water quality. If contamination is not visible to the naked eye, they may not perceive it as an issue. Additionally, some water points use chemicals for treatment—a practice introduced by the implementers—which highlights the positive impact of capacity development. However, from a broader Integrated Water Resource Management (IWRM) perspective, poor water quality should be understood within the larger system context. Without accompanying measures such as sustainable farming practices, reforestation, or proper sanitation, water quality issues are likely to persist, as the underlying causes are not being addressed.
   - ➔ To address these concerns, it is crucial to understand catchment dynamics on both the biophysical scale (e.g., locations of the sources and types of contamination) and the human and socio-economic scale (e.g., why unsustainable farming practices are used, or why people dispose waste in surface water). This broader understanding can help mitigate water quality challenges in the watershed.
   - ➔ Additionally, this study found that environmental monitoring, including water quality assessments, is limited done by the respondents. Effective monitoring is essential as first step in understanding the system (e.g.,

pathway and source approximation) and developing appropriate solutions to address water quality concerns.

7.2 Limitations

Although this study yielded valuable insights and introduced a practical approach for assessing IWRM performance in water supply interventions, there are some limitations inherent to this type of interview-based research and the challenging context in which it was conducted.

- Interviews served as a primary data source, which, while providing interesting and valuable results, also presented some limitations. A notable challenge was the discrepancy in perceptions regarding water quality between water users (the community) and governmental officials and implementers. Although interview results from the community indicated that the water quality was perceived as good, experts and other studies have highlighted that water quality in all three woredas is, in fact, lacking. This discrepancy between perceptions of the community and experts (implementers/governmental workers) and measured data, including water quality, does not necessarily constrain the alignment of the IWRM framework developed in this study, as will be further discussed in the Future Research section.
- Incorporating quantitative data, such as water quality measurements, alongside qualitative insights would enhance the depth and reliability of the study's findings. Quantitative data would allow for precise assessments of water quality indicators (e.g., pH levels, turbidity, contaminants), providing objective evidence that complements the perceptions gathered from interviews. A mixed-methods approach would enable a more rigorous evaluation of IWRM performance and help bridge gaps between community perceptions and expert assessments. By integrating both qualitative and quantitative data, the study could offer a solid framework for understanding water quality issues in the Tana Sub-basin and support evidence-based policy recommendations.
  However, this would require additional resources, technical expertise, and equipment for field data collection and analysis, as well as capacity building for those involved in gathering and interpreting the data. Despite these challenges, the inclusion of quantitative data plays an important role in validating findings and addressing the discrepancies between community perceptions and expert evaluations.
- In the evaluation, interviews with governmental workers revealed low policy alignment and limited equity and stakeholder participation. A key finding of the study was the weak inter-sectoral cooperation, particularly between sectors such as agriculture and water. This lack of coordination has negatively impacted water availability and quality. It is important to note, however, that the coordinating capacity to facilitate inter-sectoral cooperation was not fully assessed in this evaluation. A more thorough analysis of coordination mechanisms could provide further insights into how these sectors could better collaborate to improve water management outcomes.

7.3 Future Research

This research assessed the performance of IWRM in water supply interventions across three Woredas in the Tana sub-basin, using a conceptual and analytical framework developed by Acacia Water. The study outlines several potential directions for future research:

- **Integrating measurements and hydrological modeling alongside interviews**: Regularly collecting this data over time allows adaptive management, which strengthens the resilience of both IWRM and water supply interventions. While existing hydrological data offers valuable insights, it provides only a snapshot. Achieving long-term, sustainable impact requires an adaptive management approach, enabling stakeholders to anticipate and respond to disruptions as they arise. It requires measuring to signal coming disruptions and to avoid them.
- **Leveraging the simplicity of the applied methodology**: A key strength of the developed tool lies in its simplicity. Considerable effort was made to distil the broad and complex concepts of system thinking and IWRM into a practical Excel-based model. This simplicity makes the tool relatively easy to scale to other regions and projects. Additionally, scaling the tool can be accompanied by capacity-building initiatives. As individuals become trained in its use, they also gain a deeper understanding of the principles of IWRM.

These two directions can work synergistically to enhance the sustainability and impact of water supply interventions through IWRM in the Tana sub-basin. Moreover, this approach and tool hold potential for wider application in other regions.

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Annex

Annex1. List of participants

Table 10. List of government and implementer KII participants

S.N	Interviewee Name	Organization	Position	Contact date	Email
			Government Offices		
1	Habtamu Tamir	Abbay Basin Administration Office /ABAO	Water Permit Desk head	27 May ,2024	habite1985@gmail.com
2	Habtmau Oumer	Amhara Water and Energy bureau	Water Administration director	31 May, 2024	habtamuoumar66@gmail.com
3	Maru Alem	Amahar Water and Energy bureau	WASH Project coordinator	June 5, 2024	marualem75@gmail.com
4	Yibeltal Amlak	ABAO	Environmentalist & Amhara IWRM-WASH coordinator	June 7, 2024	yibeltal yibeamlak21@gmail.com
5	Bewuketu Abebe	ABAO	ABAO Water Resource Expert & WRI Project focal person	17 June, 2024	bewuketu.at@gmail.com
6	Bantie Mulie	Farta Woreda Water Office	head	July 25, 2024	
7	Zeynue Esa	Dera Woreda Water Office	head	July 14,2024	zeynuessa2@gmail.com
			Implementers		
1	Mulatu Adane	Water Aid	Project Coordinator	13 June, 2024	MulatuAdane@wateraid.org
2	Abel Gerawork	Care Ethiopia, North area office	Water Resource Advisor	18 June, 2024	Abel.Gerawork@care.org
3	Abirham Kebede	From Previous Finida interventions	WASH coordinator	July 1, 2024	Abrham@ircwash.org
4	Addisu Dagnew	Millennium Water Alliance	School WASH coordinator	July 1, 2024	Addisu.Dagnew@mwawater.org
5	Tesfaye Ewunetie	Plan International Ethiopia	Healthy Village Project Coordinator	July 223, 2024	Ewnetie@plan-international.org

Table 11. List of FDG participants

Woreda	Kebele	Village	Focal Group details	List of Participants	Gender
Dera	Huletu Wogedamie	Dilbet	WASHCO & community representatives	Terefe Zeleke	M
				Bitew Kumie	M
				Atakilt Kassie	F
				Kindie Ambelu	M
				Tesfa Mihret	M
				Enana Azene	F
				Endalech Agimas	F
				Semegne Kassie	M
				Tegegne Nigusie	M
				Sitotaw Kasahun	M
				Wubalem Baye	F
	Emashenkore	Abalo Mender	WASHCO & community representatives	Shumet Nigusie	M
				Haymanot Gebru	F
				Habtamu Niguise	M
				Goshe Nega	M
				Sintayehu Kasa	M
				Tesfahun Kasa	M
				Amogne Azene	M
				Banhcu Dessie	F
				Masreshaw Tsegaye	M
				Eshet Engidaw	M
	Emashemkore	Darebiet	WASHCO & community representatives	Maru Dagnaw	M
				Maritu Getu	F
				Adebabay Dagnaw	M
				Beletech Mengist	F
				Ytmegne Dagnaw	F
				Andualem Gashaw	M
				Moges Dagnaw	M
				Abeba Dejen	F
				Derso Maru	M
				Melkamu Dejen	M
	Wonchet	Dentaba	WASHCO & community representatives	Tegegne Amera	M
				Abitew Alemu	M
				Degu Mengist	M
				Getnet Nigat	M
				Amlaku Tamene	M
				Alene Bayelye	M
				Zyen Nigat	F
				Muhabaw Nigusie	M
				Belaynesh Haylu	F

				Addis Alemu	F
North Mecha	Edigetbehbret	Berni	WASHCO & community representatives	Muche Gebeyehu	M
				Babey Dela	M
				Telay Belete	F
				Molla Kassie	M
				Tadele Belete	M
				Melkamu Dlie	M
				Mebratie Amare	F
				Haymanotie Tadele	F
				Ayehualem Gedamu	F
				Ayanay Necho	M
				Tirengo Baye	F
				Muluhabt Tayelgn	M
	Engutie	Chorka Mender	WASHCO & community representatives	Asmamaw Chanie	M
				Alelegn Alemu	M
				Berihun Feleke	M
				Mogessie Tesema	M
				Emagnew Yewale	M
				Dessie Abie	M
				Kess Musie Abie	M
				Teje Temesgen	F
				Sewunetie Malede	F
				Zewudie Geremew	F
	Enguite	Engutie	WASHCO & community representatives	Abebaw Deress	M
				Chekol Addis	F
				Alelegn Minyechil	M
				Adis Alemu	F
				Semeneh Abere	M
				Wassie Gedamu	M
				Babey Babel	M
				Getnet Abere	M
				Ayenetie Ayele	F
				Atalel Amogne	F
	Birakat	Akale Minch	WASHCO & community representatives	Yitaketu Molla	F
				Bazawit Mucheye	F
				Minale Semegne	M
				Asmie Sinntayehu	M
				Yigermal Asmare	M
				Solomon Asmare	M
				Gebire Wubet	M
				Mitku Semegne	M
				Yaregal Tebabal	M
Farta	Kanat	Zelan Beret		Aragaw Getie	M

		WASHCO & community representatives	Belaynesh Wubante	F
			Mersha Salilew	M
			Wondie Mekonen	M
			Feleke Moges	M
			Wodnu Wagaye	M
			Sira Endale	F
			Alemniew Aragie	M
			Tagegne Byadgie	M
			Ayenalem Biks	F
			Ambie Melake	M
Kanat	Dongiet	WASHCO & community representatives	Yemata Yirdaw	F
			Mulie Menber	M
			Siraye Mihret	F
			K/Getenet Mnenber	M
			Adugan Beste	F
			Seyet Alemeu	F
			Endayewu Belay	M
			Adino Birhan	M
			Workalem tesfie	F
Awuzet	Nech Hawaria	WASHCO & community representatives	Dessie Kegegne	M
			Mengist Alene	M
			Mekuriaw Endeshaw	M
			Wuletaw Jenber	M
			Tsega alem Mekuanenet	F
			Adugna Asefa	F
			Workie Semegne	F
			Tadila Tsedale	F
			Endeshaw Biargeoi	M
			Yemata Alemu	F
	Gossie	WASHCO & community representatives	Wale Asaye	M
			Kirkim Dilu	F
			Tegodie Yehuala	F
			Yibab Achamyelew	M
			Fikadie Biks	M
			Asmamaw Atalel	M
			Getahun Sendku	M
			Bikitirew Wale	M
			Tila Temesgien	M
			Mulatu Belay	M

Annex 2. Questionnaires

Implementers questionnaire

1:

Can you elaborate on how stakeholders were identified and considered during the planning of the intervention? Please specify if you included upstream, downstream, and sectors (private, NGO, community-based, knowledge institutes, and governmental)

2:

How actively are stakeholders engaged in the planning of the intervention? (Please select)

0	1	2	3	4	5
I do not know	Not engaged	Limited and no active engagement (e.g., spontaneous listening)	Limited active and limited engagement (e.g., frequent but seldom meetings without decision-making power)	Active and somewhat engagement (e.g., good frequent meetings with some decision-making power)	Very active and honest engagement (e.g., frequently organized meetings with ability to influence decision making)

3:

How often do stakeholders meet with the intervention team to discuss progress, challenges, issues, and solutions?

0	1	2	3	4	5
I do not know	Never	Limited and sporadic (e.g., not more than once a year, and only when an issue arise)	Seldom (e.g., once a year)	Often (e.g., note more than twice a year)	Very frequent (e.g., more than once per quarter)

4:

Please elaborate on how the intervention ensures the inclusion of vulnerable groups? Vulnerable groups are for example, women-head households, women, youth, people with disabilities)

5:

To what extent do you feel that vulnerable groups (e.g., women, people with disability) are included in the intervention project?

0	1	2	3	4	5
I do not know	I feel that they are not included	I feel that we try to include them, but unsuccessful	I feel that they are included, but very limited (e.g., some are using the intervention)	I feel that they are well included (e.g., they are using the intervention)	I feel that they are excellently included (e.g. use the interventions as much as others)

6:

Are there mechanisms in place to ensure these groups are not marginalized or overlooked in water management decisions?

0	1	2	3	4	5
I do not know	No	No yet, but we are designing them	Yes, but they are not being used/applied.	Yes, and they are applied, but with limited effectiveness	Yes, and they are applied timely, with good results

7:

How many of the following aspects are environmental are measured, possibly through indicators? i. Water quantity; ii. Water quality; iii; land use & land cover; iv. vegetation cover; v biodiversity

0	1	2	3	4	5
I do not know	None	only one	2	3 or 4	all

8:

How frequently are environmental assessments conducted to evaluate the impacts of the intervention on land use, water quantity, and quality?

0	1	2	3	4	5
I do not know	Never	Seldom (e.g., less than once per 2 years)	Not often (e.g., less than once a year)	Frequently (e.g., per quarter)	On a good and regular basis (monthly basis)

9:

Can you please elaborate on the relationship you see between the WASH intervention and the rest of catchments? Think about for example, upstream (how does this influence incoming water), downstream (to where and how is discharge going), and the water balance.

10:

To what degree are upstream measures, such as 3R and Soil Water Conservation (SWC), taken to ensure compensation of the water use by the interventions, thereby ensuring a reliable source of water?

0	1	2	3	4	5
I do not know / not needed	This is not done	There are plans to do it, but nothing is implemented	This is done, but on a relatively small scale	This is done, but is unsure if it works	This is fully done on scale, and it is proven to work

11:

To what extent is the source of water contamination (e.g., defecation, soil erosion, pollutants) considered by the intervention?

0	1	2	3	4	5
I do not know / not needed	This is not done	Only few sources are investigated, with minimal monitoring	Some sources with minimal monitoring	Most sources are addressed, and monitoring is sufficient	All sources are effectively addressed and monitored

12:

How aware are you of climate change and its effects on the intervention?

0	1	2	3	4	5
I do not know	I only know about climate change	I know about climate change, but I do not think it affects the intervention	Climate change affects the intervention, but I do not know how	I have some idea of how climate change affects the intervention	I am aware of climate change and how it influences the intervention

13:

How do you consider climate change when implementing and managing the intervention? Adaption can be e.g., more upstream measures, different timings and quantities, more regulation, etc

0	1	2	3	4	5
I do not know	We do not adapt	We want to adapt but do not know how	We try to slowly adapt	We try to adapt, but not as much as we should	We fully adapt

14:

How often does the intervention break-down? A break down could be for example technical (e.g., broken part) or too less water to fully operate, or not enough fuel for operation.

0	1	2	3	4	5
I do not know	Often (e.g., once every week)	Many times (e.g., every 2 weeks)	Sometimes (e.g., monthly)	Reliable (not more than twice per year)	Very reliable (not more than once per year)

15:

Please elaborate on how the national and regional policies align with objective and implementation of your intervention in term of water management?

16:

How contributing were/are the governmental (local/regional) offices in the successful implementation of this intervention?

0	1	2	3	4	5
I do not know	Ineffective (no contribution)	Limited effectives (they provided some support, but not really useful)	Moderate effectiveness (their support was useful)	Good contribution (their support was appreciated and very useful)	Substantial contribution (their support was essential and success could not have been reach otherwise)

17:

Do you provide training regarding water management to governmental workers and/or community members?

0	1	2	3	4	5
I do not know	Never	Only two times (e.g., begin and end of project)	Every 2 years	Every year	Whenever requested

18:

Please elaborate on the topic covered in these training courses and if you think these trainings are useful, and how they can be improved?

19:

How often do conflicts or disputes occur regarding water management and water distribution?

0	1	2	3	4	5
I do not know	Weekly	Monthly	Quarterly	Yearly	Seldom (less than one a year)

20:

Could you elaborate on how these conflicts or disputes are settled, for example through water distribution keys, moderators, or higher level authorities. And how effective are these mechanisms?

21:

To what extent are decision based on facts or measurements?

0	1	2	3	4	5
I do not know	Not really	Some decisions are made based on these, but measurements are not good	Some decisions are made based on these, and measurements are mostly respected	Most decisions, and most measurements are respected	All decisions, and measurements are respected

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For governmental officials

22:

How often does your organization meet with other stakeholders that are involved in water supply intervention in Dera, Farta, and North Mecha Woreda? Does your organization have a structured platform to consult with any other institutions/ stakeholders that are involved in water supply interventions? Please explain your answer

23:

How frequently are environmental assessments conducted to evaluate the impacts of the interventions on land use, water quantity, and quality? Please explain your answer and please specify on water quality measurements.

24:

Does any intervention implemented by other implementing partners, or your organization consider water balance and implement conservation measures? Please explain your answer

25:

How is climate change affecting the Tana basin, and what is your response to this? Please elaborate.

26:

How are national and regional policies contributing to better integrated water resources management of local interventions? Please elaborate.

27:

How is your organization contributing to the local capacities for better water management? E.g., training, guidelines, database, etc. Please elaborate.

28:

Do conflicts arise in the area over water management and/or distribution, if so, how many times, and how are they resolved? Do you have a specific mechanism to resolve this (e.g., moderator, water distribution keys)? Please elaborate.

29:

Do you take measurements regarding water management in the area, and do you share this with local teams? If so, how are local teams using this data e.g., does it influence their decisions? Please elaborate.

Community (FGD) and WMC/WASHCO (KII)

30:

Do you agree with the following statements and please elaborate:

Vulnerable groups, such as women and people with disabilities, are well included in decision-making and use of the intervention; there are plenty of good mechanisms (e.g., consultation session, evaluation moments, quotes) in place to ensure this.

31:

Do you agree with the following statements and please elaborate:

I completely feel that the water is safe to drink, use for washing and cooking for me and my children. I do not have any reasons to be concerned.

32:

Do you agree with the following statements and please elaborate:

The intervention consistently provides plenty water and is a very reliable source. It has never broken-down, and if so, repairs are very swift and sound.

33:

Do you agree with the following statements and please elaborate:

We receive plenty of training about water management and quality, we know well how we can support the intervention.

34:

Do you agree with the following statements and please elaborate:

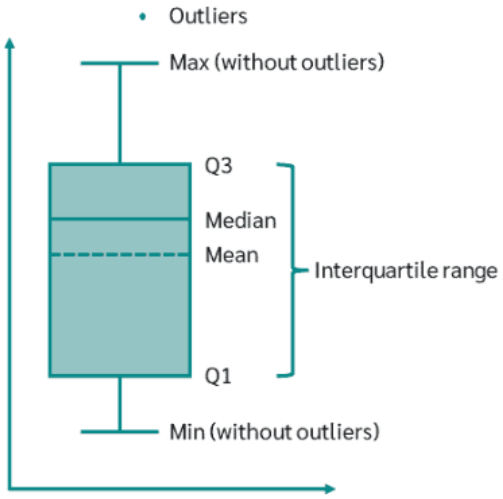
No conflicts or disputes arise regarding water management and distribution, and if they arise, they are quickly resolved through established and effective mechanisms (such as higher authorities or moderators).

Annex 3. Pictures from the FDG


INFINIX HOT 8 LITE
AI TRIPLE CAMERA

Annex 4. How to read boxplots

Obtained from: https://datatab.net/tutorial/box-plot



The box indicates the range in which the middle 50% of all data lies

Thus, the lower end of the box is the 1st quartile and the upper end is the 3rd quartile

Between Q1 and Q3, is the interquartile range

In the boxplot, the solid line indicates the median and the dashed line indicates the mean.

The T-shaped whiskers go to the last point, which is still within 1.5 times the interquartile range.

Points that are further away are considered extreme values (outliers).

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