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OUTCOME BRIEF

Advancing water sector integration in Ethiopia's One Health agenda: research outcomes from the Akaki Catchment

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Front cover photo: Water quality sampling in Akaki River (photo by Abel Zewengel).
Back cover photo: The first One Health stakeholder consultation by IWMI (photo by Abel Zewengel).

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Acronyms and abbreviations

AAEPA	Addis Ababa Environmental Protection Authority
AAHB	Addis Ababa Health Bureau
AAWSA	Addis Ababa Water and Sewerage Authority
AMR	Antimicrobial resistance
IHR	International Health Regulations
IWMI	International Water Management Institute
MoH	Ministry of Health
MoWE	Ministry of Water and Energy

Key messages

Water is a missing link in One Health: Akaki research shows the river acts as both a reservoir and transmission pathway for antimicrobial resistance (AMR), linking pollution with human, animal and food-system risks.

Integrated evidence is now available: 20 seasonal monitoring sites, 12 campaigns, three peer-reviewed papers and three guidance documents provide a baseline for pollution control and AMR surveillance.

Partnerships have changed institutional practice. The Water Champions network helped MoWE and AAWSA gain representation in regional and national One Health platforms, and MoWE and AAEPA are interested in a catchment-wide pollution prevention and control plan.

Sustained action is the next step. Routine water-quality and AMR monitoring, formal mandates, funding and community-based monitoring are needed to consolidate gains and scale the approach to other Ethiopian catchments.

Context

Antimicrobial resistance (AMR) is a growing One Health threat because resistant organisms and genes move across human, animal, plant and environmental systems. To contain AMR, Ethiopia has adopted a multisectoral One Health approach and incorporated environmental concerns into national AMR strategies. However, implementation has focused mainly on human and animal health, with limited operational attention to water pathways.

Across East Africa, national One Health platforms differ in leadership and institutional arrangements, while water is commonly addressed indirectly through environmental agencies. Ethiopia's International Health Regulations (IHR) and One Health Secretariat Office is hosted by the Ethiopian Public Health Institute EPHI. The Secretariat helps Ethiopia prevent, detect and respond to health threats where the human, animal, and environmental sectors meet, such as zoonotic diseases, pandemics and food-safety risks. However, the water sector's role still needs strengthening to achieve this.

IWMI's work in the Akaki catchment positions water as a central connector linking environmental pollution, human exposure, and animal health and food systems. This outcome brief reviews the achievements, challenges, lessons and next steps from these activities. It examines how research, institutional engagement, and capacity development can strengthen the water sector's contribution to national and regional One Health programs.

The Akaki River (Figure 1) receives untreated and partially treated wastewater from urban, industrial, healthcare and agricultural sources (Zhou et al., 2026). Downstream communities use contaminated water for irrigation, livestock, washing, and other activities, increasing exposure to pathogens and AMR. Yet evidence on AMR occurrence, sources, transport pathways and seasonal variation remains fragmented, while laboratory, surveillance and data-analysis capacity are still limited.

To address these gaps, IWMI has linked research with practice through water quality monitoring, modelling, and stakeholder engagement. Collaboration with MoWE, AAWSA, AAEPA, AAHB, researchers and communities has supported evidence generation, skills development and stronger representation of water actors in One Health processes.



Figure 1. The Akaki River and its pollution context.
Photo by Kirubel Demissie

Method

Three interlinked approaches strengthen water's role in Akaki's One Health activities: river water quality monitoring, modelling and stakeholder engagement.

Monitoring: Since December 2022, IWMI has led catchment-scale water quality monitoring in Akaki to generate evidence on how polluted rivers spread AMR and zoonotic pathogens. Based on past studies, field observations, spatial analysis and stakeholder consultation, 40 sites were initially identified across rural, peri-urban and urban pollution gradients. Hotspot analysis and validation sampling refined these to 20 seasonal research sites, 8 seasonal sites for government-led pollution monitoring and 3 monthly sites for modelling. Partner laboratories in Addis Ababa and abroad analyse samples for microbial water quality, antibiotic-resistant bacteria and AMR, helping characterize pollution sources, exposure pathways, seasonal variability and downstream transmission risks.

Modelling: IWMI's water quality modelling combines priority-site monitoring data with wastewater discharge, land use, drainage networks and planned government interventions to quantify how pollutants, pathogens, resistant bacteria and resistance genes move through the river. It assesses pollutant loads, transport pathways, seasonal variability and the exposure risks for people using the water for domestic, agricultural and urban livelihoods. By comparing baseline and practical control scenarios, it helps authorities identify priority pollution sources, evaluate intervention benefits and design coordinated One Health responses within Akaki River pollution prevention and control planning.

Figure 2 presents how the three approaches combine to achieve project objectives: monitoring, modelling (pollution prevention and control scenarios), stakeholder engagement (MoWE and AAWSA, Water Champions, capacity development).

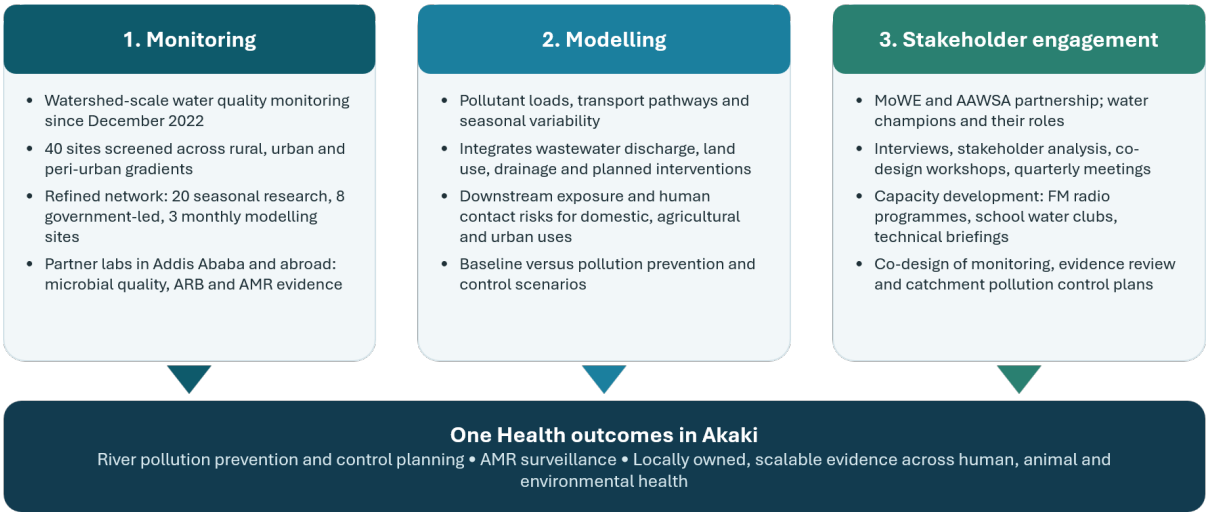


Figure 2. Research approaches to enhance the water sector's role in One Health in the Akaki catchment
Source: Designed by Authors

Stakeholder engagement was central to IWMI's One Health work in Akaki. IWMI identified influential stakeholders and Water Champions, institutional focal persons who advocated for and coordinated the water sector's One Health contribution, clarified their roles, and supported their participation in national and regional One Health platforms. Engagement methods included key informant interviews, stakeholder analysis, co-design workshops, quarterly meetings, FM radio programmes, school water clubs and technical briefings. Stakeholders helped design monitoring networks, review evidence, co-develop modelling scenarios and shape catchment-scale pollution prevention and control plans that were practical, locally owned and scalable across Ethiopia. IWMI and the Water Champions also jointly organized several awareness events (Figure 3).



Figure 3. **I**WMI and the Water Champions jointly organized an awareness-raising event during the 2026 AMR awareness week at AAEPA.
Source: IWMI

Data on achievements, challenges, lessons and priority activities were collected through key informant interviews with six Water Champions from MoWE, AAEPA and AAHB who had actively contributed to IWMI's One Health initiative.

The interview guide covered four questions:

- What achievements emerged from IWMI's One Health activities in Akaki? Consider new partnerships, access to data, innovation in tools or approaches, policy engagement, and scaling opportunities.
- What key challenges arose in implementing these activities? Focus on strengthening the water component within the One Health framework, including data availability, cross-sector coordination, stakeholder engagement, and developing evidence-based tools.
- What key lessons were learned from these activities? Highlight transferable lessons for other catchments, including technical, institutional, and community-level insights.
- What should be the next steps for One Health from 2027 onward? Suggest at least two per category: Research: priority studies or tool development; Capacity building: training, skills development; Stakeholder engagement: Water Champions and water-sector engagement in One Health.

Interview responses were organized into thematic categories corresponding to the opportunities, challenges, lessons, and priority actions presented below. The key informants then met to review how well the themes aligned with their responses and their relevance to water and One Health research and practice in Akaki.

What did we achieve by water and One Health research?

IWMI's achievements in the Akaki catchment are grouped below by thematic area (Table 1).

Governance, partnerships, and institutional coordination: IWMI's work in the Akaki catchment built and strengthened multisectoral partnerships that brought together water, health, agriculture, environment, urban planning, academia, media, private sector actors, and Water Champions around a shared One Health agenda. Consultation workshops since 2022 facilitated dialogue and joint action among the Ministry of Health (MoH), MoWE, AAWSA, AAHB, AAEPA, academic institutions, and community actors. These efforts helped formalize previously informal or ad hoc collaboration and established a foundation for clearer institutional responsibilities and sustained ownership of water commitments within One Health. As a result, MoWE and AAWSA are now represented in regional and national One Health platforms, and MoWE and AAEPA have expressed interest in co-developing a catchment-wide pollution prevention and control plan for the Akaki River, drawing on IWMI guidance (Kibret et al., 2025).

Evidence generation, surveillance, and data integration: The One Health studies produced integrated evidence on water quality, AMR, pathogens, heavy metals, and wastewater contamination. Through baseline mapping, hotspot identification, research papers, and guidelines (Haile et al., 2025; Haileselassie et al., 2025; Zhou et al., 2026), IWMI laid the foundation for regular, systematic monitoring. This evidence can inform enforcement, guide public health responses, and support decision-making, bridging the gap between fragmented research and the accessible evidence decision-makers need.

Innovation, tools, and systems approaches: IWMI's activities introduced and tested innovative tools and approaches, including pollution-control guidelines, scenario-based planning and simulations, low-cost and modern laboratory methods, and systems-thinking frameworks. By embedding systems approaches into everyday practice, the work demonstrated practical pathways for anticipating and mitigating risks before they escalate into public health emergencies.

Policy engagement, regulation, and advocacy: Evidence and lessons from the Akaki catchment informed policy engagement at city and federal levels and contributed to discussions on Ethiopia's National Action Plan on AMR, the National One Health platform, water safety standards, and preventive approaches within health programs. The project brought greater attention to water and environmental pathways in national One Health policy debates, historically dominated by the human and animal health sectors. By translating catchment-level findings into policy-relevant advocacy, IWMI helped include water sector priorities in AMR containment and prevention.

Scaling, investment, and sustainable interventions: The project developed a multi-stakeholder One Health model in Akaki that provided a basis for replication in other Ethiopian basins and rapidly urbanizing African cities facing similar challenges. The model created opportunities to expand safe water reuse, resource recovery and circular economy pilots, waste-to-wealth business models, community-based monitoring, and preventive water management.

Table 1. Achievements of IWMI's One Health Research in Akaki catchment: Outputs and Outcomes

Indicator	Cumulative achieved (No.)	Evidence / source	Notes, outcome significance, and next steps
Monitoring sites established and maintained	40 (one time sampling) and 20 (seasonal sampling)	https://doi.org/10.1007/s10661-025-13748-6	The monitoring sites can guide monitoring of similar sites by different agencies, enabling spatial and temporal trend analysis.
Seasonal monitoring campaigns completed	12	Datasets	Provides an AMR baseline for evaluating the effectiveness of pollution control and prevention interventions
Peer-reviewed papers published	3	https://doi.org/10.1007/s10661-025-13748-6 https://doi.org/10.2166/washdev.2025.093 https://doi.org/10.1016/j.envint.2026.110554	Inadequate urban wastewater management spreads AMR; targeted river monitoring and affordable treatment can jointly protect human, animal, environmental health.
Guidelines, technical briefs and manuals produced	3	https://hdl.handle.net/10568/179606 https://hdl.handle.net/10568/173086 The manual is under review.	MoWE and AAEP submitted a letter of intent to IWMI to co-create a catchment-wide pollution control and prevention plan of Akaki River using the IWMI guideline.
Water Champions identified and active	10	https://hdl.handle.net/10568/179570	40% women. They advocate for embedding water into Ethiopia's One Health and AMR committees, strengthening cross-sectoral collaboration, public awareness and national AMR policy.
Stakeholder events held	9	Agenda and participants list	Stakeholders shaped water quality monitoring network design, guidelines and manuals, while sharing knowledge and strengthening AMR and One Health capacity
FM radio reach	5	Recordings are available	Awareness-raising messages were broadcast in Amharic through Bisrat FM 101.1. Key messages focused on the role of water in preventing AMR, drawing on IWMI evidence.
Number of institutions supported to be engaged in One health platforms	2	Letters	AAWSA and MoWE are engaged in regional and national platforms.
Water quality dashboard	1	-	AAEPA will host the dashboard in November 2026, and the link will serve as evidence.

Challenges

The Water Champions identified several challenges that affected efforts to strengthen the water component within Ethiopia's One Health framework. These are grouped into four thematic areas (Table 2).

Evidence, monitoring and decision support gaps: Despite ongoing efforts by IWMI to map spatial and temporal variation in antibiotic resistance in the Akaki River, this evidence has not yet been made usable for decision-makers. Data collection remains fragmented across studies with inconsistent methods, undermining confidence in AMR trends over time and space. Findings are rarely linked to data on water quality, land use, wastewater discharge, or health outcomes, limiting holistic One Health understanding of risk. Results remain confined to academic papers and raw datasets rather than accessible formats like risk maps, dashboards, or policy briefs. Consequently, evidence cannot yet guide timely decisions, risk mapping, public health alerts, or pollution-control actions, while infrequent researcher-decision-maker engagement limits its translation into sustained action.

Low role of the water sector to One Health: National and regional platforms unite sectors to advance One Health and AMR containment, and through IWMI's support, MoWE and AAWSA are now represented, highlighting water's relevance. Ethiopia strengthened this environment by launching its National One Health Strategic Plan (2025–2029) and National Action Plan for Health Security (2024/25–2028/29) in October 2025, alongside a Regional AMR Coordinating Committee and National IHR and One Health Secretariat Office. However, the water sector joined these discussions only recently, so its role remains largely reactive. Mandates for water quality monitoring, pollution control, and AMR data-sharing are split across institutions with no clear accountability, while engagement is mainly project-based rather than standing arrangements. This ad hoc participation weakens joint planning, accountability, and rapid response, limiting the water sector's institutionalized contribution to One Health.

Technical, financial, and human-resource capacity limitations: AMR is a growing water quality concern, yet it remains largely absent from routine water testing in Ethiopia. Many laboratories lack the equipment, reagents, trained personnel, and dedicated budgets needed to test for AMR risks regularly. Because AMR testing is not yet a funded and staffed routine function, it depends largely on project support and is difficult to sustain. This constrains authorities' capacity to monitor contamination, detect emerging problems early, enforce water quality standards, and sustain long-term action to reduce AMR risks, leaving the water sector underrepresented in national AMR surveillance and response.

Stakeholder engagement and catchment pollution pressures: Weak public and private-sector engagement, combined with rapid urbanization and diverse pollution sources, reduces compliance, collective action and effective catchment-level pollution prevention. Because downstream communities depend on the river for irrigation, livestock and washing, pollution control that offers no safe alternative can threaten livelihoods and weaken community buy-in (Gashaye, 2020). Organizations such as MoWE, AAWSA and AAEPA have their own pollution control and prevention plans for the Akaki River. However, the collective effectiveness of these plans in reducing AMR contamination and its spread across the catchment remains unknown.

Table 2. Challenges to strengthening the water component of Ethiopia's national One Health coordination mechanism

Grouped thematic area	Related challenge themes
1. Evidence, monitoring, and decision support gaps	Weak evidence base and limited water-quality data; limited decision support systems and shared data platforms.
2. Limited role of the water sector to One Health	Fragmented coordination and institutional mandates; weak integration of One Health roles across water, health and environmental institutions.
3. Technical, financial, and human-resource capacity limitations	Laboratory and technical capacity constraints; resource, staffing and sustainability gaps.
4. Stakeholder engagement and catchment pollution pressures	Low awareness and limited stakeholder engagement; pollution pressure and unplanned urban development.

What do the achievements mean for the water sector's role in One Health?

Reflecting on these achievements and challenges, the Water Champions identified four groups of implications from IWMI's Akaki research, each responding to challenges in Table 3 and informing the priority activities below.

Technical and evidence generation: Water must be treated as a central pathway linking environmental pollution with human, livestock and food-system risks. Integrated monitoring of water quality, AMR, heavy metals and pathogens produced stronger, more actionable evidence than monitoring parameters in isolation. Hotspot mapping, pollution source tracing and geospatial risk analysis proved valuable for locating where risks originate and accumulate and for communicating priorities to decision-makers.

Institutions, governance and policy: One Health goals require sustained water sector involvement, since ad hoc or volunteer-based collaboration lacks accountability and continuity. Formal coordination across water, environment, health, agriculture, urban planning and research needs clear mandates, reporting lines, dedicated budgets and data-sharing mechanisms. Local evidence gained traction when linked to national priorities, such as AMR containment, water quality standards, wastewater regulation and the National One Health platform.

Community engagement and livelihoods: Awareness alone is insufficient when communities depend on polluted water for irrigation, washing, livestock or income. Practical risk reduction, safer alternatives and targeted communication work better than blanket prohibitions. Citizen science and community reporting of changes in water colour, smell, illegal dumping and disease could fill gaps between formal sampling rounds. Interventions should address occupational and gender-specific exposure pathways.

Scaling and sustainability: Replication depends on hotspot identification, integrated information systems, shared laboratories, standardized methods, joint training, university partnerships, community ownership and sustained investment. Scaling is most realistic when evidence, institutional commitment, community incentives and policy alignment develop together.

Table 3. Key implications of the achievement of the water focused One Health activities in the Akaki catchment

Lesson group	Key lessons
1. Technical and evidence-generation lessons	Water must be treated as a central One Health pathway linking environmental pollution with human, livestock, and food-system risks. Integrated monitoring of water quality, AMR, heavy metals, and pathogens provided stronger evidence than separate assessments. It also showed the value of hotspot mapping, pollution source tracing, geospatial risk analysis, laboratory strengthening, and continuous data generation for decision-making.
2. Institutional, governance, and policy lessons	One Health implementation requires formal multi-sector coordination, not ad hoc or volunteer-based collaboration. Institutions need clear mandates, reporting lines, budgets, shared responsibilities and data-sharing mechanisms. Evidence from Akaki was most useful when linked to national priorities such as AMR, water quality standards, wastewater regulation, pollution control, and the National One Health platform.
3. Community engagement and livelihood-sensitive risk reduction lessons	Awareness raising alone is not enough when people depend on polluted water for irrigation, washing, livestock, or income. Practical risk-reduction measures, safer alternatives, and targeted communication are more effective than blanket prohibitions. Community participation and citizen science can strengthen real-time monitoring. Interventions must also be sensitive to occupational and gender-specific exposure pathways.
4. Scaling, sustainability, and transferability lessons	Replicating water-focused One Health approaches in other urban and peri-urban river basins requires local assessment and adaptation, supported by hotspot mapping, integrated information systems, shared laboratories, standardized testing, joint training, university partnerships, community ownership, and sustained investment. Scaling works best when technical evidence, institutional commitment, community incentives, and supportive policy advance together.

Next steps to advance the water sector's role in One Health

From 2027, the Water Champions recommend the following priorities, addressing the gaps identified above.

Research. Long-term catchment studies should link antibiotic residues, AMR and water quality, with targeted work on AMR and pollution hotspots in urban catchments and on waste management at health facilities. Low-cost, real-time sensors for water quality and pathogens, and GIS maps combining environmental, health and socio-economic data, should be piloted within a One Health monitoring and decision-support platform for early risk detection.

Capacity building. Water Champions, MoWE and AAEPA staff, environmental officers and community health workers need training in integrated sampling, One Health and AMR surveillance, environmental risk management, bioinformatics and R-based geospatial analysis. Postgraduate fellowships, mentorship, peer-learning networks and hands-on laboratory workshops will build a cross-sector talent pipeline.

Stakeholder engagement. The Water Champions initiative should be embedded in MoWE, with incentives, regular engagement, and measurable deliverables. Community-based monitoring can build local ownership. Stronger partnerships between AAEPA and the ministries of water, health, and agriculture can embed One Health in national policy. Multi-stakeholder workshops with municipal authorities, health institutions, agricultural cooperatives, and media can then co-develop joint plans to protect shared water bodies.

Immediate next step. MoWE and AAEPA have expressed interest in co-developing a catchment-wide pollution prevention and control plan for the Akaki River, drawing on IWMI guidance (Kibret et al., 2025). Linking evidence with institutional responsibilities and measurable results will strengthen the water sector's contribution to Ethiopia's One Health agenda and offer lessons for other catchments.

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