HydroNova
INNOVATING WATER PROSPERITY

Republic of Somaliland

Environmental and Social Impact Assessment for Deep Borehole in Qoolbulale

Prepared for:

WORLD BANK GROUP

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Acronyms

BoQ	Bill of Quantities
CIR	Construction Investment Report
CoC	Code of Conduct
DEP	Department of Environment
E&S	Environment and Social
EC	Electrical Conductivity
EHS	Environment, Health and Safety
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standard
FGD	Focus Group Discussion
FGM	Female Genital Mutilation
GBV	Gender Based Violence
GRM	Grievance Redress Mechanism
GW4R	Groundwater for Resilience Project
IDP	Internally Displaced Persons
IEC	Information, Education and Communication
km	kilometers

l/s	liters per second
LMP	Labor Management Plan
m	meters
m3	cubic meters
masl	meters above sea level
mm	millimeters
MoECC	Ministry of Environment and Climate Change
MoWRD	Ministry of Water Resources Development
NGO	Non-governmental Organization
OHS	Occupational Health and Safety
PIU	Project Implementation Unit
PPE	Personal Protective Equipment
PV	Photovoltaic
POM	Project Operational Manual
PWD	Persons with Disabilities
SEA/SH	Sexual Exploitation and Abuse/Sexual Harassment
SEP	Stakeholder Engagement Plan
SLSH	Somaliland Shillings
SWL	Static Water Level
VDC	Village Development Council
VES	Vertical Electrical Soundings

WB	World Bank
WUC	Water User Committee

Executive Summary

Introduction

The Qoolbulale borehole project is part of the broader Groundwater Resilience (GW4R) initiative aimed at improving water security in drought-prone regions of the Horn of Africa. Qoolbulale, located in Somaliland's Salaxley district, was prioritized due to its reliance on seasonal and unreliable water sources. These sources frequently dry up, forcing residents to depend on costly water trucking or unsafe surface water, increasing health risks and deepening vulnerability to drought. The proposed borehole will tap into the deep Yesomma Sandstone aquifer, providing a reliable and sustainable supply of groundwater for both domestic and livestock use.

The project is justified by the chronic water scarcity faced by local and transboundary pastoralist communities, and is expected to contribute to improved health, food security, economic stability, and conflict reduction. It aligns with Somaliland's National Water Resources Strategy and the World Bank's environmental and social goals. The borehole will also incorporate solar energy, gender-inclusive governance, and strong environmental and social safeguards, supporting climate resilience and inclusive development.

The ESIA has been prepared to identify and manage the environmental and social risks associated with the borehole project. It outlines mitigation measures through a structured Environmental and Social Management Plan (ESMP), aligned with Somaliland's legal framework and the World Bank Environmental and Social Framework (ESF). The ESIA assesses impacts across all project phases—planning, construction, operation, and decommissioning—and considers both infrastructure and broader environmental, social, and institutional dynamics, including land tenure, water governance, and vulnerable groups. It ensures that the project is implemented in a responsible, sustainable, and equitable manner.

Legal and Institutional Framework

The project is governed by a robust legal and institutional framework that draws on both Somaliland's national legislation and the World Bank ESF. Key Somaliland laws include the Environment Management Act, which mandates ESIAs for projects with potential environmental risks, and the Water Act, which regulates groundwater usage and requires permits for borehole development. The project also aligns with the Somaliland National Water Strategy and the National Environmental Policy, which emphasize water security, community involvement, and sustainable resource management.

Given its financing through the World Bank, the project is also subject to the ESF and its ten Environmental and Social Standards (ESS), particularly ESS1 (Risk Assessment), ESS2 (Labor), ESS3 (Pollution Prevention), ESS4 (Community Health and Safety), ESS5 (Land Acquisition), and ESS10 (Stakeholder Engagement). A detailed gap analysis shows that while Somaliland's legislation broadly supports environmental and social safeguards, the World Bank standards require deeper stakeholder engagement, more structured grievance mechanisms, and enhanced labor protections. These have been addressed through the project's ESMP, Labor Management Procedures, and community consultations.

Institutional roles are clearly defined: the Ministry of Environment and Climate Change (MoECC) oversees ESIA approvals and compliance monitoring, while the Ministry of Water Resources Development (MoWRD) issues water abstraction permits and monitors aquifer sustainability. District authorities support land use coordination and community engagement, and the Project Implementation Unit (PIU) ensures day-to-day compliance with safeguards and contractor obligations. Together, these systems ensure the project meets both national regulatory obligations and international best practice, enabling safe, equitable, and environmentally responsible development.

Project Description

The Qoolbulale project is a rural water supply intervention located in the Maroodi Jeex Region, near the Somaliland–Ethiopia border. The project aims to improve year-round access to safe, sustainable water for both the settled population of Qoolbulale and migratory pastoralist groups who seasonally access the area. Chronic reliance on the seasonal rains, combined with the high cost of trucked water and frequent drought, has made the need for a deep groundwater solution urgent.

The project involves the drilling of a deep borehole to approximately 500 meters, targeting the Yesomma Sandstone aquifer, which has been assessed as a viable, sustainable source. The borehole will be equipped with a submersible pump powered by a hybrid energy system—a photovoltaic solar array supported by a diesel generator for backup during low sunlight periods. The infrastructure has been designed for multi-user functionality, supporting domestic water supply, livestock needs, and basic facility operation.

Key infrastructure components include:

- A 3.7km pipeline connecting the borehole to the village.
- A 30 m^3 elevated steel water tank mounted on a reinforced concrete tower.
- 2 six-tap water kiosk for household water collection.
- Three animal troughs for camels and cattle, and three smaller troughs for goats and sheep, placed separately to prevent overcrowding.
- A watchman house and fencing to protect the borehole site.
- A solar power field, mounted on a steel support frame, and a small generator house for diesel power.
- Basic sanitation and drainage systems to prevent contamination and flooding around the water point.

The borehole project will be implemented in four phases:

1. **Planning and Mobilization**: Includes ESIA finalization, site selection, land-use agreements, contractor procurement, and community engagement.
2. **Construction and Installation**: Involves drilling, casing, test pumping, infrastructure construction, and installation of power systems.
3. **Operation and Maintenance**: Long-term use and upkeep by a trained Water User Committee (WUC), supported by user fees and technical backstopping from MoWRD.
4. **Decommissioning (if needed)**: Future closure or rehabilitation activities will include safe decommissioning of the well, removal of equipment, and site restoration.

The project layout was developed to minimize environmental and social risks. The site is 350 meters from a haffir dam, reducing the risk of overlap with traditional water sources while allowing easy access for the community. It avoids known sensitive features, but mitigation plans address the risks of:

- Unregulated settlement expansion around the water point.
- Overgrazing and environmental degradation near livestock troughs.
- Cultural sensitivity, including sacred trees and customary gathering areas.
- Potential conflict between settled residents and cross-border pastoralists.

The borehole is expected to bring numerous long-term benefits, including:

- Improved health outcomes by providing clean, safe water and reducing waterborne disease.
- Reduced time burden on women and girls, who currently walk long distances for water.
- Support to pastoral livelihoods by providing consistent livestock watering points.
- Conflict mitigation through inclusive governance and equitable water access.
- Greater climate resilience through a year-round, deep groundwater source.

Community consultations show strong local support for the project, with households expressing willingness to pay for sustainable water service. A Water User Committee will help ensure transparency, accountability, and community ownership, supported by technical oversight from the Ministry of Water Resources Development (MoWRD). The Qoolbulale borehole project is not only a water infrastructure investment, but a catalyst for improved livelihoods, gender inclusion, and long-term stability in one of Somaliland's most water-stressed regions.

Environmental and Social Baseline

The project area is located in a semi-arid, ecologically fragile region of western Somaliland, where communities face chronic water scarcity, climate variability, and socio-economic marginalization. The baseline assessment outlines the physical, biological, and socio-economic characteristics of the area to inform risk management and mitigation planning under the Environmental and Social Management Plan (ESMP). It highlights both the challenges and the assets that shape project success, including the availability of a deep aquifer, strong community institutions, and clear demand for water infrastructure.

Climatic and physical conditions are harsh, with low, erratic rainfall (250–350 mm/year), long dry seasons, and high average temperatures often exceeding 38°C. The flat to gently rolling topography, combined with sandy and loamy soils, creates a landscape that is highly vulnerable to erosion and land degradation. The proposed borehole will target the Yesomma Sandstone aquifer, which is deep and relatively protected, with estimated yields of 10–15 m^3/hour based on geophysical surveys.

Biological environment highlights include:

- The area supports dryland vegetation such as *Acacia nilotica*, *Acacia tortilis*, and *Acacia bussei*, which provide forage, shade, and ecological stability.

- Wildlife observed in the area includes dik-diks, jackals, hares, and several bird species adapted to arid environments.
- While not a designated biodiversity hotspot, the area is ecologically sensitive and at risk of overgrazing and habitat fragmentation, particularly if livestock movements concentrate around the borehole.

Production from the borehole of this project will be less than 5 l/s and for only half of the year. This equates to about 32,400 cubic meters of water over a 150-day dry season, assuming 12 hours of pumping each day. Therefore, the likelihood of aquifer depletion is highly unlikely. That being said, because so little is known about the nature of the aquifer, only well tests and monitoring will reveal the sustainable abstraction rate and, ultimately, the well's potential. Water quality assessments suggest that while the borehole is expected to yield usable water, salinity levels may be elevated, necessitating appropriate treatment measures for human consumption.

Socially, Qoolbulale is a diverse and dynamic community consisting of approximately 700 resident households and an additional 2,000 migratory households from Ethiopia who access the area during dry seasons. Livelihoods are centered around pastoralism, with most families relying on camels, goats, and sheep for food, income, and social capital. There is little formal employment, but some residents engage in petty trade, seasonal labor, or small-scale retail. Women play a central role in domestic life and livestock care, yet remain underrepresented in leadership roles and decision-making processes. Youth, though numerically dominant, are similarly under-involved in governance structures.

Key vulnerable groups include:

- Female-headed households, with limited access to labor and income.
- Internally displaced persons (IDPs) and minority clan members, often excluded from land and water governance.
- Youth and persons with disabilities, who face barriers to participation and access to services.

The community currently depends on unreliable and unsafe water sources, including:

- A haffir dam, a seasonal earth dam, often dries out within months of the rainy season.
- Berkads (traditional surface catchments) are silted and often contaminated.
- Trucked water, priced at over $13.00 per cubic meter, is unaffordable for many households.

There is potential for conflict if access to the new borehole is not well managed. Tensions could arise between settled residents and migratory herders, as well as among different clans and household types, especially during periods of water scarcity. Concerns also exist about the risk of spontaneous settlement growth around the borehole, leading to land pressure and social tension.

However, Qoolbulale benefits from strong local governance structures that can support peaceful and inclusive resource management:

- The Village Development Council (VDC) provides leadership and dispute resolution through traditional mechanisms.
- The planned Water User Committee (WUC) will oversee borehole operations, fee collection, and maintenance.

- A project-supported grievance mechanism will offer a formal channel for raising and resolving complaints, including those related to access, pricing, and equity.

Overall, the baseline demonstrates that while Qoolbulale faces severe environmental stress and complex social dynamics, it also has the institutional foundation and community cohesion necessary for successful borehole management. With well-designed safeguards and inclusive engagement, the project can deliver transformative benefits while mitigating risks related to water access, land use, and social equity.

Stakeholder Engagement

Stakeholder engagement has been a foundational pillar of the Qoolbulale borehole project, designed to ensure transparent communication, inclusive decision-making, and long-term community ownership. The process aligns fully with ESS10 and Somaliland's national guidelines on environmental and water governance. Given the sensitivity of water access in a cross-border pastoralist zone, the engagement strategy emphasizes trust-building, conflict prevention, and equitable participation.

The engagement process had the following key objectives:

- To promote transparent information sharing on project scope, impacts, and management.
- To ensure inclusive participation, especially of women, pastoralists, youth, and marginalized groups.
- To identify and address potential conflicts before they escalate.
- To integrate traditional leadership and local governance into water management.
- To establish and operationalize a grievance mechanism, including SEA/SH-specific protocols.

Stakeholder identification included:

Government and regulatory actors: Ministry of Water Resources Development (MoWRD), Ministry of Environment and Climate Change (MoECC), Village Development Council (VDC), and the District Administration.

Community-based stakeholders: Traditional elders, women's groups, school committees, youth, and religious leaders.

Livelihood-focused groups: Pastoralists (local and cross-border), livestock traders, water vendors, and small business owners.

Vulnerable and marginalized groups: IDPs, marginalized clans, female-headed households, and persons with disabilities.

External actors: World Bank, NGOs, private sector contractors, and cross-border water management entities.

Stakeholders were prioritized based on their influence and interest in the project, ensuring that high-priority actors—such as the Water User Committee (WUC), MoWRD, elders, and pastoralists—received continuous engagement. Marginalized groups with high interest but low influence (e.g., IDPs, women, disabled persons) were given tailored outreach to ensure they were not excluded.

Recommended engagement strategies include:

- Community barazas, focus group discussions (FGDs), one-on-one interviews, and school and market-based outreach.
- Radio broadcasts, mosque announcements, and posters tailored for low-literacy audiences.
- Women-only forums, female-led grievance channels, and translated materials to ensure gender and cultural appropriateness.
- Mobile outreach to reach nomadic and cross-border users.

A robust grievance mechanism has been provided, featuring:

- Multiple reporting channels (verbal, written, suggestion boxes).
- Confidential handling of SEA/SH cases by trained focal points.
- Integration with traditional conflict resolution structures, such as clan elders and the VDC.

Stakeholder concerns were systematically documented and addressed, with feedback directly shaping the Environmental and Social Management Plan (ESMP). Common concerns included:

- Fair water access between pastoralists and settled residents.
- Groundwater overuse and borehole sustainability.
- Women's participation in governance.
- Risks of settlement expansion and associated land disputes.
- Borehole fee transparency and fear of elite capture.

To address these, the project will:

- Creates a representative Water User Committee with at least 30% women.
- Install flow meters and sustainable pumping limits.
- Provide separate livestock and human water points.
- Develop a land-use management plan and inclusive governance training.

Finally, a detailed stakeholder engagement schedule has been developed to guide activities through all phases of the project—from planning and construction through operation. Each stage includes targeted consultations, training sessions, grievance tracking, and satisfaction assessments to ensure accountability and transparency.

Environmental and Social Impacts

This project is expected to deliver substantial positive environmental and social outcomes, while also introducing several risks that require active management. The ESIA identifies and classifies both types of impacts, forming the foundation for the ESMP.

Positive Impacts

The positive impacts are wide-ranging and transformational for the Qoolbulale community. The borehole will provide clean, year-round access to groundwater, improving water security and reducing dependence on expensive/ unsafe sources like the haffir dam, berkads, and trucked water. This will lead to better public health, lower household water costs, and fewer cases of waterborne diseases. With more time freed from daily water collection duties, women and girls will have improved access to education, income-generating opportunities, and decision-making platforms. Small businesses and pastoral livelihoods will flourish with consistent water availability, and local institutions—particularly the Water User Committee (WUC)—will be strengthened through capacity building and financial transparency.

Additionally, the borehole is expected to reduce water-related conflict by offering a managed and inclusive access point for both settled residents and mobile pastoralists. This, combined with improved groundwater monitoring and sustainable extraction practices, will support long-term climate resilience. The project will also foster improved land use and rangeland management, helping to stabilize fragile ecosystems and reduce pressure on seasonal water points.

Key positive impacts include:

- Permanent access to safe water for households and livestock.
- Reduced time and physical burden of water collection, especially for women and girls.
- Enhanced hygiene and sanitation, improving community health outcomes.
- Economic growth from livestock trade, food vendors, and small-scale enterprises.
- Strengthened community institutions through inclusive governance and training.
- Reduced conflict over water access and improved clan relations.
- Improved resilience to drought and climate variability.

Negative Impacts

Despite these benefits, the project also presents a series of environmental and social risks. Physically, there is a risk of soil erosion, vegetation loss, and aquifer depletion due to over-extraction and livestock concentration near the water point. Construction-related impacts include dust, noise, and air pollution, as well as hazardous and non-hazardous waste generation from drilling operations and materials. The biological environment may be affected through loss of native vegetation, disruption of wildlife behavior, and degradation of sensitive grazing lands.

Social risks include potential conflict over water access, particularly between settled communities and transboundary pastoralists. Land acquisition and fencing may limit access to traditional grazing areas or raise disputes. There is also a real risk of elite capture of water governance, along with gender-based exclusion from decision-making. Women and marginalized groups may face limited representation in water management, while the presence of outside labor introduces a potential for gender-based violence (GBV), sexual exploitation, and harassment (SEA/SH). Additionally, the introduction of reliable water access could prompt unregulated settlement expansion, straining services and accelerating environmental degradation.

Key negative impacts identified:

- Soil erosion and land degradation from livestock trampling and site clearing.

- Groundwater depletion risks if extraction exceeds recharge.
- Contamination risks from livestock waste, drilling fluids, and poor waste disposal.
- Dust and air pollution during construction, along with noise disturbances from equipment.
- Disruption of wildlife migration and increased human-wildlife conflict.
- Conflicts over water access if governance structures are weak or exclusionary.
- Risk of unplanned settlement growth and overgrazing near the borehole.
- Labor-related risks, including OHS issues and the potential for child labor or GBV incidents.

Impact Significance

The significance ranking exercise classified impacts by their level of importance, duration, and whether they are direct or indirect. High-significance risks include groundwater depletion, overgrazing, water contamination, and social conflict over access. These require immediate and ongoing mitigation through a robust ESMP that includes:

- Groundwater monitoring and controlled pumping.
- Livestock and grazing management plans.
- Safe waste disposal and water quality testing.
- Inclusive water governance with equitable representation.
- Settlement control and land-use planning.
- GBV risk prevention measures, grievance redress, and capacity building.

The ESIA confirms that while the Qoolbulale borehole project carries inherent risks, it also offers transformational benefits. With effective planning, proactive mitigation, and inclusive engagement, the project can deliver sustainable water access, improve livelihoods, reduce conflict, and strengthen climate resilience in one of Somaliland’s most vulnerable rural communities.

Mitigation Measures

The Qoolbulale borehole project includes a robust set of mitigation measures designed to address identified environmental and social risks. These measures are outlined in detail in the ESMP and reflect both Somaliland’s legal framework and the World Bank ESF, particularly standards ESS1 through ESS10. The ESMP organizes mitigation actions into three main categories: impacts on the physical environment, biological environment, and social environment. For each impact, the plan specifies the mitigation strategy, responsible entities, and implementation approach.

For the physical environment, mitigation measures focus on erosion control, groundwater protection, pollution management, and settlement planning. Key actions include:

- Using geotextiles, vegetation restoration, and livestock corridors to control soil erosion.
- Installing flow meters and setting sustainable pumping limits to avoid aquifer depletion.
- Implementing sealed well construction, safe chemical handling, and routine water quality testing to prevent groundwater contamination.
- Regulating dust and noise during construction and enforcing waste sorting and safe disposal of hazardous materials.

For the biological environment, measures aim to preserve rangeland health and biodiversity. Strategies include:

- Replanting native vegetation and designating grazing buffers to reduce habitat loss.
- Avoiding disruption to wildlife corridors and installing wildlife-friendly water access points.
- Encouraging rotational grazing and grass reseeding to manage pressure on rangelands.
- Managing waste and fencing infrastructure to prevent human-wildlife conflict and ecosystem imbalance.

The social mitigation measures are especially comprehensive, reflecting the project's sensitivity to land access, gender equity, labor standards, and community dynamics. These include:

- Securing voluntary land-use agreements and avoiding disruptions to pastoral migration routes.
- Establishing a representative Water User Committee with at least 30% women and ensuring gender-sensitive infrastructure design.
- Managing risks related to water pricing, elite capture, and governance transparency through democratic selection processes and public audits.
- Providing grievance channels for SEA/SH survivors, training contractors on codes of conduct, and strengthening complaint-handling systems.

Collectively, these mitigation measures address the root causes of environmental degradation, social exclusion, and potential conflict. Their success will depend on coordinated implementation by the Water User Committee, government agencies (MoECC, MoWRD), contractors, and community leaders. Capacity building, monitoring, and strong local engagement will be essential to ensuring the borehole project is both equitable and sustainable.

Environmental and Social Management Plan

The ESMP provides the operational framework for managing and mitigating the project's environmental and social risks throughout its lifecycle. The ESMP translates the ESIA's impact findings into specific, actionable measures, backed by clearly defined roles, responsibilities, and monitoring tools. It follows the mitigation hierarchy—avoid, minimize, restore, and offset—and aligns with both Somaliland's legal requirements and the ESF.

Contractor Environmental and Social Responsibilities

Contractors will be required to:

- Prepare a Contractor-ESMP (C-ESMP).
- Appoint an Environmental, Health, and Safety (EHS) officer and a Social Liaison.
- Train workers on GBV/SEA/SH prevention and enforce a Code of Conduct.
- Provide PPE, maintain safety standards, and establish a worker grievance system.
- Comply with ESS2 provisions on:
    - To promote safety and health at work.
    - To promote the fair treatment, nondiscrimination and equal opportunity of project workers.
    - To prevent the use of all forms of forced labor and child labor.
    - To protect project workers, including vulnerable workers such as women, persons with disabilities, children (of working age, in accordance with this ESS) and migrant workers, contracted workers, community workers and primary supply workers, as appropriate.
    - To provide project workers with accessible means to raise workplace concerns.
    - To support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law.

These responsibilities are outlined in key project documents including the ESMF, ESMP, Labor Management Procedures (LMP), and tender packages.

Monitoring Program

The monitoring program ensures the project's safeguards are being implemented and adjusted over time. Indicators are established for:

- Groundwater levels and water quality.
- Soil erosion, waste management, and noise control.
- Biodiversity impacts and vegetation loss.
- Social metrics like grievance resolution, gender inclusion, and labor compliance.

Monitoring will occur on monthly, quarterly, or biannual schedules depending on the parameter. Responsibilities are shared among the PIU, Water User Committee, MoECC, MoWRD, and external auditors.

Reporting Framework

The ESMP sets out a structured reporting system to ensure transparency and accountability. This includes:

- Quarterly environmental and social monitoring and grievance reports.
- Monthly contractor compliance updates during construction.
- Biannual ESMP implementation progress and security reports.
- Annual environmental and social audits and capacity-building reports.

Reports will be submitted to MoECC, MoWRD, the World Bank, and local stakeholders, ensuring that compliance, feedback, and corrective action are consistently addressed.

Capacity Building

A targeted training program is included to strengthen the capacities of the Water User Committee, local authorities, contractors, and community members. Topics include:

- Borehole maintenance, water quality testing, and environmental safeguards.
- Conflict resolution, GBV prevention, and gender-inclusive governance.
- Occupational Health and Safety (OHS), financial transparency, and land-use planning.

Training is delivered through MoWRD, MoECC, NGOs, and consultants, and scheduled across the pre-construction, construction, and operational phases.

Grievance Mechanism

The grievance mechanism (GM) for the Qoolbulale borehole project is a critical safeguard designed to ensure that all stakeholders—particularly vulnerable and marginalized groups—can safely and effectively raise concerns about the project. The GM is fully aligned with ESS1, the GW4R GRM and integrated into the broader stakeholder engagement and risk management strategy. Its primary objectives are to ensure transparent resolution of complaints, promote accountability, protect vulnerable individuals (especially women and survivors of GBV/SEA/SH), and support adaptive project management.

The grievance system operates at multiple levels:

- Community grievance focal points, including female representatives, provide the first point of contact.
- The Water User Committee (WUC) may resolve minor water access complaints through customary processes.

- More serious or unresolved issues are escalated to the Grievance Redress Committee (GRC) within the PIU, which includes a Social Specialist, GBV Specialist, and Environmental Officer.

The grievance process is structured, timely, and inclusive. Complaints can be submitted in person, in writing, via phone, SMS, or suggestion boxes. Anonymous submissions are accepted, and all grievances are logged and tracked. Key steps include:

- Acknowledging receipt (within 7 days).
- Categorizing and assigning cases based on severity.
- Investigating and resolving (including feedback to the complainant) (within 21 working days).
- Providing feedback to complainants and offering an appeals process.
- Reporting outcomes quarterly to the MoWRD, MoECC, and the World Bank.

Special protocols are in place for GB/SEA/SH-related grievances, ensuring strict confidentiality, trained female focal points, and immediate referral to qualified support services. These cases are handled separately from general complaints and are never resolved through informal community mechanisms.

Community awareness of the GM is a key priority. The project will use:

- Posters and radio broadcasts in local languages.
- Community meetings and mosque announcements.
- Women-only sessions and outreach to pastoralist groups.
- Printed materials with symbols for low-literacy users.
- Training for grievance handlers on respectful, confidential engagement.

To ensure continued improvement, grievance data will be reviewed quarterly to identify patterns and recurring issues. These lessons will feed back into project management and inform updates to the ESMP.

In conclusion, the grievance mechanism is more than a complaint box—it is a vital tool for promoting transparency, equity, safety, and trust in the Qoolbulale borehole project. By creating safe, accessible, and culturally appropriate pathways for feedback, the GM helps ensure the project remains accountable to the people it is meant to serve.

Conclusion and Recommendations

The ESIA concludes that the Qoolbulale deep borehole project is both environmentally and socially feasible. It presents a transformative opportunity to address chronic water insecurity in a drought-prone region of Somaliland while supporting public health, economic development, and climate resilience. However, these benefits are conditional on the full implementation of the ESMP, along with sustained stakeholder engagement and institutional oversight.

The ESIA identifies significant risks—including groundwater over-abstraction, rangeland degradation, water-related conflict, and gender exclusion—but confirms that these are manageable through well-designed mitigation strategies. The project's safeguards, including a multi-layered grievance mechanism, a monitoring and reporting system, and inclusive governance mechanisms, offer a strong foundation for ensuring transparency, accountability, and sustainability.

Key recommendations include:

- Fully implement the ESMP with dedicated oversight, budgeting, and contractor compliance.
- Establish sustainable groundwater management practices such as flow metering, aquifer monitoring, and regulated pumping limits.
- Strengthen water governance through a representative Water User Committee (WUC) with 30% women's participation and clear accountability.uj near the borehole.
- Operationalize a grievance mechanism with SEA/SH-sensitive procedures and trained focal points.
- Build capacity among the WUC, contractors, and local authorities in borehole operation, GBV prevention, environmental monitoring, and financial transparency.
- Monitor social and environmental indicators regularly, with third-party audits and adaptive management protocols.
- Maintain continuous community engagement through information sharing, feedback forums, and culturally appropriate communication tools.
- Ensure close coordination between MoWRD, MoECC, and the PIU to monitor compliance and support governance structures.

By implementing these recommendations, the Qoolbulale borehole project can deliver lasting improvements to water access, public health, livelihoods, and community resilience, while minimizing environmental and social risks.

1. Introduction

1.1. Project Background

The Qoolbulale borehole project is part of the larger Groundwater for Resilience (GW4R) initiative, which aims to improve water security across the Horn of Africa by developing sustainable groundwater sources in drought-prone and water-scarce regions. Qoolbulale, located in the Salaxley district of Somaliland, was identified as a priority site due to its chronic dependence on unreliable and seasonal water sources. The primary existing source, a haffir dam, provides limited seasonal supply and is prone to sedimentation and evaporation, leaving the community vulnerable during long dry periods. In the absence of a permanent water supply, residents often rely on costly trucked water or unsafe surface sources, which increases the risk of waterborne disease and deepens household financial burdens.

The rationale for the project is rooted in the urgent need to provide a reliable, year-round water source to support domestic needs, livestock, and future small-scale economic activities. The proposed borehole will tap into the deeper and more sustainable Yesomma Sandstone aquifer, offering a resilient supply of clean groundwater. By reducing dependency on seasonal and emergency water systems, the borehole will strengthen the community's ability to cope with drought, improve public health through safer water, and reduce the time and energy—especially for women and children—spent collecting water. The project will also help mitigate resource-based conflicts by formalizing water governance structures and ensuring equitable access across different user groups.

The development of the project has been guided by meaningful community engagement from the earliest stages. Local residents, elders, women's groups, and pastoralist representatives participated in initial site selection, shared input on infrastructure placement, and identified priority needs such as livestock access and separate water points for households. Consultations were conducted through focus group discussions and village assemblies, with the support of the Village Development Council (VDC) and in coordination with local authorities. A Water User Committee (WUC) has been planned with diverse representation to ensure transparent governance, and ongoing dialogue with the community has informed the design of the ESMP, helping to ensure that the project is not only technically sound but also socially acceptable, inclusive, and locally owned.

1.2. Project Justification

The project is justified by the urgent and chronic water scarcity experienced by the community and surrounding pastoralist populations. Located in a semi-arid region of Somaliland, Qoolbulale currently depends on seasonal sources, which are prone to drying during extended droughts. Many households also rely on expensive trucked water, which can cost up to $13.50 per cubic meter—well beyond the affordability threshold for low-income families. The absence of a permanent and reliable water supply has led to poor health outcomes, limited economic opportunities, and increased vulnerability to climate shocks. A borehole, drawing from a more stable deep aquifer, provides a sustainable solution to this long-standing challenge.

The project also plays a critical role in supporting the livelihoods of pastoralist and agro-pastoralist households, who depend on water for livestock health and productivity. Without a permanent water point, livestock must be moved long distances during dry seasons, resulting in animal stress, reduced market value, and sometimes death. The borehole will significantly reduce the need for long-range migrations, while designated animal troughs and scheduled watering arrangements will help reduce competition and prevent resource conflicts. By stabilizing access to water, the project will also contribute to greater food security, enhanced income generation, and a reduction in rural poverty.

Beyond meeting immediate needs, the borehole supports broader development and policy objectives. It aligns with Somaliland's National Water Resources Strategy and the World Bank's goal of building resilience through sustainable natural resource management. By incorporating renewable energy systems, gender-inclusive governance, and robust environmental safeguards, the project serves as a model for climate-resilient, community-driven rural water development. The expected social benefits—particularly for women, youth, and vulnerable groups—extend to education, public health, and gender equity, making this project not only a technical intervention but also a driver of local development.

Beneficiaries

The estimation of beneficiaries for the newly constructed water infrastructure was derived by the socio-economic survey done by the PIU and the satellite imagery, allowing for a detailed assessment of surrounding population densities. It was also possible to identify the predominant economic activities in the area, distinguishing between farming and nomadic practices based on visible land use patterns. An average number of livestock per household was considered to characterize the community water needs.[1]

The analysis considered the villages that would benefit from the new water point, that have been previously presented in this report, home to approximately 700 households that rely mainly on pastoralism and approximately 250 nomadic families that rely on water availability at the site during the dry season. Livestock, including camels, goats, cattle and donkeys play a significant role in the local economy, with varying numbers in each category.

Table 1: Number of beneficiaries estimation

	Community households	Nomadic families	Camels	Sheep	Goats	Cattles	Donkeys
Beneficiaries	700	250	1,256	9,420	10,048	1,884	628

Water Availability

The community's main water sources are berkads, balleys, and haffir dams, located near the villages. These sources rely on surface runoff during the rainy season to store water for use in the dry season. Although surface water generally has low electrical conductivity, it carries high contamination risks. The reliability of these sources depends on both rainfall

[1] The estimates of average livestock numbers per household were derived from the study "Impact of Climate Change on Agricultural Production in Marodijeh and Gabiley Regions (Somaliland)." The analysis synthesizes data from various local agricultural surveys and expert consultations to ensure accuracy in the context of regional livestock management practices.

and the amount of water stored. When these sources are insufficient, communities rely on water trucking from distant boreholes, which often provides lower-quality water with high salinity.

Figure 1: Water structures in the area of interest: haffir, balley and berkads in the community

Water Demand

The analysis revealed that pastoralism is integral to the community's livelihoods. Crop agriculture is not practiced.

Daily consumption quantities are calculated based on the estimated number of liters for each consumer type[2] and are presented in the following two tables.

Table 2: Estimation of the water demands of people (both villagers and nomadic pastoralists).

Type of Villager	HH Size	Number of HH: Share	Number of HH: Number	Total Number of People (H)	Unitary Water Consumption [L/D/H]	Total Water Consmption [MC/D]
Agro-Pastoralists (i.e. livestock and crop land)	12.0	5%	35	420	25	10.5
Farmers (i.e. crop land only)	8.8	5%	35	306	25	7.7
Nomadic Pastoralists	6.5	26%	250	1,625	25	40.6
Pastoralists (i.e. livestock only)	8.7	49%	343	2,996	25	74.9
Village Household	9.0	15%	105	946	25	23.6
					Total Water Need for Villagers	157.3

[2] These figures are estimated based on two main sources of literature: Coppock et al. 1988 and Erik Nissen-Petersen (2006): Water for Arid Land (Danida). Hofkes (1983) emphasized that livestock in semi-arid areas require approximately 20-30 liters per Tropical Livestock Unit (TLU), with each TLU having a live weight of 250 kg. Thus, camels have a TLU of 1.6, beef cattle (as opposed to dairy cattle) have a TLU of 0.8, and sheep and goats have a TLU of 0.1. The water demand figures have been rounded to the nearest multiple of 10 for ease of reference. Household ('HH') sizes are average for that category. MC/D= m3 per day.

Table 3: Estimation of the water demand for livestock

Type of Livestock	Average Number of Livestock per HH	Total Current Number of Livestock	Total Additional Livestock that the Project can Support	Unitary Water Consumption [L/D/H]	Total Water Consmption [MC/D]
Camels	2.0	1,256	0	30	37.7
Sheep	15.0	9,420	0	5	47.1
Goats	16.0	10,048	0	3	30.1
Cows	3.0	1,884	0	24	45.2
Other	1.0	628	0	25	15.7
		Total Water Need for Livestock			**175.8**

Finally, if the proposed water structure had to -alone- satisfy the demand for the entire drought season (150 days) for all water users, the water requirement would be approximately **49,977m^3** per year or **333m^3/day**.

1.3. Purpose and Objectives of the ESIA

The ESIA for the project has been prepared to identify, assess, and manage the potential environmental and social risks and impacts associated with the construction and operation of the proposed deep groundwater supply system. As a requirement under both the Somaliland Environment Management Act and the World Bank ESF, the ESIA serves as a decision-support tool that ensures the project is designed and implemented in a manner that is environmentally sound, socially inclusive, and legally compliant.

The overarching purpose of the ESIA is to promote sustainable development by minimizing harm to people and the environment while maximizing the project's benefits. It does this by evaluating baseline environmental and social conditions, identifying potential impacts (both positive and negative), and outlining mitigation, monitoring, and stakeholder engagement measures in a structured ESMP. The ESIA also provides transparency and accountability, serving as a foundation for meaningful consultation and informed decision-making throughout the project lifecycle.

Key Objectives of the ESIA include:

- To assess the potential environmental and social risks and impacts of the borehole project at all stages—planning, construction, operation, and eventual decommissioning.
- To ensure that project design and implementation are consistent with national environmental legislation and the requirements of the World Bank ESF.
- To define site-specific mitigation and monitoring measures in the form of a comprehensive ESMP.
- To support informed and inclusive decision-making by facilitating meaningful consultation with affected communities, local authorities, and other stakeholders.
- To identify opportunities to enhance the project's social benefits, including gender inclusion, climate resilience, and livelihood support.
- To establish a baseline for future monitoring and impact evaluation, ensuring the project's ongoing compliance and adaptability.

In fulfilling these objectives, the ESIA helps ensure that the project is implemented responsibly, safeguards the rights and well-being of the local population, and contributes to sustainable groundwater resource management in Somaliland.

1.4. Scope of the ESIA

The scope of the ESIA encompasses all phases of the project lifecycle—planning, construction, operation, and potential decommissioning—and includes a comprehensive analysis of the project's physical footprint, associated infrastructure, and its area of environmental and social influence. The ESIA is designed to ensure that the borehole project is implemented in compliance with the legal and policy frameworks of Somaliland and the World Bank. It also serves to ensure that adverse impacts are avoided, minimized, mitigated, or offset.

In addition to the physical infrastructure, the ESIA also considers broader social and environmental systems that may be influenced by the project. These include:

- The natural environment surrounding the borehole site, including flora, fauna, rangelands, and groundwater systems.
- Local socio-economic dynamics, including land tenure systems, water access practices, pastoralist migration patterns, and community institutions.
- Cultural heritage resources, both tangible (e.g., sites of local significance) and intangible (e.g., customary water-sharing agreements).
- The institutional arrangements for water governance, stakeholder engagement, grievance management, and compliance monitoring.

The project's area of influence includes both the immediate site (drilling area, water points, and infrastructure) and the wider catchment area that will be affected by increased human and livestock activity, settlement growth, and changes in water access. Special attention is given to vulnerable groups such as women, IDPs, and marginalized clans, in line with ESS7 and ESS10.

Area of Influence

1. **Hydrogeological Impact Zone:** Radius: 500 meters to 2 kilometers, depending on factors like pumping rate and drawdown patterns.

2. **Social & Community Impact Zone:** Radius: Often 1–5 kilometers, depending on population density and water access patterns. For Qoolbulale, the village is about 3.7 kilometers from the borehole site.

3. **Environmental Impact Zone:** Radius: Usually up to 2–3 km, depending on proximity to sensitive habitats. For Qoolbulale, there are no sensitive habitats within 4km of the project site. This zone includes the project footprint and construction activities, such as laydown areas and parking.

In sum, the ESIA's scope ensures that the environmental and social dimensions of the borehole project are fully integrated into planning, design, and implementation, with proactive measures in place to enhance positive outcomes and manage risks effectively.

2. Legal and Institutional Framework

This chapter outlines the legal and institutional framework governing the Qoolbulale borehole project, identifying the relevant national laws, policies, and regulatory bodies in Somaliland, as well as the applicable requirements under the World Bank ESF. It provides a basis for ensuring that the project is implemented in full compliance with both local and international standards for environmental protection, social inclusion, and sustainable water resource management. The chapter also defines the roles and responsibilities of key institutions—such as the Ministry of Environment and Climate Change (MoECC) and the Ministry of Water Resources Development (MoWRD)—in environmental oversight, permitting, and enforcement. Together, these frameworks form the foundation for impact mitigation, stakeholder engagement, and long-term governance of the borehole system.

2.1. Somaliland

Constitution of the Republic of Somaliland (2001): The Constitution underscores the importance of safeguarding and preserving the environment. Article 18 specifies that the state and citizens must prioritize environmental conservation, providing a foundational basis for subsequent laws and policies.

Implication for the Project: Any borehole development must be conducted in a way that upholds constitutional mandates around environmental sustainability and public welfare.

Somaliland National Water Strategy (2020–2024): Emphasizes the importance of securing water access for both rural and urban populations through investment in infrastructure, institutional strengthening, and improved water governance. Key priorities include the expansion of groundwater development, the promotion of community-based water management, enhanced monitoring and data systems, and the protection of water quality and aquifers from overexploitation and pollution.

Implication for the Project: The project represents a practical and well-aligned intervention under the Somaliland National Water Strategy, advancing its goals of improving access to safe and sustainable water while strengthening institutional and community-level management of water resources.

National Environmental Policy (2015): This policy outlines Somaliland's broad objectives for biodiversity protection, pollution control, climate change adaptation, and sustainable resource use.

Implication for the Project: It supports integrated water-resource management, requires environmental assessments for major water infrastructure, and emphasizes community involvement in natural resource decisions.

Environment Management Act (2018): Often referred to as Somaliland's key environmental statute, it establishes the Ministry of Environment and Climate Change (MoECC) as the lead agency for environmental oversight. The Act mandates Environmental and Social Impact Assessments for projects likely to have significant impacts, and details procedures for licensing, compliance monitoring, and penalties for environmental harm.

Implications for the Project: A deep borehole falls under the category of projects requiring an ESIA or equivalent study to demonstrate that resource extraction does not harm local ecosystems or communities.

Somaliland Water Act No. (2010, Amended 2011): This law governs the ownership, allocation, and use of water resources. It outlines how permits and concessions are granted, stressing sustainable withdrawals and equitable distribution.

Implications for the Project: Drilling a new borehole requires a permit from the Ministry of Water Resources Development. Applicants must provide hydrological studies and usage plans to ensure the long-term viability of the aquifer.

Other Relevant Legislation

Solid Waste Management Act (No. 81/2018): Addresses waste disposal requirements, ensuring drilling byproducts (e.g., drilling muds, packaging) are managed properly.

Private Sector Employment Law (No. 31/2020): Guides labor practices, worker rights, and occupational health and safety, complementing World Bank ESS2 for project workers.

Note on Water Quality Standards

No Somaliland-specific drinking water regulations have been published or codified. In practice, projects, especially international and World Bank–funded initiatives like GW4R, use Somalia's Water Development Agency (WDA) guidelines as operational benchmarks within Somaliland, in combination with WHO standards for health-oriented comparisons.

For this project, water quality will be assessed against WHO guideline values for health-based parameters (including fluoride, arsenic and nitrate) with the exception of salinity, for which the Somali WDA guideline of 3500 µS/cm will be applied in line with national practice for the Horn of Africa GW4R Programme. This avoids classifying rural boreholes as "non-compliant" purely due to taste/appearance issues, and matches other GW4R country teams' practice (Ethiopia, Kenya, Somalia) where local salinity allowances are higher than WHO's aesthetic guideline.

Table 4 Water Quality Parameters

Parameter	Somalia (WDA) Guideline	WHO Guideline	Use in Somaliland Projects
Salinity (EC)	3500 µS/cm	1500 µS/cm (aesthetic)	Used operationally; WHO used for health context
Fluoride	unspecified	1.5 mg/L	WHO default applied where unclear
Arsenic	unspecified	0.01 mg/L	WHO default applied where unclear
Nitrate	unspecified	50 mg/L	50 mg/L is a commonly used default
Microbial	0 E. coli / fecal coliform per 250 mL	Same	Standard across both references

2.2. Overview of the World Bank Environmental and Social Framework

The World Bank's Environmental and Social Framework (ESF) sets out the Bank's commitment to sustainable development through a comprehensive risk management approach. It comprises:

A Vision for Sustainable Development: Emphasizes balanced economic, social, and environmental outcomes.

Environmental and Social Policy: Outlines the Bank's responsibilities in screening, appraisal, and monitoring of projects.

Ten Environmental and Social Standards (ESS): Provide requirements for Borrowers to identify, assess, and mitigate a project's environmental and social risks.

Applicable World Bank Environmental and Social Standards

Several ESSs are generally relevant to groundwater or water supply projects, especially those involving borehole drilling and ancillary infrastructure:

ESS1 – Assessment and Management of Environmental and Social Risks and Impacts: Requires a thorough Environmental and Social Impact Assessment (ESIA) and development of an Environmental and Social Management Plan (ESMP).

Implication for the Project: For this deep borehole project, ESS1 underpins the entire risk analysis: site selection, drilling methods, water usage, potential land acquisition, and overall monitoring.

ESS2 – Labor and Working Conditions: Covers workers' rights, fair pay, safe working conditions, and prohibition of child or forced labor.

Implication for the Project: Drilling contracts, technician teams, and any local laborers must be managed in line with both ESS2 requirements and local labor laws.

ESS3 – Resource Efficiency and Pollution Prevention and Management: Focuses on efficient resource use (water, energy) and minimizing pollution (e.g., safe disposal of drilling mud, control of noise and dust, management of wastewater).

Implication for the Project: Directly applies to drilling and pumping operations, potential use of diesel generators, or chemical additives in drilling fluids.

ESS4 – Community Health and Safety: Addresses traffic safety, security risks, hazardous materials, emergencies, and exposure to communicable diseases.

Implication for the Project: Relevant for mitigating any construction hazards (noise, dust, movement of heavy trucks), as well as ensuring wellhead security and water-quality risks to nearby residents.

ESS5 – Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement: Activated if the project requires permanent or temporary acquisition of land, restricts access to communal areas, or leads to displacement (physical or economic).

Implications for the Project: Even if land is community-owned or voluntarily donated, ESS5 procedures (e.g., voluntary land donation protocols) may apply.

ESS6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources: Applicable if the drilling site or pipeline routes potentially affect sensitive habitats, protected species, or unique ecosystems.

Implications for the Project: No critical habitats will be adversely impacted by this project.

ESS7 – Indigenous Peoples and Sub-Saharan African Historically Underserved Traditional Local Communities: Requires the project to ensure the protection of the cultural identity, practices, and customary lands of indigenous people and specific traditional local communities in Sub-Saharan Africa.

Implications for the Project: The screening by the World Bank determined that ESS7 does not apply to the groups in this area.

ESS8 – Cultural Heritage: Requires identification and protection of cultural heritage that may be impacted, directly or indirectly, by the project.

Implications for the Project: Although no cultural heritage sites were found during community interviews or the baseline survey, a "Chance finds" procedure must be in place in case artifacts or sites of cultural significance are discovered during drilling or excavation.

ESS10 – Stakeholder Engagement and Information Disclosure: Emphasizes meaningful engagement with affected communities and stakeholders, and the establishment of a functioning GM.

Implications for the Project: Engagement and a strong GM is central to ensuring community acceptance, conflict mitigation, and transparency about water sharing arrangements.

Gap Analysis: Somaliland Law vs. World Bank ESS Requirements

The table below compares key aspects of Somaliland legal provisions with the World Bank standards, focusing on issues most relevant to a borehole project (e.g., environmental assessment, water regulation, labor, community engagement, and land acquisition).

Table 5 Gap Analysis between Somaliland law and ESF Standards

Thematic Area / WB ESS	Somaliland Laws & Policies	WB ESS Requirements	Identified Gaps & Implications for the Project
ESS1: Environmental & Social Impact Assessment (ESIA)	- Environment Management Act LR 79/2018 mandates ESIA for projects with	- Requires comprehensive ESIA covering direct, indirect, and cumulative impacts.	- Somaliland framework is relatively clear on mandatory ESIAs.

Thematic Area / WB ESS	Somaliland Laws & Policies	WB ESS Requirements	Identified Gaps & Implications for the Project
	potential significant impacts. - Ministry of Environment & Climate Change (MoECC) issues ESIA guidelines and approvals. - National Environmental Policy (2015) calls for integrated water resource management and stakeholder input.	- Stipulates an ESMP with mitigation measures, monitoring, reporting, and adaptive management.	- Prepare a full ESIA report in line with both MoECC and World Bank standards
ESS2: Labor & Working Conditions	- Private Sector Employment Law No. 31/2020 addresses wages, working hours, and OHS but enforcement capacity may be limited in rural areas. - Constitution prohibits forced/child labor, but implementation relies on local labor offices and MoWRD for sector-specific projects.	- Workers' rights, safe working conditions, no child or forced labor. - Requires labor management procedures (LMP) and a worker GM.	- Somaliland has recognized labor rights but enforcement is variable. - Develop and implement a Labor Management Procedure (LMP) tailored to the local context, addressing hiring, code of conduct, child labor verification (documented age checks), OHS requirements (e.g., PPE, first aid kits, rest breaks), and a worker Grievance Mechanism (GM). Contractors must sign and comply with these standards.
ESS3: Resource Efficiency & Pollution Prevention	- Environment Management Act covers pollution control but does not provide detailed guidelines on	- Advocates efficient water usage, managing emissions, safe waste disposal (hazardous and nonhazardous).	- Need specific procedures for drilling byproducts, chemical usage, and potential brine disposal. - Project must incorporate specific measures into the ESMP for safe disposal

Thematic Area / WB ESS	Somaliland Laws & Policies	WB ESS Requirements	Identified Gaps & Implications for the Project
	drilling mud disposal or noise/dust emissions. - Somaliland Water Act addresses sustainable abstraction, though detailed implementing rules can vary.	- Emphasizes resource efficiency measures (energy, water).	of drilling fluids and cuttings, dust suppression (e.g., water spraying), noise control (e.g., mufflers), proper storage and disposal of lubricants and fuel, and use of solar-powered systems to minimize diesel use where feasible.
ESS4: Community Health & Safety	- No single "Community Safety" law; relevant elements found in Environment Management Act and local planning regulations. - Disaster risk management is decentralized.	- Manage traffic, construction hazards, security risks, and community exposure to communicable diseases. - Address potential infrastructure safety (e.g., water tank design).	- Gaps in cohesive community safety legislation. - Project must establish and enforce community safety measures at each site: install temporary fencing, restrict access to borehole areas, post visible warning signage in Somali language, and engage a trained safety focal point. Develop and communicate emergency response procedures to both workers and community members. Coordinate health messaging (e.g., sanitation, disease prevention) with local health authorities.
ESS5: Land Acquisition, Restrictions on Land Use & Involuntary Resettlement	- Land frequently under customary tenure. - Somaliland Land Tenure Policy (draft) outlines recognition of communal lands but not fully implemented. - Environment Management Act can require compensation if environmental damage	- Ensures fair compensation and resettlement for physically/economically displaced persons. - Encourages voluntary land donation protocols if relevant.	- Clear legislative gaps around formal land registration and compensation. - Identify and document all land acquisition through signed agreements with landowners or elders. Ensure documentation meets ESS5 Voluntary Land Donation (VLD) protocols (including due diligence and grievance options). Avoid any land take that would result in physical or economic displacement.

Thematic Area / WB ESS	Somaliland Laws & Policies	WB ESS Requirements	Identified Gaps & Implications for the Project
	or land confiscation occurs.		
ESS6: Biodiversity & Sustainable Management of Living Natural Resources	- Environment Management Act can protect ecologically sensitive areas, but enforcement remains limited. - No specialized biodiversity law.	- Requires screening for impacts on critical habitats, endangered species, and requiring offsets if critical habitat is affected.	- Potentially insufficient local capacity for thorough biodiversity assessments. - Borehole drilling must avoid or mitigate habitat fragmentation; ESMP should identify if rangeland or protected areas are impacted.
ESS8: Cultural Heritage	- Constitution references safeguarding Somali culture and heritage. - Implementation under the MoECC or Ministry of Tourism & Heritage is limited.	- Mandates identification, avoidance, and "chance finds" procedure for tangible or intangible cultural resources.	- Gaps in formal cultural heritage surveys or site registries. - Integrate a formal "chance finds" procedure into contractor agreements. Before site works begin, consult with local elders and religious leaders to identify any known cultural, sacred, or historical resources in the area. Document outcomes in the ESIA. Train crews to stop work and notify supervisors if heritage items are uncovered.
ESS10: Stakeholder Engagement & Information Disclosure	- Environment Management Act requires some public consultation for ESIAs; though not always systematic. - National Environmental Policy emphasizes community	- Demands meaningful, inclusive consultation with project-affected parties. - Requires a functioning Grievance Mechanism (GM) accessible to communities.	- Limited local legislation on thorough stakeholder engagement. - Maintain a stakeholder engagement plan with a schedule for continued consultation throughout implementation. Engage women, youth, and pastoralists through targeted meetings. Ensure materials are translated into Somali and shared orally where literacy is low. Set up a culturally appropriate, accessible

Thematic Area / WB ESS	Somaliland Laws & Policies	WB ESS Requirements	Identified Gaps & Implications for the Project
	involvement but lacks full procedural detail.		Grievance Mechanism (GM), with records maintained and responses tracked.

Key Observations from the Gap Analysis

ESIA Procedures: Somaliland's Environment Management Act requires ESIAs for major projects, aligning relatively well with ESS1. However, enforcement capacity and technical guidelines may need strengthening to match the depth of analysis prescribed by the World Bank.

Labor Protections: Somaliland's framework protects basic worker rights; however, ESS2 is more detailed and explicit about child labor prohibition, worker accommodation standards, and the need for dedicated grievance mechanisms for laborers.

Land and Resettlement: Formal land titling in Somaliland is still evolving, and usage rights frequently revolve around clan-based customary law. Under ESS5, the project team must document voluntary land donations or any partial land acquisition thoroughly to avoid disputes.

Stakeholder Engagement: Although local laws call for public input in an ESIA, ESS10 requires a structured, continuous approach to community engagement, with special attention to minority groups and women, plus a robust Grievance Mechanism.

Implementation Capacity: Regardless of statutory alignment, limited capacity within government agencies could hamper enforcement. Project-level processes (e.g., ESMP, training local stakeholders, independent monitoring) will be essential to fill gaps.

2.3. World Bank EHS Guidelines

The World Bank General EHS Guidelines are directly applicable to the project and must be integrated into project planning, construction, and long-term water management. Adhering to these standards will minimize environmental damage, enhance worker and community safety, and ensure the sustainable use of groundwater resources.

EHS Guidelines on Water and Sanitation

Table 6 EHS Guidelines on Water and Sanitation

Project Component	Relevant EHS Guidelines (2007)	Key Requirements / Measures
Groundwater Abstraction	Protect recharge zones; identify and control contamination sources	Define the recharge area; assess vulnerability to contamination and overuse; implement land-use controls and monitoring programs near the abstraction point.
Drilling & Construction	Address chemical exposure, noise, confined space hazards	Use PPE, establish confined space protocols, install barriers and noise controls; provide training and emergency procedures for chemical and physical hazards.
Wastewater / Drill Fluids	Treat waste fluids and brine; avoid discharge without treatment	Reuse or treat drilling wastewater on-site; avoid surface discharge; evaluate impacts on soil and groundwater if land application is used.
Sludge & Solids Handling	Analyze sludge content; avoid dumping in open areas	Determine whether sludge is hazardous or non-hazardous; store in lined, protected areas; dispose in accordance with local or WHO requirements.
Chemical Use & Storage	Manage chlorine, hypochlorite, and other disinfection chemicals safely	Store in ventilated, secure areas; separate incompatible chemicals; use corrosion-resistant containers; minimize storage volumes.
Sanitation at Campsites	Ensure safe septic system design and regular maintenance	Use sealed septic tanks or improved pit latrines; plan for periodic safe desludging; avoid raw discharge to environment.
Occupational Safety	Prevent injuries, exposure to pathogens, and hazardous gases	Train workers in hygiene and safety; implement fall protection, and emergency planning.
Community Health	Prevent contamination of drinking water sources; ensure secure wellhead protection	Monitor for potential leaks or backflow; design wellheads and pump houses to prevent tampering or contamination; coordinate with community health authorities.
Monitoring	Implement regular water quality, sludge, and emissions monitoring	Establish baseline and operational monitoring protocols; maintain calibrated instruments; report findings to regulators and stakeholders.

2.4. Institutional Roles and Responsibilities

Below is an overview of the main government and project-specific institutions involved in implementing and supervising the project, as well as the roles each entity plays in ensuring full compliance with project standards.

Ministry of Environment and Climate Change (MoECC)

Created under Environment Management Act, the MoECC is the primary authority responsible for environmental oversight and enforcement in Somaliland. It sets policy, develops guidelines, and approves (or rejects) the ESIAs of projects considered to have significant environmental impacts.

The Department of Environment Protection (DEP) within MoECC examines the submitted ESIA documentation for compliance with national regulations and the ministry's operational guidelines. Once satisfied with the ESIA findings, the ministry grants an environmental clearance, typically in the form of an Environmental Certificate or Approval Letter. Through site visits, document reviews, and audits, MoECC monitors compliance. If infractions are found—such as pollution breaches or unauthorized land use—MoECC can issue improvement orders or, in severe cases, suspend project activities.

MoECC regularly consults with other entities (e.g., Ministry of Water Resources Development, local authorities) for projects involving natural resources, such as water. It also collaborates with international partners, ensuring environmental standards remain consistent with best practices and donor requirements.

Ministry of Water Resources Development (MoWRD)

Oversees Somaliland's water sector governance, including issuing water abstraction permits, managing water resource mapping, and coordinating with local districts on water infrastructure projects. The Somaliland Water Act provides the legal basis for regulating water usage, ensuring sustainable groundwater extraction and equitable distribution.

Any entity wishing to drill, rehabilitate, or significantly alter a borehole must obtain a permit from MoWRD. Applicants typically provide hydrogeological data, usage plans, and ESIA approval from MoECC. Through its engineering and hydrogeological departments, the ministry can advise on best drilling practices, coordinate design reviews, and give technical clearance for pump installation and distribution systems. MoWRD tracks water extractions (where feasible) to prevent over-abstraction. It may also impose quotas or limit pumping rates if aquifer depletion is likely.

The Ministry works alongside local governments (district councils, water committees) to identify high-need areas, address water conflicts, and manage community-level water committees that often operate the distribution systems.

Relevant District Authorities

Districts typically handle land-use planning, resolving minor disputes over communal or private land, and issuing local construction permits in line with broader MoECC and MoWRD guidelines. Where farmland or pastoral lands may be affected, district authorities help facilitate voluntary land donation or compensation discussions with landowners or clan elders.

District councils often host initial stakeholder meetings, mobilize communities, and contribute to local-level grievance resolution. If land acquisition or potential resettlement (physical or economic) is required, district authorities should help ensure that ESS5 and national requirements on compensation or documentation are carried out.

They can conduct site inspections, especially to assess local labor usage and confirm compliance with safety or land-use regulations. Districts also can act as liaisons between the community, the project, and national ministries when questions of enforcement arise.

Project Implementation Unit (PIU)

The PIU is typically embedded within the Ministry of Water Resources Development (or a joint arrangement with MoECC) but may include contracted specialists (environmental, social, engineering) financed by the World Bank or other donors. It ensures day-to-day project coordination, from feasibility and design to procurement, construction oversight, and capacity-building for local water user committees.

The PIU's environmental and social specialists often prepare ESIA documents, manage stakeholder consultations, and develop the ESMP. They help ensure alignment with World Bank ESS, national legislation, and relevant district-level conditions. Where there are gaps or new requirements, the PIU typically bridges them with project-specific measures.

The PIU tracks project progress against E&S indicators, including GBV, and compiles periodic reports for MoECC, MoWRD, the World Bank, and other stakeholders. If challenges arise—like community complaints, worker grievances, or environmental noncompliance—the PIU can help organize appropriate mitigation or corrective actions and report back to both ministries.

Contracts for drilling companies, civil works, or suppliers often define compliance obligations under the ESMP, including site safety, worker conditions, and waste management. The PIU ensures these standards are included in bidding documents and that contractors adhere to them.

Compliance Monitoring and Enforcement

Compliance Monitoring

- Internal Monitoring (PIU): The PIU's environmental and social staff conducts regular site checks, reviews contractor performance, and compiles internal compliance data.
- External Monitoring (Government)**:**
    - **MoECC**: Periodic inspections to verify ESIA/ESMP implementation, pollution control, biodiversity protection.
    - **MoWRD**: Monitors groundwater usage rates, checks well construction specs, ensures alignment with the Water Act.
    - **District Authorities**: Oversee local-level labor usage, land-related issues, and minor grievances.

Enforcement Actions

- Improvement Orders or Warnings: If minor noncompliance (e.g., inadequate dust control) is detected, MoECC or MoWRD can issue corrective orders with a clear timeline.

- Stop-Work Notices: For major violations—such as drilling without a permit, hazardous waste dumping, or serious breach of safety—authorities can suspend operations until the issue is rectified.
- Penalties or Legal Action: In cases of repeated violations or environmental damage, national law allows for fines, revocation of licenses, and, if necessary, court proceedings.

Key Takeaways

MoECC has the legal mandate to review ESIAs, certify environmental compliance, and undertake on-site inspections.

MoWRD grants water abstraction licenses and ensures the borehole's technical soundness and sustainable extraction rates.

District Authorities facilitate local-level coordination, community engagement, and minor dispute resolution.

The PIU manages day-to-day project operations, integrates environmental and social safeguards into procurement and construction, and acts as the main liaison between government agencies, contractors, and the community.

By clearly defining each institution's roles—along with establishing monitoring schedules, reporting lines, and enforcement protocols—the project can maintain robust oversight from inception to post-construction operations, thereby upholding both Somaliland law and World Bank requirements.

3. Project Description

3.1. Project Location and Layout

The borehole project is located in Qoolbulale village, situated in the Salaxley District of the Maroodi Jeex Region in western Somaliland. The village lies close to the Somaliland–Ethiopia border, making it a vital water access point not only for the resident population but also for transboundary pastoralists who move across the border during dry seasons. The terrain is characterized by flat to gently undulating rangelands, used primarily for livestock grazing. The site is located in a semi-arid zone, with highly variable rainfall and prolonged dry seasons, which have intensified the community's dependence on groundwater.

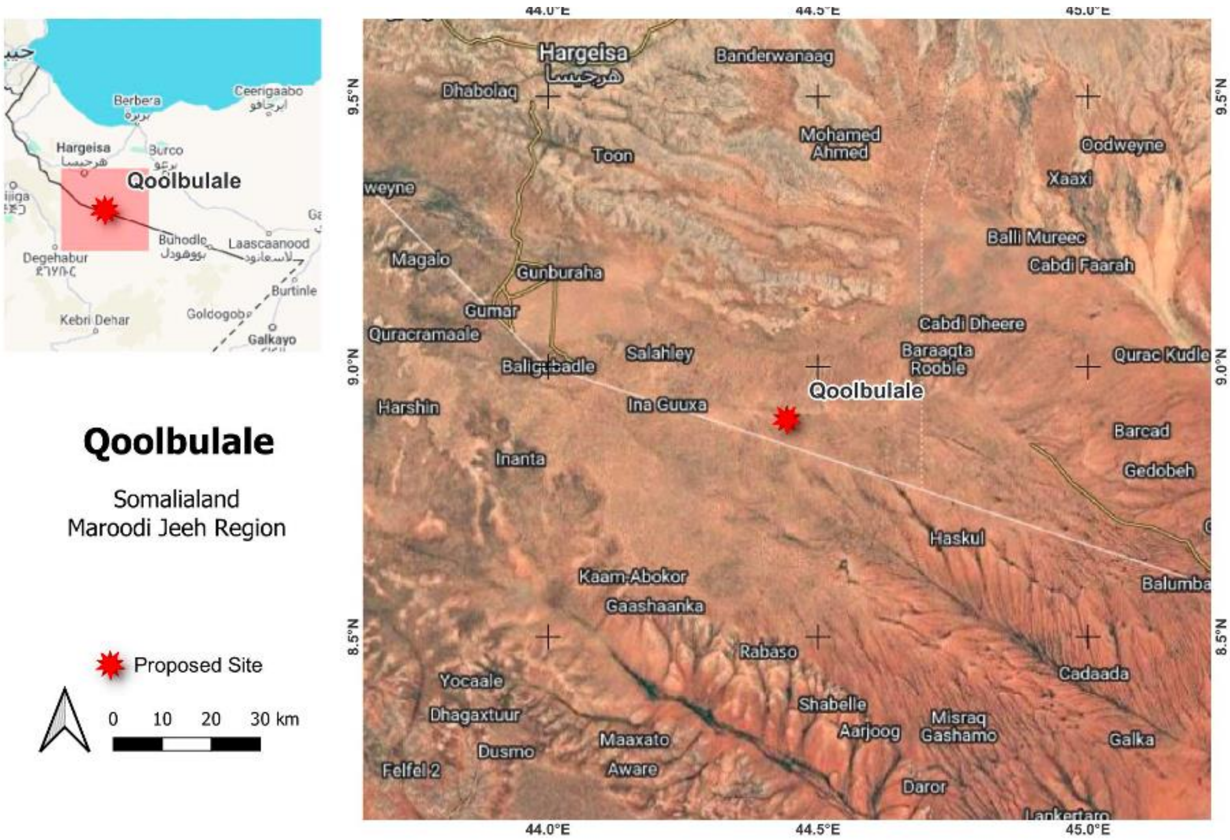


Figure 2 Project location. The white line is the international border between Somalia and Ethiopia.

The borehole will be drilled to an estimated depth of 500 meters, targeting the Yesomma Sandstone aquifer, which has been identified through hydrogeological assessments as a sustainable and high-yielding groundwater source. The precise borehole location was selected to ensure maximum accessibility while minimizing environmental disruption, therefore the PIU must ensure that the borehole is not drilled more than 200m from the site selected by the engineering consulting firm to help ensure a higher likelihood of success. The drilling site lies approximately 350 meters southeast of an existing haffir dam, a seasonal water body that currently serves as the primary, though unreliable, water source for the village. The site is also close to the main settlement area, allowing distribution of water while avoiding intrusion into sensitive grazing zones.

By placing the borehole in a location that is both close to people but away from sensitive areas, the project layout has been carefully designed to ensure efficient water distribution, reduce user conflict, support safe human-livestock interaction, and allow for easy access by women, children, and vulnerable groups. It also incorporates sanitation features and drainage channels around water points to prevent waterlogging and pathogen spread. The borehole system will be managed by a community-based Water User Committee (WUC), and its layout allows for secure, equitable, and climate-resilient access to water in one of Somaliland's most water-stressed areas.

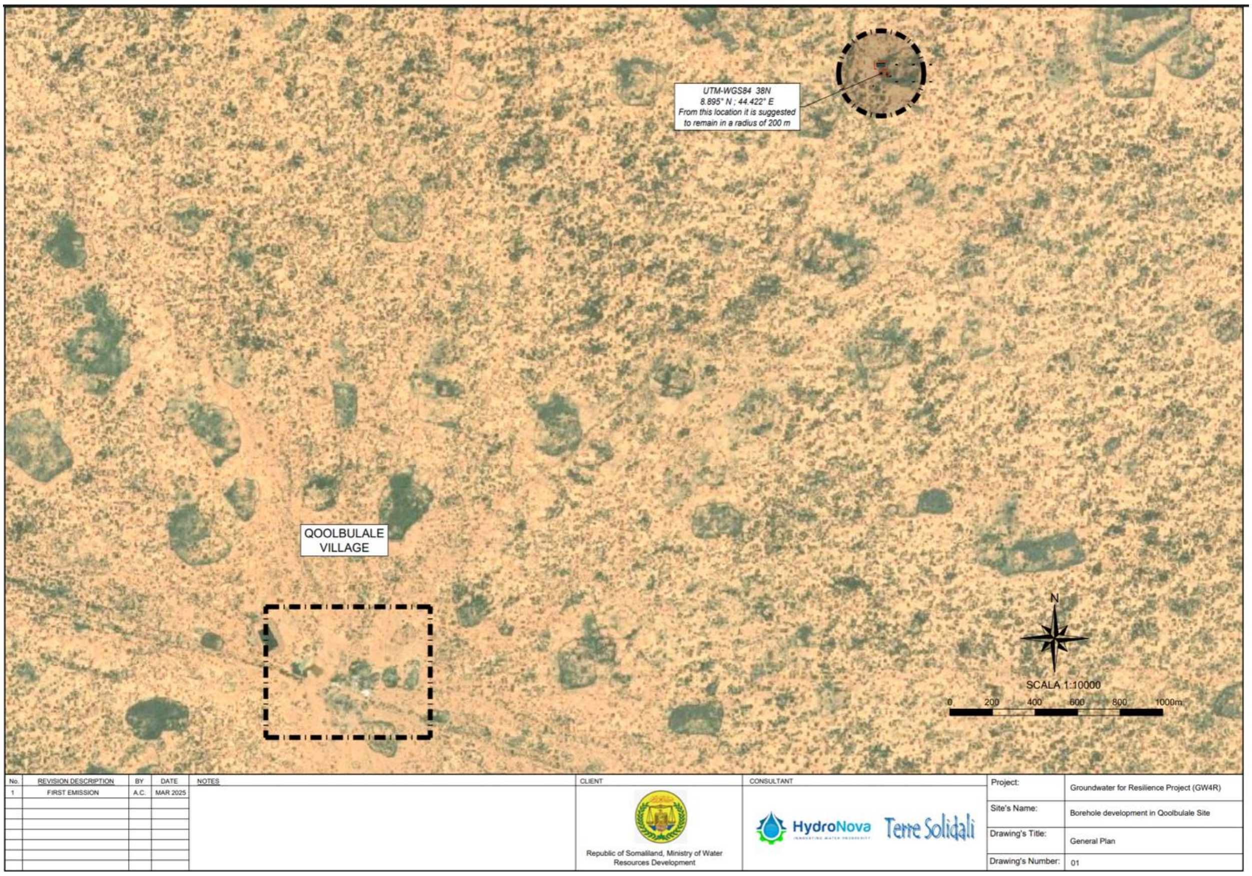


Figure 3 Project Location

The term of the Water User Committee will be one year. Members will be elected during a community engagement session after the drilling is successfully completed. A minimum of thirty to forty percent of members will be women, and members will be individuals who are willing to volunteer, are residents of the area, and possess basic literacy in reading and writing in the local language. The water tariff will be determined by the committee, with a general guidance framework for tariff setting to be developed in support of this process.

Figure 4 Layout of Project Components

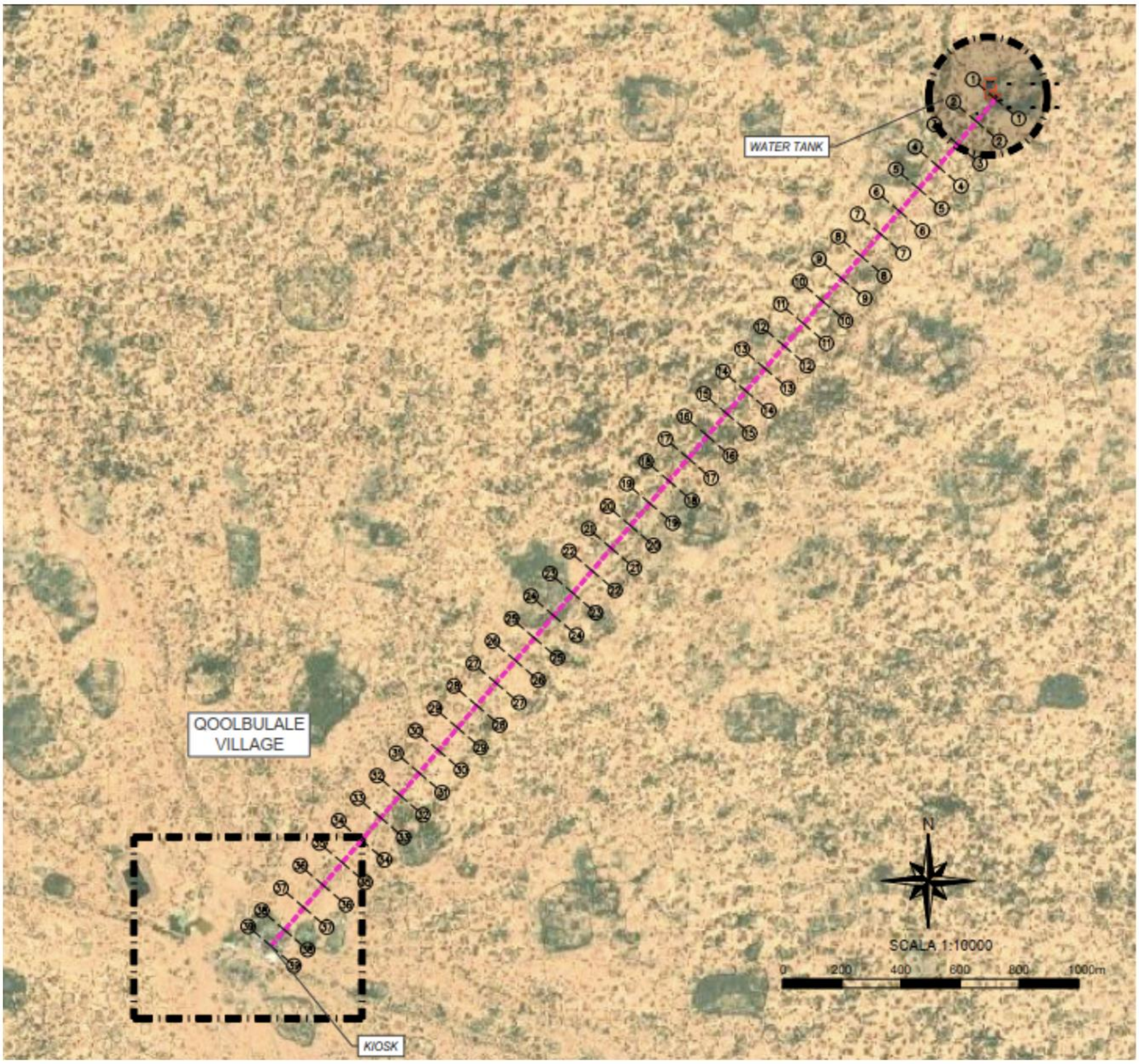


Figure 5 Pipeline to connect the borehole to the village

The overall layout of the project includes several integrated components. In addition to the borehole, the infrastructure will consist of:

- A 3.7km pipeline connecting the borehole to the village;
- A submersible pump connected to both solar power (photovoltaic field) and a diesel generator for hybrid operation;
- A 30 m³ elevated steel water tank on a reinforced concrete platform for gravity-fed distribution;
- 2 six-tap water kiosk, centrally located within the village;
- Three animal troughs for camels/cattle and three for sheep/goats, situated at appropriate distances from the human water points to reduce congestion and contamination risk;
- A watchman house for on-site security and management;
- Fenced perimeters for critical infrastructure components to protect against vandalism or accidental damage;
- Solar panel arrays for powering the pump system, installed on a secure mounting frame;

- A small generator house to store and operate the backup diesel generator during periods of low solar availability.
- A UV filter and reverse osmosis (RO) system, to treat the water. UV disinfection should ensure 0 detectable E. coli per 250 mL at the point of consumption; RO will reduce salinity (TDS), fluoride, nitrate, arsenic, and many other dissolved substances below WHO standards.[3]

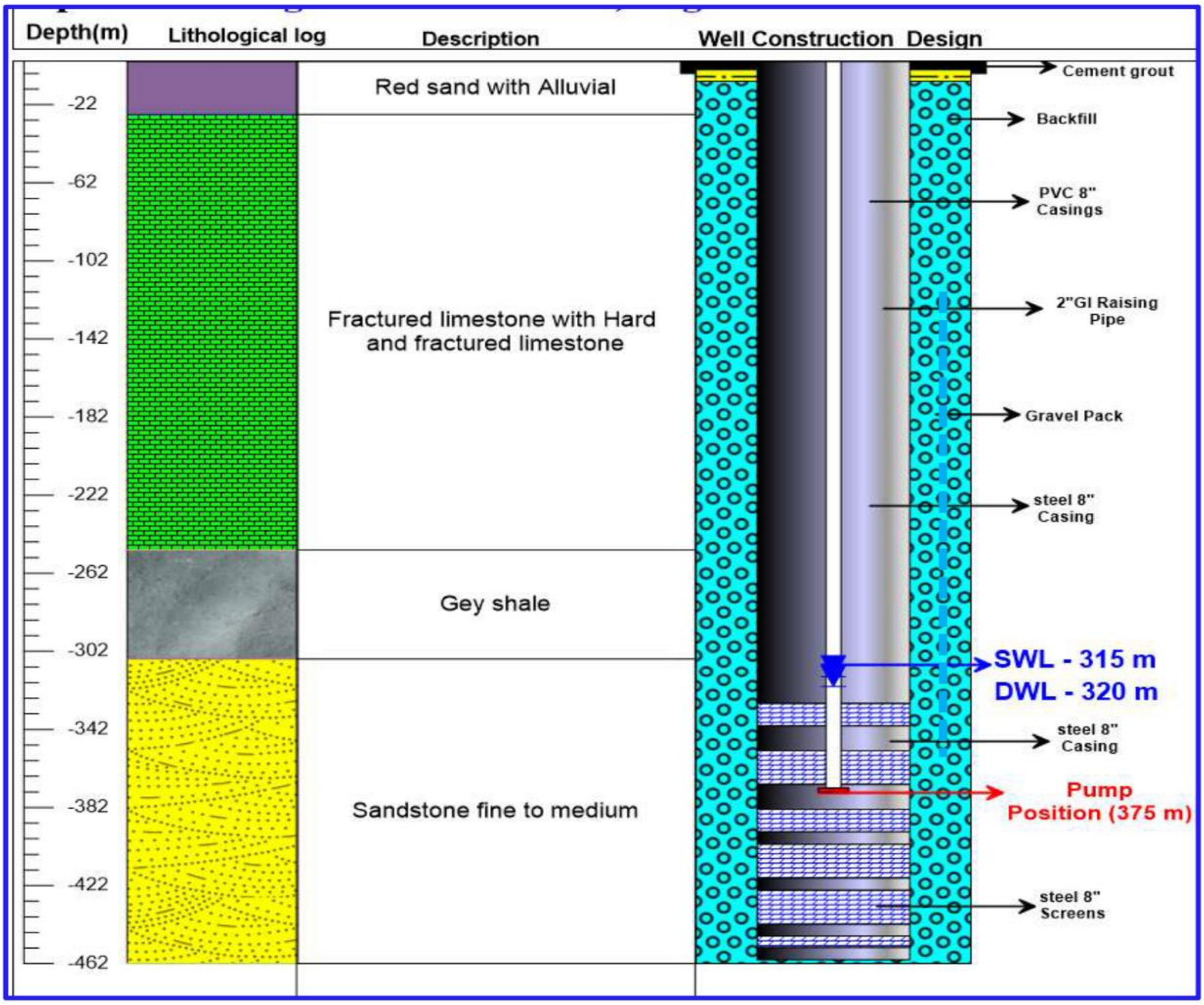


Figure 6 Cross section of borehole

[3] The WHO aesthetic standard is < 1500 μS/cm EC, considerably lower than the Somali Water Development Agency (WDA) limit of 3,500 μS/cm. The standards for both WHO and WDA are given in the Legislation chapter.

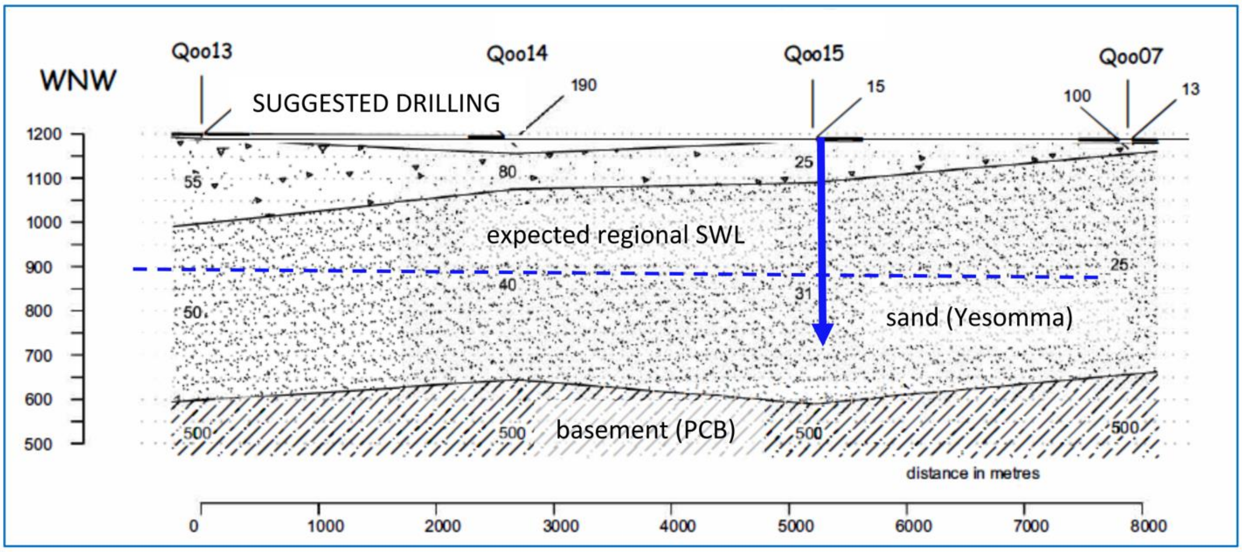


Figure 7 Geological cross section

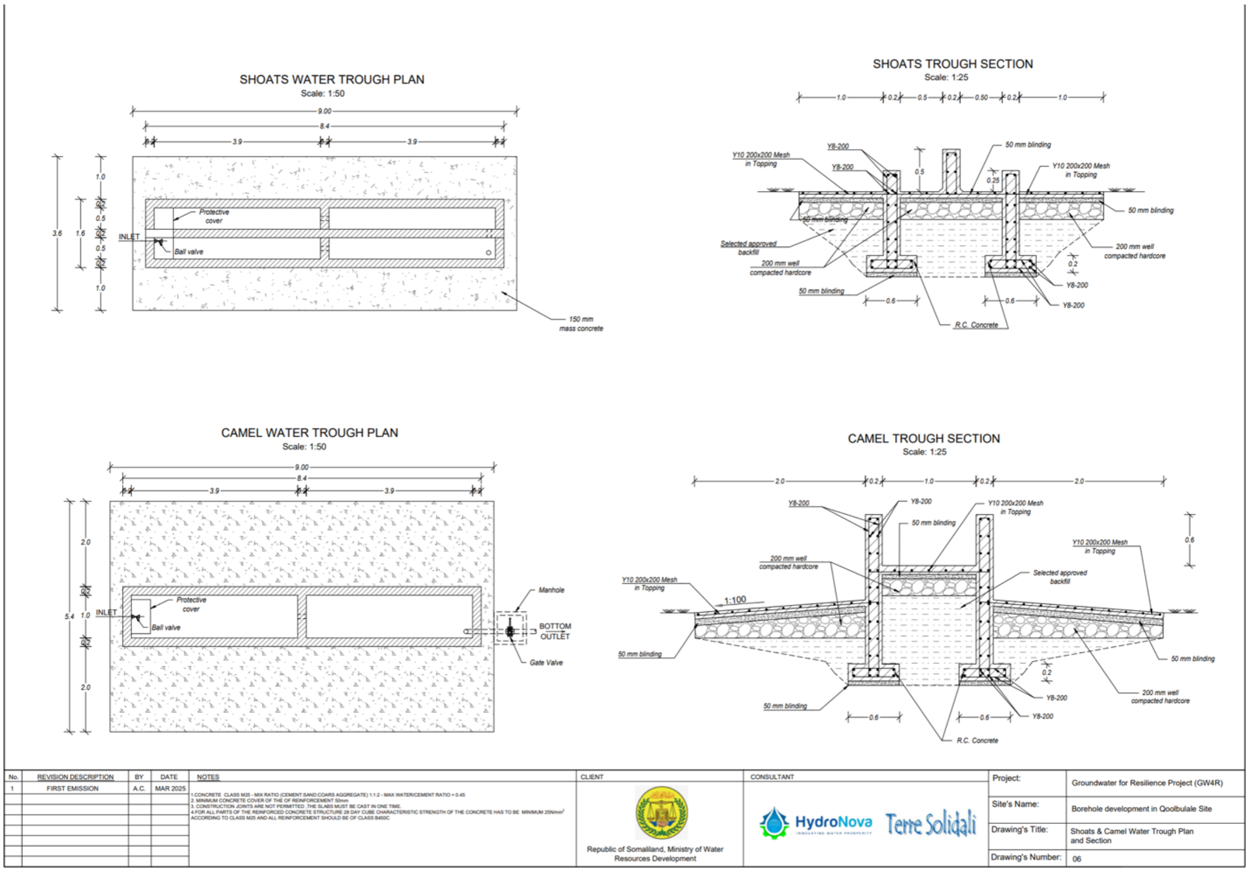


Figure 8: Design of Animal Troughs

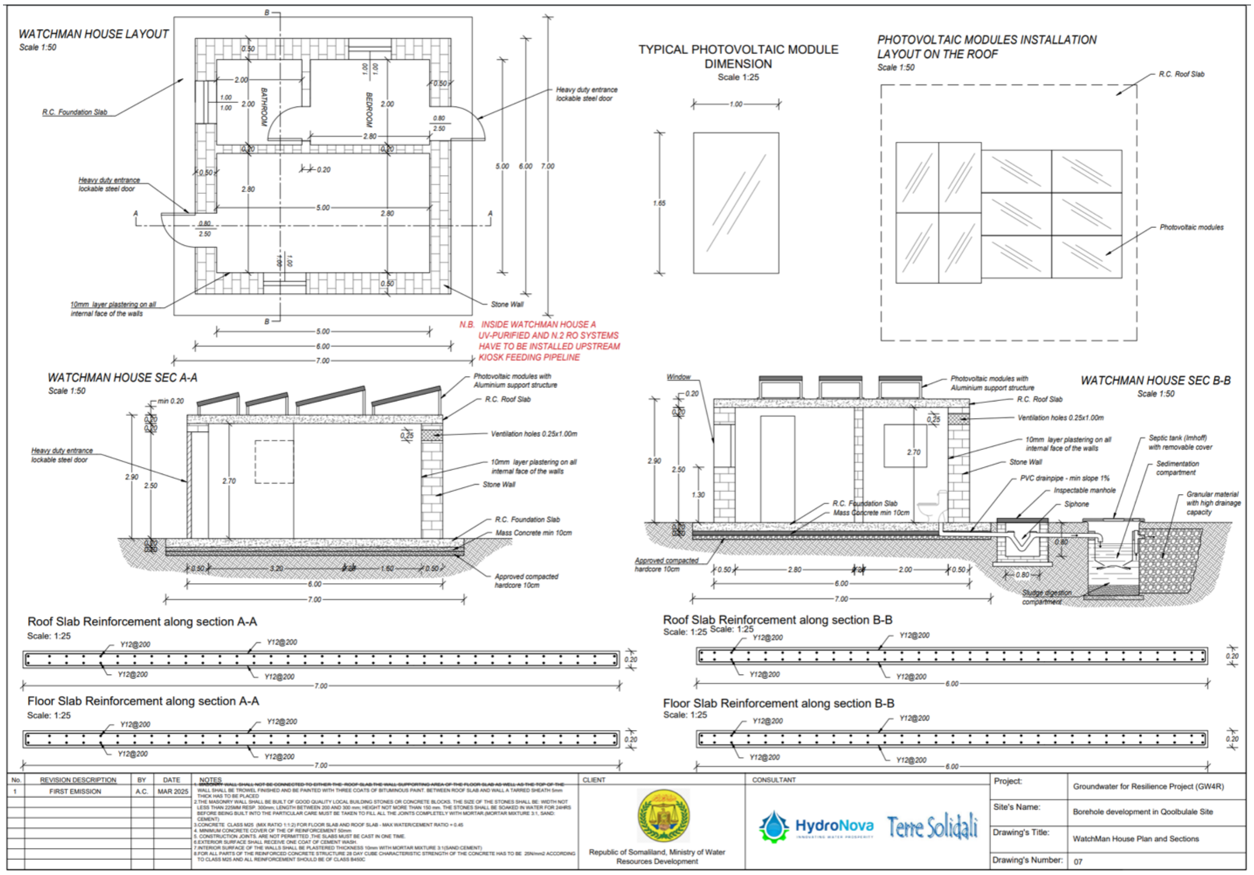


Figure 9: Design of Watchman House and PV Roof

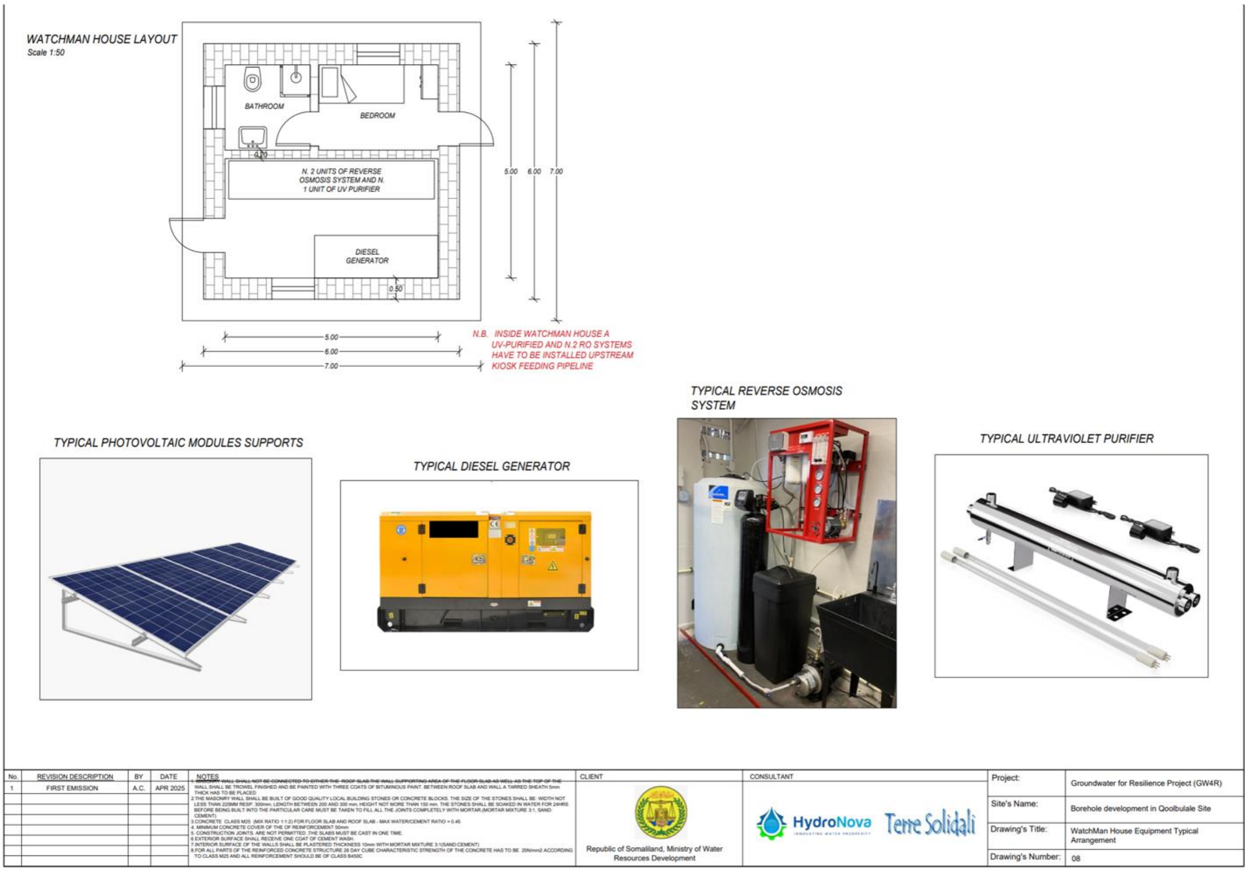
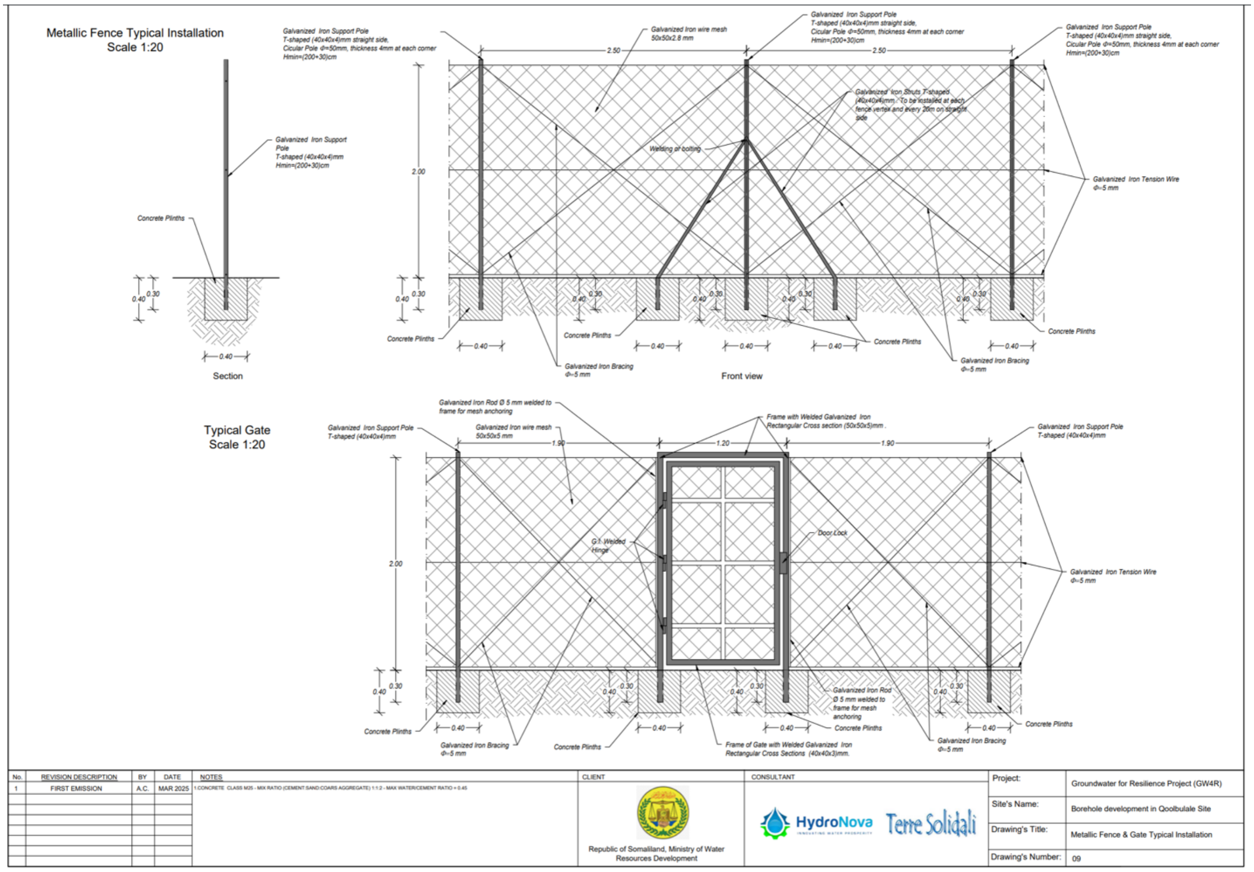


Figure 10 Elements of the Watchman House and PV Roof



3.2. Pipeline

A 3.7km pipeline will connect the borehole to the village. In the village, there will be two kiosks for the community to withdraw the water.

The pipes (bars / rolls) will be made of high density polyethylene sigma 80 PE 100, non-toxic, suitable for the transport of drinking water and / or for the transport of food fluids, in compliance with the UNI EN 12201 standard and hygiene requirements health. The material supplied must be guaranteed by test reports issued by qualified bodies. The Works Management may have acceptance tests carried out by an authorized institute, at the expense of the supplier and on a sample of the material supplied, in compliance with the standard.

The pipeline will be buried at a minimum depth 110cm below natural ground level. They will be suitably leveled and compacted, with a degree of compaction not less than 90% Proctor standard. Compaction will be carried out every cm 20 of carryover and any other charge to give the work finished in a workmanlike manner and according to the instructions given by the Engineer. The pipe must be positioned with the correct alignment and with a slope according to the project levels, must not be damaged by shocks or by incorrect use of the machinery used for laying and compaction. Pressure class PN 10 bar.

The following tests will be conducted to ensure functionality, safety, and durability before the system is commissioned. These include:

1. Pressure Testing (Hydrostatic Test): To verify the pipeline can withstand its designed operating pressure without leaks or failure.

Method: The pipeline is filled with clean water and pressurized to 1.5 times its maximum operating pressure, typically held for a period (usually 1–2 hours) while monitoring for pressure drops or visible leaks. Often based on ISO 4427, AWWA, or manufacturer specifications.

2. Leak Testing: To detect and locate any leaks at joints, fittings, or pipe segments.

Method: May be done as part of pressure testing or separately using low-pressure air or water with visual inspection along the pipeline route.

3. Flow Testing: To ensure adequate flow rate and delivery capacity from the borehole to the kiosks.

Method: A controlled volume of water is pumped through the pipeline and flow rate (litres per second) is measured using a flow meter or calibrated container and stopwatch.

4. Flushing and Disinfection: To remove debris, dust, and potential microbial contamination before use.

Method:

- Flushing: High-velocity water is run through the pipeline until the discharge runs clear.
- Disinfection: A chlorine solution (e.g., 50 mg/L) is introduced and held for a prescribed time (often 24 hours), followed by flushing until residual chlorine levels are safe.

5. Visual and Alignment Inspection: To ensure the pipeline is properly buried, supported, and free of physical damage or improper connections.

Method: Conducted throughout and after installation, often before backfilling, especially at joints, valves, and high-stress points.

Vents

There will be the installation of a dual function automatic vent for emptying or filling the pipe with a guided float. The materials include:

- PFA 10-16-25 bar.
- Flanging PN 10-16-25.
- Body and upper flange in ductile iron GS400-15 EN1563.
- Lid and protection grill in stainless steel.
- Float, float guides, guide ring and gasket seat in ABS.
- Stainless steel fixing screws.
- EPDM lip seal replaceable for maintenance.
- Internal and external coating with epoxy powders minimum thickness 250micron.

The minimum air flow that the vent must guarantee is a pressure of 0.2 bar, and must not be less than 1000 m3/h for DNs up to 65mm, and 2000 m3/h for larger DNs. The perforated connection flange will be constructed according to EN1092-2 and ISO7005-2 standards. The allowable storage temperature range is –20° / 70°C; allowable operating temperature 0° / 40°C. The vents must comply with the transport of drinking water. This item is comprehensive of an isolating gate valve before vent pipe.

There will also be the installation of gate valve in ductile iron with an oval body and internal screw. The body and cover should be in GGG50 cast iron with non-toxic food-grade epoxy coating, wedge coated in NBR/EPDM elastomer, stainless steel shaft, bronze nut; flanged and drilled in accordance with EN 1092-1. Operating pressure PFA 16 (1.6Mpa). Gate valves compliant with the transport of drinking water.

Kiosks

There will be two kiosks to distribute the water. They will be comprised of the following components:

	Site clearance		
1	Prepare site by stripping top 200 mm of soil to remove all debris including sand (if any) from site and carting away spoil	m^2	2.88
	Excavation		
2	Excavate for foundation strip commencing at stripped levels depth not exceeding 1.50m deep and removing surplus materials from site	m^3	0.48
	Filing		
3	300 mm thick approved hardcore filling spread, well rammed and compacted in 150mm layers to receive concrete surface bed	m^3	0.86
	Concrete work		
4	Mass concrete M20 (Mix Ratio 1:1.5:3, 28 DAY CUBE CHARACTERISTIC STRENGTH OF THE CONCRETE HAS TO BE MINIMUM 20N/mm2), not reinforced; all works and materials included as per TS; including all temporary and auxiliary works., not reinforced; all works and materials included as per TS; including all temporary and auxiliary works. 100mm blinding layer under foundations	m^3	0.29
5	Reinforced concrete Class M25 (28 DAY CUBE CHARACTERISTIC STRENGTH OF THE CONCRETE HAS TO BE A MINIMUM 25N/mm2), all works and materials (incl. Reinforcement bars) included as per TS; including formworks and all temporary and auxiliary works to have a complete work accordingly to the drawings and as directed by the engineers Kiosk main structure	m^3	0.81

6	Concrete Manhole 600mm x400mm complete with cover	LS	1.00
Water Supply System			
7	Supply & Install Galvanized mild steel pipes class "B" medium thickness with and including joint, curves, fittings and whatever to connect the structure to the pipe coming from the reservoir and to complete the work as per drawings or as directed by the engineers: 25mm diameter inlet pipe chased through wall 6m long with fittings (elbows, tees, etc) and whatever necessary to complete the work according to relative drawings or directed buy the engineers	m	9.00
8	Supply & Install Galvanized mild steel pipes class "B" medium thickness with and including joint, curves, fittings and whatever to connect the structure to the pipe coming from the reservoir and to complete the work as per drawings or as directed by the engineers: 25mm diameter brass gate valve with wheel and head , complete with 6 water outlets and all connecting pipes.	No	1.00

3.3. Sensitive Features Within the Project Influence Area

The project area, while largely comprised of open rangelands and communal grazing zones, includes several environmental and social features that must be considered in project planning and implementation. These features have the potential to be directly or indirectly affected by borehole drilling and associated infrastructure if appropriate safeguards are not put in place.

One of the key sensitive features is the haffir dam, located approximately 350 meters northwest of the borehole site. Although seasonal, the dam serves as a vital traditional water source for both residents and mobile pastoralists, especially during the rainy season. While the borehole will reduce reliance on this surface source, care must be taken to ensure that groundwater abstraction does not alter local hydrological balances or negatively impact the dam's recharge. Additionally, water user arrangements must be designed in a way that does not create conflict between users of the new borehole and those who still depend on the dam during transitional periods.

Figure 11: Water structures in the area of interest: haffir, balley and berkads in the community

Socially, the area is marked by the presence of transboundary pastoralist migration routes, particularly from Ethiopia. These migratory pathways are essential for livestock movement during dry seasons and are governed by customary grazing and water-sharing agreements. Introducing a permanent water source may alter these movement patterns, increase livestock concentrations, and create competition or tensions over access, particularly between resident households and nomadic groups. Furthermore, there are informal settlement clusters and small businesses near the village center which may expand toward the borehole due to improved water access. This raises the risk of unregulated settlement growth and encroachment onto communal grazing land.

No formally designated protected areas or cultural heritage sites were identified within the immediate project footprint; however, sacred trees and customary communal spaces used for clan gatherings and conflict resolution may exist near the village center. These sites must be respected during infrastructure placement, particularly in the siting of the kiosks in the village. In addition, the borehole may attract new settlement or commercial activity, necessitating land-use controls and active engagement with elders and the Village Development Council to protect socially important areas. As part of the ESMP, a chance find procedure will be adopted to ensure that any culturally significant materials discovered during construction are handled appropriately.

Drilling Mud

For this project, water-based drilling mud (WBM) will be utilized. This choice aligns with good international industry practice due to its lower environmental footprint compared to oil-based alternatives. Water-based muds are non-toxic, biodegradable, and pose minimal risk to groundwater quality or soil integrity. Their use reduces the risk of long-term contamination and simplifies handling, transport, and disposal procedures, which is especially beneficial in sensitive pastoral and agro-pastoral environments where communities depend heavily on natural resources. To mitigate any potential impacts associated with the disposal of WBM, the project will implement a suite of measures including the use of lined containment pits to prevent infiltration, careful monitoring of drilling fluids, and dewatering followed by safe disposal of residual solids in designated, approved locations.

Table 7 Drilling Mud Management

Aspect	Management Measure
Initial Containment	Drilling mud and cuttings will be collected in a lined waste pit (HDPE or compacted clay) located at least 50 m from any watercourse or well.
Separation	Solids allowed to settle and decant clear water for reuse in circulation
Drying and Stabilization	Settled solids will be allowed to dry and stabilized using lime or cement if required.
Reuse/Disposal of Cuttings	Dried cuttings can be reused as fill material. Otherwise, they will be removed to an approved disposal or encapsulation site.
Final Pit Closure	After completion, the waste pit will be dewatered, backfilled with clean soil, and compacted to prevent erosion or water collection.

Lifetime of the Well

The presumed lifespan of the borehole is 20 years, which is conservative. The typical life of a well-maintained deep borehole is 25 to 50 years. The optimistic scenario with proper management is 50+ years. With poor maintenance it can be less than 15 years. Factors that can shorten lifespan include inadequate data during drilling (especially in poorly mapped geologies), overuse or unmanaged abstraction, contamination from latrines, livestock, poor community management or vandalism and lack of maintenance culture.

Project Timeline

The following table outlines the general timeline and key activities involved in the development of a typical borehole.

Table 8 Project Timeline

Phase	Duration	Key Activities
Drilling and Construction Phase	2–3 Months	Site mobilization, borehole drilling, pump testing, preliminary water quality analysis
Pipeline Installation	1–1.5 Months (conditional)	Procurement of materials, trenching, laying of 3.7 km HDPE pipeline, valve chambers
Commissioning and Handover	0.5–1 Month	Integrated system testing (borehole + pipeline), community training, formal handover
Post-Implementation Monitoring	6–12 Months (Ongoing)	Water quality and yield monitoring, E&S audits, grievance resolution, adaptive feedback

Notes:

- The Pipeline installation will only proceed if the borehole yield meets design thresholds (typically 5 L/s or greater for this context).
- Duration estimates for the pipeline assume dry-season work, minimal topographical challenges, and proximity to local labor/materials.
- Total pre-operational timeframe: ~4–5.5 months, contingent on borehole productivity confirmation and procurement efficiency.

3.4. Project Phases

The implementation of the project will follow a structured, multi-phase process designed to ensure technical quality, environmental and social compliance, and long-term sustainability. The project phases include: (1) Planning and Mobilization, (2) Construction and Installation, (3) Operation and Maintenance, and (4) Decommissioning or Rehabilitation (if applicable). Each phase includes distinct activities, stakeholder engagement processes, and environmental and social risk management tasks.

Planning and Mobilization Phase

This phase establishes the foundation for project execution and ensures readiness across technical, logistical, and governance dimensions. Key activities include:

- Completion and approval of the ESIA and ESMP.
- Final surveys and site verification to confirm borehole location and drilling depth.
- Community mobilization and formation or strengthening of the Water User Committee (WUC).

- Land-use agreements and documentation, including consent from traditional authorities and the Village Development Council.
- Procurement and contracting of a qualified drilling contractor, including review of their environmental, health, and safety (EHS) compliance capacity.
- Site clearing and establishment of temporary facilities (e.g., laydown area, access route improvements).
- Mobilization of drilling equipment, materials, and personnel to the site.

Construction and Installation Phase

This phase involves the physical implementation of infrastructure and is typically the most impactful in terms of environmental and social risks. Key activities include:

- Drilling of the borehole to the target depth (approx. 500 meters) using rotary drilling equipment.
- Well casing, screening, gravel packing, and sanitary sealing to protect groundwater from contamination.
- Test pumping and water quality analysis to confirm yield, aquifer reliability, and suitability for use.
- Installation of a submersible pump and connection to both solar and diesel-powered energy systems.
- Construction of ancillary infrastructure, including:
    - Elevated steel water tank and reinforced concrete tower.
    - Water kiosk with six taps.
    - Animal troughs (three for camels/cattle, three for sheep/goats).
    - Watchman's house, fencing, and site security features.
    - Installation of the photovoltaic array and diesel generator with appropriate enclosures and wiring.
- Implementation of environmental mitigation measures, such as erosion control, safe waste disposal, and noise/dust suppression.
- Ongoing monitoring of contractor compliance with labor, health, and safety requirements.

The borehole construction footprint is typically 20m x 30m, including space for drilling and drill pad, equipment, tank, kiosk and other elements of the project. Clearing should be minimized and restored post-construction in line with the ESMP.

The laydown area is typically minimalist, mobile, and improvised. Based on similar projects, there will be an approximately 15m x 15m area where workers can place materials or tools. The entire laydown area is dismantled once drilling is complete; no permanent infrastructure is left behind (or erected in the first place). Construction normally takes 2-3 months.

Construction Methodology

All equipment, fixtures, installations and tools supplied by the Contractor must meet high technological characteristics, be of the best brands and comply with the national or international standards, or in their absence, with the rules of good execution, both for the quality of the raw materials, and for the manufacturing methods, dimensions, tolerances, acceptance tests and for anything else provided for by the current technical; they must, in any case, be suitable to replace the existing ones.

Therefore, the Contractor must provide the Client in advance with the technical specifications of the equipment and materials that are the object of each individual supply, the name of the suppliers and the location of their production plants, submitting the technical specifications and any certifications of tests and inspections for approval.

Each equipment must have, at the time of delivery, the following technical documentation:

1) n.1 copy of the maintenance manual;

2) n.1 copy of the corresponding catalogue sheet indicating the technical assembly characteristics;

The Company must, at any time, guarantee to the Client the execution of all tests and inspections on the supplies, deemed necessary and appropriate, both in the factory and on site.

Mobilization

Mobilization shall consist of the transport of all necessary manpower, drilling rig, tools, casing pipes and construction materials to the drilling site. Demobilization shall consist of clean-up work and operations including, but not limited to those necessary to the removal of personnel, equipment, and incidentals from the project site.

The Contractor shall also mobilize all the necessary materials such as water for drilling, drilling chemicals fuels etc, which are required during the progress of the works.

Drilling

The drilling is carried out up to a depth in the interval 400-500 m. However, the borehole can be stopped by the contracting authority and finalized also at a depth lower than 400 m. The contracting authority will appoint a supervisor for the drilling operations, who will be responsible, on behalf of MoWRD, for all activities related to drilling, completion of works and subsequent pumping tests. At the end of the drilling operations the supervisor will decide on the basis of the drilling logs, water quality etc. whether to finalize the borehole or to abandon it. The contracting Authority supervisor should be a geologist or a person with wide experience of boreholes drilling supervision.

The drilling site is near Qoolbulale village, Marodijeex region, in the area included between the coordinates are: 8.895° N, 44.422° E and 8.912° N, 44.460° E.

Expected Lithology and Water Levels

The material expected during the drilling is constituted by sand, silt and shales. It is not expected crystalline basement up to 600 m, but in case the basement is found the drilling shall stop after penetrating 10 m in it.

Groundwater is not expected up to 250-350 m of depth.

Drilling Methodology and Use of Additives

The drilling shall be executed with the only methodology of rotary with mud circulation, to face hole wall collapses. The use of bentonite may be required on the basis of specific conditions. The diameter of the drilling tools shall be suitable for the installation of 8" casing plus an annular space of 3" around the casing for the gravel pack installation, therefore no less than 14".

Centralizer

Borehole casings and screens shall be fitted into the open hole with centralizers placed at intervals of 20 m. Centralizers shall be made by plastic material or iron and of an approved design which does not hinder the installation of either gravel, backfill or cement seal.

Sampling

Samples from the cutting are taken each 2 meters, put in small transparent plastic bag and the depth interval to which the sample refers is written with black indelible ink marker. The samples are stored in a wooden or plastic box with small wooden dividing panels on which the depth is written with the same indelible markers. The wooden boxes are stored in a shady location and always available to the drilling supervisor.

Activity Recording

In a field book are registered all the operations done while drilling, including the drilling time per pipe length interval, the lithology, including grain size for sand, the drilling diameter, the use of temporary casing (and its diameter), each start and interruption of the operations, any machinery breakdown or hole collapse, and possible losses of circulation. It is requested to compile daily forms with all the data above described. In the notes shall be reported also the supposed or verified presence of water with the depth at which the water income occurred.

Gravel Pack and Piezometric Pipe

The gravel pack is made by quartz/feldspar type, selected rounded grains of diameter 3 - 5 mm maximum. The size is mandatory given the expected presence of fine deposits (fine sand and silt). Coarser gravel grains allow the passage into the hole of such deposits.

Before pouring the gravel pack, a piezometric pipe of 1" in U-PVC is installed in the annular space up to the half of the last (deepest) screened casing section. A maximum depth of 500 m is expected.

The gravel pack is washed to remove small particles then gradually inserted into the annular space around the casing. Its volume is measured before pouring. Verify the consistency between the theorical volume and the measured volume. Record the volume poured for the drilling report. During the borehole development by air and pumping gravel pack will be added as needed.

Casing

The casing shall be in PVC 8" to allow the installation of a pump with 6"diameter. The expected length is 300 m for the blind casing and 200 m for the screened sections. The screens are slotted 1-1.5 mm to allow a yield of 99-109 liters/minute per meter, open, with minimum thickness wall of 13,4 mm.

Borehole Development

Borehole development shall be limited to jetting, air lifting and over-pumping methods only. Any damage caused by development procedures shall be rectified by the Contractor to the supervisor's satisfaction. Not less than 12 hours of development pumping will be carried out.

Pumping Test

The pumping test is performed with a pump suitable for yields up to 5 l/s with a head of 400 m and 8” of diameter. The contractor shall provide, beyond the pump and the generator, a gate valve, a flowmeter, a piezometric probe or dipmeter (up to 500 m of length) and a calibrated EC-meter for the measurement of electrical conductivity. The EC-meter is calibrated on a standard solution of known conductivity, before the start of drilling operations. Field forms are supplied for each type of test. The test is followed by the drilling supervisor or by a person appointed by him/her.

The activity consists of 3 different tests, preceded by a test of one hour to verify the reasonable yield range of the borehole.

- Step Test: it is performed by 4 steps at growing yields, at ¼, ½, ¾ of the maximum expected yield. The last step is done at the maximum yield. The time of pumping for each step is 1 hour. The passage to each next step is done without intermediate recovery. After the last step is concluded, a recovery phase of 2 hours measurements is done. During the test, readings of the water level are taken in the time intervals indicated on the step test form. Flowmeter readings, EC and temperature are measured at the start of each step and in the last minute of the last step.

- Constant rate test: once the recovery from step test is completed at 100%, a constant rate test of 72 hours is performed. The yield is selected by the drilling supervisor, on the base of the results of the step test and specifically at a yield of ¾ of the critical yield. During the test, readings of the water level, of the flowmeter, of EC and temperature are taken in the time intervals indicated on the step test form. It is recommended to verify the pump yield each 12 hours calculating the time necessary to fill a 200 litres drum by stopwatch. No generators stops are admitted, in case a stop occurs to the generator, the test shall restart from time 0, after a full recovery of the water level. Before the end of the test a sample of 5 litres of water is taken for chemical analyses.

- Recovery: as soon as the pump is shut the recovery measurements start following the timing of the recovery form. The recovery is followed for a maximum of 10 hours or up to 95% of the whole draw-down is recovered by the water level.

Hole Protection

The annular space between the open hole and the PVC lining shall be filled to a depth of at least 2,0 m with a cement concrete to form the support base.

Operation and Maintenance Phase

Once construction is complete, the system is handed over to the community and relevant institutions for daily use and upkeep. This phase is long-term and involves both technical and governance responsibilities. Key activities include:

- Daily water abstraction and distribution via kiosk and livestock troughs, monitored by trained borehole attendants.
- Scheduled maintenance of pumps, solar equipment, generator, and pipework, including water quality monitoring.
- Collection of user fees and transparent financial reporting by the Water User Committee (WUC).
- Periodic training for WUC members and attendants on system upkeep, financial management, and conflict resolution.
- Implementation of the grievance mechanism to address complaints or disputes.
- Environmental monitoring (e.g., groundwater levels, vegetation recovery, erosion) as outlined in the ESMP.
- Community engagement to ensure inclusivity and feedback loops for operational improvements.

Upon completion of drilling, development, and successful testing, the borehole and all associated infrastructure will be formally handed over to the Community Water User Committee (WUC), established and trained during the construction phase. The WUC will receive full orientation on the system's technical operation, routine maintenance requirements, water quality monitoring, and record-keeping. Handover will include transfer of relevant documentation (as-built drawings, maintenance schedules, water quality records) and signing of a management agreement defining the roles, responsibilities, and cost-recovery arrangements. Continued support will be provided by the Ministry of Water Resources Development for periodic technical inspections and refresher training to ensure sustainable and equitable water service delivery in line with GW4R operational standards.

Decommissioning/Closure (if/when relevant): Well Closure and Decommissioning Process for a Non-Productive Borehole

In the event that the borehole drilled at Qoolbulale is determined to be unsuccessful—either due to lack of sustainable water yield, salinity or contamination exceeding acceptable limits, or adverse geological conditions—the borehole must be properly decommissioned and closed in accordance with good international industry practice (GIIP), national groundwater protection requirements, and World Bank safeguard expectations.

Decommissioning a failed borehole is essential to prevent the structure from becoming a physical hazard, a pathway for groundwater contamination, or a long-term liability to the community and environment. A poorly sealed well can act as a conduit for pollutants to enter otherwise protected aquifers or result in subsidence around the wellhead.

The closure procedure must be carried out by the drilling contractor under the supervision of the PIU and documented in full. The steps typically include:

- **Removal of all equipment and debris** from within the borehole;
- **Disinfection of the borehole** to eliminate any biological contamination;

- **Backfilling the borehole** with an appropriate sealing material such as neat cement, bentonite-cement slurry, or clean clay in stages to prevent settlement or water flow;
- **Cutting off the casing** at least 1 meter below ground level;
- **Placing a concrete cap or plug** over the sealed borehole to prevent intrusion;
- **Restoring the site** through removal of drilling infrastructure, backfilling of pits, and regrading to natural contours.

Where possible, the community should be notified and consulted prior to final closure, and signage should be posted during the process to ensure safety. The final location and closure status of the borehole should be reported to the national groundwater database and included in the project documentation.

Importantly, any drilling waste (e.g., spent muds, cuttings) generated during the failed drilling operation must still be managed and disposed of in accordance with the Site Waste Management Plan. Closure does not negate environmental responsibilities.

This precautionary protocol ensures that even if the exploratory effort fails to result in a viable water source, the site is returned to a safe and environmentally sound condition, and the integrity of the underlying aquifer is preserved for future use.

It should be noted the well will not be abandoned due to salinity. Instead, if the salinity exceeds 2,500 ms/cm, a desalination plant will be included to ensure water meets project standards.

3.5. Summary of Raw Materials and Inputs by Project Component

Site Preparation and Camp Setup

- Fencing materials and posts
- Small tools and consumables for camp construction
- Water for worker consumption and hygiene
- Diesel or petrol generators for lighting and small equipment
- Fuel storage tanks (for generators)

In this rural context, site preparation and construction will use light and medium equipment that can be transported along existing informal tracks, rather than large heavy machinery. Materials and components will be delivered using 4×4 flatbed trucks or smaller lorries, while personnel and light tools will arrive in pickup trucks. A small tractor-loader-backhoe or similar compact excavator may be brought in for trenching and foundation works if the track conditions allow; otherwise, excavation will be done manually with local labour. Water bowsers will deliver construction water, and portable diesel generators will provide temporary electricity for drilling, lighting, and small equipment. Welding sets, small concrete mixers, and fuel stored in drums within a bunded area will support construction tasks. Water for works will be trucked in, and separate male and female toilets will be provided for workers; these will be pit latrines, with the contents buried on site at the end of the works in accordance with safe sanitation practice. Waste will be managed on site in a designated collection area, with hazardous materials such as used oil stored securely until disposal.

Borehole Drilling

- Water for drilling mud preparation and circulation (>10,000 liters/day)
- Water-based drilling mud components (including bentonite as required)
- Foam (if needed for specific geological conditions)
- Diesel fuel for drilling rigs, compressors, and auxiliary equipment
- Steel casing pipes (203 mm plain and slotted)
- Gravel pack material
- Well screens
- Lubricants and coolants for drilling machinery
- Electrical power supply (diesel generator or grid connection)

Pumping System Installation

- Submersible electric pump
- Galvanized steel riser pipes
- Electrical cables and control panels
- Chlorine or other water treatment chemicals (for initial disinfection)
- Diesel generator or solar PV system for pump operation
- Battery backups (if solar or hybrid system)
- Water for pump testing and calibration

Storage and Distribution Infrastructure

Water Tank Installation

- Reinforced concrete (M20–M30) for foundations and support pads
- Pre-fabricated or welded steel water tanks
- Water for concrete curing
- Diesel or electric-powered concrete mixer

Pipeline Installation

- HDPE or PVC pipes (bars or rolls)
- Valves and fittings for flow control and connections
- Excavated soil and backfill materials

Ancillary Structures

Animal Troughs

- Masonry and concrete materials
- HDPE or steel piping
- Water for construction and cleaning

Watchman House

- Concrete, blockwork, roofing sheets

- Water for mixing materials and domestic use
- Solar panels or small diesel generator for lighting and appliances

Water Kiosks

- Concrete and reinforcement steel for foundations and slabs
- Blockwork or masonry for walls
- Roofing materials (corrugated metal or equivalent)
- Finishing materials: cement plaster, paint, water-resistant sealants

4. Environmental and Social Baseline

4.1. Physical Environment

Below is an overview of the physical environment in Qoolbulale. Each section draws on desktop research, project documents, and field surveys.

Rainfall Analysis

The assessment of precipitation in the area of interest is essential for identifying local rainfall patterns that may indicate the water availability and water needs of the population. For this analysis, data from ground weather stations provided by SWALIM and remotely sensed data from GPM (Global Precipitation Measurement) and TMPA (TRMM Multisatellite Precipitation Analysis) using TRMM (Tropical Rainfall Measurement Mission) data will be utilized. The available ground monitoring network alone cannot be expected to fully represent the area's diverse precipitation patterns, so remotely sensed data will complement these observations. GPM and TRMM, a joint mission of NASA and the Japan Aerospace Exploration Agency launched in 1997 to monitor rainfall for weather and climate studies, offer precipitation data at a 3-hour interval with a 0.25° x 0.25° spatial resolution. This dataset will be analyzed to assess its capability to accurately represent local precipitation compared to data from weather stations.

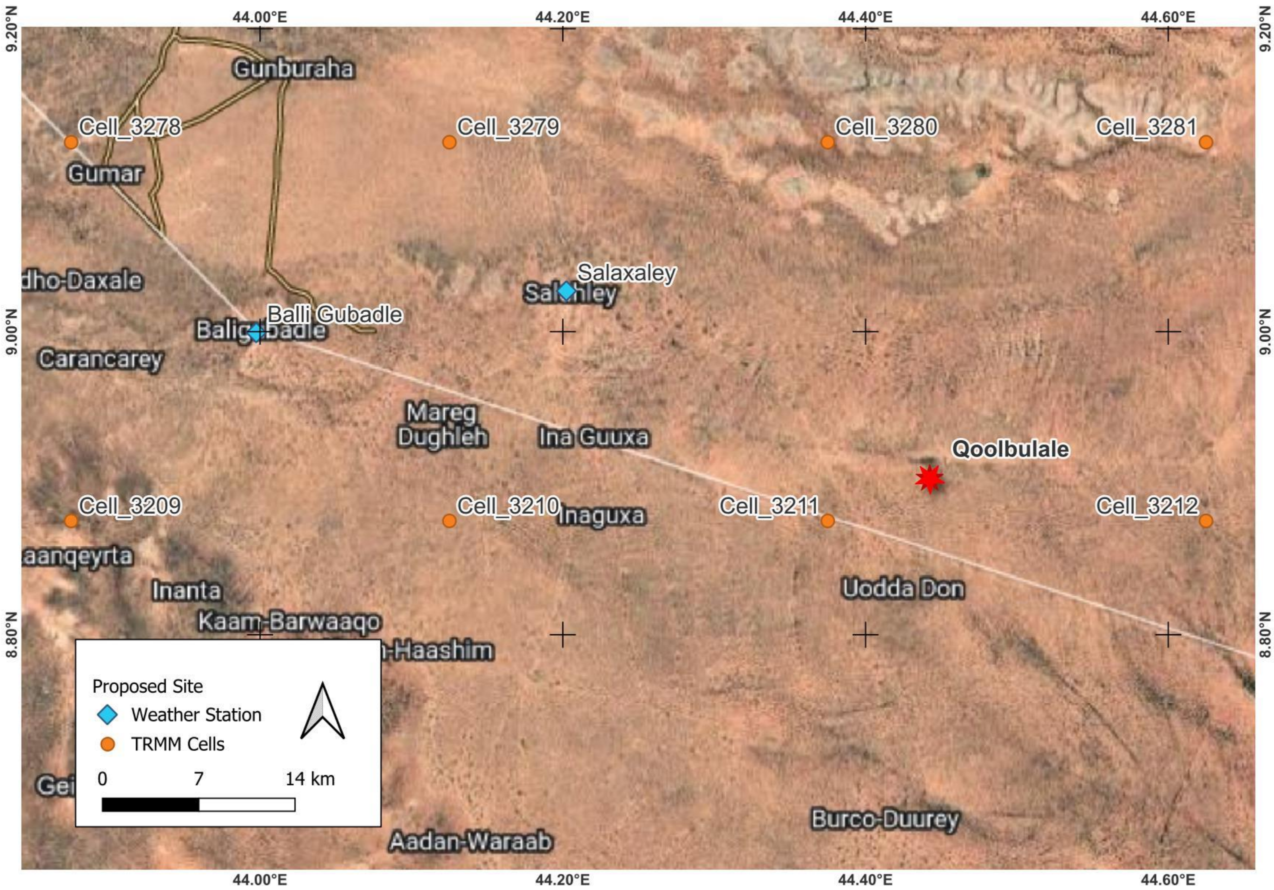


Figure 12: Location of the closest weather station and TRMM cell compared to the location of the site

An analysis was performed on the TRMM dataset, comparing the Balli Gubadle station (the closest with the longest series of data) with the closest TRMM cell available (3209 in the map above). The comparison of the two datasets considered both the monthly pattern and the average yearly values. As shown below, the analysis demonstrates a quite good correlation between the two records, with similar monthly patterns and a ratio between the average annual rainfall of the two-time series of 0.9 (this means that, on average, there is less than 10% difference between the recorded data and those provided by TRMM).

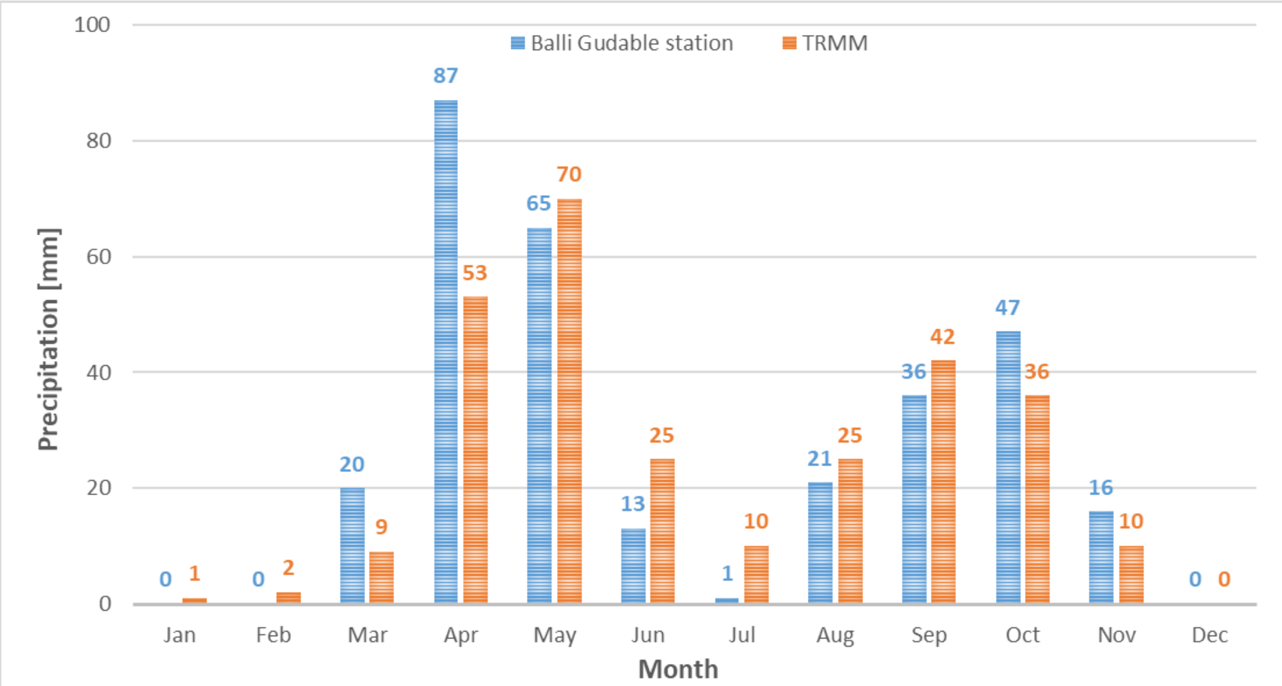


Figure 13: Average cumulative monthly rainfall data comparison between the Balli Gubadle weather station and the closest TRMM cell

Table 9: Comparison between the average cumulative annual rainfall between the Balli Gubadle weather station and the closest TRMM cell in mm

Weather Station	TRMM	Ratio
306	283	0.9

Given the distance between Balli Gubadle weather station and the location of the proposed site (about 50 km) and the satisfactory match between TRMM data and ground observed data, the TRMM dataset can be employed since it is assumed to be more representative of the rainfall in the area of interest, it provides data every 3 hours and has a longer series of data.

TRMM dataset is available for a total of 22 years. According to such records, average rainfall precipitation is 261 mm/year. The following figure shows the extent of the annual precipitation records.

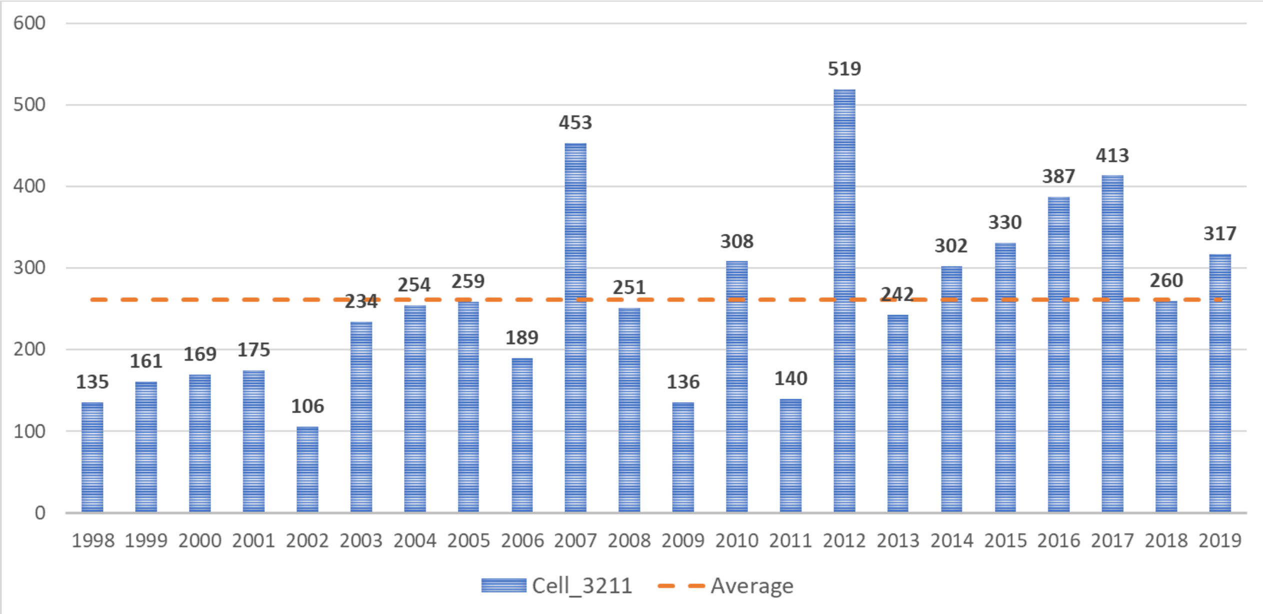


Figure 14: Cumulative yearly rainfall data of the cell 3211 of TRMM database

From the data available the average cumulative monthly was calculated and the average trend is presented below.

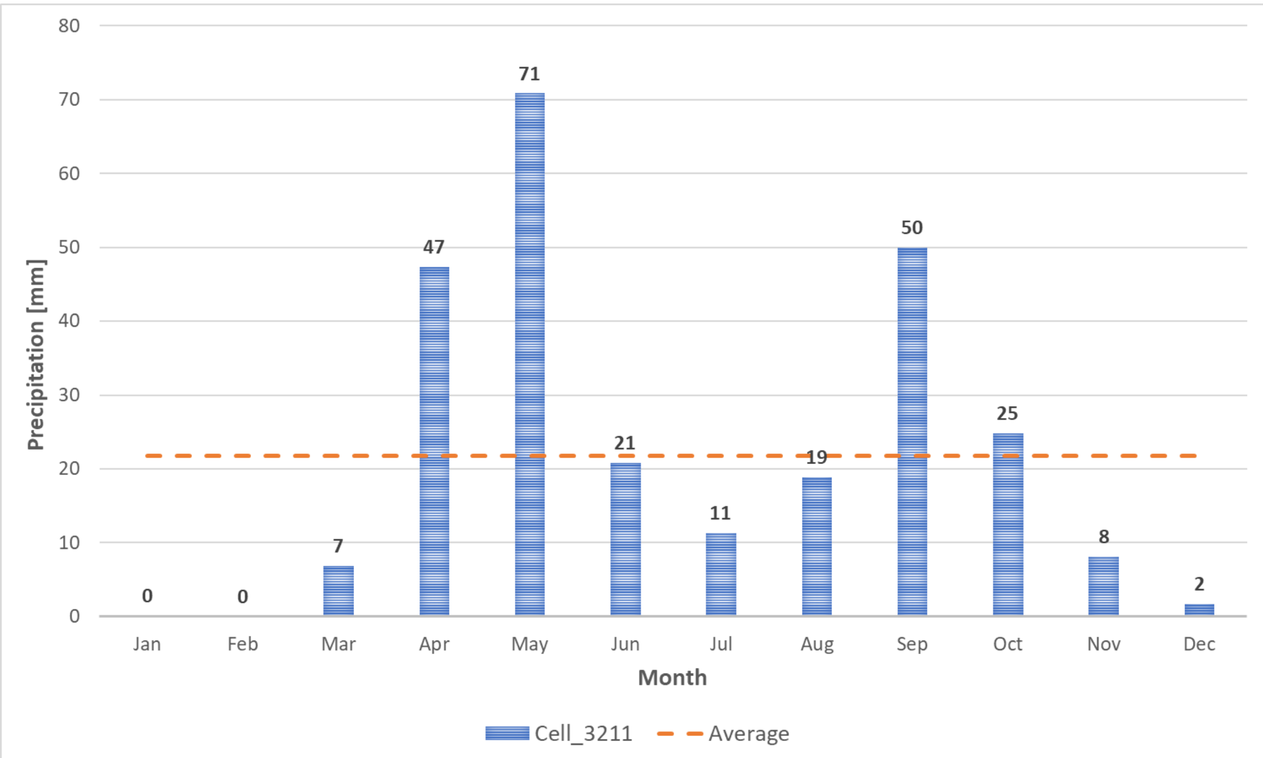


Figure 15: Average cumulative monthly rainfall data of the cell 3211 of the TRMM database (1998-2019)

According to the data, the rainfall peaks usually occur during the months of April/May and during September/October. The very dry period extends from November to March.

4.2. Hydrogeological Investigations

Geological Frame

The survey area is located near the border, approximately 46 km ESE of Bali Gubadle village. The regional geology consists of two primary geological units covered by a thin layer of alluvial-aeolian deposits from the Quaternary period:

- Yesomma Sandstones (Cretaceous): The Yesomma formation (Ky) is a continental unit composed of variegated quartz-rich sandstones and siltstones, primarily of fluvial-lacustrine origin. This unit extends over most of the Haud Plateau, typically reaching thicknesses of over 400 meters. In key tectonic trenches, such as the Nugal Valley and Xood Trench, this unit lies unconformably on Jurassic limestones. However, no data currently confirm the presence of Jurassic limestones in the border area near the study region. It is assumed that in the study area, the Yesomma Sandstones lie directly and, once again, unconformably on the basement rock.

- PRB (Precambrian Undifferentiated Basement): This is a complex of crystalline rocks, ranging from intrusive to metamorphic, that formed part of the ancient African Shield. It outcrops along the border between the Awdal and Marodijeex regions and at the northern edge of the Haud Plateau. The PRB has been encountered in most of the drill sites in the Marodijeex region, where its depth varies from less than 100 meters at Tog Wajale to over 350 meters in the Salaxley-Balli Gubadle area. In the study area, it is estimated to lie at depths exceeding 500 meters, although no drilling data exists for the area from Bali Gubadle towards the southeast. At Balidhiig, the PRB was not found, indicating it lies at a depth greater than 460 meters.

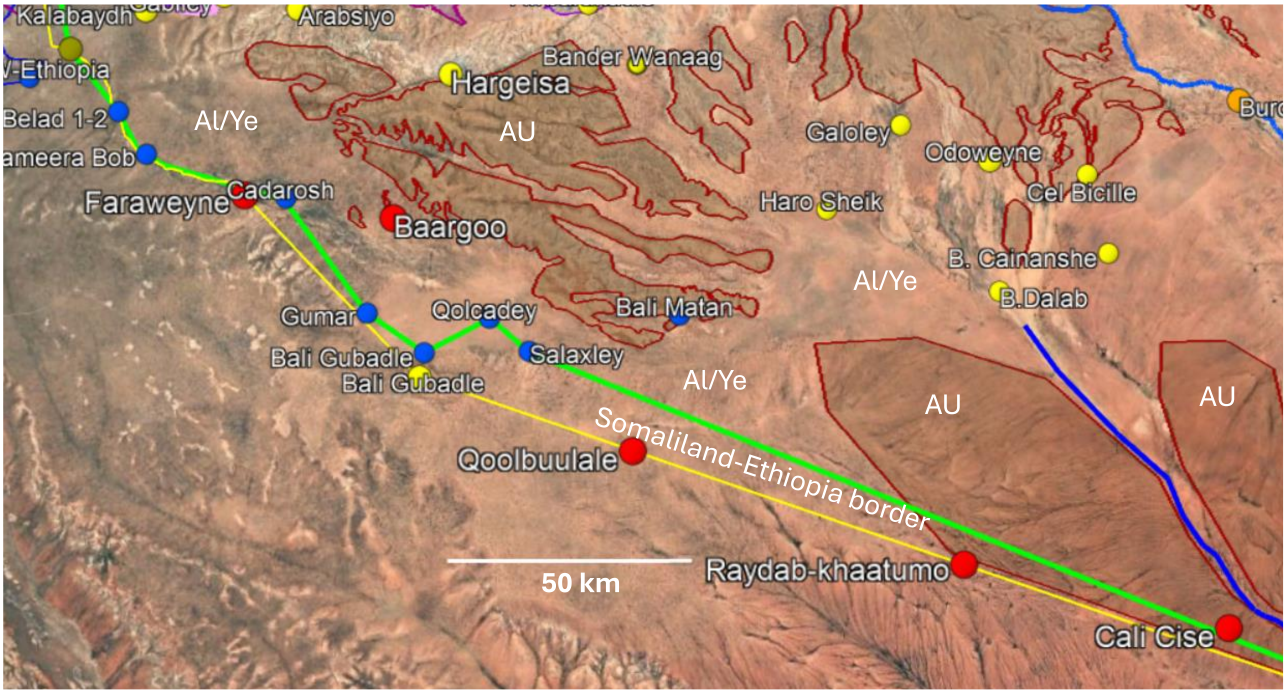


Figure 16: Geological map of South Somaliland – Al/Ye: Yesomma Sandstone, with alluvial cover – AU: Auradu Limestones – yellow line: border – green line: cross-section (also shown in figure below) – blue/green points: boreholes – red points: project proposed sites – map modified by Abate et Al (1994)

The Auradu limestones, though visible on the map, are absent in the Qoolbulale area. The closest, very small outcrops of these limestones are located near Salaxley.

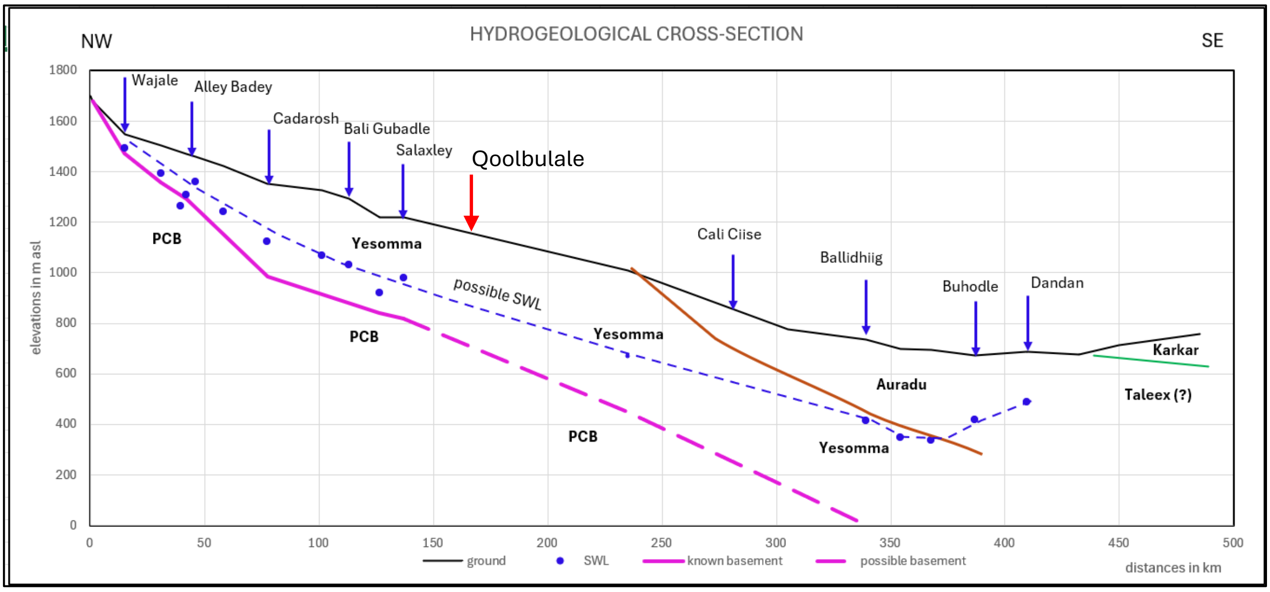


Figure 17: Hydrogeological cross-section along the Somaliland Ethiopia border

Hydrogeology

Along the border from Tog Wajale to Balidhiig, the aquifer is located within the sandy deposits of the Yesomma Formation. In the Marodijeex section, extending up to Salaxley, the static water level (SWL) lies close to the basement top, and the saturated section of the Yesomma Formation rarely exceeds 50 meters in thickness. As a result, the yields of drilled boreholes seldom exceed 10 m^3/hour. This limited yield may also be attributed to the abundance of fine deposits within the Yesomma Formation, the challenging drilling conditions, inadequate completion of some boreholes, and the restricted yield of submersible pumps that require significant power to lift water from depths of 200-300 meters.

Water quality measurements taken with an EC meter in July indicate medium-quality water (2,300-3,000 µS/cm) in the area from Geed Belad to Wadabarish and in the Bali Gubadle borehole. In contrast, water quality is poor in Gumar, Salaxley, and Shanshacade, and at Balidhiig it was not measurable, nor was it assessed during pumping tests.

According to this assessment, the aquifer in the study area is expected to lie within the Yesomma Formation, where sandy layers are predominant. The SWL is anticipated to be between 250 and 350 meters, with potential yields reaching 10-15 m^3/hour. However, the water quality in this specific area remains unknown.

The following table provides a summary of borehole data collected by the Ministry of Water Resources Development (MoWRD), listed in the SWALIM database, and reviewed during a field mission in July 2024. The mission inspected boreholes near the border, starting from Tog Wajale—where three new boreholes have recently been drilled—and continuing to Shanshacade and Balidhiig in Togdher. Unfortunately, most boreholes were temporarily closed due to heavy rains that had filled local valleys, which the population preferred as a water source. At some sites, no personnel were available to provide information on yield, daily pumping duration, or other operational data, and it was also not possible to collect water samples for EC measurement. However, the field geologist confirmed the presence of Precambrian basement (PCB) fragments near the boreholes, indicating that the basement had been reached during drilling.

Table 10: boreholes location and hydraulic parameters – PVB: Precambrian Basement

name	Latitude	Longitude	Depth	SWL	DWL	pump depth	Yield	pump time	Yield	EC	Status	Lithology
	decimal degree		m	m bgl	m bgl	m	m3/hr	hours	m3/day	µS/cm		
Tog-wajale 1	9.63330	43.36373	180	68.7		abandoned					not working	
Tog-wajale 2	9.63736	43.35383	180	67		155	12	3	36	3700	Active	
Tog-wajale 3	9.64334	43.40393	180	66.5		138	14	new		4650	new	PCB frag.
Tog-wajale 4	9.63769	43.38407	218	65	72	145	27	new		4500	new	PCB frag.
Tog-wajale 5	9.63481	43.37925	210	65	70	148	26	new		5457	new	PCB frag.
Geed Belad 1	9.48774	43.42720	144	sealed		232	3.5	0-23		2550	Active	
Geed Belad 2	9.48531	43.42803	160	sealed		146	2.5	0-23	10	2620	Active	
Walixdoor	9.42022	43.46156	216	174		210	10	0-18		2370	Active	PCB frag.
Dameera Bob	9.40679	43.48204	250	sealed		180	15	0-23			Active	PCB frag.
Cadaroosh	9.32703	43.74477	377	sealed		310	13.5	18		2800	Active	PCB frag.
Wadabarish	9.20625	43.79685	326	sealed		305	4			3020	not working	PCB frag.
Gumar	9.11774	43.90090	340	sealed	260	280	3	3	10	3600	Active	PCB frag.
Baligubadle	9.04583	44.00847	360	sealed		300	13	3	50	2790	Active	
Qolcadey	9.11047	44.12960	360	sealed		damage					not working	
Salaxley	9.05532	44.20271	400	300		362	11	5	55	4080	Active	
Salaxley new	9.06256	44.19918	400	borehole under completion. Drilling samples label (depth) not readable								
Balidhiig	8.37452	45.90854	462	320	No	370	11				not working	PCB frag.
Shanshacade	8.64969	45.95254	360	182		315	15	3	45	5010	Active	

Table 11: Location and hydraulic parameters of the boreholes along Somalia-Ethiopia border

name	Latitude	Longitude	Elevation	Depth (m)	SWL	Pump depth	Yield	pump time	Draw-Down	DWL	AqH//SCL	T	K	EC	Recovery 90%	Ye/PCB depth		Main Aquifer	Year	Agency	Region
	decimal degree		m asl	m	m bgl	m	m^3/hr	hours	m	m bgl	m	m^2/day	m/day	µS/cm	min	m					
Tog Wajale	9.60065	43.33477	1555	84	57		2.5	dried up								77	PCB	YE	2003	Africa 70	
Wado Godka	9.54815	43.42520	1530			abandoned for water salinity												YE	2005	Africa 70	
Geed Belad 1	9.48531	43.42803	1508	160	130		8.7	23						2450				YE	2005	Africa 70	
Geed Belad 2	9.48774	43.42720	1505	162	112		12.9	12	13.35	129	33	1.2E+02	3.6E+00		50	148	PCB	YE	2006	COSOB Co.	
Walixdoor	9.42010	43.46150	1480	216	150													YE	2019	SWALIM	
Dameera Bob 1	9.40679	43.48204	1471	200/212	>150/80	188	12/7							2870				YE	2005/14	A70/SWALIM	
Dameera Bob 2	9.40650	43.48180	1467	230	200				22									YE	2019	SWALIM	
Alley Badey	9.38700	43.51370	1459	180	100		7											YE	2014	SWALIM	
Wado Makail	9.35944	43.61015	1422	265	180		4											YE	2019	SWALIM	Marodijeex
Fararweyne	9.33240	43.66869	1401	270	245		4		12					2570	3			YE	2019	SWALIM	
Cadaroosh	9.32800	43.74579	1374	377	232.5	300	16	24	23	46.65	242	1.4E+02	2.4E+01		10	368	PCB	YE	2021	MoWRD	
Wadabarish	9.20602	43.79650	1384	300	225		16							3020				YE	2019	SWALIM	
Gumar	9.11774	43.90090	1327	340	257	300	9	72	3.45	260.5	41			1730	40			YE	2018	MoWRD	
Qolcadey 2	9.11047	44.12960	1223	376	300-330		4	7	2					3170	4			YE	2017	TS/SWALIM	
Qolcadey 1	9.08800	44.19152	1198	340	300	abandoned for low yield												YE	2019	TS/SWALIM	
Salaxley	9.05014	44.20447	1200	390	240		12	8						3300				YE	2022	SWALIM	
Bali Matan	9.11882	44.48454	1426	460	430		5	20						3160				YE	2022	SWALIM	
Balidhiig	8.37452	45.90854	736	462	320	370	18	24	3	323	80	4.2E+02	2.9E+00		10	306	YE	YE	2022	MoWRD	
Shanshacade	8.64969	45.95254	784	395	183	370	12	24	122	305	146	3.1E+00	1.5E-02		70			AU	2022	MoWRD	
Coodanle	8.33506	46.04233	700	350	320		8	5						1670					2022	SWALIM	
Xadhadhanka	8.29970	46.15640	696	360	333		16	24	not working in 2019 for problem to pump										2019	SWALIM	
Qori Lugud	8.56011	46.23796	741	354	176		16	12						1360					2022	SWALIM	Togdheer
Shangalli	8.28255	46.31196	656	398	239		18	12						3830					2022	SWALIM	
Buhodle 3	8.25550	46.31960	672	350	270	12	16	24											2022	SWALIM	
Buhodle 2	8.24664	46.32216	672	400	252	380	14.4	24	47	298.55	75.4	1.6E+01	1.04E-01	n.a.	240	397	YE	AU +YE	2021	MoWRD	
Qararrooyin	8.22000	46.35600	660	360	270																
Dandan	8.25140	46.52950	683	370	200	200	16	12						4280					2019	SWALIM	

data source	MoWRD	SWALIM	COSOB Co.	Africa 70	TS
red color	dried or abandoned or temporarily not working				

AqH//SCL	aquifer thickness/filters lenght
Ye/PCB	Yesomma/Precambrian basement

VES Survey

The survey was conducted with 15 Vertical Electrical Soundings (VES) using an AB/2max of 1,000 meters from September 10th to 14th, 2024. The VES layout was generally oriented between 100° and 130° E, in a direction roughly parallel to the border, with a few deviations due to accessibility constraints. VES 1 was conducted near Salaxley to correlate the current survey with a previous survey performed in the Salaxley area in 2007 by Africa 70, whose data are available.

In 2007, two additional surveys were conducted along a cross-section from Hargeisa airport to the border near Salaxley (denoted as "ton") and in the vicinity of Bali Gubadle (denoted as "BAG"). A preliminary re-interpretation of these datasets was undertaken to assess the regional geophysical model.

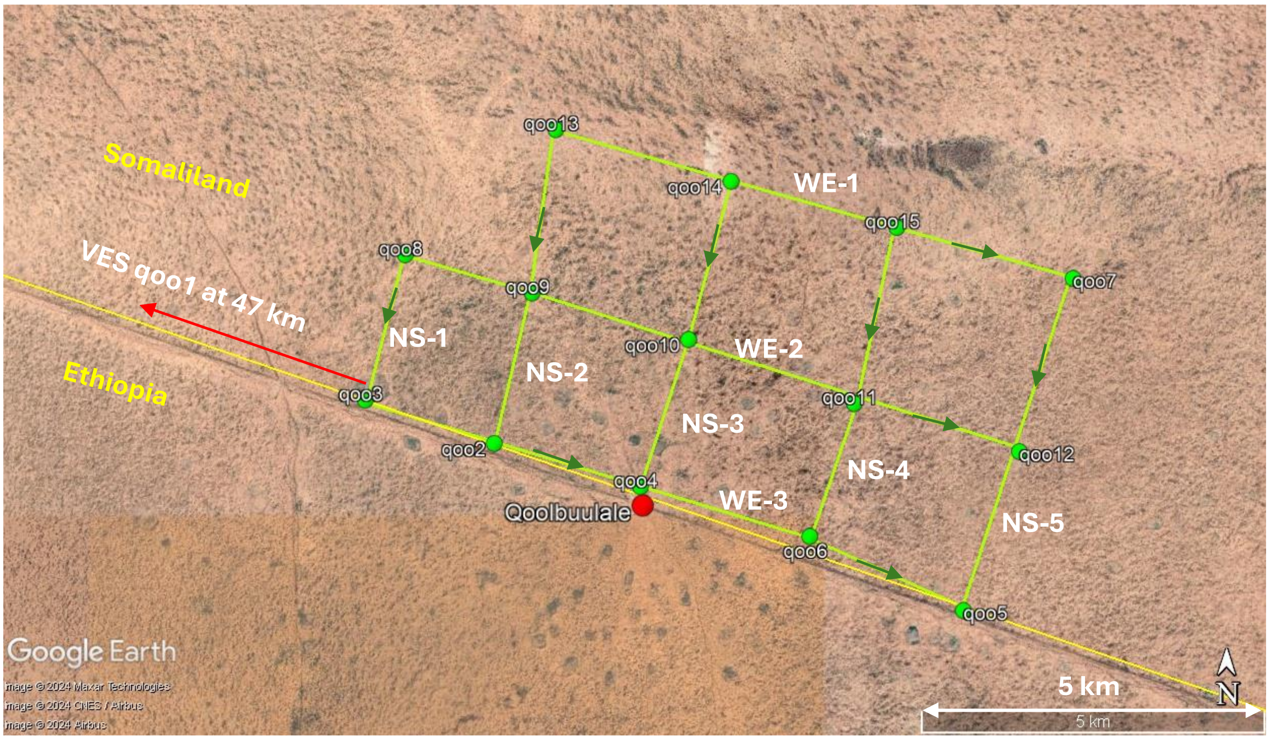


Figure 18: VES and cross-sections positions (green points and lines) – green arrows: cross-section direction – white letters: cross-section name – yellow line: Ethiopia – Somaliland border

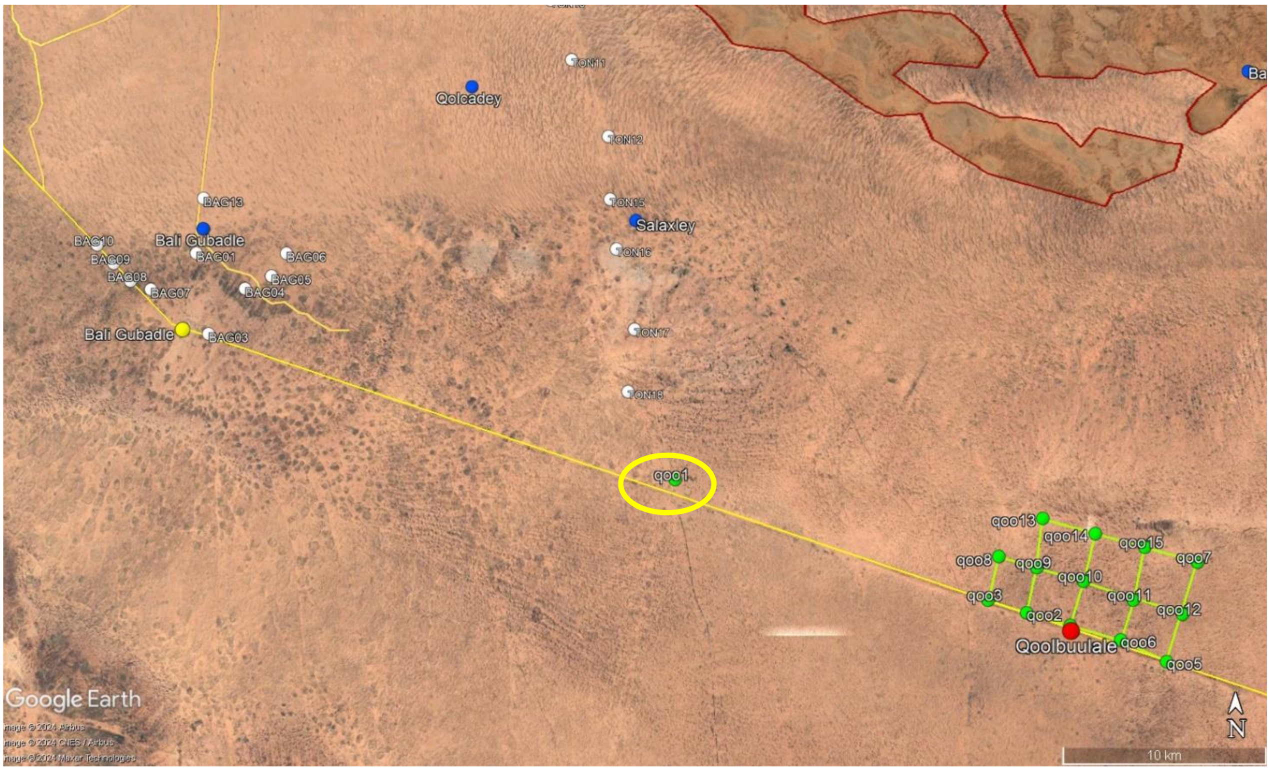


Figure 19: VES of the Qoolbulale survey (green points) and of previous surveys (white points) – yellow ellipse: VES qoo1 of the present survey - blue points: active boreholes

The following cross-section "ton_03" shows the location and depth of a new borehole drilled near Salaxley, reaching a depth of 390-400 meters. This borehole likely terminated upon encountering the Precambrian Basement, as evidenced by basement fragments scattered around the site (though no drilling log is available). It is clear from the data that the basement unit is characterized by resistivity (Rho) values around 500 Ωm. Near Salaxley, the resistivity of the overlying deposits, which belong to the Yesomma Sandstones, is below 15 Ωm, indicating a high clay content. The declared yield for this borehole is 10 m^3/h.

The cross-section "baligud_02" depicts the Bali Gubadle borehole, precisely located at VES "bag02." The VES data suggest the basement lies at a depth of 420 meters, while the borehole reached 360 meters. Although no basement fragments were found near this borehole, an estimation error of 60 meters in basement depth is considered acceptable in this type of investigation. The VES interpretation indicates that the resistivity of the deposits above the basement is 19 Ωm, and the borehole's reported yield is 13 m^3/h.

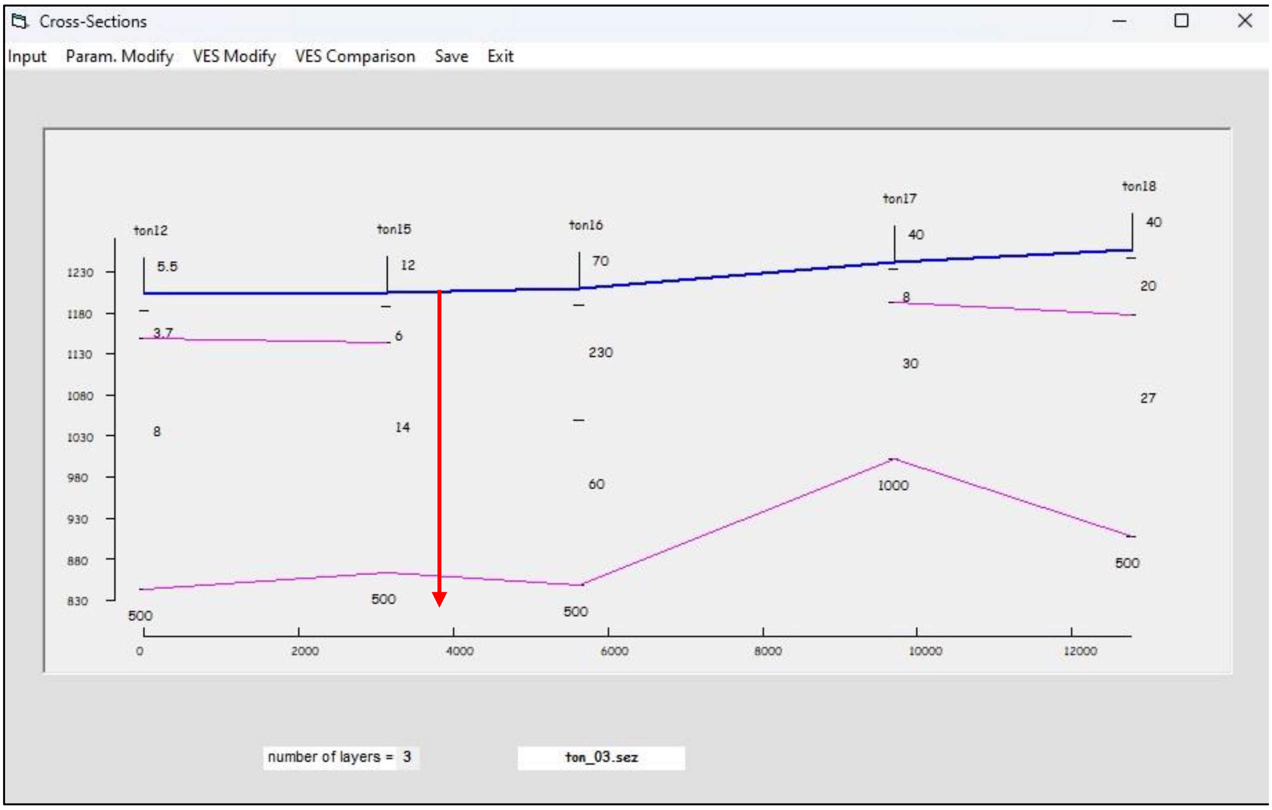


Figure 20: Cross-section ton_03 and Salaxley borehole location (red arrow)

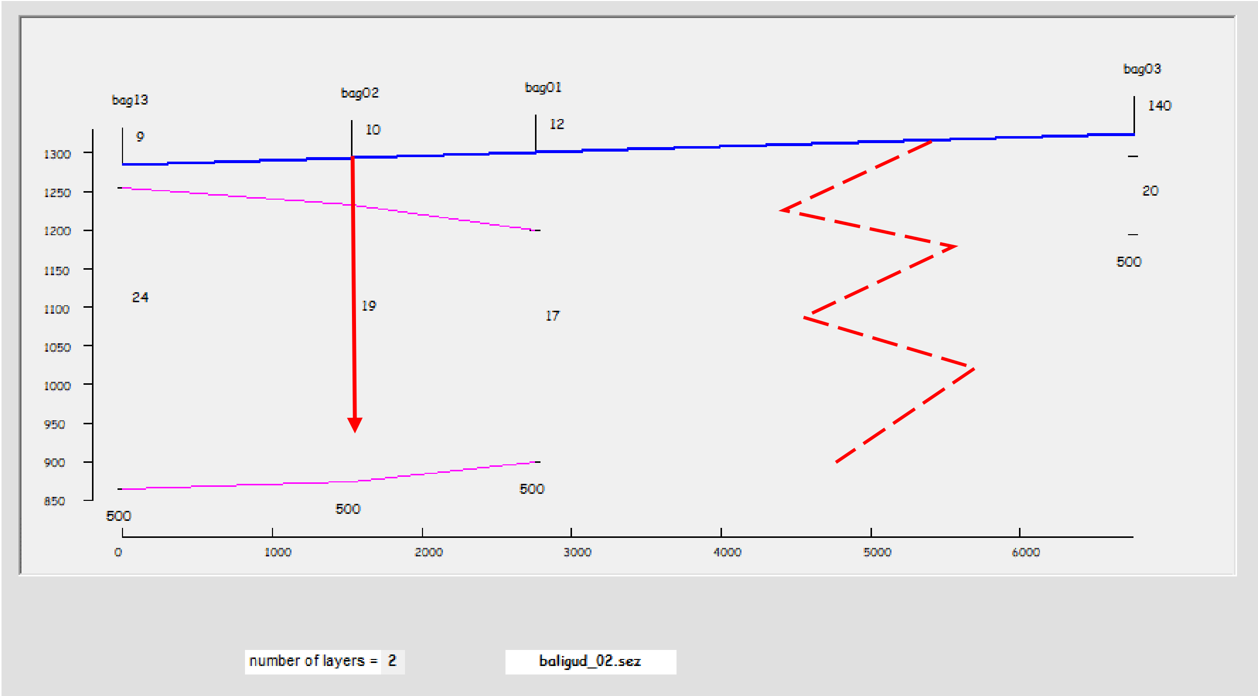


Figure 21: Cross-section baligud_02 and Bali Gubadle borehole location (red arrow) -red dashed line: possible geological unconformity

The summary of the data review for the Bali Gubadle-Salaxley area is as follows:

- Validation of Interpretative Model: The interpretative model used in previous surveys is largely confirmed by recent drilling results.

- Yesomma Formation Deposits: The Yesomma Formation deposits, which have resistivity values between 10 and 20 Ωm, generally yield low water productivity. However, this low yield could also be influenced by the challenges of drilling at depths greater than 300 meters.

- Basement Depth: The basement rock is consistently found at depths of 350-400 meters, as estimated by VES interpretations, though these estimations may overstate depth by approximately 15%.

This interpretative model is likely applicable to the Qoolbulale area as well, based on its presumed geological uniformity with the Salaxley area.

In the Qoolbulale area, 14 VES soundings were performed along three cross-sections aligned WNW-ESE.

The VES data exhibit two main resistivity patterns, indicating distinct subsurface structures:

1. Type 1 VES (e.g., qoo10): This pattern, illustrated on the left in the following figure, reveals two minor shallow layers, followed by a resistive layer with a resistivity of 60 Ωm (indicated by a yellow arrow). Beneath this is a conductive layer with a resistivity of 25 Ωm (blue arrow), followed by a deep, highly resistive layer with a resistivity of 500 Ωm (red arrow).

2. **Type 2 VES (e.g., qoo15)**: In this pattern, after a minor shallow layer, there are two semi-resistive layers with resistivity values between 25-31 Ωm (orange and blue arrows), followed by a deep, highly resistive layer with a resistivity of 500 Ωm (red arrow).

These resistivity patterns suggest fairly homogeneous subsurface characteristics across the study area.

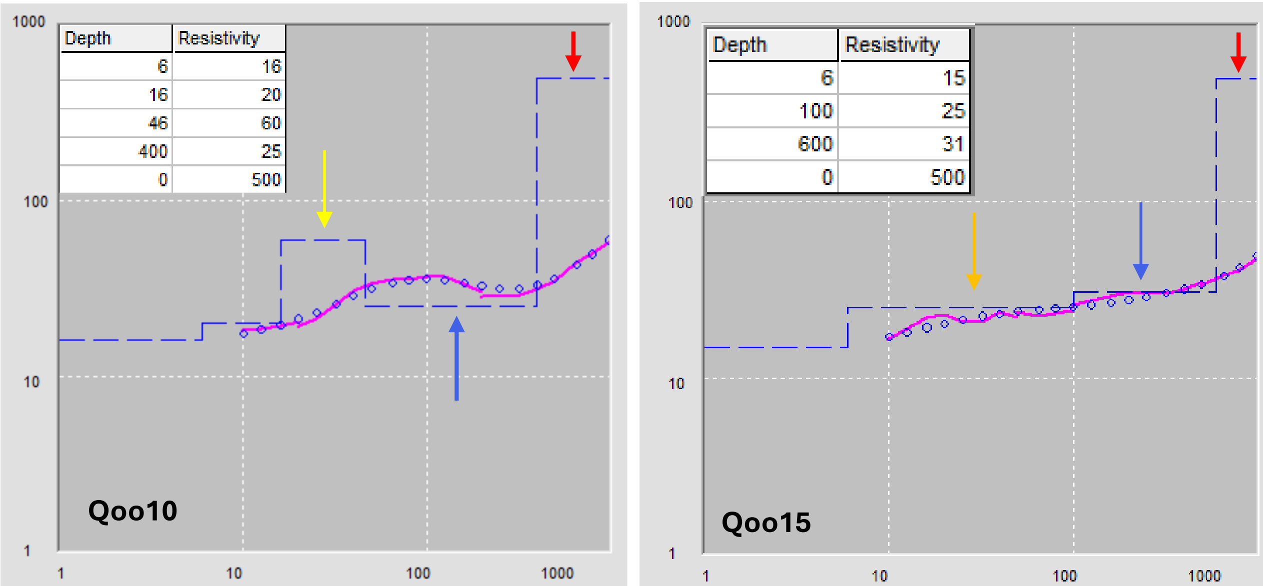


Figure 22: Comparison between different VES patterns – the dashed blue lines show the interpretative model (see the data in the rectangle in the upper left corners); the blue circles simulate field values from the model; the violet lines show the field resistivity data

The two VES models, though appearing quite different, show minimal difference in the resistivity values of the conductive layer at depth, which is where the aquifer is anticipated. The primary difference in the VES curves is the depth of the highly resistive layer: in the left VES, this layer lies at around 400 meters, whereas in the right VES, it reaches 600 meters.

Based on this interpretation, four primary resistivity units have been identified:

- **Top Unit:** This is a thin layer, generally less than 10-20 meters thick, with highly variable resistivity values ranging from 10 to 200 Ωm. These variations suggest a mix of loose alluvial and aeolian deposits, from sandy to clay-rich materials. In several VES profiles (e.g., VES qoo-10 in Figure 7), this unit is composed of two minor sub-layers.

- **Shallow Unit:** This second unit consists of two resistivity value groups, combined as one unit due to their similar position. The first group, with resistivity values of 50-100 Ωm, likely represents sandy deposits extending to depths greater than 100 meters. The second group, with resistivity values between 20 and 50 Ωm, indicates a higher clay content. Both layers are part of the Yesomma Formation and lie above the regional water table, so they are considered dry.

- **Deep Semi-Resistive Unit:** This third unit, with resistivity values between 20 and 50 Ωm (dropping to 18 Ωm in one case), extends to depths ranging from 300 to 600 meters, reaching down to the Precambrian basement. This unit is consistently detected across all VES profiles, confirming its continuity and depth. It is attributed to the Yesomma Formation and is thought to contain predominantly sandy deposits. This unit has the potential to host the aquifer below depths of 250-300 meters.

- Bottom Resistive Unit: The deepest unit, with a resistivity estimated at around 500 Ωm, is consistently detected at depths between 300 and 600 meters. This unit corresponds to the Precambrian basement (PCB). The basement depth decreases gradually from NNE to SSW, meaning it is shallower closer to the border. The NS-oriented cross-sections (see Figure 8) and the Precambrian basement isobath map illustrate this trend. Additionally, these cross-sections show a possible regional piezometric surface, beginning at depths of 250 to 350 meters in the highest northern section of the surveyed area (NNE) and rising by 20-30 meters toward the southern edge (SSW), where the village is located.

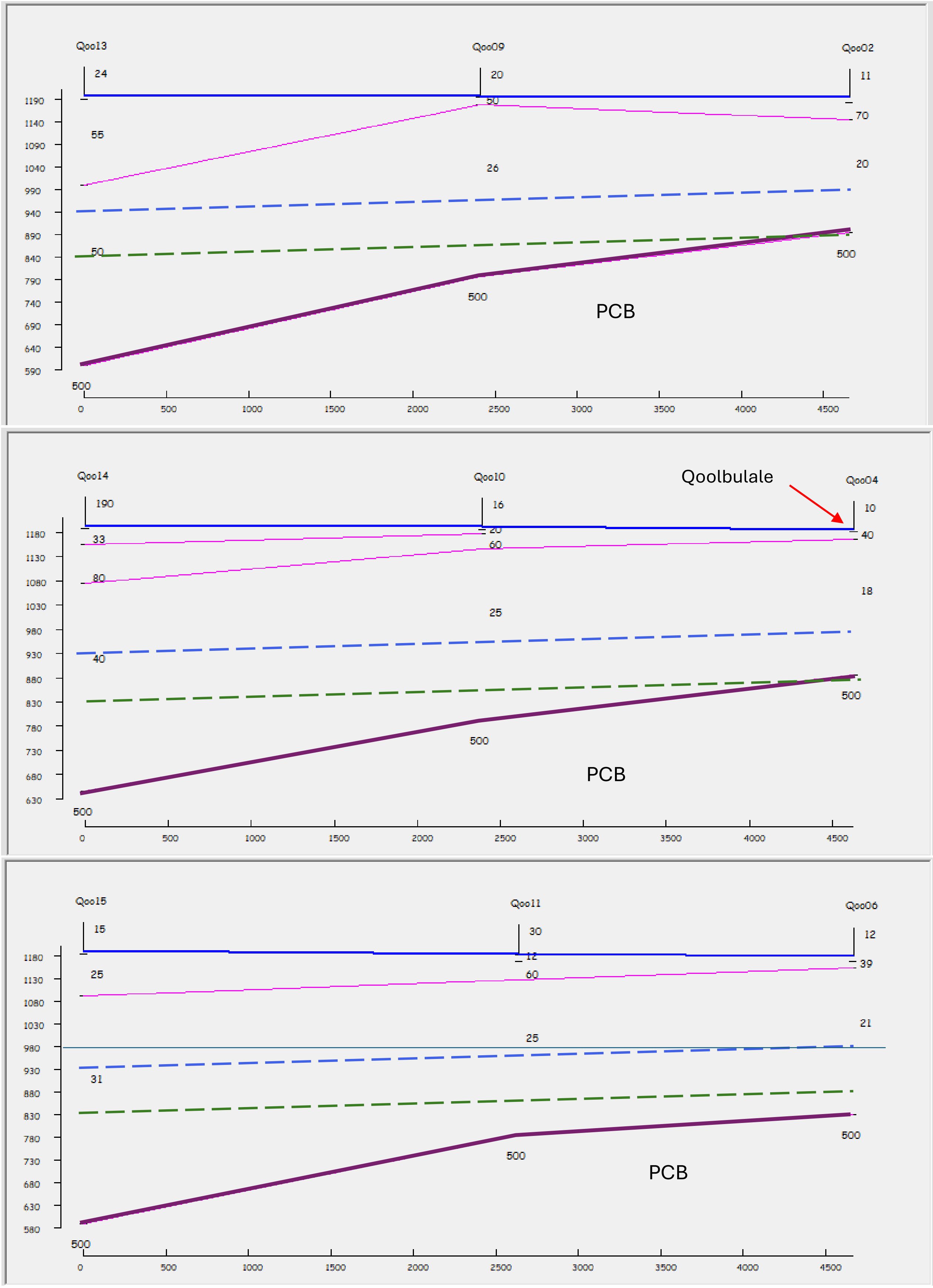


Figure 23: Cross-sections NS-2, 3 and 4, NS oriented – dark violet line: expected Precambrian Basement – dashed blue line: minimum expected depth of the regional SWL – green dashed line: maximum expected depth of the regional SWL

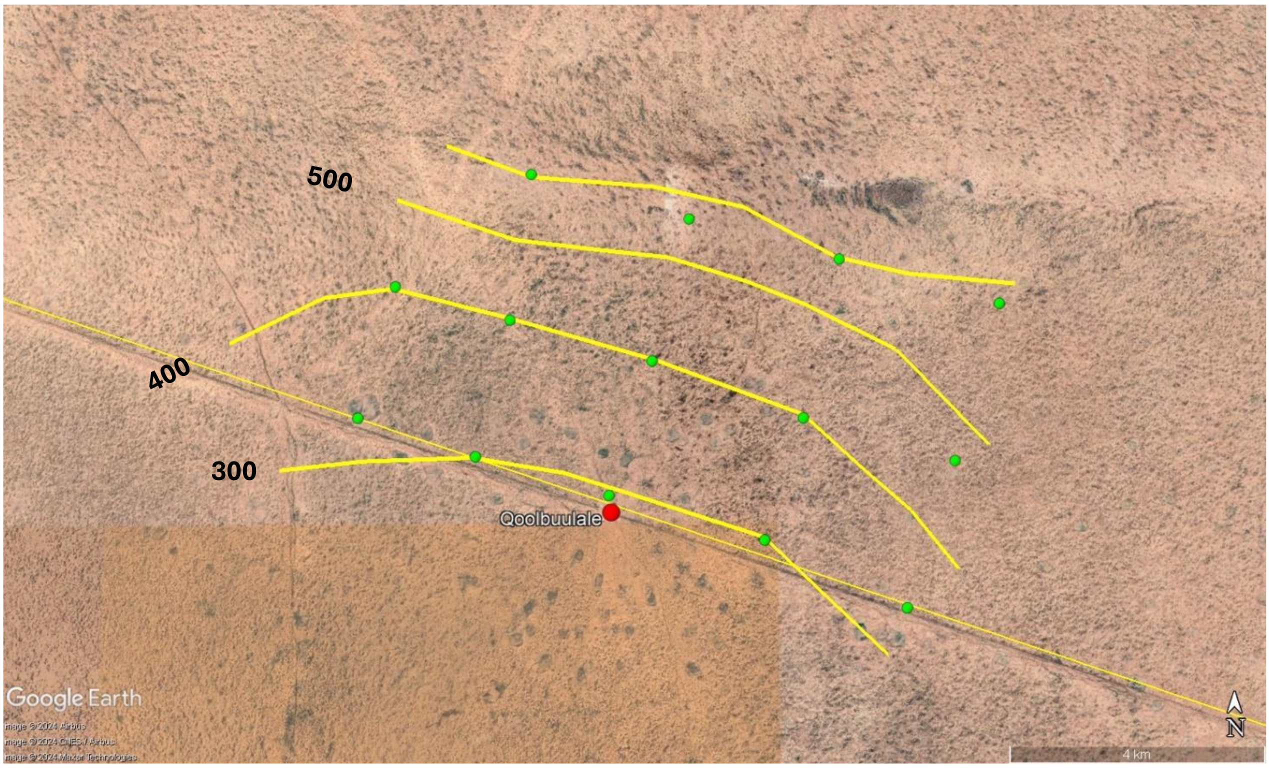


Figure 24: Map of the basement isobaths; values in meters bgl

The geophysical survey results reveal that the Precambrian basement lies at depths of 300-600 meters, sloping downward from the border towards the inner part of the area to the NNE.

Currently, there is no direct data on the depth of the aquifer in the study area. Available data is extrapolated from boreholes located approximately 30 km WNW (Salaxley), northward (Bali Matan), and 175 km ESE (Balidhiig). The limited data includes a standing water level (SWL) of 320 meters at Balidhiig, with other SWL values derived from various sources (SWALIM, borehole operators) with uncertain accuracy. SWL values in these boreholes vary from 250 to 320 meters below ground level (bgl), reaching 400 meters at Bali Matan. Therefore, it is reasonable to estimate an SWL range of 250 to 350 meters. Although the reliability of the Bali Matan data is uncertain, it is likely that the basement slopes downward from the border toward the center of the plateau, suggesting that the water table may also follow this descending pattern. This basement slope has been confirmed by the VES survey conducted in the Qoolbulale area.

In the previous cross-sections, a slight downward trend has been applied to the potential piezometric surface from the border and village area toward the inner plateau (NNE). This descent of the water table impacts the thickness of the potential saturated section. In two out of three sections near the border, the regional water level, under a pessimistic scenario, may lie below the basement surface, which would imply the absence of an aquifer. Accessing water along that section of the border would require three favorable conditions:

1. The VES interpretation must be accurate, and the basement must not be slightly higher than VES data suggests, as observed at Bali Gubadle and Gumar.
2. The true depth of the water level aligns with the more optimistic assumptions.

3. The slope of the piezometric surface is no shallower than the assumed gradient.

For these reasons, the area to the NNE is indicated as more favorable for drilling. A borehole reaching 400-500 meters in this area would likely encounter a saturated section of at least 100 meters, even in a worst-case scenario.

An additional factor supporting the NNE area as the most suitable for drilling is that the deep section of the Yesomma Formation in this area has higher resistivity values than in other VES cross-sections. The iso-resistive contour lines (in Ωm) of the Yesomma Formation, based on VES data, indicates the NNE area's suitability for aquifer exploration.

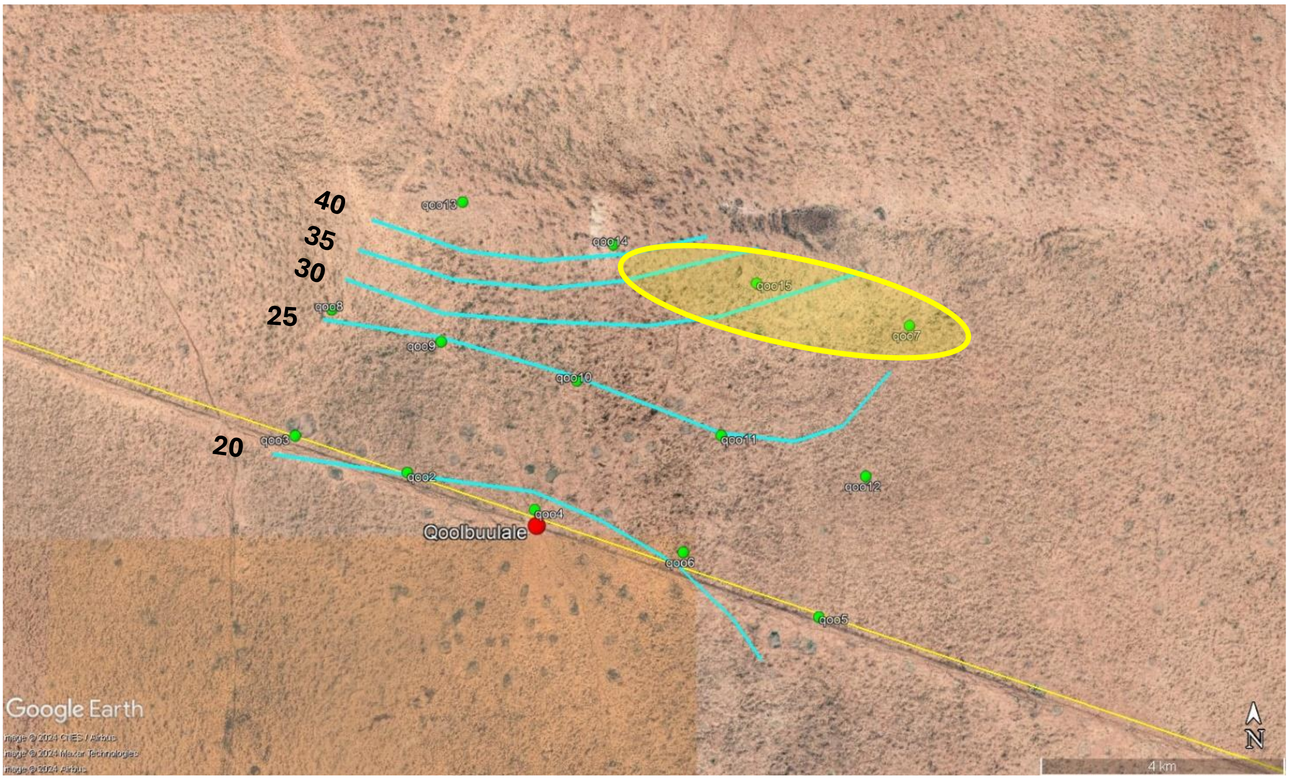


Figure 25: Map of the resistivity contour lines (cyan color) in the deepest section of the Yesomma Fm (possible aquifer) – values in Ωm – yellow ellipse: area selected for drilling

In the previous map is shown also the area considered more suitable for new drillings. A depth of 500 m is suggested with mud circulation and diameter > 16''.

The geophysical survey carried out in the Qoolbulale area was interpreted with the help of previous surveys, re-examined at the light of next drillings. The results are synthesized below.

- The applied methodology (VES Schlumberger with AB/2 =1,000 m allowed the investigation of the subsoil up to a depth of 600 m.
- The VES detected with good precision and a narrow margin of error the interface between Yesomma Fm and the PCB, that ranges between 300 and 600 m, dropping from the border area toward NNE.
- The resistivity of the possible aquifer, located in the sandy fractions of the Yesomma Sandstones, increases from the border toward NNE, indicating a growth of sandy component.

- It is suggested to locate the drilling as it is shown in the map above, avoiding the lowest values that indicate a consistent clayey component, mostly near border, and the highest ones at the NW corner of the area, because high values could indicate a cemented fraction of the Yesomma Fm. For this reason, the area indicated is located around VES 07 and 15 where *Rho* values range between 25 and 31 Ωm and the basement is at depth > 500 m.

- The depth of the aquifer and of the piezometric surface is unknown, because is not detectable only by the *Rho* values, because the nearest boreholes are at 30-50 km and the data of the pumping tests are not available. Anyway, the estimate is in the range of 250-350 m.

- The drilling is located in the area included between the coordinates: 8.895° N, 44.422° E and 8.912° N, 44.460° E.

- The drilling shall have a depth between 400 and 500m, shall be executed with mud circulation and drilling tools diameter > 16 '', to allow the insertion of 10" casing and a pump of 8" of diameter.

For the VES data and graphs and Resistivity cross sections, please see the Annexes.

4.3. Aquifer Recharge and Sustainability

The Quoobulale borehole taps into an aquifer system in a remote, semi-arid region of Somaliland where hydrogeological data is notably sparse. Detailed investigations specific to this aquifer, such as its boundaries, hydraulic properties, storage capacity, and recharge dynamics, have not yet been conducted. This knowledge gap reflects broader challenges across Somaliland and the Horn of Africa, where aquifer systems often remain unmapped or under-characterized due to logistical, technical, and institutional limitations.

Notwithstanding the limited site-specific data, it is possible to provide a preliminary understanding of aquifer recharge in the Quoobulale area by considering regional hydroclimatic and geological characteristics. The borehole is likely located in a fractured basement or sedimentary aquifer, typical of the region. These aquifers rely primarily on episodic recharge events linked to rainfall infiltration during the Gu and Deyr rainy seasons.

Recharge is generally diffuse and occurs through the infiltration of precipitation, often enhanced in localized zones such as seasonal wadis or areas of concentrated runoff. In fractured rock systems, recharge is typically limited and depends on the presence and connectivity of fractures, faults, and weathered zones. Additionally, indirect recharge may occur through seepage from ephemeral surface flows, though this mechanism is highly dependent on rainfall intensity and duration, as well as surface permeability. Given the arid to semi-arid climatic setting of Quoobulale, annual recharge rates are expected to be low, and aquifer replenishment may be irregular.

The Quoobulale borehole is expected to abstract approximately 5 liters per second (L/s), a rate considered modest by regional standards. At this rate, the borehole is projected to meet essential domestic and livestock water needs, rather than support large-scale agricultural or industrial use. As such, the immediate risk of over-extraction is relatively low.

Nevertheless, because the aquifer supplying the borehole is not well studied, a precautionary approach remains warranted. While the current abstraction rate is unlikely to cause immediate aquifer stress, monitoring and adaptive management remain essential. Regular groundwater level measurements, water quality assessments, and controls on abstraction volumes should be institutionalized as part of a long-term groundwater management framework. This will ensure the borehole remains sustainable under current and future conditions, and that early warning signs of aquifer depletion are detected and addressed promptly.

4.4. Biological Environment

Flora and Habitats

The project area is situated within a semi-arid rangeland ecosystem, characterized by a combination of shrubs, grasses, and drought-resistant tree species. According to site-specific observations and community interviews, the vegetation cover in the area is considered relatively dense compared to surrounding degraded zones. This relatively intact vegetation supports traditional pastoralist livelihoods and provides vital ecological functions such as soil stabilization, microclimate regulation, and fodder production for livestock.

Figure 26 Aerial view of project area

Figure 27 Picture of trees and shrubs in the project area

Figure 28 Picture of trees and shrubs in the project area

The dominant tree species in the area include several varieties of Acacia, which are well-adapted to arid conditions:

- *Acacia bussei* (Busse)
- *Acacia nilotica* (Mara*)*
- *Acacia tortilis* (Qudhac)
- *Acacia malifera* (Bilcil)

These species are critical to the ecological balance of the region. For example, *Acacia nilotica* is not only important for shade and forage, but also valued for its medicinal properties—its bark, leaves, and pods are used in traditional healing practices. Though none of these trees are classified as endangered or protected, their cultural and ecological significance warrants careful consideration during construction. Community feedback also indicates a risk from unsustainable tree-cutting and charcoal production, which although not directly located at the project site, poses a broader threat to vegetative health in the region.

The project area does not contain officially designated protected habitats or rare plant species, nor is it situated within a known biodiversity hotspot. There are no KBAs or IBAs within or near the project area. That being said, project activities should be designed to minimize vegetation clearance, promote sustainable land use, and ensure that infrastructure placement does not fragment or degrade critical grazing or vegetative zones. These considerations are incorporated into the environmental safeguards of the ESMP.

Fauna

Among the most commonly observed wild mammals in the area are:

- Salt's dik-dik (*Madoqua saltiana*), a small antelope that relies on shrubs and undergrowth for both forage and cover.
- African hares (*Lepus capensis*), often found in open scrubland and grass-dominated habitats.
- Common jackals (*Canis aureus*), which are opportunistic scavengers and occasionally seen near human settlements and livestock sites.
- Somali hedgehogs (*Atelerix sclateri*), a nocturnal insectivore found in dry grasslands and shrub zones.
- Occasional sightings of hyenas and desert foxes, though these are less common and typically avoid areas of concentrated human activity.

These animals are not listed as endangered or threatened as per the list of endangered species in Somalia according to the IUCN Red List.[4] Scarcity of large predators or specialized fauna suggests low risks of severe human-wildlife conflicts. There are no protected or critical habitat areas within the area of impact. Most of the wildlife is believed to move through the region opportunistically, correlating with the brief rainy seasons and availability of forage.

The avian population includes both resident and migratory species. Birds often observed in the area include:

[4] For the list of endangered species in Somalia, see https://worldrainforests.com/biodiversity/en/somalia/EN.html.

- **Yellow-billed hornbill (*Tockus flavirostris*)**, frequently seen in acacia trees.
- **Secretary birds (*Sagittarius serpentarius*)**, which hunt small rodents and reptiles in open grassland.
- **Bustards, doves, starlings, and weaver birds**, which are common in rangeland and village-edge environments.

Reptiles are also present, including agile lizards, geckos, and non-venomous sand snakes, which play a role in pest control and are common in dry, sandy areas. Though no endangered species have been recorded at the Qoolbulale site, the presence of this wildlife contributes to local biodiversity and ecological stability.

Livestock—mainly camels, goats, sheep, and cattle—are by far the most dominant faunal presence. These animals form the economic and cultural backbone of local livelihoods. However, their concentration around water points can displace smaller wildlife and degrade natural habitats if grazing and watering are not properly managed. The ESMP includes provisions for designated animal troughs, rotational grazing, and fencing of sensitive areas to reduce wildlife disturbance and minimize habitat degradation.

Existing Land Use

The land use in and around Qoolbulale is predominantly shaped by the needs of pastoralist and agro-pastoralist communities, who rely extensively on the region's communal rangelands for livestock grazing. The area falls within the Haud Plateau, a semi-arid zone characterized by seasonally variable vegetation, including acacia-dominated shrublands, scattered grasses, and bare patches of land subject to wind and water erosion. Livestock form the economic backbone of the community, and the movement of herds across large distances defines the landscape's use, particularly during dry seasons when water and forage become scarce.

The rangelands are not formally demarcated or privately owned but are governed through customary clan-based systems that determine access to pasture and watering points. These rules are often informal but strongly enforced through social norms and negotiation between elders, especially during times of scarcity. Mobility is essential to the land-use system; pastoralists migrate seasonally, and the area serves as both a dry-season fallback zone and a corridor for transboundary herding, especially for those crossing in from neighboring Ethiopia. The introduction of a permanent borehole could intensify grazing pressure near the site, which may shift existing migratory patterns and contribute to localized degradation if not carefully managed.

In addition to grazing, limited settled land uses exist within the village center. These include residential compounds, small-scale shops, religious facilities, two primary schools, and basic community infrastructure such as a health post and market area. No formal agricultural activity was reported at the time of assessment, largely due to poor soil fertility and lack of irrigation. However, with improved water availability from the borehole, some households have expressed interest in starting kitchen gardens or micro-irrigation plots, which could introduce new land uses and water deamnd over time. There is also informal infrastructure such as berkads and remnants of earlier shallow wells, many of which are now non-functional or heavily silted.

Charcoal production and tree cutting were reported in some nearby areas, although not directly within the borehole site footprint. These activities, driven by income needs and energy demands, pose a threat to tree cover and soil integrity if left unchecked. Finally, access routes to and from Qoolbulale, while unpaved and informal, are heavily used by herders, traders, and water trucks, forming a seasonally shifting network of livestock paths and vehicle tracks. These routes often overlap with communal lands and grazing areas, further reinforcing the interconnected nature of land use in this pastoralist landscape.

4.5. Socio-Economic and Cultural Environment

Demographics

The project area is a rural and sparsely populated village. Based on field assessments and community engagement conducted during the site surveys, the Somaliland side of Qoolbulale is estimated to have approximately 700 households, with an average household size of six to seven individuals, giving a rough population estimate of around 4,200 to 5,000 people. However, the population can fluctuate seasonally due to pastoralist migration and cross-border movement, especially during the dry season when the area becomes a critical destination for water and grazing.

Qoolbulale lies along a transboundary livestock corridor, and across the nearby Ethiopian border there are an estimated 2,000 additional households who regularly access the area for grazing and water. This makes the broader population influenced by the borehole project significantly larger than the settled community itself. The residents are primarily ethnically Somali and organized along clan-based structures that play a central role in decision-making, conflict resolution, and land access. There is a Village Development Council (VDC) that includes traditional elders, and a separate Water User Committee (WUC) has been established to oversee the management of water infrastructure, including the proposed borehole.

The community is largely youthful, with a high proportion of children and adolescents. Although there are two primary schools (one in Somaliland and one across the border), many students, particularly girls, face barriers to consistent attendance due to household labor responsibilities, especially during periods of water scarcity. Women play a key role in domestic life and are the primary collectors of water, yet they remain underrepresented in formal leadership structures, though there is increasing participation through women’s groups and representation on the WUC. The population also includes internally displaced persons (IDPs) and marginalized minority groups, who although small in number (estimated at around 15 households), are considered active members of the community with recognized participation in decision-making processes. These demographic patterns reinforce the need for inclusive governance, gender-responsive planning, and flexible service delivery to meet the needs of a dynamic and diverse population.

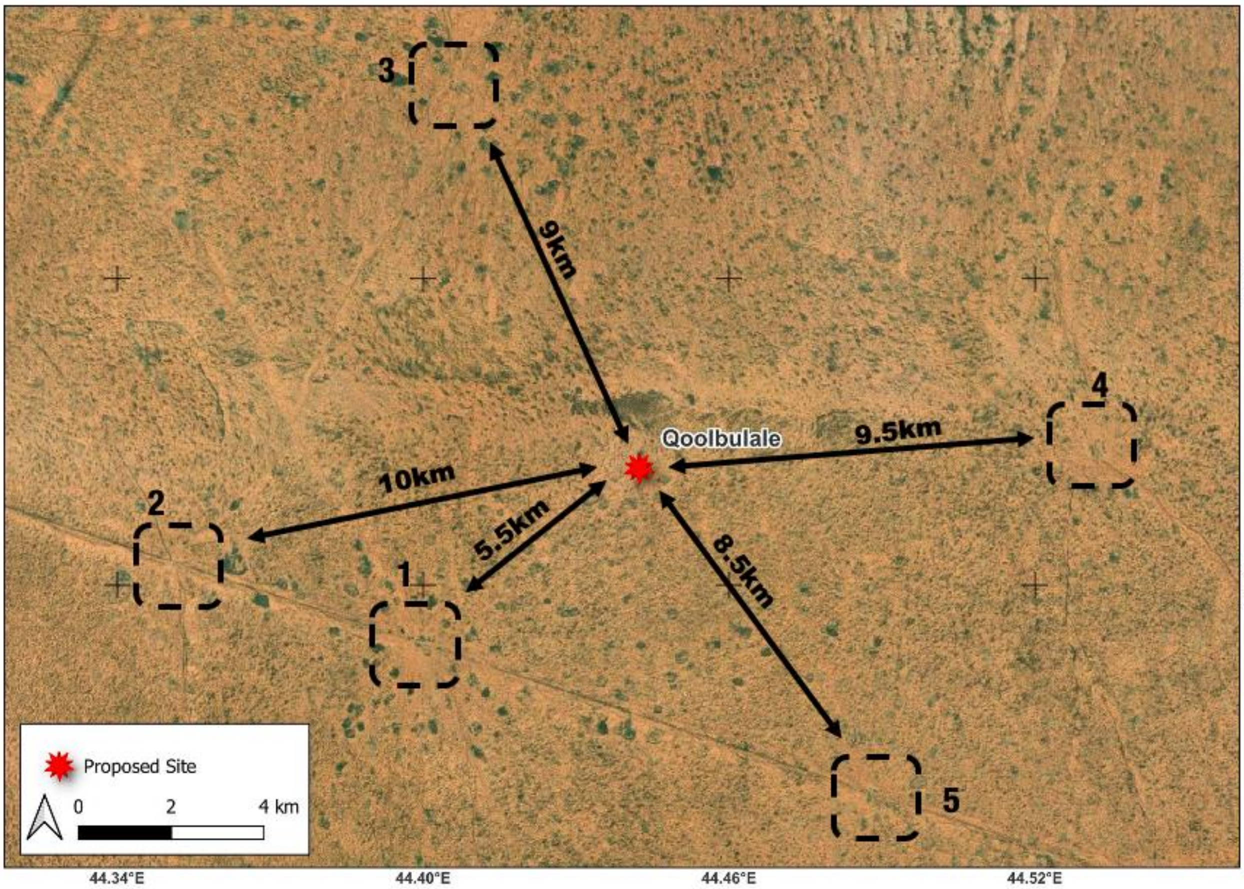


Figure 29: Communities near the Project Area

Figure 30 Community near project area

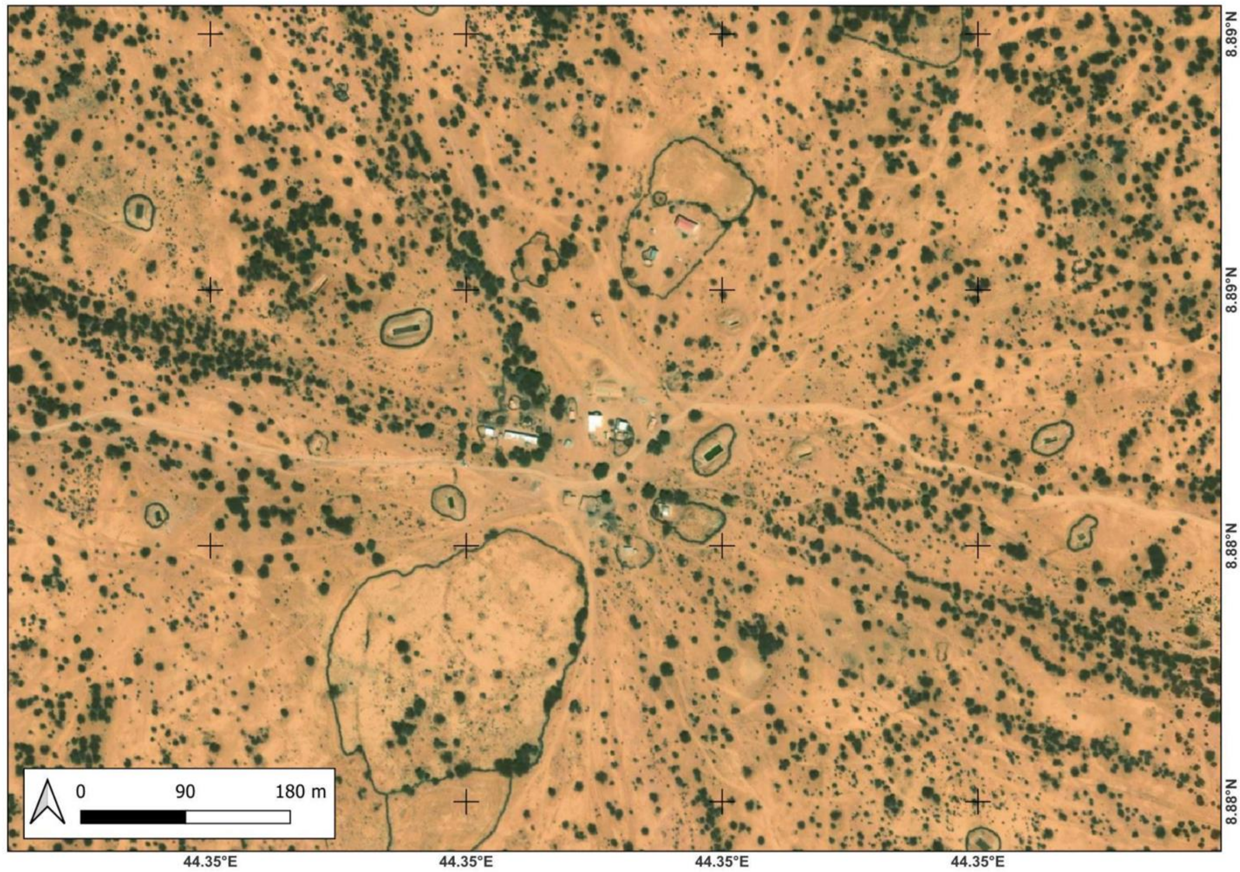


Figure 31 Community near project area

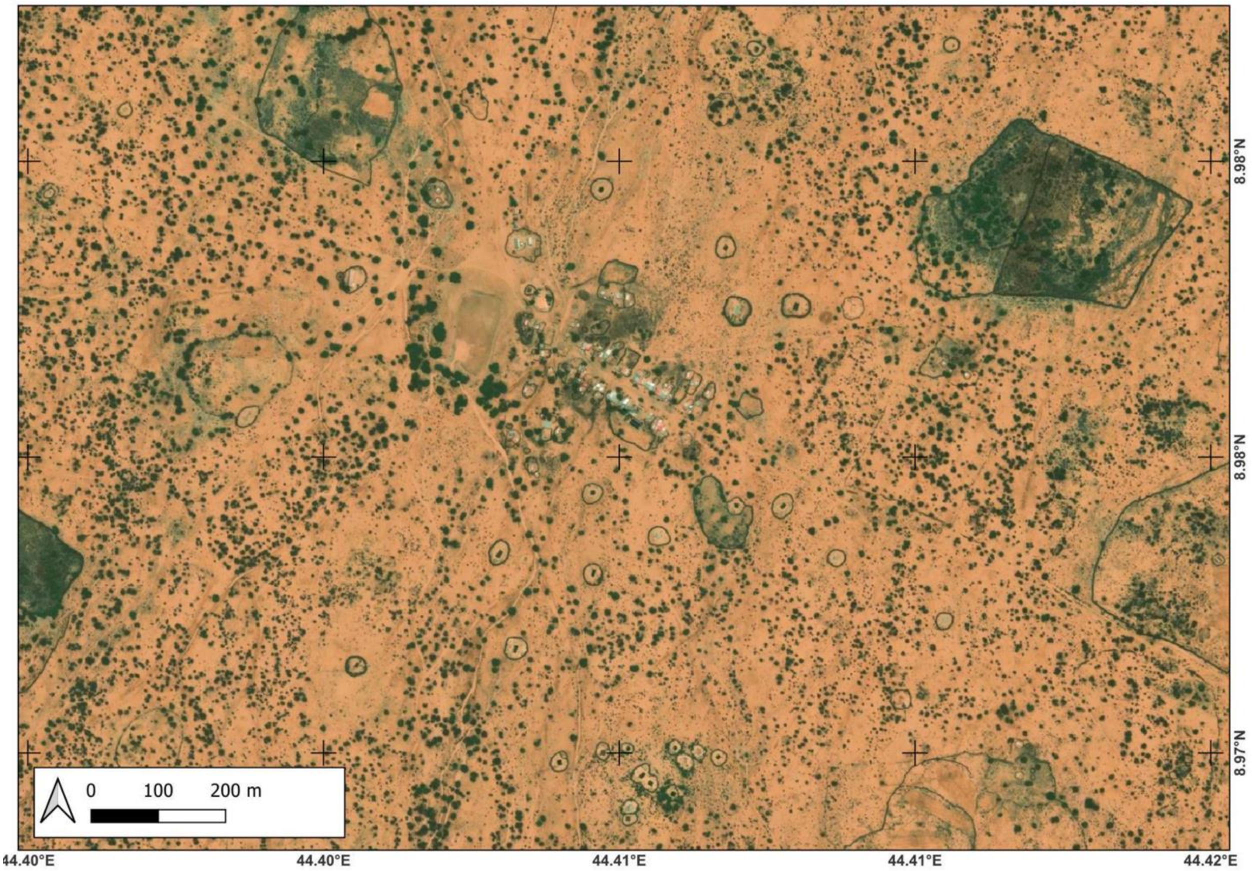


Figure 32 Community near project area

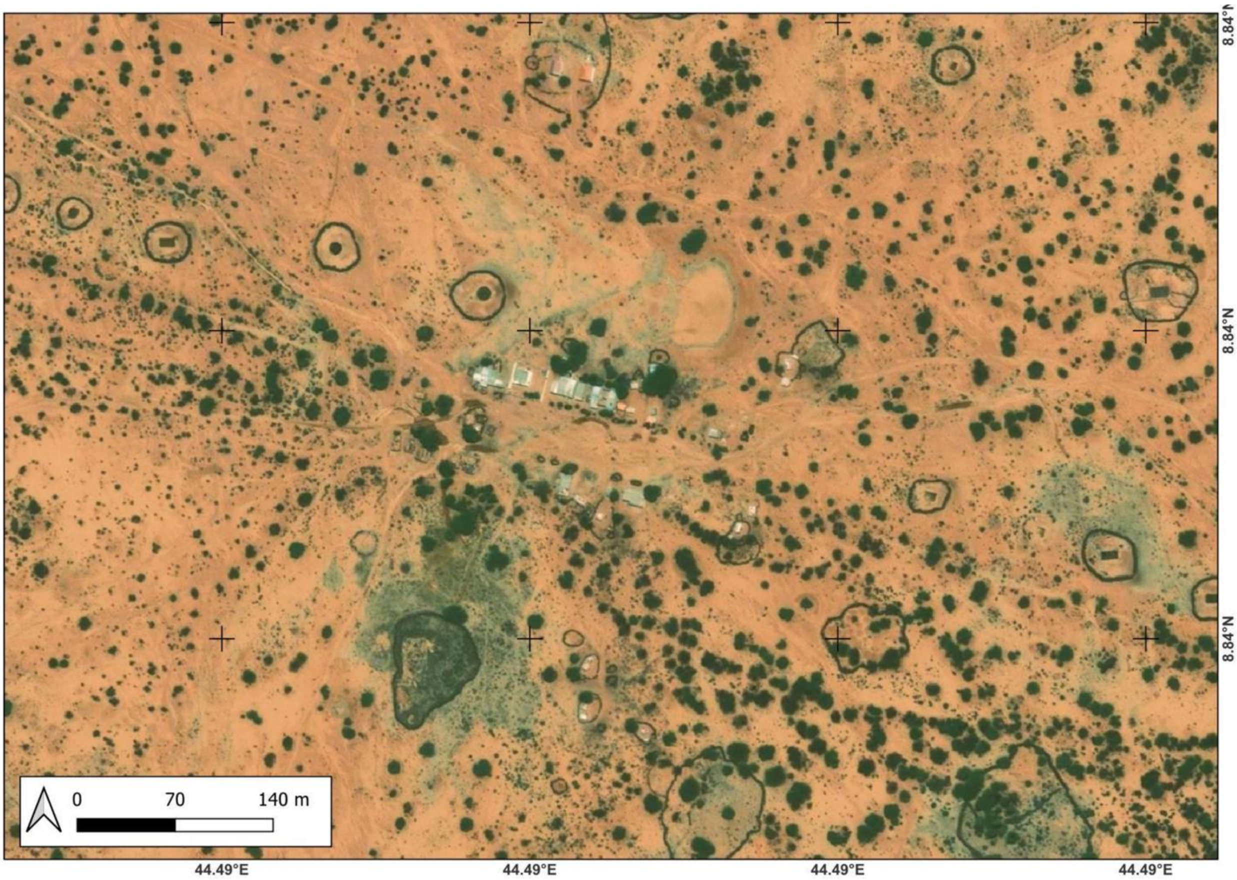


Figure 33 Community near project area

Livelihoods

The dominant livelihood in Qoolbulale is pastoralism, which serves as the foundation of the local economy, food security, and social identity. Most households rely on the rearing of livestock, particularly camels, goats, sheep, and cattle, for both subsistence and income generation. Livestock are used for milk, meat, transport, and trade, and are frequently sold in local and regional markets to cover expenses such as food, education, and healthcare. Camels are especially valued for their drought resilience and ability to travel long distances in search of grazing and water, while goats and sheep are often sold more frequently to meet daily household needs. Livestock wealth is also closely tied to social status and clan structures, reinforcing its centrality in community life.

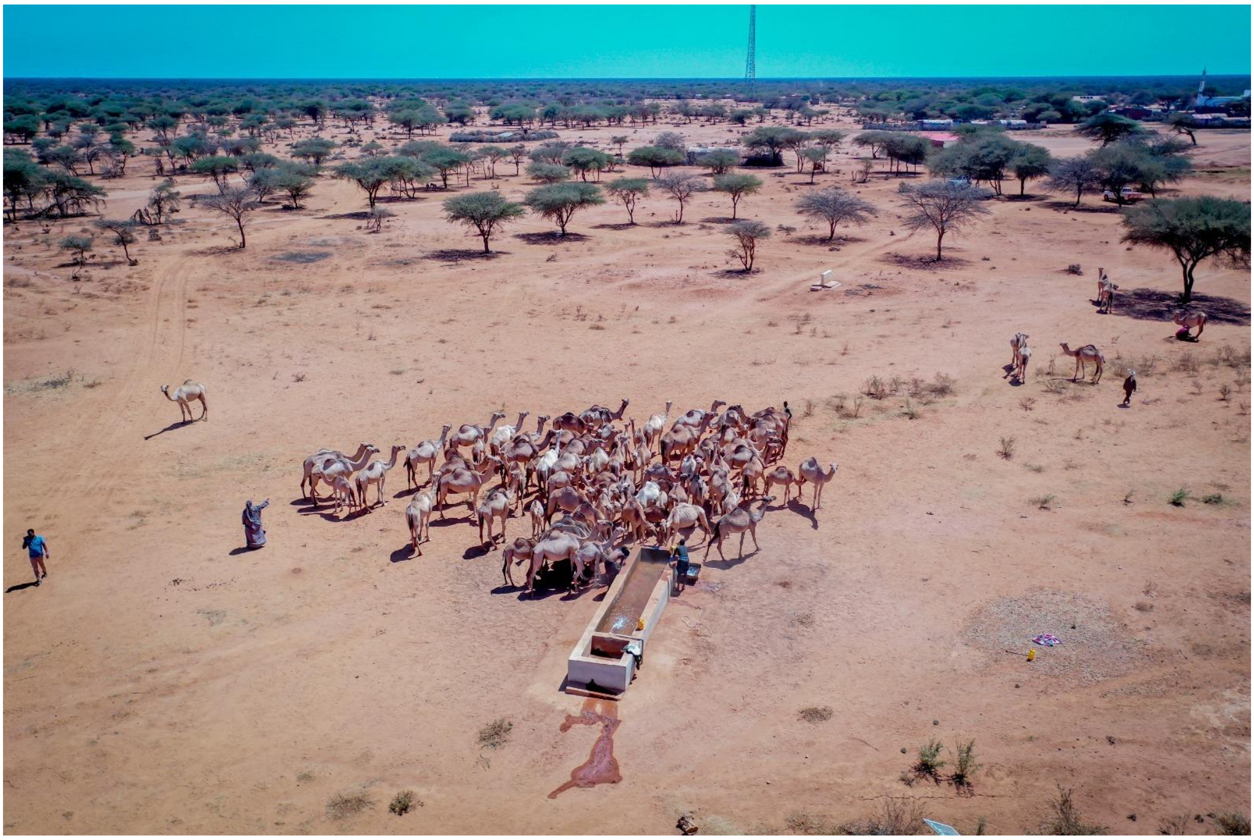


Figure: 34 Camels visiting a local trough

Due to the transboundary location of Qoolbulale, the area supports mobile and semi-nomadic herders from both Somaliland and Ethiopia. These migratory groups often pass through or temporarily settle in the area during the dry season, taking advantage of the haffir dam or temporary water points when available. The seasonal influx of pastoralists adds pressure to local water and rangeland resources but also sustains a local economy based on livestock trading, fodder sales, and basic services, including water vending and small-scale commerce. Many families operate informal shops or tea stalls, sell firewood or charcoal, or engage in petty trade. A few men and youth seek casual labor opportunities related to livestock handling, construction, or transport services, often during times of drought when livestock productivity declines.

Women in the community are primarily engaged in domestic labor, water collection, and informal income-generating activities. Some women participate in milk processing and sale, small-scale trade of household goods, and the management of tea shops or roadside kiosks. With limited access to water and arable land, crop farming is virtually non-existent, although there is expressed interest among women's groups and youth to pursue small-scale gardening if water becomes available year-round. The presence of two primary schools and a maternal and child health (MCH) post also supports limited employment in education and basic healthcare, though such positions are few and often under-resourced. Overall, livelihoods in Qoolbulale are heavily climate-dependent, making the borehole project a potentially transformative intervention for economic resilience, food security, and gender-inclusive development.

Land Tenure

Land tenure in Qoolbulale, as in most rural areas of Somaliland, is governed primarily by customary systems rooted in clan-based ownership and communal access. The rangelands surrounding the village are traditionally considered communal property, managed and used collectively by members of local clans and sub-clans for grazing, water access, and seasonal livestock movement. Rights to access and use land are typically negotiated through traditional elders, and decisions are based on established norms of reciprocity, historical clan claims, and seasonal needs. These customary arrangements are widely respected and serve as the foundation for conflict resolution and land management in the absence of formal titling systems.

Within the village center itself, residential and small commercial plots may be allocated more informally to individual households or families, with approval from the VDC or community elders. While these allocations may be recognized locally, they are not supported by formal land titles or deeds under Somaliland's statutory legal system. However, such arrangements are generally secure and respected within the community, with disputes typically resolved through clan mechanisms rather than state courts. For public infrastructure—such as schools, health posts, and water systems—land is often contributed voluntarily by clans or households under community agreements.

In the case of the borehole project, the land selected for the drilling site and associated infrastructure was identified through community consultation and confirmed through voluntary land-use agreements with the VDC and local elders. This process ensures both social legitimacy and alignment with World Bank ESS5, which discourages involuntary land acquisition and requires that any land use be free of coercion and fully documented. While there is currently no risk of physical displacement, the project must remain sensitive to grazing patterns, livestock corridors, and transboundary pastoralist access, which are essential features of the communal tenure system. Integrating land governance into ongoing stakeholder engagement will help reinforce land use agreements, avoid disputes, and promote equitable resource sharing.

Community Facilities

Qoolbulale is a small but strategically located rural settlement with limited but essential community infrastructure. The most prominent public facilities in the village include two primary schools—one located on the Somaliland side and the other across the nearby Ethiopian border. These schools provide basic education for local children, though they are modest in structure, often lacking consistent access to water, sanitation, and teaching materials. Attendance, especially among girls, is highly sensitive to water availability and household labor demands. With the introduction of a permanent borehole, school operations are expected to improve due to more reliable access to water for drinking, handwashing, and latrine use.

The village also hosts a Maternal and Child Health (MCH) post, which provides basic health services such as immunizations, antenatal care, and treatment of common illnesses. However, the health post is under-resourced and faces operational challenges during the dry season when water is scarce. The lack of clean water has limited the facility's ability to maintain hygiene and provide full services, particularly for deliveries or infection control. Improving water access through the borehole project will significantly enhance the health post's functionality and contribute to better maternal and child health outcomes.

In addition to these public services, Qoolbulale has a small market area where local traders sell dry goods, livestock products, and daily necessities. There are a few tea shops and informal kiosks, mostly operated by women, providing simple food and beverages to villagers and passersby. A community meeting space under a large shade tree is frequently used for village assemblies, dispute resolution, and stakeholder consultations. Access roads are unpaved and often difficult to traverse during the rainy season, but they serve as key links between Qoolbulale and other villages, grazing areas, and the Ethiopian border.

Gender Dynamics

Gender roles in Qoolbulale reflect broader patterns observed across Somaliland, where deeply entrenched social norms define a clear division of labor and responsibility between men and women. Women and girls in the area carry the bulk of domestic responsibilities, including the critical task of fetching water—often from distant and unreliable sources. This responsibility not only consumes a large portion of their day but also exposes them to safety risks and reduces time available for education, livelihood activities, or civic participation. Reports and consultations from the community also indicate that girls frequently miss school during drought periods when water fetching becomes even more time-consuming and physically demanding.

In pastoral and agro-pastoral households, which are the dominant livelihood systems in Qoolbulale, women are heavily involved in household livestock management, including milking, feeding, and sometimes marketing dairy products. However, they are generally excluded from decision-making structures around land, water access, and natural resource management. As noted in the Environmental and Social Management Framework (ESMF), traditional power structures and clan-based authority systems rarely include women in leadership positions. The ESMF notes that although women play a critical role in water provision and household resilience, they have very limited participation in water governance, both at community and institutional levels.

Additionally, the gender gap in access to education and employment in the region is significant. Many women, particularly in rural and underserved settlements like Qoolbulale, lack formal education and vocational training. This restricts their access to paid work and limits their ability to participate in project planning or employment opportunities. Socio-cultural expectations often discourage or prevent women from engaging in what are considered physically demanding or "male" activities, including construction or borehole maintenance, although some women do engage in informal petty trade or seasonal livestock-related sales.

The risks of gender-based violence (GBV), sexual exploitation, and harassment (SEA/SH) are also elevated in water-scarce and conflict-sensitive environments like Qoolbulale, particularly during periods of labor influx associated with construction works. The ESMF and project documents emphasize the importance of gender-sensitive mitigation measures, including the implementation of codes of conduct for contractors, community training, and grievance redress mechanisms with survivor-centered protocols.

Vulnerable and Marginalized Groups

The project area includes a mix of settled households and mobile pastoralist communities, some of whom fall into vulnerable or marginalized categories due to their limited access to resources, reduced participation in decision-making, or increased exposure to environmental and social risks. The ESMF for the GW4R program emphasizes the importance of identifying and including these groups in project design and implementation, in alignment with World Bank ESS1, ESS7, and ESS10.

Among the most notable vulnerable groups in Qoolbulale are female-headed households, who often face social and economic disadvantage. These households typically have limited labor capacity for water collection, fewer livestock assets, and reduced access to traditional support networks, especially in a context where land and water governance are male-dominated. Without targeted engagement, these women may struggle to access water equitably, particularly during times of peak demand or when pricing structures are introduced.

The community also includes IDPs and minority clan members, who may lack formal land tenure and face subtle forms of exclusion from communal decision-making or access to water points. Although their numbers in Qoolbulale are relatively small—estimated at around 10 to 15 households—these individuals are especially vulnerable during periods of water scarcity or conflict. They may not have livestock to justify equal access to troughs or sufficient income to pay for water if a fee-for-service model is adopted. Their integration into the WUC and other project mechanisms will be essential to avoid reinforcing existing inequalities.

Youth and persons with disabilities also face barriers to participation in project activities and long-term benefits. Youth, despite being a demographic majority, are often excluded from community governance structures and lack employment or vocational training opportunities. The borehole project presents an opportunity to engage youth through maintenance training, environmental monitoring, or fee collection roles. Persons with disabilities may face physical challenges in accessing water infrastructure, especially if designs do not consider mobility constraints. Inclusive design features—such as low-tap kiosks, shaded waiting areas, and clearly marked paths—can ensure their safe and dignified access to water.

Considerations for Vulnerable Groups

The borehole's proximity to the main settlement area significantly reduces the distance that women and children, who are traditionally responsible for water collection, must travel. At present, households depend on a seasonal haffir dam located over 350 meters away, which often dries up and exposes users to unsafe, difficult terrain and long waiting times. Locating the borehole and kiosks nearer to the village ensures that the daily burden of fetching water, particularly for women and girls, is substantially eased.

The project layout also integrates designated water points for both human use and livestock. By separating human kiosks from animal troughs and situating them along safe access paths, the design minimizes the risk of accidents, harassment, or congestion at shared points. This is especially important for children and persons with disabilities, who are more vulnerable in crowded or unsafe collection environments.

Furthermore, the distribution system is planned so that kiosks are located within short walking distance of households, avoiding the need to cross grazing zones or seasonal floodplains. This not only improves safety but also ensures that vulnerable users, including the elderly and pregnant women, can access water without exposure to livestock movement, rough terrain, or long waiting queues.

Cultural Heritage

The Qoolbulale project area, like much of rural Somaliland, is shaped by deep-rooted Somali cultural traditions, clan-based social organization, and a rich body of oral history, customary practices, and sacred sites. While there are no officially recognized or registered archaeological or historical sites within the immediate project footprint, local cultural heritage is strongly embedded in traditional governance institutions, communal rangeland practices, sacred trees, and sites used for religious gatherings, ancestral remembrance, or conflict resolution. These forms of intangible cultural heritage may not appear on national inventories, but they are significant to the social fabric of the community and must be respected throughout project planning and implementation.

During community consultations in Qoolbulale, no tangible heritage sites (such as ancient structures, burial grounds, or historic monuments) were identified near the borehole site. However, as with many Somali pastoralist communities, certain trees and shaded gathering spaces may be informally regarded as culturally important, especially those used by elders for holding clan meetings (shir) or mediating disputes. Additionally, some seasonal wells or berkads in the area may carry historic or clan-specific value. The project's ESMP includes a chance-find procedure, which ensures that if any culturally significant materials are encountered during construction, work will stop immediately and the appropriate authorities and elders will be notified.

Somaliland does not yet have a comprehensive or widely enforced cultural heritage law, though its interim constitution and broader environmental policies recognize the importance of protecting historical and cultural assets. The National Environmental Policy refers to safeguarding "natural and cultural heritage," and the Environmental Management Act makes mention of the need to respect traditional knowledge systems and sacred sites, especially in rural and pastoral communities. However, implementation is limited, and there is no formal registry or mapping system for intangible cultural heritage or unexcavated archaeological sites.

At present, there is no standalone Ministry of Culture, though the Ministry of Education and Science and the Ministry of Environment and Climate Change occasionally support conservation activities in partnership with local universities, civil society, and UNESCO-backed initiatives. Therefore, in practical terms, the protection of cultural heritage in Somaliland relies heavily on community-based knowledge, customary authority, and project-level safeguards, such as those required under ESS8, which applies to this project.

The closest officially recognized cultural heritage site to Qoolbulale is likely to be the Laas Geel rock art complex, located near Hargeisa, approximately 120 kilometers to the north of the project area. Laas Geel is one of the most important archaeological sites in the Horn of Africa, renowned for its Neolithic cave paintings, some of which date back over 5,000 years. While Laas Geel is geographically distant from Qoolbulale and well outside the project's area of influence, it highlights the wider regional significance of Somali heritage and underscores the need to incorporate cultural awareness into infrastructure development—even in seemingly undeveloped or remote areas.

Figure 35 A painting at Laas Geel, photo from World Monuments Fund

While no formally protected cultural heritage sites are located near Qoolbulale, the project area holds intangible cultural value tied to local tradition, pastoralist life, and sacred social spaces. The absence of a national cultural heritage enforcement system places additional responsibility on the project to apply ESS8, respect customary practices, and implement a chance-find procedure. Doing so will ensure that cultural heritage is preserved, community trust is maintained, and development proceeds in a respectful and inclusive manner.

Current Water Sources and Usage

The project community currently relies on a limited and highly unreliable set of water sources, which include a seasonal earth dam (Haffir Dam), berkads (traditional surface catchments), and, during dry periods, expensive water trucking. These sources are inadequate to meet the year-round domestic and livestock needs of both the settled population and the mobile pastoralists who transit the area, especially during periods of drought.

Primary Water Sources

Haffir Dam: This is the main traditional water source in Qoolbulale, capturing rainwater during the short rainy seasons (Gu and Deyr). It provides water for both human and livestock consumption, but it is highly seasonal, often running dry within 2–3 months after the rains. The dam also suffers from high evaporation rates and sedimentation, which reduce its capacity and longevity.

Figure 36: The haffir dam near the project site

Berkads: These are small, hand-dug water catchments lined with cement or clay that store rainwater. They are scattered around homesteads and grazing areas. Most are in poor condition, silted, and lack proper covers or filtration, making the water prone to contamination.

Water Trucking: During dry periods, many households are forced to rely on trucked water from distant boreholes. This water is costly, often exceeding $13.00 per cubic meter, and is unaffordable for many, especially vulnerable or marginalized households. Trucked water is typically unregulated and of uncertain quality, increasing the risk of waterborne diseases.

Figure 37: This is a water tank in the village filled by water truckers when there are no other sources

Figure 38: A cart for carrying water

Figure 39: Children filling jerry cans with water

Water Uses

Domestic Use: Water is used for drinking, cooking, handwashing, and basic household hygiene. Due to scarcity, households prioritize drinking and cooking, often reducing or foregoing washing during dry periods.

Livestock Use: Water is vital for camels, goats, sheep, and cattle, especially during the dry season when herds converge near the Haffir Dam. Camels in particular require large quantities of water at intervals, while goats and sheep need more frequent watering. The pressure from livestock often leads to congestion, degradation of watering areas, and conflict over access.

Institutional Use: Schools and the Maternal and Child Health post also rely on the same sources. Water scarcity at these facilities limits hygiene, especially for girls in school and for maternal health services, contributing to school absenteeism and reduced health service quality.

Small-scale Commercial Use: Some water is used for tea shops, informal eateries, and livestock trading activities, though water scarcity restricts growth of these livelihood activities. There is growing demand for water to support kitchen gardens or micro-irrigation, but this remains largely aspirational under current conditions.

Qoolbulale's existing water sources are seasonal, unprotected, and insufficient to meet current needs, let alone future demand. Water scarcity negatively affects health, education, livelihoods, and social cohesion. The proposed borehole project aims to replace this fragile system with a deep, permanent, and safely managed water supply, offering a significant improvement for the community's resilience and quality of life.

Potential for Conflict and Institutional Arrangements

Water-related conflict is a critical issue in Qoolbulale, both due to the chronic scarcity of water and the social and geographic context of the area. Qoolbulale is located in a transboundary dryland zone that serves as a seasonal convergence point for Somaliland-based pastoralists and cross-border herders from Ethiopia. As a result, water access in this area is not only a basic survival need but also a point of strategic control, linked to clan relations, seasonal migration, livestock management, and customary authority. With the introduction of a permanent borehole, the potential for conflict—if water access is not well governed—may increase.

Potential Sources of Conflict

Competition Between Local Residents and Mobile Pastoralists: During dry seasons, Qoolbulale experiences a large influx of migratory pastoralists seeking water and pasture. The current seasonal sources, particularly the Haffir Dam, already experience congestion and informal competition. With a permanent borehole in place, demand is likely to increase, especially from herders whose grazing corridors extend across the Ethiopia–Somaliland border. If the borehole is perceived as exclusive or dominated by one group, tensions could arise.

Intra-community Disputes Over Access and Management: Even within the resident population, conflict could emerge over issues such as:

- Who gets priority access during shortages (e.g., households vs. herders).
- How water is priced and who manages the funds.

- Perceptions of favoritism in infrastructure use (e.g., kiosk vs. animal troughs). This is particularly sensitive in a context where women, minority clans, and IDPs may feel excluded from decision-making.

Clan and Lineage Rivalries: In the Somali context, resource management often intersects with clan dynamics. If water governance structures are perceived as favoring one sub-clan or excluding others, disputes can escalate, especially in rural areas with limited external oversight. The fact that both Somaliland and Ethiopian communities use the area adds a layer of cross-border clan politics that must be managed carefully.

Encroachment and Unregulated Settlement Expansion: As water becomes more available, there is a high risk of spontaneous settlement growth around the borehole, potentially encroaching on traditional grazing lands. This may provoke conflict between settled and mobile users or between older and newer residents.

Known Local Tensions: While there have been no reported violent conflicts in Qoolbulale directly tied to the borehole site, consultations and assessments confirm that resource-related disputes have happened, especially during drought years. Local elders and community members have expressed concern that the presence of a borehole may attract more people and livestock, creating overcrowding and new tensions if governance is not well structured.

Existing Institutions for Conflict Prevention and Resource Management

Despite the risks, Qoolbulale benefits from several traditional and emerging institutional mechanisms that can be leveraged to prevent or de-escalate conflict:

Village Development Council (VDC): The VDC is the central community coordination body, comprised of elders, religious leaders, and respected household heads. It plays a key role in conflict mediation, land allocation, and inter-clan negotiation, especially during times of environmental stress. The VDC is widely respected and can serve as a bridge between formal project structures and customary governance.

While the VDC's authority is rooted in the local community, it can also manage influx from outside areas by applying established customary governance mechanisms. VDCs often address cross-boundary issues through inter-clan negotiation and temporary access agreements, facilitated by respected elders and religious leaders. In the event of spontaneous settlement growth or increased water demand from mobile or displaced populations, the VDC could convene joint meetings with leaders from the incoming groups, alongside district administration representatives, to agree on rules for land use, grazing access, and water rationing.

Similarly, the WUC, described below, which oversees day-to-day operation and allocation of borehole water, can implement user registration systems, scheduled access times, and tiered tariff structures to ensure that local needs are met first while providing a transparent framework for serving non-resident users.

Traditional Elders and Clan-Based Mediation: Elder councils (guurti) are the primary conflict resolution mechanism in rural Somaliland. They are skilled at customary negotiation, compensation, and peacekeeping, especially over issues like grazing access and water sharing. These mechanisms operate based on Somali Xeer (customary law), which emphasizes reciprocity, dialogue, and clan responsibility.

Water User Committee (WUC): A WUC has been established as part of the project's early engagement activities. The committee includes representatives from local households, elders, women, and youth. It is tasked with overseeing water access schedules, fee collection, maintenance, and grievance handling. Importantly, the WUC includes cross-clan representation and is expected to work closely with the VDC to avoid monopolization or misuse.

Customary Water Sharing Agreements: In areas of seasonal migration, Somali pastoralist communities have long relied on oral agreements between clans to manage shared access to water and pasture. These can be activated at the village level to regulate access to the borehole by Ethiopian or nomadic users, with guidance from elders.

Grievance Redress Mechanism (GRM): As required under the ESF, the project will establish a formal, multi-tiered grievance mechanism, allowing residents and pastoralists to file complaints or concerns anonymously and without fear of retaliation. This mechanism will operate alongside traditional systems, ensuring early warning of emerging disputes.

While the risk of conflict is real and must be taken seriously, the presence of strong traditional institutions and community governance structures offers a solid foundation for peaceful water management. The key will be to integrate formal project safeguards (such as the WUC and GRM) with these existing institutions, ensure inclusive participation across clans and social groups, and proactively manage water access and infrastructure layout. With these safeguards in place, the borehole has the potential to strengthen—not undermine—community cohesion and build resilience in a region where peace and cooperation are vital for survival.

5. Stakeholder Engagement and Public Disclosure

5.1. Objectives of Stakeholder Engagement

The stakeholder engagement process for the borehole project is designed to ensure transparency, inclusivity, and meaningful participation from all affected parties. Given the critical role that water resources play in livelihoods, health, and social stability, it is essential that local communities, government agencies, and other stakeholders are actively involved in decision-making. The engagement process follows ESS10 on stakeholder engagement and information disclosure, as well as Somaliland's environmental and water governance policies.

The key objectives of the stakeholder engagement process include:

Ensuring Transparent Information Sharing – Provide timely, clear, and accessible information about the borehole project, including its objectives, potential impacts, and management strategies. Stakeholders should have a full understanding of the project scope and their role in decision-making.

Encouraging Inclusive Participation – Ensure that all relevant stakeholder groups, including pastoralists, settled residents, women, youth, marginalized groups, and local authorities, have the opportunity to participate in discussions and contribute their perspectives.

Identifying and Addressing Concerns Early – Gather stakeholder feedback on water access, environmental risks, and socio-economic impacts to identify potential issues before they escalate into conflicts. This includes concerns related to groundwater sustainability, land access, livestock management, and potential settlement expansion due to improved water availability.

Promoting Equitable and Sustainable Water Governance – Strengthen local water governance structures by involving traditional leaders, the Water User Committee, and district-level authorities in the planning and decision-making process. Ensuring that community-led resource management is integrated into the borehole's operations will contribute to long-term sustainability.

Minimizing Social and Environmental Risks – Engage stakeholders to discuss potential risks such as over-extraction, land degradation, and conflicts over water allocation. This process will help develop locally accepted solutions, ensuring that mitigation measures are practical and culturally appropriate.

Enhancing Community Ownership and Long-Term Commitment – Foster a sense of local ownership and accountability over the borehole by ensuring that users are engaged in the design, implementation, and management phases. When communities feel ownership of the project, they are more likely to contribute to its maintenance and long-term sustainability.

Facilitating Grievance Redress and Conflict Resolution – Establish a formal grievance mechanism to allow community members and other stakeholders to raise concerns, report complaints, and seek resolution through fair and transparent processes. The grievance mechanism must be accessible, culturally appropriate, and protect vulnerable groups, particularly in cases related to GBV and water access disputes.

By prioritizing these objectives, the stakeholder engagement process will ensure that the borehole project meets the needs of the community while promoting environmental sustainability, social equity, and long-term resilience.

5.2. Alignment with GW4R SEP

Stakeholder engagement for the project has been conducted in full alignment with the Stakeholder Engagement Plan (SEP) prepared for the GW4R Project in Somaliland. The approach adopted reflects the SEP's core principles of inclusivity, cultural appropriateness, and continuous engagement. Communities have been consulted throughout the planning process using participatory methods adapted to the local context, and special efforts have been made to ensure that traditionally underserved groups—such as nomadic pastoralists, women-headed households, and internally displaced persons—have had meaningful opportunities to contribute to decision-making. The engagement process has also incorporated the SEP's provisions for grievance redress, feedback loops, and coordination with local governance structures, thereby ensuring that stakeholder voices inform both project design and mitigation planning.

Key Areas of the SEP

The GW4R SEP establishes a comprehensive framework for how stakeholder engagement should be structured across all components of the project. It emphasizes that effective engagement is not a one-time exercise but a continuous, adaptive process.

In line with the SEP, stakeholder engagement for the borehole project has included activities appropriate to each phase:

- During planning, community meetings and focus groups were held in accessible locations.
- Information has been disseminated via oral communication and local leaders, ensuring inclusivity for low-literacy populations.
- Village Development Committees (VDCs) have served as trusted intermediaries, helping to coordinate feedback and convey community concerns to the project team.

Inclusion of Vulnerable Groups

The SEP places a strong emphasis on the active inclusion of marginalized and underserved groups. In the sub-project, this has been achieved by:

- Holding separate consultations with women, minority clans, and nomadic households;
- Ensuring that vulnerable groups have input into project decisions.

Grievance Redress Mechanism (GRM)

Consistent with the SEP, a multi-tier grievance redress mechanism has been operationalized for the borehole project. Stakeholders can submit complaints or suggestions through:

- Local focal points and suggestion boxes;
- SMS, telephone, or in-person reporting to project staff;
- Escalation channels leading to the PIU and Ministry of Water Resource Development (MoWRD) if needed.

In cases of Gender-Based Violence (GBV) or Sexual Exploitation, Abuse, or Harassment (SEAH), the grievance system ensures survivor confidentiality and referral to appropriate services, in accordance with the SEP's safeguards.

Monitoring, Reporting, and Resources

The stakeholder engagement process is being continuously monitored to ensure it remains effective and inclusive. Indicators include the number and diversity of participants, grievance resolution rates, and community satisfaction with consultation processes. Dedicated staff—including a social specialist and communications officer—are responsible for implementation, and a defined budget has been allocated to support engagement activities, outreach, and grievance handling.

This alignment with the GW4R SEP has not only fulfilled safeguard requirements but also contributed to greater community ownership, reduced risk of conflict, and enhanced sustainability of the borehole investment.

5.3. Alignment with World Bank ESS10 and Somaliland Guidelines

The stakeholder engagement process for the Qoolbulale deep borehole project is designed to align with both ESS10 and Somaliland's national guidelines on environmental management and water governance. These frameworks emphasize the importance of transparency, public participation, and equitable decision-making in infrastructure projects that affect communities. Ensuring compliance with both international best practices and national regulations strengthens the project's legitimacy, enhances community ownership, and reduces risks of disputes or unintended negative impacts.

Alignment with World Bank ESS10

World Bank ESS10 establishes minimum standards for stakeholder engagement, information disclosure, and grievance redress mechanisms in investment projects. The key areas of alignment with this standard include:

Inclusive Stakeholder Identification and Participation – The project engages a wide range of stakeholders, including local community members, pastoralist groups, women, youth, traditional elders, local government representatives, and environmental authorities. Special attention is given to ensuring the participation of vulnerable and marginalized groups, including IDPs) and female-headed households.

Timely and Accessible Information Disclosure – The project commits to providing clear, culturally appropriate, and easily understandable information about the borehole's design, expected impacts, and long-term management. Information is shared through community meetings, printed materials, and radio announcements, ensuring that all community members, regardless of literacy level, have access to project details.

Meaningful Consultation Process – Consultations are structured to be free from coercion, inclusive, and gender-sensitive. The project organizes community *barazas* (public meetings), focus group discussions, and one-on-one interviews, particularly with women and marginalized groups, to ensure their perspectives are incorporated.

Establishment of a Functional Grievance Mechanism – A formal grievance redress system is established to handle complaints, disputes, and feedback from community members. The mechanism ensures confidential handling of sensitive issues, such as GBV and disputes over water access. Multiple reporting channels, including suggestion boxes, verbal complaints to elders, and a grievance officer, make the process accessible to all.

Commitment to Ongoing Engagement and Monitoring – Stakeholder engagement is not limited to the pre-construction phase but continues throughout implementation, operation, and decommissioning. Regular updates and public meetings will ensure that community concerns are continuously addressed.

Figure 40: Community meeting

Alignment with Somaliland Guidelines

The borehole project also aligns with Somaliland's national policies on environmental management, water governance, and community participation. Key areas of compliance include:

Somaliland Environment Management Act (2018) – The project follows requirements for conducting an ESIA before any large-scale infrastructure development. The assessment process includes stakeholder consultations and mitigation planning for potential environmental and social risks.

National Water Resources Strategy (2020-2024) – The project supports the national goal of improving rural water access through sustainable groundwater development. The borehole aligns with the strategy's emphasis on community-led water governance and integrated resource management.

Somaliland Water Act (2010, Amended 2011) – This law governs groundwater abstraction and water service management. The project ensures that permits from the MoWRD are obtained, water abstraction is monitored, and extraction rates remain within sustainable limits.

Community Engagement Requirements in ESIA Guidelines – Somaliland's ESIA guidelines emphasize the need for meaningful public participation in development projects. The borehole project engages community representatives, traditional elders, and relevant ministries to ensure fair and sustainable water resource allocation.

Customary Water Management Systems – The project integrates traditional governance mechanisms, including clan-based resource management and conflict resolution, to ensure that water access remains fair and equitable. This alignment with local governance structures ensures that the borehole is effectively managed in accordance with community expectations.

5.4. Stakeholder Identification

The following tables categorize key stakeholder groups involved in the project, outlining their roles, interests, and levels of influence in decision-making, water governance, and project sustainability.

Local Authorities and Government Entities

Table 12 Local Authorities

Stakeholder Group	Role/Interest in the Project	Level of Influence
Ministry of Water Resources Development (MoWRD)	Regulates groundwater abstraction, issues water permits, and oversees borehole sustainability.	High
Ministry of Environment and Climate Change (MoECC)	Ensures compliance with environmental regulations and impact mitigation measures.	High
Qoolbulale Village Development Council (VDC)	Represents community interests, facilitates local engagement, and oversees land-use agreements.	High
District Administration	Supports coordination between local authorities and national ministries, facilitates dispute resolution.	Moderate

Stakeholder Group	Role/Interest in the Project	Level of Influence
Water User Committee (WUC)	Manages water distribution, fee collection, maintenance, and local governance.	High
Ministry of Health	Monitors public health impacts related to water quality and sanitation.	Moderate

Figure 41: A meeting with local authorities

Community-Based Stakeholders

Table 13 Community Based Stakeholders

Stakeholder Group	Role/Interest in the Project	Level of Influence
Traditional Elders and Clan Leaders	Mediate conflicts, enforce customary water-sharing agreements, and ensure community compliance.	High

Stakeholder Group	Role/Interest in the Project	Level of Influence
Women's Groups	Advocate for gender-inclusive water governance, ensure fair access for households.	Moderate
Youth Representatives	Engage in water management training, promote sustainable practices.	Moderate
Religious Leaders	Influence community acceptance of the project, support grievance redress.	Moderate
School Committees	Ensure water access to schools, improve hygiene and sanitation for students.	Low to Moderate

Figure 42: Women's meeting

Figure 43: Elderly, some of whom are disabled, at the meeting

Water-Dependent Livelihood Groups

Table 14 Water dependent Livelihood Groups

Stakeholder Group	Role/Interest in the Project	Level of Influence
Pastoralists (Local and Transboundary)	Depend on borehole water for livestock, key users of water infrastructure.	High
Livestock Traders	Ensure reliable water supply for healthier animals, benefiting trade and market value.	Moderate
Water Vendors	May be affected by reduced demand for trucked water, may require alternative roles.	Low to Moderate
Small Business Owners	Seek stable water supply to expand commerce (tea shops, food processing).	Moderate
Transporters and Water Truck Operators	May need new roles if borehole reduces reliance on trucked water.	Low

Vulnerable and Marginalized Groups

Table 15 Vulnerable and Marginalized Groups

Stakeholder Group	Role/Interest in the Project	Level of Influence
Female-Headed Households	Heavily impacted by water access improvements, often primary water collectors.	Moderate
Internally Displaced Persons (IDPs)	May face access challenges without formalized rights to water.	Low to Moderate
Marginalized Communities	Require specific inclusion strategies to ensure equal water access.	Low
People with Disabilities	Need accessible water collection points and infrastructure.	Low

External Stakeholders and Development Partners

Table 16 External Stakeholders

Stakeholder Group	Role/Interest in the Project	Level of Influence
World Bank	Provides financial support and ensures project compliance with ESF standards.	High
NGOs and Humanitarian Organizations	Support water governance, training, and capacity building.	Moderate
Private Sector (Drilling Contractors)	Responsible for borehole construction and equipment installation.	High (during implementation)
Research and Academic Institutions	Conduct hydrogeological studies and assess groundwater sustainability.	Moderate
Cross-Border Water Management Entities	Manage potential transboundary water-sharing agreements.	Low to Moderate

Stakeholder Prioritization Matrix

The following matrix categorizes stakeholders based on their level of influence and level of interest in the project. This helps determine which stakeholders require the most engagement, consultation, and capacity-building efforts to ensure the project's success.

Table 17 Stakeholder Prioritization Matrix

Stakeholder Group	Level of Influence	Level of Interest	Engagement Priority
Ministry of Water Resources Development (MoWRD)	High	High	**Key Player** – Must be actively engaged in decision-making and governance.
Ministry of Environment and Climate Change (MoECC)	High	High	**Key Player** – Ensures environmental compliance and impact mitigation.

Stakeholder Group	Level of Influence	Level of Interest	Engagement Priority
Water User Committee (WUC)	High	High	**Key Player** – Manages water distribution, maintenance, and fee collection.
Qoolbulale Village Development Council (VDC)	High	High	**Key Player** – Facilitates local engagement and ensures social cohesion.
District Administration	Moderate	High	**Important Stakeholder** – Supports coordination between local and national entities.
Traditional Elders and Clan Leaders	High	Moderate	**Key Player** – Mediate disputes and enforce customary water-sharing rules.
Pastoralists (Local and Transboundary)	High	High	**Key Player** – Primary water users, critical for ensuring sustainability and fair access.
Women's Groups	Moderate	High	**Important Stakeholder** – Advocates for fair access and gender-inclusive water governance.
Internally Displaced Persons (IDPs)	Low	High	**Monitor and Include** – Ensure fair access to water and avoid exclusion risks.
Marginalized Communities	Low	High	**Monitor and Include** – Require specific outreach to prevent discrimination in water access.
School Committees	Low	Moderate	**Monitor and Include** – Ensure schools benefit from improved water access.
Religious Leaders	Moderate	Moderate	**Consult as Needed** – Can support community awareness and dispute resolution.
Private Sector (Drilling Contractors)	High (during construction)	Moderate	**Important Stakeholder** – Key to borehole development but less involved in long-term governance.
Livestock Traders	Moderate	High	**Important Stakeholder** – Depend on reliable water supply for animal health and trade.

Stakeholder Group	Level of Influence	Level of Interest	Engagement Priority
Water Vendors	Low	Moderate	**Monitor and Include** – May need alternative livelihoods if trucked water demand decreases.
NGOs and Humanitarian Organizations	Moderate	Moderate	**Consult as Needed** – Support capacity building and governance strengthening.
World Bank	High	Moderate	**Key Player** – Ensures funding and compliance with environmental and social safeguards.
Cross-Border Water Management Entities	Low	Low	**Monitor and Include** – May have a role in transboundary water agreements but limited direct impact.

Key Insights from the Matrix

Key Players (High Influence, High Interest) – These stakeholders require continuous engagement through regular meetings, consultations, and decision-making roles. This includes government ministries, the water user committee, local leaders, and pastoralists.

Important Stakeholders (Moderate Influence, High Interest) – These groups should be actively consulted to ensure their concerns are addressed. Women's groups, district authorities, and livestock traders fall into this category.

Monitor and Include (Low Influence, High Interest) – Stakeholders such as IDPs, marginalized communities, and school committees may have limited decision-making power but are highly affected by water access changes. They require targeted engagement efforts to avoid exclusion.

Consult as Needed (Moderate Influence, Moderate Interest) – Stakeholders such as religious leaders, NGOs, and private drilling contractors may not need frequent involvement but should be engaged at key project stages.

Low Priority (Low Influence, Low Interest) – Cross-border water entities and other less directly affected stakeholders should be monitored for potential future engagement needs, particularly in the case of transboundary water-sharing discussions.

5.5. Consultation Approach

Given the significance of water resources to households, pastoralists, and marginalized groups, the engagement process emphasizes meaningful dialogue, structured feedback mechanisms, and conflict-sensitive water governance. Consultations should be conducted through various engagement strategies, ensuring that all relevant stakeholder groups—including local authorities, community members, water-dependent livelihood groups, and vulnerable populations—can contribute to decision-making.

Engagement Strategies and Methods

The following table outlines the key consultation methods, their objectives, and the targeted stakeholder groups:

Table 18 Stakeholder Engagement Methods

Engagement Method	Objective	Target Stakeholders	Frequency
Community Meetings (Barazas)	Provide project updates, gather feedback, and discuss concerns.	General community, traditional elders, women, youth, pastoralists.	Quarterly
Focus Group Discussions (FGDs)	Gather in-depth perspectives from specific stakeholder groups.	Women's groups, youth, marginalized communities, IDPs.	Biannually
One-on-One Interviews	Ensure input from individuals who may not speak in large meetings.	Elders, water vendors, religious leaders, local government representatives.	As needed
Local Radio Announcements	Disseminate project information and key updates to a broader audience.	General public, mobile pastoralists, cross-border water users.	Monthly
Printed Materials (Posters, Flyers)	Provide visual and written information in accessible formats.	Low-literacy groups, schools, market vendors, water kiosk users.	As needed
Suggestion Boxes and Complaint Forms	Allow anonymous feedback and concerns to be submitted confidentially.	All community members, particularly vulnerable groups.	Continuous
Stakeholder Review Workshops	Validate findings from the ESIA and ensure community endorsement of the water governance structure.	Water User Committee, government agencies, NGOs, elders.	Annually
Engagement with Water User Committee (WUC)	Strengthen governance and promote community ownership of the borehole.	Elected community members, women's representatives, youth leaders.	Monthly

Engagement Method	Objective	Target Stakeholders	Frequency
Field Visits and Site Assessments	Monitor project progress and environmental/social impacts.	Local government officials, MoECC, MoWRD, project engineers.	As needed

Special Measures for Women, Youth, and Vulnerable Groups

Ensuring the meaningful participation of women, youth, and marginalized groups is a key priority in the consultation process. These groups often face barriers to engagement, such as traditional decision-making structures, time constraints, and lower literacy levels. To address these challenges, the following special measures should be implemented:

Women's Inclusion in Water Governance

- Dedicated women-only focus group discussions will be held to ensure women's concerns about water access, safety, and household needs are properly addressed.
- At least 30% of Water User Committee (WUC) members will be women, ensuring active participation in borehole management and decision-making.
- Water collection points will be designed with women's safety in mind, including well-lit locations, separate livestock and human water stations, and security measures to prevent harassment.

Youth Engagement in Decision-Making

- Youth representatives will be trained in water resource management and governance, allowing them to take on leadership roles within the WUC.
- Skills development programs, including technical training on borehole maintenance, will be introduced to provide employment opportunities for young people.
- Interactive sessions, including community radio discussions and school-based engagement, will ensure youth voices are included in discussions about water governance.

Targeted Outreach for Marginalized Groups and IDPs

- Specific engagement sessions will be organized for marginalized households and IDPs, ensuring that they are not excluded from accessing borehole water.
- IDPs and landless pastoralists will be integrated into local water-sharing agreements to prevent discrimination in borehole access.
- A confidential grievance mechanism will be established, allowing vulnerable groups to report water access issues, unfair pricing, or harassment without fear of retaliation.

5.6. Summary of Stakeholder Concerns

Below is a comprehensive table of stakeholder concerns, their details, and corresponding project adjustments and ESMP integration.

Table 19 Table of Stakeholder Concerns and Project Adjustments

Stakeholder Concern	Details of the Concern	Project Adjustments and ESMP Integration
Water Access and Distribution	Concerns that water distribution will favor certain groups, particularly settled households over pastoralists.	- Establish a Water User Committee (WUC) with diverse representation, including pastoralists, women, and marginalized groups. - Designate separate water points for humans and livestock to prevent congestion and ensure fairness. - Implement a rotational water collection system during peak demand periods.
Livestock Watering Conflicts	Fear that livestock troughs will be overwhelmed, reducing water availability for household use.	- Construct four livestock watering troughs with separate stations for camels, sheep, and goats. - Develop a watering schedule for livestock herders to prevent overuse. - Engage traditional elders in water-sharing agreements between pastoralists and settled residents.
Groundwater Over-Extraction	Concern that high demand may deplete the aquifer, particularly in dry seasons.	- Install flow meters and monitoring systems to track water extraction. - Establish sustainable pumping limits based on hydrogeological assessments. - Conduct biannual groundwater recharge studies to ensure long-term sustainability.
Land Acquisition and Access	Uncertainty regarding who controls borehole land and whether infrastructure may restrict grazing routes.	- A voluntary land agreement in line with ESS5 has been secured. - Ensure that pastoralists retain access to grazing corridors around the borehole site. - Avoid permanent fencing that restricts seasonal livestock movement.
Water Quality and Health Risks	Concerns about water contamination from livestock waste or poor maintenance.	- Implement regular water quality testing for bacteria, nitrates, and salinity.

Stakeholder Concern	Details of the Concern	Project Adjustments and ESMP Integration
		- Ensure proper well-casing and sealing to prevent contamination. - Educate the community on safe water handling and hygiene practices.
Gender and Women's Participation	Women are responsible for water collection but may be excluded from decision-making.	- Ensure at least 30% representation of women on the Water User Committee. - Hold women-only focus group discussions to gather input on water access needs. - Design water collection points close to households to reduce travel time and workload for women.
Marginalized Groups and IDPs	Fear that displaced persons and marginalized groups may face discrimination in water access.	- Implement equitable pricing models to ensure affordability for vulnerable groups. - Allow IDPs to participate in community water governance through representation on the WUC. - Establish a confidential grievance mechanism for reporting access issues.
Borehole Management and Governance	Concerns about corruption, mismanagement, and unfair fee collection.	- Implement transparent water pricing, with revenue used for borehole maintenance. - Train WUC members in financial management and governance. - Conduct quarterly community audits to ensure accountability.
Potential for Settlement Expansion	Improved water access may attract new settlers, increasing pressure on grazing lands.	- Develop a land-use management plan to regulate settlement growth. - Engage local authorities in urban planning discussions. - Monitor population trends and water demand over time.
Security and Conflict Risks	Concerns over clashes between different clans, pastoralists, and new settlers regarding water rights.	- Implement a customary water-sharing agreement mediated by elders and local authorities. - Set up a conflict resolution mechanism within the WUC.

Stakeholder Concern	Details of the Concern	Project Adjustments and ESMP Integration
		- Conduct inter-community meetings to promote peaceful resource-sharing.

5.7. Stakeholder Engagement Plan

The table below outlines the stakeholder engagement schedule, detailing specific activities, target stakeholders, engagement methods, and timing for each phase of the borehole project in Qoolbulale.

Table 20 Stakeholder Engagement Plan

Phase	Engagement Activities	Stakeholders Involved	Method of Engagement	Timing
Pre-Construction (Planning & ESIA Completion)	- Present ESIA findings and collect feedback. - Secure community land-use agreements. - Establish Water User Committee (WUC). - Define roles of local authorities in borehole governance.	- Village Development Council (VDC). - Traditional elders and clan leaders. - Pastoralist representatives. - Women's groups. - Ministry of Water Resources Development (MoWRD).	- Community barazas (public meetings). - Focus group discussions (FGDs) with women and marginalized groups. - One-on-one meetings with government officials.	Two months before drilling begins
Early Construction (Drilling & Infrastructure Setup)	- Inform community about construction schedules and safety protocols. - Provide grievance mechanism details. - Conduct training on borehole governance and conflict resolution.	- General community members. - Water User Committee (WUC). - Contractors and drilling team. - Ministry of Environment and	- Notice boards at borehole site and water kiosks. - Loudspeaker announcements in village center. - Radio broadcasts for mobile pastoralists.	One week before drilling begins

Phase	Engagement Activities	Stakeholders Involved	Method of Engagement	Timing
		Climate Change (MoECC).		
Mid-Construction (Infrastructure Installation & Testing)	- Monitor and address emerging community concerns. - Provide updates on construction progress. - Conduct first round of water quality testing and share results.	- Local households and pastoralists. - WUC and elders. - Health Ministry representatives.	- Site visits and interactive Q&A sessions. - Suggestion boxes at water points. - Mobile community outreach.	Monthly during construction
Post-Construction (Handover & Operation Start)	- Train WUC members on maintenance, water pricing, and dispute resolution. - Final community consultation to confirm satisfaction & concerns. - Distribute water-sharing agreements to local users.	- Water User Committee (WUC). - MoWRD and district authorities. - Pastoralist representatives. - Women's groups.	- Capacity-building workshops. - Printed materials with operational guidelines. - Community validation meetings.	One month after construction is complete
Ongoing Operation & Monitoring	- Conduct quarterly reviews of borehole function & water distribution fairness. - Monitor groundwater levels & sustainability. - Hold annual community feedback meetings.	- WUC & community elders. - MoWRD & MoECC. - Health Ministry & NGOs. - External auditors (as needed).	- Quarterly public meetings. - Annual satisfaction survey. - Water quality reports posted at kiosks.	Continuous (quarterly & annual reviews)

Phase	Engagement Activities	Stakeholders Involved	Method of Engagement	Timing
	- Resolve grievances & address emerging conflicts.			

5.8. Disclosure of ESIA Findings

The table below outlines the formats, locations, and target audiences for the dissemination of ESIA findings, ensuring that information is accessible, transparent, and culturally appropriate for all stakeholders in Qoolbulale.

Table 21 Disclosure of ESIA

Format	Location and Access Points	Target Audience
Printed Reports in Somali	- Village Development Council office. - Health center. - Local school. - Ministry of Water Resources Development (MoWRD) office.	- Village elders and leaders. - Government authorities. - Educated community members.
Simplified Summaries (Posters & Flyers)	- Mosque bulletin boards. - Water kiosks and borehole site. - Community meeting spaces. - Livestock market areas.	- General community members. - Low-literacy groups. - Pastoralists and water users.
Audio Announcements (Radio & Loudspeakers)	- Local radio stations. - Mosque loudspeakers. - Village market announcements.	- Mobile pastoralists. - Nomadic groups. - Households without formal education.
Community Meetings & Public Readings	- Village meeting area (main tree gathering space). - Women’s group meetings. - School assemblies.	- Non-literate residents. - Women and youth groups. - Schoolchildren and teachers.
Stakeholder Review Workshops	- District administration office. - Water User Committee meetings. - MoECC and MoWRD meetings.	- Government agencies. - NGOs and development partners. - Water management institutions.

Format	Location and Access Points	Target Audience
Online & Government Archives (if applicable)	- MoWRD and MoECC websites. - Project implementation unit (PIU) digital archives.	- NGOs and researchers. - External auditors and funding agencies.

5.9. Culturally Appropriate Adjustments for Inclusion

To ensure that the ESIA disclosure process is inclusive, accessible, and aligned with project standards, the project will implement culturally appropriate engagement strategies that reflect local norms, literacy levels, and traditional governance structures in Qoolbulale. Special attention will be given to ensuring that women, youth, marginalized groups, and pastoralists have equal access to project information and decision-making processes.

Key Culturally Appropriate Adjustments

Women-Specific Consultation and Disclosure Approaches

- Many women in Qoolbulale have limited decision-making power in public meetings but play a central role in water collection and household management.
- Women-only discussion forums will be organized, led by female facilitators, to encourage open participation without the influence of male community leaders.
- Water kiosks, health centers, and markets—places where women frequently gather—will be prioritized as information hubs for ESIA disclosure.
- Radio programs and storytelling formats will be used to share project information in a way that aligns with traditional learning methods.

Respect for Traditional Leadership and Decision-Making Structures

- Traditional elders and clan leaders play a key role in land and resource governance. Their support is critical to ensuring project acceptance and preventing conflicts.
- The ESIA findings will be formally presented to the Village Development Council (VDC) and clan elders, allowing them to disseminate key messages in ways that are culturally appropriate and respected by the community.
- Elders will also be integrated into the grievance redress system, ensuring that local conflict resolution mechanisms are utilized alongside formal complaint procedures.

Mobile Outreach for Pastoralist and Nomadic Communities

- Many pastoralists and transboundary water users do not reside permanently in the village and may not have regular access to community meetings or printed materials.
- Mobile consultation teams will travel to grazing areas to share project updates, gather feedback, and address concerns.
- Radio broadcasts in Somali and Oromo languages will be used to ensure that cross-border water users are aware of the project's scope and grievance mechanisms.
- Community megaphone announcements and mosque loudspeaker messages will be used to reach those who may not have access to printed materials.

Low-Literacy and Visual Communication Strategies

- Many community members, particularly women and older residents, may have limited formal education, making written reports ineffective for communication.
- Illustrated posters and infographics will be used to explain water governance structures, borehole operations, and grievance mechanisms in a way that is easy to understand without reading skills.
- Community theater and storytelling will be incorporated into disclosure events to provide a relatable and engaging way to explain project risks and benefits.

Incorporation of Religious and Cultural Influences

- Religious leaders have a strong influence on community trust and social behavior.
- Imams and mosque committees will be engaged to support awareness campaigns, ensuring that messages align with religious values and cultural traditions.
- Project materials will avoid sensitive language or imagery that may conflict with local beliefs about water management, gender roles, or environmental responsibility.

Ensuring Safe and Confidential Participation for Vulnerable Groups

- Internally displaced persons (IDPs) and marginalized groups may fear discrimination or exclusion from water access.
- Confidential grievance mechanisms, such as private suggestion boxes and one-on-one interviews, will ensure that concerns can be raised without fear of retaliation.
- At least one female representative will be designated as a grievance focal point to handle gender-based complaints and ensure inclusivity.

Timing and Location Adjustments to Facilitate Participation

- Community meetings and engagement sessions will be scheduled at times that do not interfere with daily chores, livestock herding, or prayer times.
- Public consultations will be held in easily accessible locations, such as the village center, school compounds, or water collection points.

By incorporating gender-sensitive approaches, respecting traditional governance, and tailoring communication methods to the local context, the ESIA disclosure process will be transparent, participatory, and effective in reaching all segments of the Qoolbulale community.

6. Alternatives

6.1. No-Project Alternative Analysis

The no-project alternative evaluates what would happen if the proposed deep borehole in Qoolbulale is not developed, leaving the community reliant on existing water sources and supply systems. This scenario provides a baseline for assessing the necessity and urgency of the project by highlighting the social, economic, and environmental consequences of inaction.

Continued Water Scarcity and Unreliable Supply

Qoolbulale currently depends on the Haffir Dam that experiences high evaporation losses and sediment buildup, reducing its capacity to provide consistent and clean water throughout the year. Without the borehole, residents will remain highly vulnerable to prolonged drought periods, forcing them to resort to water trucking, which is both unaffordable and unreliable. During dry seasons, the cost of trucked water can rise to $13.50 per cubic meter, creating a financial strain on households and limiting access to safe drinking water.

Additionally, berkads in the area have deteriorated due to lack of maintenance, further reducing available water storage options. As a result, community members will continue to face long walking distances and time-consuming water collection, particularly women and children, who are primarily responsible for household water fetching.

Health and Sanitation Risks

The lack of a permanent, safe water source will continue to exacerbate public health issues, particularly waterborne diseases such as diarrhea, cholera, and typhoid. Many existing water sources are unprotected and prone to contamination, leading to high levels of bacterial and chemical pollutants. If the project is not implemented, residents will remain dependent on unsafe water supplies, increasing the risk of disease outbreaks, malnutrition, and poor hygiene.

Schools and health facilities will also struggle to maintain adequate sanitation without a reliable water source. The existing health center in Qoolbulale already lack sufficient water for sanitation and medical use. Without intervention, the ability to provide safe childbirth, infection control, and general healthcare services will remain severely compromised.

Negative Impacts on Livelihoods and Food Security

The absence of a permanent borehole will continue to negatively impact livestock productivity and economic stability. Qoolbulale is a livestock-dependent community, where herders must migrate long distances in search of water for their animals. Without a borehole, pastoralists will face higher livestock mortality rates, lower milk production, and decreased market value for their animals due to water scarcity and poor animal health.

Additionally, water shortages will prevent any potential for small-scale agriculture, limiting household food security and keeping the community dependent on external food supplies. Without access to stable water sources, economic diversification opportunities will remain limited, preventing local businesses from growing and increasing vulnerability to market shocks and climate variability.

Increased Conflict Over Water Resources

Without a reliable borehole, water competition will intensify between resident communities, nomadic pastoralists, and cross-border users from Ethiopia. The Haffir Dam is already under pressure, and as population and livestock numbers increase, the risk of clashes over water access will grow. In times of drought, tensions can escalate into resource-based disputes, disrupting social cohesion and leading to forced migration and displacement.

Without a borehole, there will be no structured water governance system, and disputes over prioritization of water use—between domestic needs, livestock, and potential settlement expansions—will remain unresolved. This could undermine local governance structures and weaken community resilience.

Gender and Social Equity Implications

Women and girls in Qoolbulale bear the greatest burden of water collection, often walking several kilometers daily to fetch water. If the borehole is not developed, they will continue to spend hours each day collecting water, reducing opportunities for education, economic participation, and overall well-being.

Without an improved water supply, the community's gender inequalities will persist, as women's time and energy will remain fully consumed by water-fetching duties, rather than being invested in income-generating activities or leadership roles in water governance.

Environmental Consequences

Continued reliance on surface water and shallow, unregulated groundwater sources could lead to land degradation, worsening desertification, and increased pressure on fragile ecosystems. Overuse of the Haffir Dam could accelerate siltation and ecological decline, reducing its long-term viability. Without a sustainable groundwater source, the community will continue to extract water inefficiently from less reliable sources, further depleting shallow aquifers and contributing to environmental degradation.

Conclusion

The no-project alternative would leave Qoolbulale in a continued state of water insecurity, with severe social, economic, and environmental consequences. Given these factors, the borehole project is essential to securing sustainable water access, improving public health, reducing conflict, and enhancing economic stability in Qoolbulale. Without intervention, the cycle of water insecurity and socio-economic vulnerability will persist, putting future generations at even greater risk.

6.2. Analysis of Design Alternatives

In considering the most effective way to provide a sustainable water source for Qoolbulale, several design alternatives exist. Each alternative has its own advantages and disadvantages in terms of cost, reliability, environmental impact, and social feasibility.

Location Alternatives

The selection of the final drilling site for the proposed borehole in Qoolbulale was informed by a rigorous technical, hydrogeological, and participatory process, in alignment with World Bank ESF standards and Somaliland national guidelines. The process integrated geophysical investigations, environmental assessment, and consultations with local communities.

Initial Site Screening

An initial appraisal of the Qoolbulale area in Maroodi Jeeh Region, near the Somaliland–Ethiopia border, identified several potential zones for groundwater development. Key screening criteria included:

- Severe water scarcity and reliance on seasonal berkads, haffir dams, and balleys
- Absence of nearby boreholes (the closest being approximately 30 km away)
- Location within the broader Yesomma Sandstone outcrop zone, with favorable aquifer potential
- Strategic accessibility to approximately 700 resident households and 250 nomadic families
- Avoidance of flood-prone areas or zones with high clay content unsuitable for groundwater storage

Geophysical and Hydrogeological Analysis

A detailed hydrogeophysical survey was conducted, including 15 Vertical Electrical Soundings (VES) using Schlumberger arrays with an AB/2 of 1,000 meters. The geological context comprises:

- **Yesomma Sandstone Formation**: the primary aquifer target, consisting of sandy strata with moderate resistivity values (20–40 Ωm)
- **Precambrian Basement**: impermeable bedrock identified by high resistivity (~500 Ωm), indicating the aquifer base

VES interpretations delineated a favorable hydrostratigraphic profile in the northern part of the study area, where the saturated thickness of the Yesomma aquifer is expected to exceed 100 meters. The estimated depth to static water level is 250–350 meters, with potential yields of 10–15 m^3/hour.

Preferred Site Identified

Based on aquifer geometry, resistivity mapping, and logistical considerations, a primary candidate zone was delineated around VES points 07 and 15. This location was preferred due to:

- Depth to Precambrian basement exceeding 500 meters, offering substantial saturated thickness
- Resistivity values between 25–31 Ωm, indicating sand-rich, water-bearing formations
- Safe separation from areas with high clay content or cemented strata
- Central location relative to surrounding settlements, reducing future pipeline infrastructure costs
- Strong community support and confirmed government land tenure

Final Site Selection

The recommended drilling corridor is bounded by the following coordinates:

- **Latitude**: 8.895° N to 8.912° N
- **Longitude**: 44.422° E to 44.460° E

Drilling will be conducted within this corridor, with a planned depth of 450–500 meters. The aquifer is expected to yield up to 5 l/s (~18 m³/hour), with water quality ranging from slightly to moderately brackish (EC 2,500–4,000 µS/cm), suitable for livestock and basic domestic uses during extended dry periods. This structured selection process ensures that the borehole location is optimized for hydrogeological performance, social benefit, and cost-efficiency, while mitigating environmental and technical risks.

Energy Supply Alternatives

Option 1: Borehole with Solar-Powered Pump Only (No Diesel Backup)

This design would use a fully solar-powered pumping system, with solar panels providing energy for water extraction and distribution.

Advantages

- Sustainability and Environmental Benefits – No fossil fuel consumption, reducing greenhouse gas emissions and environmental pollution.
- Lower Operating Costs – Once installed, solar energy is free, eliminating the ongoing fuel costs associated with diesel generators.
- Minimal Maintenance – Fewer moving parts compared to diesel generators, reducing the frequency and cost of maintenance.
- Alignment with Climate Resilience Goals – Supports renewable energy adoption and reduces reliance on non-renewable energy sources.

Disadvantages

- Limited Water Availability in Low-Sunlight Conditions – Water pumping is reduced during cloudy days or nighttime, which may lead to shortages if storage tanks are not sufficient.
- High Initial Cost – Solar panel systems require higher upfront investment, although they have lower long-term costs.
- Potential for Theft and Vandalism – Solar panels and electrical components may be at risk of theft, especially in remote areas.
- Battery Storage Issues – If battery backup is required, storage system costs increase, and batteries may need replacement every 5 to 7 years.

This alternative is best suited for communities with predictable sunlight patterns and sufficient water storage capacity. However, the lack of a diesel backup system may result in unreliable water access during extended cloudy periods.

Option 2: Borehole with Diesel-Only Pump System

This design relies solely on a diesel-powered pump for water extraction and distribution. It is the most traditional method and is commonly used where solar power is not viable.

Advantages

- High Pumping Capacity – Can operate 24/7, ensuring continuous water availability without dependence on sunlight.
- Lower Initial Cost – Diesel pump systems require lower capital investment compared to solar-powered alternatives.
- Easier to Repair – Diesel engines and mechanical systems are well-understood and easier to repair with locally available skills and parts.

Disadvantages

- High Operating Costs – Diesel fuel is expensive, and fuel price fluctuations can make operation unsustainable in the long term.
- Environmental Impact – Diesel generators produce carbon emissions and noise pollution, contributing to air and environmental degradation.
- Logistics and Fuel Supply Issues – Requires a steady supply of fuel, which may be challenging and costly in remote areas like Qoolbulale.
- More Frequent Maintenance – Diesel engines require regular servicing, oil changes, and filter replacements, increasing maintenance demands.

This alternative ensures reliable water supply but comes with significant financial and environmental costs. It is only suitable as a short-term solution or for locations where renewable energy solutions are not feasible.

Option 3: Borehole with Hybrid Solar-Diesel Pump System (Recommended Option)

This design integrates both solar power and diesel generators, allowing the pump to operate primarily on solar energy during daylight hours, with a diesel backup for nighttime or low-sunlight conditions.

Advantages

- Reliability and Continuity of Water Supply – The diesel backup ensures continuous operation, preventing water shortages during cloudy days or high demand periods.
- Lower Long-Term Operating Costs – Since the system runs primarily on solar power, fuel costs are significantly reduced compared to a fully diesel system.
- Lower Carbon Footprint – While diesel is used, its usage is minimized, reducing overall carbon emissions and environmental impact.
- Balanced Investment Costs – Although initial costs are higher than a diesel-only system, long-term savings from reduced fuel dependency make it more cost-effective.

Disadvantages

- Higher Initial Investment – The combination of solar panels, diesel generator, and hybrid controls requires a larger upfront budget than a diesel-only system.
- Technical Complexity – Requires trained personnel to manage and maintain both solar and diesel components.
- Battery Storage Still Needed for Maximum Efficiency – If full off-grid autonomy is needed, battery storage may be required, adding to costs.

This hybrid system offers the best balance of sustainability, cost-efficiency, and reliability, making it the preferred choice for the Qoolbulale borehole project. It ensures sufficient water supply during both high-demand and low-sunlight periods while keeping operational costs manageable.

Summary of Energy Alternatives

Table 22 Summary of Energy Supply Alternatives

Alternative	Advantages	Disadvantages	Suitability
Solar-Powered Pump Only	No fuel costs, environmentally friendly, lower maintenance.	Cannot operate at night, expensive battery storage, vulnerable to theft.	Best for areas with high sun exposure and strong security measures.
Diesel-Only Pump System	Can operate continuously, lower initial cost, easy to repair.	High fuel costs, environmental impact, requires constant fuel supply.	Suitable only as a short-term or emergency solution.
Hybrid Solar-Diesel System (Recommended Option)	Reliable water supply, lower long-term costs, reduced carbon footprint.	Higher initial investment, requires technical management.	Best balance of sustainability, cost, and operational efficiency.

After evaluating the three energy supply alternatives, the hybrid solar-diesel pump system is the most suitable choice for the Qoolbulale borehole project. It provides the reliability of a diesel backup with the cost savings and environmental benefits of solar energy, making it the best long-term solution for sustainable groundwater management in the community.

Drilling Method Alternatives

The selection of the drilling method depends on geological conditions, borehole depth, water yield requirements, and cost considerations. The two primary options are rotary drilling and percussion drilling.

Rotary Drilling (Mud or Air Rotary)

Rotary drilling is the most common method used for deep boreholes in arid regions like Qoolbulale. This technique employs a rotating drill bit to cut through rock formations, while drilling fluid (mud or compressed air) carries cuttings to the surface.

- Advantages:
  - Suitable for deep boreholes (up to 500m as planned in Qoolbulale)
  - Faster drilling speeds than percussion methods.
  - Works well in consolidated formations like sandstone, which is present in the Yesomma Formation.
- Disadvantages:
  - Higher costs due to the need for drilling mud or air compressors.
  - Complex operation and maintenance, requiring skilled labor.
  - Environmental concerns related to disposal of drilling fluids.

Percussion Drilling (Cable Tool)

Percussion drilling involves raising and dropping a heavy bit to crush rock and create a borehole. It is effective in hard rock formations and requires no drilling fluids.

- Advantages:
  - Lower initial equipment costs.
  - Suitable for hard rock formations and areas where groundwater is relatively shallow.
  - No need for drilling fluid disposal.
- Disadvantages:
  - Slower than rotary drilling, making it unsuitable for deep boreholes.
  - Less effective in unconsolidated formations like sand and gravel.
  - Higher labor costs due to extended drilling time.

Recommended Option

Considering the 500m target depth and Yesomma Sandstone Formation, mud rotary drilling is the preferred option due to its efficiency, speed, and ability to handle varying geological conditions.

Drilling Mud Alternatives

Drilling muds, also referred to as drilling fluids, are essential in the borehole drilling process to stabilize the borehole wall, cool the drill bit, remove cuttings, and maintain hydrostatic pressure. The choice of mud affects both drilling efficiency and the environmental and social footprint of the project.

Water-Based Mud:

Water-based muds are the most common type of drilling fluids and use freshwater or brine as a base, mixed with bentonite clay, as needed. They are generally regarded as the most environmentally acceptable option.

- Advantages:
    - Lower environmental impact compared to oil-based systems
    - Easier to dispose of and manage with simple lined pits
    - Readily available materials and additives
    - Lower cost and simpler logistics
    - Safer for handling by workers and less hazardous to nearby communities
- Disadvantages:
    - May require additives to control clay swelling and hole stability
    - Potential for bacterial growth in stagnant pits if not managed properly

Synthetic-Based Mud

Synthetic-based muds use synthetic oils (e.g., esters, olefins) as a base fluid, offering better lubricity and thermal stability while being less toxic than traditional oil-based muds. They are commonly used in challenging geologies or deeper wells.

- Advantages:
    - Excellent lubricity for deep or deviated wells
    - Reduced bit wear and improved rate of penetration
    - Lower toxicity than traditional oil-based systems
- Disadvantages:
    - More expensive than WBM
    - Requires specialized waste handling and disposal procedures
    - Can still pose groundwater contamination risks if improperly managed

- Not widely available in Somaliland and may involve importation delays

Oil-Based Mud

Oil-based muds use diesel or mineral oil as the base fluid and are known for their superior performance in reactive shales, high-pressure zones, and complex formations. However, their environmental risks are significant.

- Advantages:
  - Superior wellbore stability in difficult geological conditions
  - Excellent thermal resistance and lubricity
  - Lower fluid loss compared to WBM
- Disadvantages:
  - High environmental risk if spilled (especially near aquifers)
  - Toxic to flora, fauna, and human health if not carefully contained
  - Requires advanced equipment and trained personnel
  - Expensive and difficult to dispose of in Somaliland due to lack of hazardous waste infrastructure

Recommendation

Given the depth and location of the borehole, Water-Based Mud is recommended as the most appropriate drilling fluid. It offers an acceptable balance of performance, cost, safety, and environmental protection for the Somaliland context. However, the formulation of the WBM must include additives that improve borehole stability and reduce environmental risks from cuttings and mud disposal.

Use of a Hand Pump (Manual Pump System)

Instead of installing a motorized submersible pump, the borehole could be fitted with a deep well hand pump (e.g., India Mark II).

Advantages:

- Low capital and operational costs.
- Simple to operate and maintain using local labor.
- No need for electricity or fuel, making it resilient during outages.

Disadvantages:

- Not suitable for very deep boreholes (>50–70 meters); Qoolbulale's borehole is 500m deep.
- Cannot meet the water demands of a large population and livestock—limited output (max ~1 m^3/hour).
- Manual pumping is labor-intensive and not feasible for elders or persons with disabilities.

Conclusion: Not feasible given the aquifer depth and community water needs.

Surface Water Storage with Rainwater Harvesting

Instead of a deep borehole, invest in improved water harvesting systems (e.g., lined berkads, cisterns, or ferrocement tanks) to capture rainwater during the wet season.

Advantages:

- Can be community-managed and scaled to household or institutional levels.
- Reduces dependence on groundwater and complements borehole use.
- Relatively low-tech, low-carbon, and replicable.

Disadvantages:

- Highly seasonal and unreliable due to erratic rainfall patterns.
- Significant evaporation losses in the hot climate.
- Not suitable as a standalone solution for year-round water access.

Conclusion: Useful as a supplementary measure, but insufficient as the main water source in drought-prone Qoolbulale.

Development of a Multi-Village Water Scheme (Regional Water Supply)

Link Qoolbulale to a broader rural water supply network through piped connections from larger boreholes or dams.

Advantages:

- Can reduce duplication of infrastructure across villages.
- Allows for centralized management and economies of scale.
- More efficient resource use if integrated across multiple communities.

Disadvantages:

- Very high initial investment and complex engineering required.
- Potential land and right-of-way issues for laying pipelines.
- Governance challenges—greater risk of inequitable access or politicization.

Conclusion: Viable in densely populated areas but not cost-effective for Qoolbulale's remote, dispersed population.

Shallow Well Development with Managed Recharge

Rather than a single deep borehole, multiple shallow wells could be dug and augmented with managed aquifer recharge (MAR) techniques.

Advantages:

- Spreads water access geographically, reducing congestion at one site.

- Encourages sustainable recharge through infiltration ponds or catchments.
- Could support agriculture in addition to household use.

Disadvantages:

- Shallow aquifers are generally dry or saline in Qoolbulale.
- High risk of contamination and lower yield compared to deep boreholes.
- Requires intensive local monitoring and technical support.

Conclusion: Technically interesting but unsuitable for this site due to poor shallow aquifer characteristics.

Summary Table

Alternative	Advantages	Disadvantages	Feasibility
Hand pump	Low cost, simple	Not viable at 500m depth, low output	Low
Rainwater harvesting	Sustainable, complementary	Seasonal, evaporation losses	Moderate (as a supplement)
Multi-village scheme	Scalable, efficient	High cost, governance complexity	Low to moderate
Shallow wells with recharge	Decentralized, good for agriculture	Low yield, poor water quality	Low

While a deep borehole with a solar or hybrid (solar + diesel) system remains the most viable and sustainable solution for Qoolbulale, complementary options like rainwater harvesting or regional water planning may add value in the future if supported by feasibility studies and community demand. These alternatives should be revisited as part of long-term resilience and expansion planning.

7. Environmental and Social Impacts and Mitigation Measures

7.1. Impact Assessment Methodology

The impact assessment follows a structured methodology to determine the significance of each environmental and social impact, based on its magnitude, duration, and type. This approach enables a transparent and consistent evaluation of both positive and adverse impacts and informs the appropriate design of mitigation or enhancement measures.

Impact Significance

Impact significance is a function of:

- **Magnitude** (extent and severity of the impact),
- **Receptor sensitivity** (social or ecological),
- **Probability of occurrence**, and
- **Reversibility or persistence**.

Impacts are categorized as follows:

Table 23 Impact Significance

Category	Definition
High	The impact is expected to cause major, long-term or irreversible changes to sensitive social receptors. Likely to require significant mitigation or design changes.
Moderate	The impact may cause appreciable but manageable changes to physical, biological, or social environments. Can be reduced through well-defined mitigation.
Low	The impact is minor, short-term, reversible, or occurs in a context of low sensitivity. Requires standard mitigation or monitoring.

Note: Both positive and negative impacts are rated using the same scale. For example, a *High positive* impact may significantly enhance water access or health outcomes.

Duration

The duration refers to the length of time the impact is expected to persist:

Table 24 Duration

Category	Definition
Temporary	Impact occurs only during the construction or short-term operational phase and dissipates shortly after the activity ends. Typically <2 years.
Permanent	Impact continues throughout the project life cycle or has long-lasting effects that persist beyond project closure (e.g., groundwater depletion, land use change).

Type of Impact

Impact type describes the relationship between the project activity and the effect:

Table 25 Type of Impact

Category	Definition
Direct	The impact results immediately from a project activity (e.g., noise from drilling, contamination from fuel spills). Causality is immediate and traceable.
Indirect	The impact occurs as a secondary or downstream effect of the project (e.g., population influx leading to resource competition, rangeland degradation from increased access). These impacts may be delayed or mediated by other factors.

Assessment Procedure

Each identified impact is assessed using the following steps:

1. **Identification** of the source (project activity) and the receptor (environmental or social system).
2. **Evaluation of magnitude**, sensitivity of the receptor, and potential cumulative effects.
3. **Assignment of significance** based on predefined criteria (High, Moderate, Low).
4. **Characterization of duration and type** (Temporary/Permanent; Direct/Indirect).
5. **Documentation** of rationale, including any assumptions or uncertainty.

Example

Table 26 Impact Evaluation Examples

Impact	Significance	Duration	Type	Rationale
Dust from construction	Low	Temporary	Direct	Localized and reversible, easily mitigated through spraying
Conflict over resource access	Moderate to High	Permanent	Indirect	May emerge gradually from population influx or exclusion

Mitigation Hierarchy

The borehole project applies the mitigation hierarchy in line with World Bank ESS1 and the Somaliland ESIA Operational Guidelines. This systematic approach ensures that environmental and social risks are managed in a structured and transparent manner throughout the project lifecycle.

First, during planning and design, the project seeks to avoid impacts altogether wherever possible. This includes careful site selection to prevent disturbance to sensitive habitats, avoidance of areas of cultural significance, and designing works to limit vegetation clearance. Where avoidance is not feasible, the project moves to minimize potential impacts through design modifications, best practice construction methods, and timing activities to reduce disruption to communities and ecosystems.

Where impacts still occur despite these measures, the project commits to restore affected areas to their original or an improved condition, such as replanting native vegetation, reinstating grazing areas, or rehabilitating temporary access tracks. Finally, if significant residual impacts remain after avoidance, minimization, and restoration, the project will consider offset or compensation measures, such as contributing to community resource management initiatives or supporting alternative livelihoods to balance unavoidable losses.

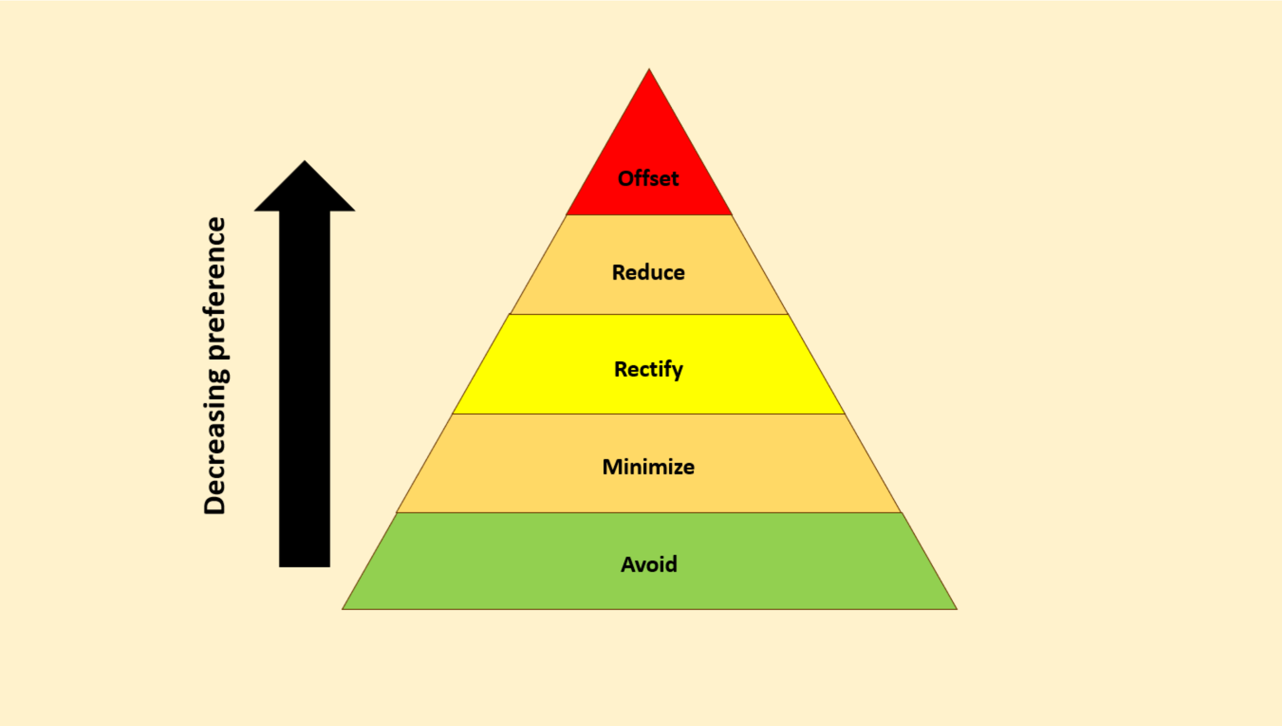


Figure 44 Mitigation Hierarchy

This stepwise application ensures that the most effective and least damaging options are always prioritized, and that any unavoidable impacts are addressed with appropriate and equitable measures.

Non-Significant Impacts

For non-significant impacts, those categorized as "low" or "negligible" in terms of their severity, duration, extent, or reversibility, are acknowledged but do not require detailed mitigation planning. This aligns with international best practice and is consistent with both ESF guidelines and national ESIA procedures.

While non-significant impacts do not trigger standalone mitigation measures, they are still subject to general good practice measures embedded in the project's design, operational protocols, and ESMP. For example, minor dust generation or temporary noise in an uninhabited area are not significant enough to warrant a bespoke mitigation plan but will still be managed through routine measures such as use of water sprays or maintenance of equipment.

7.2 Positive impacts

The implementation of the deep borehole is expected to bring significant benefits to the local community and environment, improving water security, public health, economic resilience, and social stability, as detailed below.

Improved Access to Clean and Reliable Water

The borehole will provide a stable, year-round source of groundwater, significantly reducing the community's dependence on seasonal and unreliable water sources. This will:

- Ensure continuous access to clean drinking water for households, livestock, and small businesses, reducing the risk of water shortages during dry seasons.
- Lower household water costs by eliminating reliance on expensive trucked water.
- Improve livestock hydration and productivity, supporting pastoralists by reducing animal mortality rates and increasing milk and meat production.

Reduced Time and Effort for Water Collection

Currently, many residents, particularly women and children, spend several hours per day fetching water from distant sources. The borehole will:

- Reduce the time spent collecting water, freeing up hours for education, economic activities, and household responsibilities.
- Improve school attendance rates, as children—especially girls—will no longer need to miss classes to fetch water.
- Ease physical strain on women and girls, who often carry heavy water containers over long distances.
- Allow women to engage in new livelihood opportunities, such as small-scale businesses and market trading, boosting household incomes.

This impact will directly improve gender equality, aligning with ESS5 and ESS10.

Improved Public Health and Sanitation

Access to safe, uncontaminated water is crucial for disease prevention and improved hygiene. The borehole will:

- Reduce the incidence of waterborne diseases such as cholera, typhoid, and diarrhea, which are currently prevalent due to unsafe surface water consumption.
- Provide a safe water supply for health facilities, improving medical care, especially for mothers, newborns, and children.
- Support better sanitation and hygiene, as residents will have more water for handwashing, cooking, and bathing, lowering infection rates.
- Enhance menstrual hygiene management for women and girls, improving dignity and school attendance for female students.

By ensuring clean water access, the project will strengthen overall public health, reduce medical costs for families, and improve life expectancy.

Strengthened Livelihoods and Economic Stability

Reliable water access will expand economic opportunities, particularly for livestock owners, small businesses, and traders. The borehole will:

- Increase livestock productivity, allowing pastoralists to raise healthier animals for trade and dairy production.

- Encourage small-scale businesses such as tea shops, food processing, and construction, as businesses will no longer be constrained by limited water access.
- Reduce economic losses related to livestock deaths and declining agricultural potential, allowing households to invest in income-generating activities.
- Attract new investments, such as livestock markets and veterinary services, strengthening the local economy.

This impact aligns with Somaliland's rural development strategies and ESS9, which supports sustainable economic growth in water-scarce regions.

Climate Resilience and Sustainable Resource Use

Groundwater is a more stable and drought-resistant water source compared to surface water, which is vulnerable to seasonal evaporation and contamination. The borehole will:

- Reduce reliance on rain-fed sources like berkads and open reservoirs, ensuring greater resilience during drought years.
- Provide a consistent water supply for livestock, reducing the need for long-distance migrations that degrade rangelands.
- Support long-term groundwater monitoring, preventing over-extraction and depletion risks.
- Promote sustainable land use practices, reducing deforestation and overgrazing near traditional water points.

By improving climate adaptation strategies, the project aligns with ESS3 and Somaliland's National Water Strategy.

Strengthened Local Water Governance and Capacity Building

A key component of the project is the establishment of a Water User Committee to oversee water distribution, infrastructure maintenance, and dispute resolution. This will:

- Ensure transparent management of water fees and usage, preventing corruption and unfair access.
- Build technical capacity for local borehole operators and community members, improving long-term maintenance and sustainability.
- Promote community-led governance, empowering local leaders, women, and youth in water management roles.
- Provide training programs on borehole operation, environmental monitoring, and financial accountability.

This governance model supports Somaliland's decentralization efforts and aligns with ESS2 and ESS10.

7.3 Negative Impacts on the Physical Environment

While the project is expected to bring significant benefits, it also presents potential risks to the physical environment that must be carefully managed. Without proper mitigation measures, the project could contribute to soil degradation, groundwater depletion, contamination, and air and noise pollution.

Soil Erosion and Land Degradation

The construction of the borehole and associated infrastructure—including water kiosks, pipeline, livestock troughs, storage tanks, and access road—will disturb the natural soil structure.

- Drilling activities will disturb topsoil, leading to increased vulnerability to wind and water erosion.
- Heavy machinery use during construction will cause soil compaction, reducing water infiltration and increasing runoff.
- Uncontrolled livestock movement around water collection points can lead to overgrazing and trampling, accelerating land degradation.
- Clearing of vegetation to make way for infrastructure may reduce soil stability, increasing the risk of desertification in the long term.

Mitigation Measures

- Restore disturbed areas with native vegetation after construction.
- Establish livestock movement corridors to prevent overgrazing near the borehole site.
- Introduce rotational grazing systems to allow vegetation regeneration.

Water Contamination Risks

Water contamination is a concern, particularly if proper well-sealing, waste disposal, and livestock management practices are not in place.

- Drilling fluids and lubricants used during borehole construction could seep into groundwater if not properly contained.
- Livestock waste near water points could introduce bacterial contamination, increasing the risk of waterborne diseases.
- Improper waste disposal from construction materials, fuel spills, and maintenance activities may pollute surrounding soil and water sources.

Mitigation Measures

- Implement sealed well casing and sanitary borehole construction standards to prevent surface contaminants from entering the aquifer.
- Designate separate watering areas for livestock to reduce contamination risks.
- Ensure safe disposal of drilling fluids and lubricants in lined pits away from water sources.
- Conduct regular water quality testing to monitor contamination levels.

Dust and Air Pollution from Construction Activities

During the borehole drilling and construction phase, dust and particulate matter will be released into the air, leading to temporary declines in air quality. The village is approximately 4km from the project site so no impact to residents is anticipated.

- Excavation, drilling, and road and pipeline construction will generate airborne dust, which can cause respiratory issues for workers. There are no nearby residents.
- Diesel-powered generators and machinery will emit carbon dioxide (CO_2), nitrogen oxides (NO_x), and particulate matter (PM2.5 and PM10), contributing to local air pollution for workers.

Mitigation Measures

- Spray water on unpaved roads and construction sites to control dust.
- Cover construction material stockpiles to prevent wind dispersal.
- Require regular maintenance of machinery to reduce emissions.
- Schedule high-dust activities during low-wind periods to minimize exposure.

Noise Pollution from Drilling and Pump Operations

The drilling process and ongoing operation of the borehole pump—especially if powered by diesel generators—could generate noise pollution. The community is about 4km from the site and therefore is not anticipated to be impacted. But workers should wear appropriate PPE.

- Rotary drilling rigs and compressors can produce high-decibel noise levels.
- Continuous operation of the diesel generator (if used instead of solar power) may contribute to low-frequency noise pollution.

Mitigation Measures

- Use noise barriers or enclosures around generators and drilling equipment.
- Encourage use of solar-powered pumps to reduce long-term noise pollution.
- Rotating shifts to limit the duration of individual worker exposure.
- Provision of hearing protection devices such as:
  - Earplugs (foam, molded)
  - Earmuffs (passive or electronic)
  - Noise-canceling headsets for prolonged exposures

Increased Waste Generation from Drilling and Construction

The borehole project will produce various types of waste, including:

1. Non-Hazardous Wastes

   a. Construction and Inert Waste: Concrete debris, surplus aggregates, broken masonry, excess pipe segments, and packaging (plastic, wood, cardboard).

   Estimated Quantity: 1–2 tons

   Management:

   - Segregated at source.

- Reused for site backfilling or landscaping where feasible.
- Remainder disposed at designated municipal disposal sites.

b. Domestic Waste: Food remnants, plastic bottles, general refuse from workers.

Management:

- Sorted into biodegradable and recyclable fractions.
- Biodegradable waste composted or disposed via municipal routes.
- Plastics and cans sent to recycling points or collected for off-site disposal.

2. Hazardous Wastes

a. Waste Oils and Lubricants: Equipment servicing (generators, compressors, drill rigs).

Management:

- Stored in marked, sealed drums.
- Transferred to approved waste oil handlers or incinerated at approved facilities.

b. Obsolete Electrical and Solar Equipment: Broken panels, cables, connectors, batteries.

Management:

- Stored in secure enclosures.
- Transferred to e-waste recycling handlers in accordance with MoECC and international guidelines.

c. Chemical Containers (e.g. chlorine, biocides)

Management:

- Triple-rinsed and punctured prior to disposal.
- Stored in ventilated, locked enclosures until safe off-site disposal.

3. Drilling Waste: Cuttings and Water-Based Mud (WBM)

Use of Water-Based Drilling Muds (WBM)

The proposed drilling will use a water-based mud (WBM) system, which is recognized in the drilling industry as the least hazardous mud type and is considered non-toxic by design. WBM is composed primarily of fresh water with naturally occurring clays such as bentonite, and weighting materials such as barite, together with small amounts of additives (e.g., viscosifiers, pH control agents, lubricants) to optimize drilling performance. No oil-based or synthetic-based muds will be used.

In this formulation, the base fluid and solids are inert or of very low toxicity. However, certain additives can be mildly alkaline or irritating to skin and eyes if handled without appropriate personal protective equipment (PPE). The drilling process can also result in the mud becoming contaminated with fine rock cuttings or naturally occurring salts from the formation. While these do not present a high hazard, uncontrolled discharge could cause localized increases in suspended solids, pH, or salinity in soils or surface waters.

Mitigation Measures:

- All WBM additives will be selected from products with low aquatic toxicity and will be accompanied by Safety Data Sheets (SDS) to confirm hazard classifications.
- Workers handling WBM or additives will wear gloves, eye protection, and protective clothing to avoid direct contact.
- Drilling returns (mud and cuttings) will be contained in lined pits or tanks; fluids will be reused where possible and residuals allowed to settle before disposal.
- No spent mud or cuttings will be discharged to watercourses; disposal will follow MOECC guidelines and ESS3 requirements, ensuring no adverse effect on soils or water quality.
- pH will be monitored; if above neutral range prior to disposal, mud will be conditioned to neutral pH.

4. Use of Bentonite

- During transport, storage, and mixing, fine bentonite particles can become airborne. Inhalation of this dust may pose health risks to workers. Although workers in this project will only be exposed for a few weeks and therefore unlikely to experience health impacts, all workers should be provided with appropriate PPE.
- Because bentonite is a type of clay (that swells and becomes pliable when wet), if bentonite slurry is improperly disposed of, it can clog soil pores and interfere with natural percolation of water.
- The use of bentonite will be determined on-site by the drilling engineer.

Management:

- Equip workers with masks and gloves and implement dust suppression measures.
- Use lined containment pits for bentonite waste and dispose of them at designated sites.

5. General Waste Management and Compliance Measures

All waste handling and disposal activities must align with:

- World Bank ESS3 on Resource Efficiency and Pollution Prevention,
- Somaliland Environmental Management Act LR 79/2018, and
- Approved site-specific Environmental and Social Management Plans (ESMPs).

Implementation Procedures

- On-site waste segregation, labeling, and secure storage.
- Availability of Waste Management Plans (WMP) approved by the Ministry of Environment and Climate Change (MoECC).
- Training of all site workers in proper waste handling and safety.
- Use of personal protective equipment (PPE) during drilling and waste handling.

- Regular audits by PIU and environmental specialists to verify compliance.

Without proper waste management protocols, these materials could lead to environmental pollution, contamination of local water sources, and long-term land degradation.

Potential for Increased Settlement Expansion and Unregulated Land Use

A new reliable water source could encourage increased migration and settlement expansion near the borehole, leading to:

- Increased pressure on rangelands, resulting in overgrazing and vegetation loss.
- Unregulated land use, where informal housing developments emerge without proper infrastructure planning.
- Increased human-wildlife conflicts.

Mitigation Measures

- Develop a land-use management plan with local authorities to regulate settlement growth.
- Establish controlled access policies to prevent unplanned housing development near the borehole.
- Work with traditional leaders to enforce grazing and settlement zoning regulations.
- Monitor population growth trends to adjust water distribution planning accordingly.

7.4 Negative Impacts on the Biological Environment

The borehole project in Qoolbulale, while addressing critical water scarcity issues, also poses potential risks to local ecosystems, vegetation, and wildlife.

Loss of Vegetation and Habitat Degradation

The construction of the borehole and associated infrastructure, including water kiosks, livestock troughs, pipelines, and access road, will result in land clearing and vegetation loss. This could have the following impacts:

- Direct destruction of native plant species, particularly drought-resistant trees and shrubs such as *Acacia bussei*, *Acacia tortilis*, and *Commiphora* species, which are critical for preventing soil erosion and providing shade.
- Increased soil exposure to erosion, as the removal of vegetation weakens soil stability, accelerating land degradation and desertification.
- Alteration of grazing patterns, as water availability may encourage higher livestock concentrations near the borehole, leading to overgrazing and trampling of plant life.

Mitigation Measures

- Implement a vegetation restoration plan by replanting native trees and shrubs in disturbed areas.
- Designate buffer zones around the borehole to prevent excessive vegetation loss.
- Enforce controlled livestock movement corridors to reduce trampling near the water point.
- Introduce alternative fodder sources to reduce pressure on natural vegetation.

Disruption of Wildlife Populations

Qoolbulale is home to some small to medium-sized mammals, reptiles, and bird species. The presence of a permanent water source could alter wildlife behavior. Key risks include:

- Displacement of wildlife, as human activity and infrastructure development force species to travel to less disturbed areas.
- Increased human-wildlife interactions, leading to potential conflicts with scavengers such as hyenas and jackals, which may be drawn to livestock areas.

Mitigation Measures

- Maintain natural vegetation buffers around borehole infrastructure.
- Conduct wildlife monitoring programs to assess changes in species distribution post-construction.

Pressure on Grazing Lands and Overgrazing Risks

The borehole is expected to increase livestock numbers near the water source, leading to higher grazing pressure on surrounding rangelands. Key risks include:

- Localized overgrazing around the borehole site, as livestock repeatedly use the same areas for water and forage.
- Depletion of plant cover, reducing the ability of native grasses such as *Cenchrus ciliaris* and *Aristida mutabilis* to regenerate.
- Land degradation due to trampling, compacting the soil and making it harder for vegetation to recover.
- Risk of invasive plant species growth, as degraded land conditions create favorable conditions for non-native, low-nutrient plants that reduce grazing quality.

Mitigation Measures

- Establish rotational grazing systems to prevent land degradation.
- Work with traditional leaders and pastoralist groups to develop livestock watering schedules.
- Encourage the use of alternative water sources during wet seasons to reduce pressure on the borehole.
- Introduce grass reseeding programs in degraded areas.

Contamination of Water Sources

Improper waste management and livestock waste accumulation near water collection points can lead to contamination of water sources, affecting both human and ecological health. Key risks include:

- Increased algae growth and water stagnation, particularly in livestock troughs, leading to poor water quality and potential disease outbreaks.
- Soil salinization, as concentrated water extraction and evaporation can increase salt buildup, affecting plant growth and soil health.

Mitigation Measures

- Design and maintain livestock troughs with proper drainage and regular cleaning schedules to prevent stagnation and biological buildup.
- Introduce lined troughs and promote efficient water use practices to minimize seepage and evaporation, reducing salt accumulation in soils.

7.5 Negative Impacts on the Social Environment

While the project is expected to bring significant social benefits, it also introduces potential risks that must be managed to ensure equity, social stability, and long-term sustainability. If not properly mitigated, these risks could lead to conflicts over water access, gender inequalities, disruptions in traditional governance, and negative consequences for certain groups within the community.

Access Restrictions

Although the borehole is planned on community land, its development will require land for infrastructure such as water kiosks, livestock troughs, and the pipeline. This could lead to temporary lack of access to the area while the borehole and water pipeline is under construction.

There will be no temporary or permanent economic disruption, including livelihood disruption. The project footprint, including the pipeline and associated facilities, is minimal. The borehole site is 4 km from the village and the associated works are outside of the normal grazing areas. Stakeholder consultations were done with pastoralists from both Somalia and Ethiopia, and they assured the field team there will be no disruption to their activities.

Mitigation Measures

- Secure voluntary land-use agreements with transparent documentation.
- Ensure community-level consultation and consent prior to infrastructure installation.
- Avoid fencing or permanent structures that block livestock routes.

Potential for Water Conflicts

The introduction of a permanent borehole could create conflicts if access is not properly managed:

- Competing demands between household users and large-scale livestock herders could lead to disputes over who gets priority access to water.
- Tensions between local residents and cross-border water users from Ethiopia, particularly during dry seasons when migratory pastoralists seek water.
- Clan-based disagreements over borehole management and water pricing structures.

Mitigation Measures

- Develop and enforce customary water-sharing agreements.
- Include pastoralist representatives in the WUC.
- Conduct seasonal coordination meetings with Ethiopian cross-border groups.

- Establish a grievance mechanism to manage disputes.

Gender Inequality and Limited Participation of Women

Women and girls are the primary water collectors in Qoolbulale, yet they often have limited decision-making power over water governance. Risks include:

- Exclusion from borehole management structures, reinforcing existing gender disparities.
- Increased burden on women if livestock owners dominate water access, leading to longer waiting times at collection points.
- Potential exposure to harassment if borehole locations are poorly lit or lack designated areas for women.

Mitigation Measures

- Ensure 30% representation of women in the WUC.
- Hold women-only consultations to integrate their perspectives.
- Design safe, accessible, and well-lit water points close to homes.
- Train male leaders on gender-sensitive governance.

Increased Settlement Expansion and Unregulated Growth

A permanent water source could attract new residents, traders, and settlers, leading to:

- Unregulated settlement expansion, which may increase demand beyond the borehole's capacity.
- Overburdened social services, including health centers and schools, if population growth is not planned.
- Increased grazing pressure, potentially leading to land disputes between long-term residents and new arrivals.

Mitigation Measures

- Collaborate with local authorities to implement a land-use plan.
- Define and monitor buffer zones around the borehole.
- Engage communities in planning to avoid encroachment on grazing lands.

Labor and Working Conditions Risks

The construction and operation phases will require skilled and unskilled labor, which could present risks related to wages, working conditions, and child labor:

- Potential for unfair wages or exploitative labor conditions if local workers are not properly contracted.
- Risk of child labor in construction activities, particularly among low-income families.
- Occupational health and safety risks, including exposure to hazardous drilling equipment and emissions.

Mitigation Measures

- Require formal employment contracts and age verification.
- Conduct occupational health and safety training for workers.
- Monitor contractor compliance with ESS2 labor standards.

Exposure to Gender-Based Violence (GBV) and SEA/SH Risks

The presence of an outside workforce and increased economic activity could raise risks of gender-based violence (GBV), sexual exploitation and abuse (SEA), and sexual harassment (SH), particularly for women and adolescent girls.

Key risks include:

- Harassment at water collection points, especially if they are not safely designed.
- Potential exploitation of women and girls by workers or vendors in exchange for access to water or services.
- Limited reporting mechanisms for victims of GBV-related incidents.

Mitigation Measures

- Implement a Code of Conduct for all workers, including sanctions for violations.
- Establish a confidential, survivor-centered grievance mechanism.
- Conduct community-wide GBV prevention training, including separate sessions for men and women.
- Designate female grievance focal points.

Disruption of Traditional Water Governance Structures

Qoolbulale has long relied on clan-based and customary water management systems, which could be disrupted if the new governance model does not integrate traditional leadership. Risks include:

- Resistance from traditional elders if they feel excluded from borehole decision-making.
- Confusion over pricing and access rights, leading to dissatisfaction among community members.
- Weak enforcement of water-sharing agreements, leading to conflicts over resource control.

Mitigation Measures

- Involve traditional leaders and elders in borehole management.
- Harmonize customary and formal governance frameworks.
- Provide capacity building to support transparent financial management.

Risk of Elite Capture and Corruption

If borehole management is not transparent and accountable, there is a risk that water fees, maintenance funds, or borehole access rights could be controlled by a small group of elites or influential community members. This could:

- Reduce fair access to water, favoring wealthier or politically connected individuals.
- Lead to financial mismanagement, undermining borehole sustainability.
- Increase community tensions and grievances.

Mitigation Measures

- Require democratic selection of WUC members with community validation.
- Establish public disclosure of water pricing and revenue use.
- Conduct quarterly community audits and open meetings.

7.6 Significance Ranking

The table below consolidates all positive and negative impacts of the Qoolbulale borehole project, categorized by significance (High/Moderate/Low), duration (Temporary/Permanent), and type (Direct/Indirect). For the definition of these parameters, see section 7.1

Table 27 Comprehensive Impact Classification Table

Impact	Phase	Significance	Duration	Type	Enhancement /Mitigation	Residual Impact
To be confirmed						
Increased access to clean water for households and livestock	Operation	Positive	Permanent	Direct	Ensure timely completion, regular maintenance, and community awareness on equitable access.	Positive (enhanced through project design)
Reduced time and effort for water collection, benefiting women and girls	Operation	Positive	Permanent	Direct	Install water points in safe, central locations; provide seating/shade for queues.	Positive (enhanced through project design)
Improved public health due to lower rates of waterborne diseases	Operation	Positive	Permanent	Direct	Promote hygiene awareness through WUC meetings and school outreach.	Positive (enhanced through project design)
Strengthened pastoral livelihoods and livestock productivity	Operation	Positive	Permanent	Direct	Support rotational grazing awareness; ensure reliable livestock	Positive (enhanced through project design)

Impact	Phase	Significance	Duration	Type	Enhancement /Mitigation	Residual Impact
					watering facilities.	
Reduced conflicts over water resources among pastoralist groups and settled communities	Operation	Positive	Permanent	Indirect	WUC to apply fair water-sharing rules and mediate disputes with elders' support.	Positive (enhanced through project design)
Economic growth through improved trade, small businesses, and market access	Operation	Positive	Permanent	Indirect	Encourage small-scale water-dependent businesses via local outreach.	Positive (enhanced through project design)
Increased climate resilience through sustainable groundwater use	Operation	Positive	Permanent	Indirect	Promote water conservation practices and diversify water use planning.	Positive (enhanced through project design)
Strengthened local water governance through the Water User Committee (WUC)	Operation	Positive	Permanent	Direct	Provide basic training to WUC on record-keeping, transparent decision-making.	Positive (enhanced through project design)
Job creation during borehole construction and maintenance	Construction and Operation	Positive	Temporary	Direct	Prioritize local hiring; offer short skills training during construction.	Positive (enhanced through project design)

Impact	Phase	Significance	Duration	Type	Enhancement /Mitigation	Residual Impact
Reduction in water trucking costs for households	Operation	Positive	Permanent	Direct	Maintain affordability via transparent WUC tariff setting.	Positive (enhanced through project design)
To be confirmed						
Soil erosion and land degradation from construction and livestock overuse	Construction and Operation	Moderate to High	Permanent	Direct	Limit vegetation clearing; demarcate boundaries; controlled livestock routes; gravel/concrete bases at watering points.	Moderate (if mitigation fully implemented)
Potential contamination of groundwater from livestock waste and poor waste disposal	Operation	Moderate to High	Permanent	Direct	Use non-toxic drilling fluids; bunded storage for chemicals; drainage channels; separate human/livestock access.	Moderate (if mitigation fully implemented)
Dust and air pollution from construction activities and heavy machinery	Construction	Low	Temporary	Direct	Water spraying; limit vehicle speeds; cover stored materials; schedule noisy works in daylight.	Low
Noise pollution from drilling and diesel-powered pumps	Construction	Low	Temporary	Direct	Limit noisy activities to daylight; provide	Low

Impact	Phase	Significance	Duration	Type	Enhancement /Mitigation	Residual Impact
					ear protection; rotate tasks.	
Waste generation from lubricants and plastic materials	Construction	Low	Temporary	Direct	Construct lined waste pits; segregate waste; reuse/recycle where possible; proper hazardous waste storage.	Low
Unregulated settlement expansion due to new water availability	Operation	Moderate to High	Permanent	Indirect	WUC to integrate land-use rules with elders; raise awareness on sustainable use; monitor new settlements.	Moderate (if mitigation fully implemented)
To be confirmed						
Loss of native vegetation due to construction and livestock trampling	Construction and Operation	Moderate to High	Permanent	Direct	Restrict clearing to footprint; seasonal rotation of livestock; avoid lighting at night.	Moderate (if mitigation fully implemented)
Disruption of wildlife and feeding areas	Construction and Operation	Moderate	Permanent	Indirect	Avoid unnecessary clearing; control livestock access; limit noise and light disturbance.	Low to Moderate

Impact	Phase	Significance	Duration	Type	Enhancement /Mitigation	Residual Impact
Overgrazing and pressure on rangelands near the borehole	Operation	High	Permanent	Direct	Promote rotational grazing; control livestock numbers via WUC rules.	Moderate (if mitigation fully implemented)
Alteration of ecosystem balance due to increased human activity near water points	Construction and Operation	Moderate	Permanent	Indirect	Designate livestock routes; protect buffer zones; community awareness on ecosystem care.	Low to Moderate
To be confirmed						
Conflicts over water access between settled residents and mobile pastoralists	Operation	High	Permanent	Direct	Inclusive WUC; agreed water access guidelines; dispute resolution training.	Moderate (if mitigation fully implemented)
Potential gender inequality in borehole governance and water distribution	Operation	Moderate	Permanent	Indirect	Ensure women's representation in WUC; gender-sensitive training; equitable water allocation.	Low to Moderate
Exposure to gender-based violence (GBV) and harassment at water collection points	Construction and Operation	High	Permanent	Direct	Worker CoC; lighting at water points; confidential	Moderate (if mitigation fully implemented)

Impact	Phase	Significance	Duration	Type	Enhancement /Mitigation	Residual Impact
					SEA/SH reporting system.	
Weak financial management or elite capture of borehole revenue	Operation	Moderate to High	Permanent	Indirect	Train WUC in bookkeeping; transparent revenue records; regular audits.	Moderate (if mitigation fully implemented)
Disruptions to traditional water governance structures	Operation	Moderate	Permanent	Indirect	Integrate customary practices; engage elders; adapt rules collaboratively.	Low to Moderate
Poorly planned settlement expansion leading to unregulated land use	Operation	High	Permanent	Indirect	Community planning discussions; enforce agreed land use; monitor growth.	Moderate (if mitigation fully implemented)

Note:

High-significance impacts require urgent mitigation measures to prevent serious environmental and social consequences.

Moderate-significance impacts need targeted management strategies to reduce risks.

Low-significance impacts can be addressed through standard environmental safeguards and best practices.

7.7 Risk Assessment of Drilling Activities

This assessment identifies potential unplanned hazards during drilling and evaluates each by:

1) estimating the Likelihood of occurrence (Very Unlikely, Unlikely, Possible, Likely) based on site conditions, similar projects, and expert judgment; and
2) estimating the Consequence (Low, Moderate, Severe) to people, property, and the environment.

The overall Risk Level (Low/Moderate/High) is assigned using a qualitative risk matrix that combines Likelihood and Consequence. Mitigation/controls do not define the risk level; they are listed separately to show how risk will be reduced to ALARP (as low as reasonably practicable).

- High: The event is likely and/or could have severe consequences (serious injury or major damage). Requires pre-planning, competent supervision, and continuous monitoring.
- Moderate: The event could occur under certain conditions and/or could have noticeable consequences beyond the immediate work area. Active controls and routine monitoring are warranted.
- Low: The event is very unlikely or would have minor, localized consequences. Standard procedures are sufficient.

Note: Mitigation and key controls are listed in the table under 'Key Controls / Mitigation Measures' and are used to reduce the risk level toward ALARP; they are not part of the risk level definition.

Risk Level Definitions (Measure of Risk, not Mitigation)

Catastrophic scenarios such as a full-scale diesel fire or chemical explosion are highly improbable due to the small fuel quantities and low chemical inventory expected at the site. However, even small-scale events (e.g., a 50-liter diesel spill) can cause localized harm and must be prevented through proactive risk management.

Table 28 Qualitative Risk Matrix

Likelihood	Minor Consequence	Moderate Consequence	Major Consequence
Rare	Low	Low	Moderate
Unlikely	Low	Moderate	High
Possible	Moderate	Moderate	High
Likely	Moderate	High	High
Almost Certain	High	High	High

Table 29 Risk Assessment

Risk Category	Potential Hazard	Receptor	Likelihood	Consequence	Risk Level	Key Controls / Mitigation Measures
Fuel Spill	Diesel spill from storage or refueling	Soil, shallow groundwater	Unlikely	Moderate (localized)	Moderate	Use secondary containment for fuel; limit storage (<1,000 L); train staff; spill kits onsite
Fire or Explosion	Ignition of diesel from spark, cigarette, or equipment	Workers, nearby materials	Very unlikely	Severe (injury, damage)	Moderate	No-smoking policy; firefighting equipment; proper grounding; safe fuel handling practices
Drilling Mud Spill	Mud overflow or improper disposal	Soil, vegetation	Possible	Low (non-toxic WBM)	Low	Line mud pits with plastic; manage fluid levels; dry and bury spent cuttings
Fall or Crush Injury	Equipment movement, lifting heavy items, or slips	Workers	Possible	Severe	High	Site safety training; PPE; edge protection at pits; equipment maintenance

Risk Category	Potential Hazard	Receptor	Likelihood	Consequence	Risk Level	Key Controls / Mitigation Measures
Exposure to Chemicals	Cement, lubricants, degreasers used in minor quantities	Workers	Possible	Low	Low	PPE; safe storage in locked containers; MSDS available
Injury from Equipment	Rotating machinery, entanglement risk	Workers	Likely	Moderate	High	Guards on equipment; job hazard briefings; enforce lock-out/tag-out procedures
Unauthorized Access	Community entry into drilling site	Local residents	Possible	Moderate	Moderate	Temporary fencing; signage in Somali; community awareness outreach

7.8 Cumulative Impacts

For groundwater development, cumulative impacts can arise at both the program scale, from multiple boreholes operating within the same hydrogeological unit under the GW4R program and other water sector initiatives, and at the site scale, where a single borehole's influence accumulates over years of operation. The assessment in this section considers both perspectives to ensure that the proposed borehole is developed and managed in a way that safeguards aquifer sustainability, ecosystem health, and community well-being over the long term.

Cumulative Impacts

Program-Scale (GW4R and Other Regional Water Development)

The proposed borehole is part of the GW4R Somaliland component, which will construct and rehabilitate multiple strategic boreholes across priority regions. In addition, other government, NGO, and private initiatives are developing groundwater sources within the same hydrogeological zones. When considered collectively, these interventions may have cumulative impacts, including:

- Aquifer Stress – Increased abstraction from multiple boreholes tapping the same confined or semi-confined aquifers may, over time, exceed natural recharge, leading to falling water tables and potential reduction in yields.
- Altered Settlement and Land Use Patterns – Establishing several permanent water points within a grazing corridor can concentrate livestock and human populations, creating grazing pressure, vegetation loss, and soil erosion.
- Regional Conflict Risk – Multiple high-yield sources in contested areas may alter traditional water-sharing arrangements, creating or intensifying inter-clan or inter-community tensions.
- Hydro-ecological Changes – Reduced baseflows to springs or shallow wetlands in connected aquifer systems, particularly where recharge areas are limited or degraded.

Mitigation at the program scale will involve coordination of abstraction rates and siting through the Ministry of Water Resources Development's groundwater allocation plans, periodic aquifer monitoring, and the integration of water-use bylaws into Water User Committee (WUC) management frameworks.

Site-Scale (Long-Term Effects of This Borehole)

Independently of other projects, this borehole could, over its operational life, generate cumulative effects within its local influence area:

- Progressive Water Table Decline – Because so little is known about this aquafer, despite the relatively low anticipated yield of this borehole and pumping system, a precautionary approach is warranted. When pumping starts, water levels near the borehole drop to form a cone of depression, called a "drawdown". The depth of this drawdown depends on pumping rate, pumping duration, aquifer transmissivity, and recharge rate. If pumping is intermittent and within sustainable limits, the cone recovers. If pumping is heavy or continuous, the cone deepens and widens, lowering the water table locally and potentially regionally if multiple boreholes are doing the same. Until more is known about the aquifer transmissivity and recharge rate, the sustainable limit is not known. Therefore, the project must start conservatively and monitor and adapt, as the outlined below.
- Local Overgrazing and Land Degradation – Permanent water access may attract more livestock than the surrounding rangeland can sustainably support, causing gradual vegetation loss and erosion.
- Social Pressure and Access Inequities – As use expands, management challenges within the WUC may arise, potentially leading to inequitable distribution or disputes over allocation.
- Wastewater and Sanitation Risks – Increasing volumes of greywater from human and livestock use near the borehole could, if unmanaged, affect soil quality or contaminate shallow groundwater.

Site-level mitigation will include regular monitoring of borehole yield and water levels, enforcement of agreed water-use bylaws, rotational grazing plans with community enforcement, and proper drainage and sanitation facilities at the water point. To monitor this, the following measures are recommended:

- Continuous monitoring of actual abstraction and usage patterns from commissioning and well tests;
- Early-warning triggers for unsustainable drawdown;
- Community water governance measures to manage high-demand periods;
- Periodic review of demand and supply data to inform operational adjustments.

Access to borehole water will likely need to be temporarily halted in the case of unsustainable drawdown, in line with abstraction WUC bylaws that may be developed.

Table 30 Cumulative Impacts

Receptor / Valued Component	Program-Scale Cumulative Impacts (GW4R + other projects)	Site-Scale Cumulative Impacts (this borehole over time)	Significance (Unmitigated)	Mitigation / Management Measures	Residual Significance
Aquifer water levels	Increased abstraction from multiple boreholes in same	Progressive drawdown.	High	Continuous monitoring of actual abstraction and	Low–Moderate

Receptor / Valued Component	Program-Scale Cumulative Impacts (GW4R + other projects)	Site-Scale Cumulative Impacts (this borehole over time)	Significance (Unmitigated)	Mitigation / Management Measures	Residual Significance
	aquifer may exceed recharge, leading to long-term decline in water tables.			usage patterns from commissioning and well tests; Early-warning triggers for unsustainable drawdown; Community water governance measures to manage high-demand periods; Periodic review of demand and supply data to inform operational adjustments. Regulate abstraction via WUC bylaws.	
Rangeland vegetation cover	Multiple permanent water points increase livestock concentrations across grazing zones, risking overgrazing.	Localized overgrazing within walking distance of the borehole, causing vegetation loss and erosion.	Moderate–High	Implement grazing rotation plans; enforce stocking limits via community agreements; promote alternative fodder sources.	Low–Moderate
Community cohesion / conflict risk	Expanded permanent water access alters traditional migration and water-sharing arrangements,	Potential disputes within WUC over allocation as usage increases; tension with migrants/refugees seeking water.	Moderate	Pre-agreed water-sharing bylaws; inclusive WUC membership; regular stakeholder	Low

Receptor / Valued Component	Program-Scale Cumulative Impacts (GW4R + other projects)	Site-Scale Cumulative Impacts (this borehole over time)	Significance (Unmitigated)	Mitigation / Management Measures	Residual Significance
	potentially causing inter-clan disputes.			meetings; conflict resolution training.	
Groundwater-dependent ecosystems (springs, wetlands)	Cumulative abstraction reduces baseflows to dependent ecosystems in connected aquifer systems.	Minimal direct link unless connected to nearby GDE; long-term monitoring needed.	Moderate	Map and monitor connected GDEs; adapt abstraction rates if ecological indicators decline.	Low
Soil and water quality near borehole	Widespread poor waste management at multiple water points may cumulatively affect soil/groundwater quality.	Gradual soil compaction and nutrient loading from livestock congregation; possible contamination from greywater.	Low–Moderate	Provide drainage and soakaways; designate livestock watering zones; maintain separation from human water collection points.	Low

Monitoring of Cumulative Impacts

Each monitoring indicator has been selected to measure a specific risk pathway:

- Aquifer water levels and yield provide direct evidence of groundwater abstraction pressures across seasons and years, helping to determine whether combined withdrawals from multiple boreholes are approaching or exceeding sustainable limits.
- Rangeland vegetation cover and livestock pressure track land degradation trends linked to increased and permanent water access, informing rotational grazing and stocking limits agreed under WUC bylaws.
- Conflict incidents act as a proxy for social pressure and governance performance, highlighting whether cumulative water developments are disrupting traditional water-sharing arrangements or creating inequities.
- Soil and water quality near the borehole detects localized contamination risks that, if occurring at multiple sites, could lead to cumulative degradation of shallow aquifers and surface environments.

The monitoring results will be reviewed by the Ministry of Water Resources Development and aggregated across GW4R sites in the same aquifer to assess regional trends. Where thresholds or negative trends are identified, such as consistent declines in static water levels, increased frequency of disputes, or declining rangeland condition, the MoWRD and WUC will implement corrective measures, which may include adjusting abstraction rates, enforcing stricter grazing controls, or modifying water allocation agreements.

Table 31 Cumulative Impact Monitoring Plan

Receptor / Valued Component	Indicator	Method / Tools	Frequency	Responsible Party	Reporting
Aquifer water levels	Static water level (meters below ground level)	Manual depth-to-water measurements in borehole and selected nearby wells	Quarterly	WUC operator (trained), MoWRD Hydrogeology Unit	ESMP Monitoring Report to MoWRD & World Bank
Aquifer yield	Pumping test yield (m^3/hr)	Step-drawdown / constant-rate tests during routine maintenance	Annually	MoWRD Hydrogeology Unit	Annual GW4R Aquifer Status Report
Rangeland vegetation cover	% ground cover within 5 km radius	Fixed-point photographic monitoring; vegetation transects	Pre- and post-rainy season	WUC with Ministry of Livestock / local rangeland officers	Seasonal Rangeland Condition Report
Livestock pressure	Average daily livestock counts at borehole	Manual counts (peak morning/evening watering)	Monthly	WUC	WUC Monthly Water Use Log
Conflict incidents	Number and type of water-use disputes recorded	Review of WUC meeting minutes & grievance records	Monthly	WUC, MoWRD Social Development Officer	Quarterly Social Safeguards Report
Soil / water quality near borehole	pH, EC, nitrate, and E. coli in nearby shallow wells or soakaways	Field kits / lab analysis	Twice yearly	MoWRD Water Quality Lab	Semi-Annual Water Quality Report

7.9 Key Observations from the Impact Classification

The impact classification table provides important insights into the environmental and social risks and benefits of the Qoolbulale borehole project. These observations will help prioritize mitigation measures, stakeholder engagement, and sustainability planning.

The Project Has Strong and Lasting Positive Impacts

- Water access improvements have the highest significance rating, as the borehole will provide clean, reliable water to both households and livestock.
- Public health benefits will be substantial due to lower rates of waterborne diseases, improved hygiene and sanitation, and better maternal and child health services.
- Economic growth and livelihood strengthening are expected, particularly for pastoralists, small businesses, and traders who will benefit from stable water access.
- Reduction in time spent collecting water will significantly benefit women and girls, improving gender equality and educational access.
- Climate resilience will improve as the borehole reduces dependence on seasonal and unreliable water sources, making the community less vulnerable to drought and climate variability.

Groundwater Sustainability and Land Degradation Are the Most Critical Environmental Risks

- Land degradation and soil erosion are a risk, particularly due to increased livestock concentration near the borehole, overgrazing, and trampling of fragile rangelands.
- Loss of native vegetation from construction and livestock movements could accelerate desertification if not properly controlled.
- Water contamination risks are high, especially from livestock waste, drilling fluids, and improper waste disposal near the borehole.

Social Conflicts and Governance Challenges Must Be Addressed Early

- Water conflicts between settled residents and mobile pastoralists could arise if clear governance and water-sharing agreements are not established.
- Unregulated settlement expansion may occur near the borehole, increasing pressure on land, social services, and grazing areas.
- Gender inequalities in water governance remain a concern. If women are excluded from the WUC, gender-based access issues and inequities in decision-making may persist.
- Weak financial management or elite capture risks could undermine the transparency and sustainability of borehole operations. A clear revenue management plan is required to ensure water pricing is fair and infrastructure maintenance is funded.

Short-Term Construction Impacts Are Manageable but Require Attention

- Waste generation from drilling fluids, packaging, and lubricants needs to be carefully managed to prevent long-term environmental contamination.
- Labor rights issues, worker safety, and potential child labor risks must be monitored to comply with ESS2.

8 Environmental and Social Management Plan

8.1 Introduction

The ESMP for the Qoolbulale borehole project serves as the operational framework for ensuring that all identified environmental and social risks are effectively mitigated, monitored, and managed throughout the project lifecycle. Its core purpose is to translate the findings of the ESIA into concrete, actionable measures that safeguard the physical environment, protect community interests, and promote equitable access to water resources. The ESMP outlines the specific mitigation measures for each identified impact, assigns responsibilities to implementing parties, defines monitoring indicators and frequencies, and provides guidance on stakeholder engagement, grievance redress, and compliance reporting.

The scope of the ESMP encompasses the full duration of the project—from planning and construction through operation and potential decommissioning. It addresses issues such as soil erosion, groundwater protection, waste disposal, biodiversity impacts, land acquisition, conflict management, labor standards, and gender-based violence (GBV) prevention. It ensures alignment with both Somaliland's Environment Management Act and the World Bank ESF, particularly ESS1, ESS2, ESS3, ESS4, ESS5, and ESS10.

A core principle of the ESMP is adherence to the mitigation hierarchy, which prioritizes impact management through a sequential approach: avoid, minimize, restore, and offset. In this project, the siting of the borehole away from ecologically sensitive areas helps avoid major biodiversity loss. Design measures such as proper well-casing and designated livestock water points help minimize risks of groundwater contamination and overgrazing. Restoration measures include replanting native vegetation in disturbed areas and implementing erosion control features. Where residual impacts remain—such as economic displacement of water vendors—compensation and livelihood support strategies are proposed to offset harm. By following this hierarchy, the Qoolbulale project demonstrates a commitment to sustainability and responsible development while enhancing resilience and social inclusion within the community.

8.2 Objectives

This ESMP is designed in accordance with the requirements of the Somaliland Environmental Management Law No. 79/2018, as well as the World Bank Environmental and Social Framework (ESF), particularly ESS1 on Assessment and Management of Environmental and Social Risks and Impacts. It includes detailed mitigation measures for all identified significant impacts, defines institutional responsibilities, establishes monitoring protocols, and sets out capacity-building needs and reporting mechanisms. The plan is intended to guide contractors, the Project Implementation Unit (PIU), regulatory authorities, and other stakeholders throughout the project lifecycle—from pre-construction and drilling to operational handover—ensuring that environmental and social safeguards are fully integrated into project implementation.

The ESMP objectives include:

- Serve as a guiding document for the environmental and social monitoring activities for the supervising consultant, contractor and the client management including requisite progress reports.
- Provide detailed specifications for the management and mitigation of activities that have the potential to negatively affect the environment and social milieu.
- Provide instructions to relevant project personnel regarding procedures for protecting the environment and minimizing environmental effects.
- Document environmental concerns and appropriate protection measures; while ensuring that corrective actions are completed in a timely manner.

8.3 Audits

The PIU, the contractor and other concerned parties should conduct regular audits of the ESMP to ensure that the system for implementation of the ESMP is operating effectively. The audit should ensure that:

- The ESMP being used is the up-to-date version;
- Variations to the ESMP and non-compliance and corrective action are documented;
- Appropriate environmental training of personnel is undertaken;
- Emergency procedures are in place and effectively communicated to personnel;
- A register of major incidents (spills, injuries, complaints) is in place and other documentation related to the ESMP; and
- Appropriate corrective and preventive action is taken by the contractor(s) once instructions have been issued.

These audits are also used to ensure compliance with environmental standards, and to facilitate any needed project design or operational changes. A monitoring program, backed up by agencies or other groups that can ensure corrective action when the monitoring results show it necessary, is a proven way to ensure effective implementation of mitigation measures. By tracking the sub-project's actual impacts, monitoring reduces the environmental and social risks associated with the project, and allows for project modifications to be made where required.

8.4. Management of Change in the ESMP

The Management of Change process ensures that the ESMP remains relevant and effective throughout the project lifecycle. It enables the Project Implementation Unit (PIU), in collaboration with contractors, supervising engineers, and regulatory bodies, to make informed updates to the ESMP based on:

- Monitoring results,
- Incident investigations,

- Stakeholder feedback,
- Emerging risks or non-compliance issues,
- Technical or design changes.

This process supports continuous improvement and compliance with the World Bank ESF and Somaliland environmental regulations.

Change Triggers

Modifications to the ESMP may be triggered by:

- Monitoring data showing that mitigation measures are ineffective or insufficient,
- Environmental or social incidents (e.g., contamination, grievances, near misses),
- Changes in project scope or design,
- Regulatory updates or new environmental permits,
- Feedback from communities, Village Development Committees (VDCs), or regulators.

Roles and Responsibilities

Table 32 Management of Change Roles and Responsibilities

Actor	Responsibilities
MoWRD Project Implementation Unit (PIU)	Lead the ESMP change process; assess proposed modifications; coordinate with stakeholders; submit to regulator and WB, if required.
Environmental & Social Specialists (PIU)	Identify deficiencies during monitoring; draft revised mitigation measures or monitoring protocols.
Contractor's ESHS Officer	Report on-ground challenges and suggest practical improvements to mitigation measures; implement revised C-ESMP.
Supervising Engineer	Confirm need for technical changes; review potential environmental and social consequences of design or construction changes.
World Bank (if applicable)	Review and clear substantial changes, especially those affecting ESF classification or introducing new risks.

Change Management Procedure

1. Identification and Documentation

A non-conformity, change request, or improvement need is identified during:

- Monitoring,
- Incident reporting,
- Community engagement,
- Contractor reporting.

2. Evaluation of Proposed Change

The PIU's Environmental and Social Specialists assess the environmental and social implications of the proposed change, including:

- Effectiveness of current measures,
- Feasibility of alternatives,
- Impact on compliance, budget, or schedule.

3. Consultation and Coordination

For significant changes, consultation is carried out with:

- Contractors and supervising engineers,
- Local authorities and VDCs,
- Regulators like MoECC.

4. Approval and Documentation

- Minor changes (e.g., improved fencing or dust suppression methods) are documented internally by the PIU and implemented via C-ESMP updates.
- Major changes (e.g., new waste handling methods, relocation of components) may require approval from regulators like MoECC, or require review by World Bank.

5. Implementation and Training

- Revised measures are integrated into updated site protocols, contractor instructions, and training materials.
- Contractors receive briefings on new requirements, and the PIU monitors compliance.

6. Recordkeeping

- All ESMP modifications are logged in a Change Register maintained by the PIU.
- The updated ESMP is reissued with a version number and date, and shared with relevant stakeholders.

Transparency and Accountability

- All changes to the ESMP will be communicated to affected stakeholders through the Stakeholder Engagement Plan (SEP) mechanisms.
- Where relevant, changes will be summarized in quarterly environmental and social monitoring reports submitted to the World Bank.

8.5. ESMP Roles and Responsibilities

The successful implementation of the ESMP depends on the coordinated efforts of several institutions, each with distinct roles and responsibilities. These include entities at the national, regional, and community levels, as well as the contractors and supervisory consultants engaged during project execution. The structure reflects both Somaliland's national legal frameworks and the World Bank's safeguard policies.

1. Ministry of Water Resources Development (MoWRD) – Project Implementation Unit (PIU)

The MoWRD, through its designated Project Implementation Unit (PIU) for the GW4R project, holds overall responsibility for ensuring that the ESMP is effectively implemented throughout the project lifecycle.

Responsibilities:

- Incorporate ESMP requirements into bidding documents and contractor contracts.
- Supervise contractor compliance with environmental, social, health and safety (ESHS) obligations.
- Assign dedicated Environmental and Social Specialists within the PIU to oversee safeguards.
- Coordinate with relevant ministries and local authorities for permitting, inspections, and land-related issues.
- Maintain documentation of monitoring reports, grievance records, and incidents.
- Report ESMP implementation status to the World Bank and the National Environmental Authority.

2. Contractor(s)

The construction contractor selected through competitive procurement will be contractually obligated to implement the ESMP on-site. This includes preparation of a Contractor's Environmental and Social Management Plan (C-ESMP) consistent with the project ESMP.

Responsibilities:

- Implement mitigation measures identified in the ESMP and C-ESMP.
- Maintain daily records of environmental and safety performance.

- Appoint an on-site ESHS Officer responsible for compliance and reporting.
- Train workers on health, safety, environmental, and social protocols.
- Comply with all national laws and permit conditions related to waste, emissions, and labor.

3. Supervision Consultant (or Independent Engineer)

If a supervising engineering consultant is engaged, they will play a critical role in monitoring contractor performance with respect to ESMP implementation.

Responsibilities:

- Conduct regular site inspections and verify contractor compliance.
- Support the PIU in issuing non-compliance notices and corrective action plans.
- Review and approve contractor reports, including C-ESMP updates and health & safety logs.
- Document and escalate any environmental or social incidents.

4. Ministry of Environment and Climate Change (MoECC)

The MoECC is the national regulatory authority responsible for environmental compliance and permitting. It also plays a key role in external monitoring.

Responsibilities:

- Review and approve the ESIA and ESMP documents.
- Issue the Environmental Clearance Certificate (ECC).
- Conduct periodic inspections of project activities for regulatory compliance.
- Participate in public consultations and respond to grievances when applicable.
- Collaborate with the MoWRD PIU in monitoring high-risk environmental aspects.

5. Local Government (Togdheer Regional Administration and Burao District Authorities)

Local authorities serve as key facilitators and liaisons between the community and project implementers.

Responsibilities:

- Facilitate access to land, local permits, and security coordination.
- Participate in site inspections and stakeholder engagement events.

- Support resolution of local grievances and social conflicts.
- Coordinate with Village Development Committees on community issues.

6. Community Institutions and Village Development Committees (VDCs)

Community participation is essential for long-term sustainability and social acceptance of the project.

Responsibilities:

- Support local monitoring of environmental and social impacts (e.g., waste disposal, influx, safety).
- Participate in grievance resolution at the community level.
- Mobilize community members for awareness-raising and participatory planning activities.
- Communicate concerns to the PIU via the project's Grievance Redress Mechanism (GRM).

7. Water Management Committee

Serves an essential role in maintenance of the borehole.

Responsibilities:

- Operation and Maintenance (O\&M) Oversight
- Water Quality and Safety Monitoring
- Tariff Collection and Financial Management
- Community Engagement and Grievance Handling, with the VDC
- Gender and Social Inclusion, with the VDC
- Recordkeeping and Reporting

8. World Bank

As the project financier, the World Bank provides oversight to ensure compliance with the Environmental and Social Framework (ESF).

Responsibilities:

- Review and clear the ESIA/ESMP and associated safeguard instruments.
- Conduct supervision missions and desk reviews of implementation progress.
- Provide technical guidance on corrective actions and capacity building.

- Monitor high-risk incidents and responses, particularly those involving ESS2 (Labor), ESS4 (Community Health and Safety), and ESS10 (Stakeholder Engagement).

E&S Experts

Below is a detailed description of the Environmental and Social (E&S) experts who should be stationed at the borehole project site during the site preparation and drilling phases.

1. Environmental Safeguards Officer (Site-Based)

Role & Responsibilities:

- Oversee daily implementation of environmental mitigation measures outlined in the ESMP and C-ESMP.
- Monitor and document key environmental parameters, including:
  - Waste generation and disposal (e.g., drilling mud, cuttings, fuel/oil containers),
  - Dust and noise levels,
  - Erosion and sediment control,
  - Spill prevention and response.
  - Ensure compliance with national environmental regulations and site-specific conditions in the Environmental Clearance Certificate.
  - Maintain the site's Environmental Monitoring Logbook with records of inspections, non-compliance, and corrective actions.
  - Coordinate environmental incident reporting to the PIU and Ministry of Environment and Climate Change (MoECC).
  - Supervise environmental induction training for contractor personnel.

Qualifications:

While the specific qualifications will be determined by the PIU, the following are generally expected:

- Minimum Bachelor's degree in Environmental Science, Environmental Engineering, or related field.
- At least 5 years of experience in construction-related environmental supervision, preferably with donor-funded projects.
- Demonstrated knowledge of ESMP implementation, waste handling, and water protection in arid or semi-arid contexts.

- Familiarity with World Bank Environmental and Social Standards, particularly ESS1 and ESS3.

2. Social Safeguards Officer (Site-Based)

Role & Responsibilities:

- Monitor and manage social risks and community interactions at the project site.
- Ensure implementation of social mitigation measures related to:
  - Labor and working conditions (ESS2),
  - Community health and safety (ESS4),
  - Gender-based violence (GBV) and SEA/SH risk mitigation (ESS4/ESS10),
  - Stakeholder engagement and grievance redress (ESS10).
- Serve as the primary point of contact for community liaison, grievance intake, and resolution coordination.
- Ensure compliance with Labor Management Procedures, including worker code of conduct enforcement.
- Lead daily briefings and toolbox talks on GBV, cultural sensitivity, and safety protocol for both local and external workers.

Qualifications:

- Minimum Bachelor's degree in Sociology, Social Work, Community Development, or a related field.
- At least 5 years of field-based experience in social safeguards implementation or community development.
- Proven ability to work in culturally sensitive settings with pastoral and rural communities.
- Knowledge of World Bank ESS2, ESS4, and ESS10, including grievance mechanisms and SEA/SH protocols.

3. Optional (Recommended): Gender or SEA/SH Focal Point

The Social Safeguards Officer may also serve as the Gender Focal Point.

Role:

- Conduct awareness sessions on GBV and SEA/SH.
- Act as a confidential reporting contact for community members and workers.
- Coordinate survivor referrals through the project's GBV service provider network.

Qualifications:

- Background in gender studies, public health, or social work.
- Experience in community-based GBV programming or case management preferred.

Staffing and Logistics Notes:

- These staff may be contracted by the contractor (with PIU approval) or directly embedded within the supervising consultant's team.
- They must be present full-time during the site preparation and drilling period, with reporting lines to both the Contractor's Site Manager and the PIU E&S Specialists.
- All must complete induction training on the project's ESMP, GRM, and World Bank safeguard requirements before mobilization.

Other Plans

In addition to this Environmental and Social Management Plan (ESMP) and the Contractor's Environmental and Social Management Plan (C-ESMP), the following project-specific plans should be prepared to address particular operational and site risks:

Site Waste Management Plan (SWMP) – Prepared by the Contractor prior to mobilization and implemented throughout construction and drilling. The SWMP (draft attached in Annex 8, can be amended as needed) will describe how solid and liquid wastes, including drilling muds, cuttings, packaging, and general site refuse, will be stored, handled, transported, and disposed of in compliance with the ESMP and Somaliland waste management regulations.

Emergency Response Plan (ERP) – Prepared by the Contractor prior to mobilization and implemented throughout the works. The ERP (draft attached in Annex 9, can be amended as needed) will define roles, responsibilities, and communication procedures in case of incidents such as fire, injury, equipment failure, fuel or drilling fluid spills, or severe weather. The ERP will also include contact details for local authorities and nearby health facilities.

Water Resources Management Plan (WRMP) – Prepared by MoWRD with input from the Contractor, before commissioning of the borehole. The WRMP will set out the intended operational pumping regime, abstraction limits (once confirmed from pumping test data), and monitoring arrangements for water levels and quality. It will be proportionate to the rural scale of the project, focusing on sustainable use of the aquifer and equitable water allocation through the WUC.

Given the rural location, small footprint, and limited environmental and social sensitivities within 4 km of the site, no other specialist management plans are anticipated. However, the MoWRD and the Supervising Engineer reserve the right to request additional plans if site conditions or risks change significantly during implementation.

Table 33 ESMP Summary

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
ESS 1: Assessment and Management						
Environmental and social risks and impacts must be fully evaluated and accounted for	Preparation of this ESIA Report; Stakeholder engagement to understand and capture the potential social and environment risks and impacts, including community concerns Site visits to both the village and project area Engineering design takes into account potential E&S impacts, to avoid when possible and mitigate when avoidance is not possible	ESIA Report cleared by WB Documentation of E&S tools (E&S checklist, etc) Records of stakeholder engagement Photographs of site visits CIR and other engineering reports	As necessary	PIU	PIU	TBD
ESS 2: Labor and Working Conditions						
OHS Risks	All workers operating or working near heavy machinery (e.g., drilling rigs, trucks, cranes) must undergo certified health and safety training before starting work. Only certified and experienced operators should be permitted to use machinery and power tools. Secure tools, pipes, and materials at elevation. Use tool lanyards or restraints when working at height. Enforce the use of hard hats, steel-toed boots, and gloves on all construction sites. Provide and enforce the use of gloves, goggles, overalls, and respirators when handling hazardous substances. Store all lubricants, fuel, and chemicals in designated, ventilated, bunded areas with secondary containment.	Safety risk assessment and management plan and implementation record Training of workers on OHS including safe handling of equipment, traffic safety, security measures and use of PPEs Toolbox meetings reinforce key safety protocols All incidents recorded PPE issuance register Monitoring reports Pictures of posters displayed	Daily by the contractor site supervisor/ Weekly visits from PIU	Contractor/PIU	Contractor/PIU	TBD

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
	Implement shift rotation and mandatory rest breaks, especially during the hottest hours (11:00 a.m. to 3:00 p.m.) Ensure constant access to clean drinking water and encourage hydration breaks.					
Traffic accidents cause injury or death of workers	All drivers undergo safe driving checks. Traffic safety protocols are closely adhered to.	Checks on drivers' documentation (qualifications and driving licenses) Traffic safety awareness raising and monitoring are documented.	Monthly	Contractor/PIU	Contractor/PIU	No additional cost
Risks of child and forced labour	Strict age verification process and documentation for all workers Ensure that all contracts have contractual provisions to comply with the minimum age requirements including penalties for non-compliance Include minimum age (18 years) in procurement documents. Raise awareness on child protection with contractors and in the communities. Posters prohibiting child labor at all sites	Labor register showing age and sex of persons engaged Worker's GRM in place Provisions in the contracts Records of awareness sessions Pictures of posters displayed	Monthly	PIU	PIU	No additional cost
Labor and Working Conditions	Require all contractors and subcontractors to sign and comply with a Labor Management Procedure (LMP) aligned with national laws and World Bank ESS2. Ensure that all workers—skilled and unskilled—receive at least the national minimum wage, with equal pay for equal work and no wage discrimination based on gender, clan, or status. Provide workers with written contracts in Somali, clearly stating wages, work	Records of workers and recruitment processes and criteria. All employment related grievances and resolution times are logged.	Monthly	Contractor/PIU	PIU	No additional cost

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
	hours, job duties, duration of employment, and grievance procedures. Enforce limits on working hours, rest breaks, and provide access to paid sick leave and weekly rest, in line with Somaliland labor regulations. Establish and enforce procedures to verify the minimum age of all workers (typically 18 years) before employment. Require identity documents at hiring. Include explicit anti-child labor clauses in all contracts, and conduct spot checks on subcontractor laborers. Make first-aid kits available on-site and train workers in basic health and safety. Link to a nearby health clinic for emergencies. All employees should sign a code of conduct addressing behavior expectations, health and safety, GBV/SEA/SH prevention, and respect for community norms. There is a confidential, accessible grievance mechanism for workers to raise concerns about wages, conditions, discrimination, or misconduct. Ensure that grievances are investigated promptly and resolved within a set timeframe. Communicate the grievance procedure during worker onboarding and display it at the worksite in Somali.					

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
Workers are not observing safety requirements	Sensitize workers on importance of adherence to site safety protocols All workers sign a code of conduct including responsibilities and rights regarding GBV, Grievances, observing OHS and security protocols etc.	Proper records of all signed forms Training records	Daily by the contractor site supervisor/ Weekly visits from PIU	Contractor/PIU	Contractor/PIU	No additional cost
ESS 3: Resource Efficiency and Pollution Prevention Management						
Potential soil contamination	Store fuel, oil, and lubricants in clearly marked, bunded areas with impermeable flooring. Refuel and maintain machinery only in designated containment zones. Equip construction sites with spill kits (absorbent materials, gloves, disposal bags). Train all workers in spill prevention, containment, and clean-up procedures. Collect used oils, lubricants, and filters in sealed containers and dispose of them through approved handlers or in lined pits approved by MoECC. Prohibit dumping of any liquids or waste on bare soil.	Proper records of oil & lubricant change and disposal	Monthly	Contractor	Contractor/PIU	TBD

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
Impacts of waste generation (drilling mud and cuttings, packaging waste, oil and fuel waste)	Construct lined waste pits or other disposal area at the drilling site to collect and contain drilling mud and cuttings. Ensure these are at least 50 meters from the borehole and outside any recharge zone. Prohibit the dumping of drilling fluids directly onto the ground. After drilling, backfill and seal waste pits to prevent seepage or accidental reuse. Coordinate with MoECC or local authorities for any required permits or inspections of waste handling procedures. Deliver training to workers on proper sorting and disposal procedures. Ensure regular waste collection and transport to approved local waste disposal or recycling facilities. Reuse wooden pallets and crates where possible; otherwise, dispose of them through approved channels or offer them for local repurposing. Prevent wind-blown litter by using covered bins or containers at all work areas. Designate a fuel handling and equipment maintenance zone, at least 100 meters from the borehole, with a concrete or impermeable surface and bunding (containment walls). Store oil, lubricants, and fuel in labeled, leak-proof containers, in shaded and ventilated locations with secondary containment (bunds or trays).	Waste management plan Records of amount of solid waste re-used, recycled, and disposed of	Monthly	Contractor	Contractor/PIU	TBD

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
	Use drip trays under generators and fuel-dispensing areas to catch accidental leaks. Collect used oil and lubricants in sealed, labeled drums and store them in a covered hazardous waste area until collected by approved waste handlers. Train all staff in spill response procedures, and keep spill response kits (absorbent pads, gloves, disposal bags) at fuel handling locations					

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
Impacts on water quality (contamination from chemicals, improper well casing, wastewater and livestock contamination)	Use non-toxic or biodegradable drilling fluids whenever possible. Store all chemicals, fuels, and lubricants in bunded, covered areas with impermeable surfaces, away from the borehole site. Avoid surface discharge of drilling fluids—dispose of them in lined waste pits or other method approved by MoECC. Use high-quality, corrosion-resistant casing materials that meet national and international borehole standards. There will be pressure and integrity testing of casing and sealing before final commissioning. Avoid over-pumping, which can draw saline water into freshwater zones—follow extraction limits based on aquifer tests. Construct drainage channels around the water kiosk and livestock troughs to divert runoff to lined soak pits or gravel infiltration beds. The livestock and human water access points have been designed to be 80 meters apart, with fencing to avoid co-use and crowding. Rotate livestock access to prevent overuse of any single trough area; consider vegetation buffer zones.	Waste management plan Records of amount of solid waste re-used, recycled, and disposed of	Monthly	Contractor	Contractor/PIU	TBD

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
Impact on air quality (dust and noise)	Spray water on unpaved access roads, drill pads, and cleared areas at least twice per day during dry, windy periods. Store drilling cuttings, sand, gravel, and other materials under tarpaulins or shade netting to prevent wind dispersion. Limit vehicle speeds on-site and along access roads to a maximum of 20 km/h to reduce dust emissions. Provide masks or respirators to all workers exposed to dust and conduct regular training on respiratory protection. Restrict high-noise activities (e.g., drilling, hammering, generator operation) to daylight hours (e.g., 7:00 a.m.–6:00 p.m.) to avoid nighttime disturbance. Provide ear protection (earplugs or earmuffs) to workers near high-decibel equipment and rotate tasks to limit prolonged exposure.	Number of sound machinery and equipment Frequency of watering of surfaces to reduce dust Frequency & maintenance plan	Monthly	Contractor	Contractor/PIU	No additional cost
Resource Depletion (declining water table and reduced aquifer recharge)	Set an extraction rate based on hydrogeological test results to ensure it remains below the estimated sustainable yield of the Yesomma Sandstone aquifer. If possible, equip the borehole with a calibrated flow meter to monitor daily water abstraction in real-time. If possible, conduct monthly or quarterly measurements of static water levels to detect drawdown trends. Implement fixed operating hours for the pump, aligned with seasonal demand and recharge patterns.	Flow meter readings and static water readings GM complaints related to water levels	Monthly	PIU	PIU	TBD

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
	The WUC, VDC or other appointed entity should clearly define and communicate allowable volumes for different user groups (e.g., households, livestock, institutional). Strengthen the WUC with fair representation of vulnerable and mobile groups and train them on water equity principles. Set up a system to flag low water levels or signs of pressure from users in nearby zones, with protocols to reduce pumping if needed. If possible, combine well metering with groundwater monitoring to ensure that withdrawals remain within safe yield limits. Track changes in grazing areas and vegetation health, using visual assessments or drone mapping if feasible. Use flexible or reinforced materials for surface infrastructure (e.g., tank stands, pipe joints) in case of minor subsidence. Implement rotational grazing and limit livestock congregation near the borehole to avoid localized land degradation.					
ESS 4: Community Health and Safety						
Conflict over water usage	Ensure the WUC includes fair representation from: Settled residents Pastoralists (including seasonal migrants) Women Marginalized clans or groups	GM complaints related to water usage Documentation of trainings to WUC/VDC Documentation of any water access guidelines developed	Monthly	PIU	PIU	TBD

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
	Develop and publicly share agreed water access guidelines, including: Time-of-day schedules for different user groups Livestock versus household usage allocation Rotation schedules for pastoralist groups Equip the WUC with training on mediation and dispute resolution, supported by traditional elders and local authorities. Develop flexible arrangements for seasonal or emergency access by mobile groups, balanced against local needs and sustainability limits. The project design has designated specific areas for livestock watering that are separated from human water access points. Encourage herders to access veterinary checks before using communal troughs during high-risk periods. Periodically clean and disinfect troughs to prevent disease transmission. Inform users about risks of disease spread and the importance of rotational grazing and livestock control. Allow any community member to submit grievances about water access, favoritism, or disputes through the project's GM.					

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
Increased GBV/SEAH cases	Require all contractors and laborers to sign and comply with a code of conduct that explicitly prohibits SEA/SH, GBV, and any form of harassment or discrimination. Conduct mandatory induction training for all workers on appropriate behavior, local cultural norms, and SEA/SH prevention. Position water kiosks and troughs in visible, well-used public areas with adequate lighting (if nighttime use is expected). The village has stated that at least 30% of Water User Committee (WUC) members will be women. There were women-only consultation meetings during stakeholder engagement to capture concerns that may not be voiced in mixed settings. Enforce policies requiring equal pay for equal work and zero tolerance for discrimination in hiring or task assignments. The project GM has a confidential and survivor-centered SEA/SH reporting system, ensuring anonymity, appropriate referral services, and non-retaliation guarantees.	• Audit report in place • Records in place	Monthly	Contractor / PIU/ SPTs/ MDAs	PIU	No additional cost

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
Health and safety risks from an influx of workers	Prioritize local hiring to reduce the influx of outside workers and minimize the potential for social disruption. There will be a code of conduct for all workers, covering behavioral expectations, including respect for local cultures, gender equality, and avoiding alcohol or substance abuse. A GM has been established for the community to report any security or behavioral concerns related to workers.	GM complaints related to workers Number of security or other incidents reported	Monthly	Contractor	PIU	No additional cost
The transition to a borehole system could change social dynamics; borehole might encourage new settlements, leading to land-use pressures, increased demand for resources, and possible social tensions.	Form or strengthen the WUC with equitable representation from all clans, genders, youth, elders, and IDPs to reflect traditional and current stakeholders. Incorporate customary water rights and conflict mediation practices into new water management rules where appropriate, in consultation with elders. Strengthen conflict prevention measures, such as incorporating rotational access for mobile pastoralist groups and setting rules for resource use in dry vs. wet seasons. Conduct outreach on sustainable borehole usage, livestock rotation, and water conservation, targeting both established and new residents.	GM complaints related to the project Site visits to confirm if there are new settlements Documentation of any outreach for awareness raising	Monthly	PIU	PIU	No additional cost

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
Exposure of community members to physical/biological hazards on the project site (vehicular accidents, stagnant water pools, etc)	Implement speed limits (e.g., 20 km/h) on unpaved access roads to reduce the risk of accidents. Design and implement proper drainage systems at the water collection points, especially at kiosks and livestock troughs, to prevent the formation of stagnant water pools that could act as breeding grounds for mosquitoes.	Records to show community sensitization on safety	Monthly	Contractor	PIU	No additional cost
Breakdowns could leave the borehole unusable; community payment model may not function properly.	Select pumps, solar components, and piping systems that use non-proprietary, easily sourced parts available in regional markets (e.g., Hargeisa, Berbera). Provide a simple maintenance manual in Somali and train two or more community members on routine servicing and early fault detection. Basic O&M measures were included in the CIR, for example, which could be translated and used for this purpose. Develop a clear, transparent community water payment system (e.g., per jerrycan, per household, or livestock-based contributions) that reflects community preferences and ability to pay. Train the VDC/WUC on basic bookkeeping, transparent recordkeeping and budgeting for preventive and corrective maintenance.	Documentation of O&M manual Documentation of a water payment system Records of training	As necessary	Contractor/PIU	PIU	TBD
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement						

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
Physical or economic displacement of legal and illegal residents or traders in or around the construction sites	The PIU has facilitated voluntary, documented agreements for all land areas affected by the project, including pipeline routes, water kiosks, and livestock infrastructure. All agreements have been negotiated transparently with landowners, elders, women's representatives, and local authorities, in accordance with statutory frameworks and in line with ESS5. The Community Engagement Report and voluntary land donation form are provided in the Annexes. The project has been designed to avoid siting infrastructure in areas that may provoke conflict or disrupt essential livelihoods.	Documentation by social specialist	Monthly	PIU	PIU	No additional cost
Blocked access to people in the area	Ensure that the local routes, drainage and community access are not blocked by construction. The project has been designed to utilize existing access roads, minimizing disruption to productive land.	GM complaints related to blocked access	Monthly	Contractor/PIU	PIU	No additional cost
Conflict over land	Before signing land agreements, consult all owners (private land) or users and residents (community land) and ensure that agreements and certificates are in place. Ensure that any complaints about land use restrictions or unfair treatment are addressed through the project's grievance mechanism, with attention to marginalized and vulnerable groups. Include land-related grievances as a specific category in grievance tracking.	Land agreements and certificates. Records of consultations with land owners and users	As necessary	PIU	PIU	No additional cost
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources						

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
Erosion from construction activities	Limit vegetation clearing strictly to the footprint of the borehole, pipelines, and necessary access roads. Clearly demarcate construction boundaries to avoid unnecessary site disturbance. Design and enforce controlled livestock routes and resting areas near troughs to reduce trampling. Use gravel or concrete bases at watering points to minimize soil damage and erosion. Install shallow diversion channels or berms around cleared areas to redirect stormwater.	Record of appropriate measures taken	Monthly	Contractor	Contractor/PIU	No additional cost
Habitat Disturbance (loss of vegetation and disturbance to wildlife)	Restrict clearing to the exact footprint needed for infrastructure. Avoid clearing buffer zones or grazing areas unnecessarily. Install fencing or barriers to guide livestock to designated watering points, preventing free roaming and trampling in sensitive zones. Work with the community to implement seasonal rotation of livestock access around the borehole, allowing vegetation recovery. Schedule noisy construction activities (e.g., drilling) during daylight hours only. Avoid nighttime lighting around the borehole. If lighting is necessary for security, use low-intensity, downward-facing, motion-activated lights. Educate residents and the Water User Committee on the importance of wildlife conservation and how to avoid	Record of appropriate measures taken	Monthly	Contractor	Contractor/PIU	No additional cost

E&S Risks and Impacts	Mitigation Measures	Monitoring Indicators	Monitoring Frequency	Responsibility		Cost
				Mitigation	Monitoring	
	behaviors that provoke wildlife (e.g., leaving waste or chasing animals).					
ESS8: Cultural Heritage						
Risk of damage to as-yet undiscovered items/areas of cultural significance	Have a "Chance Find" procedure in place Train workers to be aware of the potential of a chance find and what to do	Chance Find Procedure in place	As necessary	Contractor	Contractor	No additional cost
ESS10: Stakeholder Engagement and Information Disclosure						
Inadequate, ineffective, and inappropriate stakeholder and community engagements and disclosure of information	Keep community leaders informed of progress/delays or activities that may impact community. Conduct regular community consultations as necessary Consultation to be held in culturally appropriate means and language	Stakeholder engagement documentation Records of meetings	Monthly	PIU	PIU	No additional cost
Poor access or low trust in GM	Poster of GM and contacts always displayed outside project sites. All complaints are logged and resolved within 7 days Undertake consultations on the effectiveness of the GM	Posters and displays in place Records of consultation meetings	Monthly	PIU	PIU	No additional cost

This table presents a comprehensive, actionable framework to prevent, reduce, or manage the environmental and social risks associated with the Qoolbulale borehole project. These measures form the basis for the project's ESMP and should be implemented through regular monitoring, community participation, and government oversight to ensure compliance, sustainability, and equity.

8.6 Contractor E&S Requirements

To ensure compliance with Somaliland national law and World Bank ESF standards, the appointed contractor for the deep borehole development project will be required to meet comprehensive Environmental, Social, Health, and Safety (ESHS) obligations. These requirements will be clearly defined in the Request for Proposals (RFP) and will form a core component of the contract. They aim to ensure environmentally and socially responsible project implementation and safeguard the health, safety, and rights of both workers and local communities.

General Compliance Obligations

All contractors must operate in full compliance with applicable national legislation, including the Somaliland Environmental Management Law No. 79/2018, the Solid Waste Management Act, and the Private Sector Employment Law. Equally, they are expected to align with the World Bank's Environmental and Social Standards, particularly ESS1 (Assessment and Management of Environmental and Social Risks and Impacts), ESS2 (Labor and Working Conditions), ESS3 (Resource Efficiency and Pollution Prevention), ESS4 (Community Health and Safety), and ESS10 (Stakeholder Engagement).

Contractors will be contractually obligated to implement the mitigation measures defined in the project's Environmental and Social Management Plan (ESMP), including those specific to each borehole site.

Construction Environmental and Social Management Plan (C-ESMP)

A key requirement is the development of a Construction Environmental and Social Management Plan (C-ESMP). This plan must operationalize the ESMP provisions and tailor them to the contractor's scope of work. It must be submitted to the PIU prior to site mobilization and approved by the project's Environmental and Social Safeguards Specialists.

The C-ESMP shall include, at minimum:

- A site-specific mitigation plan covering all environmental and social risks;
- A waste management plan detailing the handling, storage, and disposal of drilling mud, rock cuttings, oils, domestic refuse, and hazardous substances;
- Measures for dust suppression, noise control, erosion prevention, and spill response;
- Water abstraction plans, identifying sources and usage volumes;

- Site layout maps indicating fencing, waste pits, access roads, and environmental features.

The plan must also include a strategy for minimizing community impacts, such as maintaining safe distances between drilling operations and settlements or sensitive areas, and implementing buffer zones to reduce environmental disturbance.

Health and Safety Plan

The contractor must prepare a detailed Occupational Health and Safety Plan as part of the C-ESMP. This plan must conform to both Somaliland labor law and the World Bank Group Environmental, Health, and Safety Guidelines. It must include the following core elements:

- Identification and mitigation of job-site hazards;
- Mandatory use of personal protective equipment (PPE);
- Emergency response procedures, including on-site first aid and evacuation protocols;
- Worker training in safety procedures and environmental awareness;
- Specific provisions for managing community safety risks, such as securing open pits, posting warning signage, and restricting unauthorized access.

Labor and Employment Standards

All labor practices must conform to the project’s Labor Management Procedures (LMP). The contractor must provide workers with formal contracts, maintain accurate employment records, and ensure equal opportunity in recruitment and pay.

A Workers’ Code of Conduct must be developed, covering core principles such as:

- Prohibition of child labor and forced labor;
- Prevention of sexual exploitation, abuse, and harassment (SEA/SH);
- Respect for community customs and norms;
- Prohibition of discrimination and promotion of respectful workplace behavior.

Workers must be informed of and have access to a grievance redress mechanism (GRM) that allows confidential reporting and timely resolution of employment-related concerns.

Training and Capacity Building

The contractor is responsible for training all workers and subcontractors on environmental and social safeguards, occupational health and safety, and the community interaction protocols established for the project. This includes:

- Pre-employment induction sessions;
- Toolbox talks and periodic refresher trainings;
- Specialized training for high-risk tasks (e.g., handling drilling chemicals or operating generators).

Contractors are expected to cooperate with the PIU's monitoring and safeguards teams to verify training quality and participation.

Monitoring, Reporting, and Accountability

Each contractor must assign a qualified ESHS Officer to oversee compliance at the site level. Monthly progress reports are to be submitted to the PIU and should include:

- Waste handling records and disposal logs;
- Health and safety statistics (e.g., incidents, near misses, injuries);
- Labor force composition and grievances filed;
- Summary of community interactions and stakeholder engagement activities.

Contractors must allow the PIU, the Ministry of Environment and Climate Change (MoECC), and World Bank representatives full access to project sites for the purposes of inspections, audits, and spot-checks. Any non-compliance will result in the issuance of corrective action requests and, if necessary, enforcement actions such as payment withholding, penalties, or contract suspension.

RFP and Contractual Clauses

The RFP and the subsequent works contract shall contain legally binding provisions requiring full adherence to ESHS performance standards. These include:

- Submission and implementation of a compliant C-ESMP and Occupational Health and Safety Plan;
- Inclusion of ESHS conditions in all subcontracts;
- Measurable performance indicators for environmental and social compliance;
- Clear enforcement provisions for breaches of ESHS obligations, including potential contract termination.

8.7 Reporting Plan

Based on the ESMF for the GW4R Project, the table below outlines the reporting plan for the Qoolbulale deep borehole subproject.

Reporting Plan Summary

Table 34 Reporting Plan Summary

Report Type	Submitted To	Frequency	Responsible Entity
Environmental and Social Monitoring Report	MoECC, World Bank	Quarterly	PIU E&S Specialists (Environmental and Social)
Grievance Redress Report	PIU Coordinator, MoWRD, World Bank	Quarterly	Social/GBV Specialist, Grievance Focal Points
Contractor Compliance Report	PIU, Supervising Engineer	Monthly during construction	Contractor HSE Officer, Site Supervisor
ESMP Implementation Progress Report	MoWRD, MoECC, World Bank	Biannually	PIU Environmental and Social Specialists
Annual Environmental and Social Audit	MoECC, World Bank	Annually	Independent Third-Party Auditor
Security Risk Management Report	PIU, MoWRD, World Bank	Biannually or as required	Project Security Officer / Consultant
SEAH/GBV Incident Report (Confidential)	Designated GBV Focal Point, PIU, World Bank (summary only)	Immediate upon case occurrence	GBV Specialist (following survivor-centered protocol)
Capacity Building and Training Report	MoWRD, World Bank	Annually	PIU Training Coordinator / E&S Team
Community Stakeholder Engagement Report	PIU, MoECC, Local Authorities	Semi-annually	PIU Social Specialist, Community Liaison Officer

Report Type	Submitted To	Frequency	Responsible Entity
Environmental and Social Completion Report	MoWRD, MoECC, World Bank	At end of construction phase	PIU E&S Team, Supervising Engineer

8.8 Capacity Building

The capacity building program targets a wide range of actors, including the WUC, local government authorities, contractors, and community representatives, with tailored training sessions addressing technical, environmental, and social responsibilities. Strengthening local capacity will enable community ownership of the project, enhance resilience to future water challenges, and ensure compliance with international standards.

Technical training will focus on borehole operation and maintenance, groundwater monitoring, and water quality testing. WUC members and borehole attendants will be trained on flow meter usage, sustainable abstraction rates, safe handling of pumps and solar equipment, and maintenance scheduling. Environmental training will cover erosion control, waste management, and habitat conservation, enabling local actors to monitor and respond to environmental risks. Social training will address grievance management, gender equity, labor standards, and conflict resolution, with special sessions on GBV prevention and the handling of SEA/SH-related grievances. These trainings will be conducted in collaboration with the MoWRD, the MoECC, and experienced NGOs or technical consultants.

The program will also include institutional strengthening for district-level agencies, enabling them to oversee compliance and provide long-term support to community water governance structures. Periodic refresher trainings, community sensitization campaigns, and cross-learning exchanges with other GW4R project sites will be organized to maintain engagement and promote shared learning. Importantly, the program will ensure that women, youth, and members of marginalized groups have equal access to capacity-building opportunities, not only to ensure inclusive governance but also to expand their roles in resource management and local development.

Training Schedule

The table below presents the proposed training activities for the Qoolbulale borehole project, including key topics, participants, facilitators, and timing. These activities are aligned with the ESMP and World Bank ESF requirements.

Table 35 Capacity Schedule

Training Topic	Participants	Trainer / Facilitator	Schedule
Borehole Operation & Maintenance	Borehole operators, WUC	MoWRD Technical Officers, Private Sector Technician	Pre-operation (1 week course)
Groundwater Monitoring & Water Quality Testing	WUC, local youth technicians, MoWRD district staff	MoWRD Hydrologists, Environmental Consultant	Biannually (refresher every 6 months)
Environmental Safeguards & Waste Management	WUC, VDC members, contractor team	MoECC, Environmental NGO	Pre-construction & mid-project
Grievance Mechanism and Conflict Resolution	WUC, elders, community liaison officers	Social Specialist, Local NGO	Pre-operation & quarterly refreshers
Gender Inclusion in Water Governance	Women leaders, WUC members, community facilitators	Gender Specialist, Women's Affairs Office	Pre-operation & annually
GBV/SEA/SH Risk Prevention & Survivor-Centered Response	Contractors, WUC, health staff, grievance focal points	GBV Expert, Local NGO	Pre-construction & annually
Occupational Health and Safety (OHS)	Contractor workers, borehole attendants	MoWRD Engineer, Contractor HSE Officer	Pre-construction & monthly toolbox talks
Financial Management & Transparent Tariff Setting	WUC treasurer and finance subcommittee	MoWRD Finance Team, Independent Auditor	Pre-operation & annual audits
Community Awareness on Sustainable Water Use	General community, school groups, pastoralists	WUC, District Officers, local CBOs	Quarterly outreach
Land Use Planning & Environmental Protection	VDC, local authorities, elders	MoECC, District Planner	Post-construction

9 Grievance Mechanism

9.1 Objectives of the Grievance Mechanism

In accordance with ESS10 on Stakeholder Engagement and Information Disclosure, the grievance mechanism (GM) for the Qoolbulale borehole project is designed to provide a transparent, accessible, and culturally appropriate process for receiving and addressing concerns and complaints from project-affected people and other stakeholders. The primary objective of the GM is to ensure that grievances are addressed promptly, fairly, and through a predictable and respectful process, without fear of retaliation or discrimination.

The mechanism serves as an early warning system to identify issues before they escalate into disputes, providing project implementers with real-time feedback from the community. It reinforces accountability by enabling individuals or groups to raise concerns related to environmental and social impacts, water access equity, labor practices, land use, GBV, or any aspect of project operations. The system also allows for the collection and analysis of grievance trends, helping to improve project performance and responsiveness.

The GM prioritizes inclusivity and is particularly designed to ensure the safe participation of women, youth, marginalized groups, and vulnerable individuals. Special provisions are made to handle sensitive grievances such as those related to SEA/SH through confidential and survivor-centered procedures. The grievance mechanism is integrated into the overall project structure, with designated focal points, a clear escalation path, and regular reporting to both community stakeholders and project oversight entities. Ultimately, the GM supports trust-building, conflict resolution, and the equitable delivery of project benefits, in full alignment with ESS10 principles of meaningful engagement and social accountability.

The primary objectives of the grievance mechanism are:

Ensure Transparent and Fair Conflict Resolution: The GM provides a formal, unbiased process for addressing community concerns, ensuring that complaints are handled promptly, fairly, and equitably.

Promote Community Participation and Trust: By providing a safe and open channel for feedback, the GM helps strengthen relationships between the project team and the local population, reducing potential tensions.

Mitigate Project-Related Social and Environmental Risks: The mechanism allows for early identification of disputes or grievances, enabling the project team to resolve issues before they escalate into conflicts.

Protect Vulnerable Groups and Prevent Retaliation: The GM ensures that all community members, including women, youth, and marginalized groups, can voice concerns without fear of intimidation or retaliation.

Support Compliance with International and National Standards: The grievance mechanism aligns with Somaliland's legal framework and World Bank safeguards, ensuring that complaints related to land acquisition, labor rights, GBV, or environmental damage are addressed in line with global best practices.

Improve Project Accountability and Learning: By documenting and analyzing grievance trends, the GM provides valuable insights into recurring issues, allowing for continuous improvement in project implementation and governance.

9.2 Alignment with GW4R GRM

The Grievance Redress Mechanism (GRM) developed for the GW4R Project provides a structured, transparent, and accessible process through which project stakeholders can raise concerns, complaints, or feedback related to the project's activities. It is aligned with World Bank Environmental and Social Framework (ESF) standards—particularly ESS10 on stakeholder engagement—and supports responsive, equitable project implementation.

The GRM is designed to address a wide range of issues, including:

- Environmental and social impacts,
- Disruption of access to water or land,
- Misconduct by contractors or project staff,
- Gender-based violence (GBV) and Sexual Exploitation, Abuse, and Harassment (SEAH),
- Labor and working conditions.

The GRM operates at three levels: community (village), state (FMS), and federal (FGS). Complaints may be submitted through multiple channels, including:

- **A 24-hour toll-free number (9992)**,
- **Designated email addresses** for general and GBV-specific grievances,
- **In-person reporting** via village focal points, Village Development Committees (VDCs), or contractor representatives,
- **Suggestion boxes** and verbal reporting during community meetings.

Confidentiality is prioritized—especially in GBV cases—and grievances are logged, investigated, and resolved within clear timeframes: acknowledgment within 7 days, and resolution where feasible within 21 days. Unresolved or serious complaints are escalated to higher levels and, if necessary, shared with the World Bank for further action.

Extension of the GRM to the Borehole Project

For the borehole sub-project, the existing GRM structure will be fully applied and reinforced at the local level. The borehole project may trigger concerns related to land access, water sharing, labor practices, or the influx of people—thus necessitating a localized yet connected grievance system.

Key adaptation measures include:

- **Appointing a dedicated GRM focal point at the borehole site**, either through the Village Development Committee or project staff. This individual will receive and document complaints using the national Kobo-based digital platform or paper forms.
- **Training contractor personnel and site supervisors** on how to recognize, document, and refer grievances, especially those related to health and safety, construction impacts, or labor issues.
- **Disseminating GRM information at the site** through posters, oral announcements, and community meetings to ensure accessibility by illiterate or nomadic populations.
- **Ensuring survivors of GBV or SEAH have safe, confidential referral pathways**, with links to trained GBV focal points at state and federal levels.
- **Tracking all grievances from the borehole site through the national GRM database**, ensuring follow-up, resolution, and reporting are consistent with the broader project requirements.

By embedding the GRM into the operational framework of the borehole project, stakeholders will have a reliable avenue to raise concerns, enabling the Project Implementation Unit (PIU) to manage risks proactively, resolve tensions early, and reinforce community trust and accountability.

9.3 Structure and Process of the Grievance Mechanism

The GM, as outlined in the project's ESMF, provides a clear process for stakeholders to raise concerns related to environmental and social issues, water access, labor conditions, SEA/SH risks, or any other aspect of project activities. The system is designed to operate at multiple levels—beginning with the community and escalating to the PIU and relevant government bodies when necessary.

Structure of the Grievance Mechanism

Community Level Focal Points: Each community has designated grievance focal points (including at least one woman), who are trained to receive and document complaints and guide complainants through the process. These focal points act as the first point of contact and help facilitate early resolution of minor issues.

Water User Committee (WUC): Minor water access complaints and disputes may be addressed at the community level by the WUC through customary resolution processes, provided the resolution is fair, inclusive, and documented.

Grievance Redress Committee (GRC) at PIU Level: For grievances that cannot be resolved at the local level, the PIU's GRC—which includes the Social Specialist, GBV Specialist, and Environmental Officer—reviews, investigates, and proposes corrective actions.

Special Protocols for SEA/SH and Sensitive Cases: The GM includes confidential, survivor-centered procedures for sexual exploitation, abuse, and harassment (SEA/SH). These are managed separately from other complaints, with no obligation for the survivor to disclose sensitive details or confront alleged perpetrators. SEA/SH cases are referred to appropriate service providers through established referral pathways.

Labor-Related Grievances: The GM includes a separate channel for worker complaints, aligned with the Labor Management Procedures (LMP). Contractors are required to have internal grievance processes that are monitored by the PIU.

Process for Handling Grievances

1. Submission: Grievances can be submitted through multiple channels—verbally, in writing, by phone, SMS, email, or via community suggestion boxes. No fee is required, and anonymous complaints are accepted.
2. Acknowledgment: Acknowledgment of receipt is provided to the complainant within 5 days, unless submitted anonymously.
3. Assessment and Registration: The grievance is registered in a centralized tracking system maintained by the PIU Social Specialist. It is then assessed and categorized based on urgency and risk.
4. Investigation and Resolution:
    a. Low-risk grievances are resolved at the community level within 15 working days.
    b. More serious grievances are referred to the PIU GRC and resolved within 30 working days, following an investigation and community consultation if necessary.
5. Feedback to Complainant: The outcome of the grievance is communicated to the complainant, and the resolution is recorded.
6. Appeal: If the complainant is unsatisfied, they may escalate the issue to higher authorities, such as district officials, the MoWRD, or, in unresolved cases, the World Bank.

7. Reporting: All grievances and outcomes are summarized in quarterly reports to the MoECC, MoWRD, and the World Bank. SEA/SH cases are reported in summary form only, to protect survivor confidentiality.
8. Monitoring and Learning: Trends and patterns in complaints are reviewed periodically to inform adaptive management and improve project responsiveness.

Key Safeguards

- Grievances are handled without retaliation, coercion, or discrimination.
- The system is designed to accommodate illiterate or low-literacy users through oral reporting and community facilitation.
- Outreach and awareness activities are conducted regularly to ensure all stakeholders, especially women and marginalized groups, know how to access the GM.

9.4 Step-by-Step Process Table

The table below outlines the GM process for the project, detailing each step from complaint submission to resolution.

Table 36 GM Step by Step

Step	Action	Responsible Party	Timeframe
1. **Submission**	Receive complaint through oral, written, phone, SMS, email, or suggestion box. Complaints can be anonymous.	Community Grievance Focal Point / WUC / PIU Social Specialist	Continuous
2. **Acknowledgment**	Confirm receipt of the grievance to the complainant, unless anonymous.	PIU Social Specialist / Grievance Focal Point	Within 5 working days
3. **Registration**	Log the grievance in the central Grievance Log with a unique ID, category, and brief description.	PIU Social Specialist	Within 2 working days of receipt
4. **Screening and Categorization**	Assess the type and severity (e.g., minor, sensitive, urgent, SEA/SH-related), and assign to appropriate handling level.	PIU Social Specialist / GRC	Within 3 working days of registration

Step	Action	Responsible Party	Timeframe
5. **Investigation and Response Proposal**	Investigate grievance through field visit, stakeholder interviews, and review. Prepare resolution proposal.	PIU Grievance Redress Committee (GRC), with technical input from relevant departments	Within 10–15 working days (30 days maximum for complex cases)
6. **Communication of Resolution**	Communicate resolution to the complainant and seek their agreement. If unresolved, advise of appeal process.	PIU Social Specialist / GRC	Immediately upon resolution
7. **Implementation of Corrective Action**	Carry out agreed remedial actions (e.g., repair damage, change procedure, provide access).	PIU, Contractor, or WUC (depending on case)	Within 10–20 working days (as applicable)
8. **Appeal (if needed)**	If unsatisfied, complainant may appeal to district authorities, MoWRD, or World Bank.	Complainant, District Administration, PIU	Within 15 working days of response
9. **Closure**	Mark grievance as closed if the complainant is satisfied or after appeal is resolved. Document outcome in log.	PIU Social Specialist	Ongoing
10. **Reporting and Learning**	Summarize grievance trends, outcomes, and corrective actions in quarterly reports. Use findings to improve ESMP implementation.	PIU Social Specialist / Project Implementation Unit	Quarterly and annually

Confidentiality and Survivor-Centered Protocols for GBV, SEA/SH Cases

To ensure that the GM is safe and accessible for survivors of GBV, SEA, and SH, the project follows a survivor-centered approach aligned with World Bank guidance. Below are the key features and safeguards:

Confidentiality is strictly maintained at all stages of the grievance process. Survivors are never required to share personal details publicly or with individuals not directly involved in service provision.

Dedicated and trained female grievance focal points will be assigned at the community level to receive SEA/SH-related complaints, ensuring comfort, privacy, and cultural sensitivity.

Survivors can report anonymously and are not required to disclose the identity of the perpetrator or participate in investigations unless they choose to.

SEA/SH grievances are handled separately from general complaints and are never referred back to local leaders or committees for informal resolution.

Immediate referral pathways are activated to connect survivors with medical, psychosocial, legal, and protection services, in line with established national or humanitarian protocols.

No retaliation or judgment is permitted against survivors. Project workers, WUC members, and contractors are bound by a Code of Conduct that strictly prohibits GBV and SEA/SH.

Grievances are not documented with identifiable details, and only aggregate, anonymized data is reported to the World Bank and government entities.

Awareness campaigns will be conducted to inform communities—especially women and girls—about their rights, available support, and how to report incidents safely.

Training is mandatory for all project staff and contractors on GBV sensitivity, survivor-centered response, and the consequences of misconduct.

These measures are essential to protect survivors, promote reporting, and ensure the grievance mechanism does no harm while supporting dignity, safety, and access to justice.

9.5 Grievance Tracking, Logging, and Reporting

Grievance tracking, logging, and reporting are critical elements of the GM, ensuring that complaints are handled transparently, efficiently, and in a manner that promotes accountability. Every grievance submitted—whether verbal, written, or anonymous—is entered into a centralized grievance log managed by the PIU Social Specialist. This log includes key details such as the date of submission, nature of the complaint, location, category (e.g., environmental, social, SEA/SH-related), action taken, and status of resolution. Each grievance is assigned a unique identifier to ensure confidentiality and facilitate systematic tracking. For sensitive or SEA/SH-related complaints, identifying information is omitted or anonymized to protect the survivor's privacy.

The log serves as a dynamic tool for monitoring how complaints are progressing through the resolution process. It allows the PIU and project stakeholders to detect trends, identify recurring issues, and assess the effectiveness of mitigation measures. All grievance records are updated regularly to reflect actions taken, dates of investigation, outcomes, and whether or not the complainant was satisfied with the response. For SEA/SH cases, a separate, secure system is maintained with restricted access, and only non-identifiable data is shared externally.

On a quarterly basis, the PIU compiles grievance summaries into monitoring and compliance reports, which are submitted to the MoWRD, the MoECC, and the World Bank. These reports include statistics on the number of grievances received, resolution rates, average response times, and any outstanding or escalated cases. Community members will also be informed of grievance trends and project responses during stakeholder engagement sessions, enhancing transparency and trust. This structured approach ensures that grievances are not only resolved but used as a learning tool to improve project performance and responsiveness.

9.6 Awareness and Disclosure of the Grievance Mechanism

Ensuring that the community is fully aware of the GM is essential for its effectiveness. Awareness and disclosure efforts will focus on making the GM accessible, culturally appropriate, and widely understood by all stakeholders, including women, pastoralists, youth, and marginalized groups. Outreach will be conducted using multiple communication channels to ensure that all community members, regardless of literacy level or access to technology, can understand how to submit complaints and seek resolution.

Community Awareness Strategies

Posters and Notices at Public Locations: Informational posters will be displayed at water kiosks, livestock watering troughs, village meeting areas, health centers, schools, and mosques. These posters will provide simple, clear instructions on how to submit grievances, the contact details of grievance focal points, and the process for resolving complaints. Posters will be designed with visual symbols and illustrations to ensure accessibility for those with low literacy levels.

Radio Announcements and Loudspeaker Broadcasts: Regular radio announcements will be made on local stations **in** Somali and other relevant languages to explain the purpose, process, and accessibility of the GM. Announcements will be scheduled during high-listenership hours, particularly before or after community prayers. Additionally, loudspeaker broadcasts will be conducted in weekly village markets or during community meetings to reach mobile pastoralists and other hard-to-reach populations.

Village Meetings and Sensitization Sessions: The Village Water Committee (VWC) and community elders will host public meetings to explain how the GM works, ensuring that residents understand their rights and the process for submitting complaints. These meetings will be conducted in a culturally appropriate manner, allowing for questions, discussion, and clarification.

Engagement with Women and Vulnerable Groups: Specific focus group discussions with women's groups, youth, and displaced persons will be conducted to ensure that marginalized groups understand their rights to report grievances, including sensitive cases related to gender-based violence or discrimination. Special emphasis will be placed on confidentiality protections for survivors of GBV and SEA/SH complaints.

Training of Local Focal Points: Grievance focal points, including members of the Village Water Committee, local leaders, and women's representatives, will be trained in recording, handling, and referring grievances in a professional and confidential manner. These individuals will serve as community liaisons, ensuring that grievances are collected and forwarded properly.

Printed Materials in Local Languages: Flyers and leaflets explaining the grievance process, contact details, and confidentiality protections will be distributed at key community locations. These materials will be translated into Somali and any other locally spoken languages, ensuring wider comprehension.

Ensuring Accessibility and Cultural Sensitivity

- Anonymous reporting options will be made available through suggestion boxes at water points and village centers to protect individuals who fear retaliation.
- Multiple reporting channels (verbal, written, phone-based) will be provided to accommodate different literacy levels and communication preferences.
- Gender-sensitive communication will be prioritized by ensuring that grievance information is shared through trusted female representatives and that survivors of GBV and SEA/SH have access to confidential and safe reporting mechanisms.

Ongoing Engagement and Feedback

Community engagement on the GM will be an ongoing process, not just a one-time activity. Quarterly review meetings will be held with village elders, the Water User Committee, and local government authorities to assess whether the community is aware of the GM and if any modifications are needed. Periodic surveys and feedback sessions will also be conducted to evaluate whether stakeholders feel comfortable using the mechanism and whether it is effectively addressing grievances.

10 Conclusion and Recommendations

The ESIA for the Qoolbulale borehole project has comprehensively evaluated the potential environmental and social risks, impacts, and benefits associated with the development of a deep groundwater source under the Groundwater for Resilience (GW4R) program. The findings confirm that the project is both environmentally and socially feasible, provided that the recommended mitigation measures are implemented in full and that the ESMP is effectively operationalized. The project presents significant positive impacts, including enhanced water security, improved public health, strengthened livelihoods for pastoralist communities, and reduced vulnerability to climate-induced droughts.

Nonetheless, the assessment also highlights several risks that require careful management, including groundwater over-extraction, land degradation, biodiversity disturbance, water access conflicts, gender inequality, and labor-related concerns. These impacts are manageable through the application of mitigation strategies aligned with national regulatory frameworks and the World Bank ESF. The ESMP, stakeholder engagement plan, grievance mechanism, and monitoring system collectively offer a comprehensive framework to ensure that the project is inclusive, accountable, and sustainable.

With strong institutional coordination, community participation, and ongoing monitoring, the borehole project in Qoolbulale can serve as a model for equitable and climate-resilient rural water development in Somaliland. The project offers not only technical and economic value but also an opportunity to reinforce local governance, build adaptive capacity, and improve the quality of life for some of the region's most water-insecure populations.

10.1 Key Recommendations of the ESIA Report

Implement the ESMP in full, including all mitigation measures for physical, biological, and social impacts, with appropriate oversight and budgeting.

Adopt sustainable groundwater management practices, including the use of flow meters, groundwater level monitoring, and pumping limits to prevent over-extraction and ensure long-term resource availability.

Strengthen water governance through an inclusive WUC that represents pastoralists, women, youth, and marginalized groups, with transparent financial management and equitable water access policies.

Enforce land-use agreements and grazing controls to prevent land degradation, habitat loss, and settlement expansion around the borehole site.

Apply gender-sensitive approaches to water infrastructure design and governance, ensuring 30% women's representation in the WUC and the inclusion of women in consultation and training activities.

Operationalize the GM with confidential SEA/SH reporting pathways, accessible complaint channels, trained focal points, and regular reporting of grievance trends.

Conduct targeted capacity-building programs for the WUC, borehole operators, local authorities, and community members on topics including water system maintenance, conflict resolution, GBV prevention, environmental safeguards, and financial accountability.

Establish and implement a comprehensive monitoring program with clearly defined indicators, regular inspections, and third-party environmental and social audits.

Promote continuous stakeholder engagement through community meetings, public disclosure of project information, and feedback mechanisms that are culturally appropriate and inclusive.

Ensure coordination between implementing partners and government institutions, particularly MoWRD and MoECC, to support enforcement of environmental and water regulations, facilitate capacity building, and monitor compliance.

Monitor and manage potential cumulative impacts due to increased water availability, such as overgrazing and wildlife displacement, and prepare adaptive management strategies as needed.

By acting on these recommendations, the project will be better positioned to deliver its intended benefits while minimizing negative impacts and ensuring social equity, environmental sustainability, and long-term resilience.

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Annexes

Annex 1: Summary of BoQ

The complete borehole drilling cost breakdown is below, showing all items and associated costs as listed in the project's Bill of Quantities. This includes drilling, casing, sampling, and installation components.

Table 37 Costs of Borehole Drilling

Description	Unit	Quantity	Rate (USD)	Amount (USD)
Mobilization and demobilization of all drilling equipment (incl. transportation of rig, compressors, materials and crew/personnel to and from site and setting up and dismantling of equipment).	Ls	1	4000	4000
Drilling by 14" diameter: 0-500 m. Using Rotary with mud drilling method	m	500	260	117000
Sampling (at 2m interval) and storage of representative drill samples (incl. driller's log)	No.	225	5	1125
Supply and installation of 203 mm (8,Äù), minimum wall thickness 13.4 mm (R12.5) blind casing, selected and approved by the supervisor (provisional). This will be a remeasurable cost.	m	270	50	13500
Supply and installation of 203 mm (8,Äù), wall thickness 13.4 mm (R12.5) screened pipe, 1,0-1.5 mm slotted and give a minimum open area of 10% selected and approved by the supervisor (provisional). This will be a remeasurable cost.	m	180	60	10800

Supply and install centraliser approved by the supervisor.	unit	22	45	990
Supply and install 1" U-PVC pipes for piezometric measurement in the annular space	m	430	1.5	645
Supply and installation of well-graded gravel pack filter material (of siliceous rock resistant to weathering and rounded) 3-5 mm	Cum	65	180	11700
Installation of inert backfill material above the gravel packing / bentonite seal to 10 m bgl.	Ls	1	2000	2000
Supply and installation of Bentonite / cement seal at approved depth above the gravel pack (sanitary sealing), for 10 meters	Ls	1	500	500
Cement grout between the inner casing and the outer surface casing (including 1.00mX1.00mX0.60m well neck protective concrete slab casting in place).	unit	1	560	560
Install a standard well cap made of steel, as per Engineer's approval	No	1	500	500
Clear site of all drilling remains and debris including backfilling and leveling of mud pits, drains, temporary structures, etc.	Items	1	500	500
Borehole development through jetting, air lifting or over-pumping until clear sediment-free water is attained	hr	12	450	5400
Supply, mobilize, set-up and install test pumping equipment as necessary and dismantle when completed.	Unit	1	4000	4000

Perform step draw-down/ recovery testing under the supervisor's instruction as necessary	steps	4	500	2000
Perform perform constant-discharge test and full recovery test under the supervisor's instruction as necessary.	hr	48	100	4800

Summary of Appurtenant Structures

Based on the detailed Bill of Quantities (BoQ), the following is a written summary of the appurtenant structures planned for the Qoolbulale borehole system, including water access facilities, support buildings, and power systems.

1. Water Kiosk

- A six-tap water kiosk is included to serve households with safe and convenient water access.
- The structure includes concrete foundations, piping, valves, and water distribution fittings.
- Total estimated cost: approximately 503.87 USD

2. Animal Troughs

- Three camel/cattle troughs and three sheep/goat troughs are to be constructed.
- These are reinforced concrete structures with adequate drainage, piping connections, and fencing to manage livestock flow.
- Total estimated cost:
    - Camel/Cattle troughs: 17,489.10 USD
    - Sheep/Goat troughs: 11,365.50 USD
    - Combined total: 28,854.60 USD

3. Water Tank

- A large elevated water tank is included for water storage and pressure management.
- The design includes a reinforced concrete base, galvanized steel tank, access ladders, and valves.
- Total estimated cost: approximately 21,756.83 USD

4. Watchman House

- A simple residential structure for a caretaker to oversee borehole operations and site security.
- Includes a single-room house with plastered walls, roofing, doors, windows, and a small latrine.
- Total estimated cost: approximately 11,017.96 USD

5. Power Supply – Photovoltaic Field

- The project includes a solar array to power the water pumping system sustainably.
- The photovoltaic field consists of 10 solar modules (600 W each), with mounting structures, wiring, and protective equipment.
- Total estimated cost: 90,000 USD

6. Backup Power – Diesel Generator

- A diesel generator is included as a backup power source to ensure uninterrupted water supply.
- Includes the generator, installation, fuel tank, and electrical connections.
- Total estimated cost: 19,500 USD

Total Cost for Appurtenant Structures

Approximately 171,633 USD, covering water distribution infrastructure, livestock facilities, storage, power systems, and operational support.

Annex 2: Operation and Maintenance

The ongoing operation and maintenance of the Qoolbulale borehole system is essential to ensure sustained water supply, infrastructure longevity, and environmental integrity. The O&M program will be managed by the Water User Committee (WUC) with technical support from the Ministry of Water Resources Development (MoWRD) and trained local technicians.

1. Borehole and Pump System

- Daily inspection of pump functionality, water flow, and pressure levels.
- Monthly cleaning of the borehole apron, valve chambers, and headworks to prevent debris accumulation.
- Quarterly pump servicing, including lubrication, voltage checks (for solar components), and inspection of fittings.
- Annual full servicing or overhaul of the submersible pump and related mechanical and electrical systems.

2. Solar Power and Generator Backup

- Weekly dusting and inspection of solar panels to maintain efficiency.
- Monthly inspection of inverter systems, battery units (if applicable), and electrical wiring.
- Scheduled generator maintenance, including oil and filter changes after every 100 operating hours, and quarterly fuel system checks.

3. Water Distribution Infrastructure

- Monthly leak detection and pipe flushing to prevent blockages or stagnation.
- Routine valve and tap servicing at kiosks and troughs.
- Quarterly inspection of elevated tanks for structural integrity, overflow function, and interior cleaning.

4. Livestock and Domestic Facilities

- Weekly cleaning of animal troughs to reduce algae and pathogen buildup.
- Periodic structural inspection of kiosks, troughs, and water tank stands to detect wear, vandalism, or corrosion.

5. Environmental and Sanitation Maintenance

- Ongoing waste disposal from water use points to prevent sludge and contamination.
- Vegetation maintenance and erosion control around borehole facilities and access roads.
- Water quality testing on a quarterly basis to monitor for contaminants (e.g., salinity, coliforms).

6. Administrative and Financial O&M

- Daily collection of user fees, with transparent bookkeeping.
- Monthly reporting on expenditures and system condition.

- Annual financial audit of O&M expenditures to ensure accountability.

O&M Summary

Effective maintenance of the Qoolbulale borehole is essential to ensure its long-term performance, protect groundwater quality, and avoid costly failures. The maintenance plan includes both preventive (routine, scheduled) and corrective (as-needed repair) measures.

The table below outlines routine tasks carried out on a daily, weekly, monthly, and annual basis to prevent system failures and ensure the borehole operates efficiently.

Table 38 Preventative O&M tasks

Maintenance Task	Frequency	Responsible Party	Purpose
Visual inspection of borehole headworks, apron, and valves	Daily	Borehole Attendant	Detect damage, leaks, or vandalism early
Clean and sweep borehole surroundings	Weekly	Borehole Attendant	Prevent debris and contamination buildup
Check water flow rate and pressure	Weekly	WUC Technician	Monitor pump performance and detect early signs of blockage
Inspect solar panels for dust or shading	Weekly	Solar Technician / Trained WUC Member	Maintain energy efficiency
Clean solar panels	Monthly	WUC Technician	Ensure optimal power output
Lubricate pump parts (where applicable)	Monthly	Pump Technician	Prevent mechanical wear and failure
Inspect and test safety features (e.g., grounding, fuses)	Monthly	Electrician / WUC	Electrical safety assurance

Maintenance Task	Frequency	Responsible Party	Purpose
Flush water lines and troughs	Monthly	WUC / Animal Management Focal Person	Remove sediment and algae buildup
Water quality testing (basic parameters)	Quarterly	MoWRD / Health Ministry	Ensure potable water standards are met
Structural inspection of tank, kiosk, and generator house	Biannually	WUC / District Engineer	Detect cracks, leaks, or corrosion
Full pump system inspection	Annually	Certified Technician	Comprehensive assessment and servicing
Generator servicing (if in use)	Per 100 operating hours or quarterly	Generator Technician	Maintain backup power reliability

This table summarizes the types of repair and response actions required when faults or damage occur, ensuring the system is quickly restored to safe and functional condition.

Table 39 Corrective O&M tasks

Issue	Corrective Action	Required Personnel/Skills	Estimated Response Time
Drop in water flow rate or pressure	Check and clear blockages, test pump motor	Pump Technician	Within 48 hours
Water contamination (e.g., smell, color, bacteria)	Shut down system, conduct water quality test, disinfect or repair well casing	MoWRD, Health Ministry	Within 24–72 hours
Damaged solar panel or inverter	Replace or repair damaged component	Solar Technician	Within 72 hours

Issue	Corrective Action	Required Personnel/Skills	Estimated Response Time
Generator malfunction	Fuel check, filter change, or part replacement	Generator Mechanic	Within 3 days
Leak or break in pipeline	Locate break, replace damaged section	Plumber / Technician	Within 48 hours
Livestock trough overflow or damage	Repair trough structure, fix valve or float	WUC Maintenance Team	Within 48 hours
Security breach or vandalism	Notify authorities, reinforce fence or security	VDC / Watchman / Local Police	Immediate to 24 hours
Electrical short or unsafe wiring	Disconnect system, repair or replace wiring	Electrician	Within 24–48 hours
Major mechanical pump failure	Remove, service or replace submersible pump	Specialist Contractor	Within 5–7 days

The maintenance plan ensures that the borehole infrastructure in Qoolbulale remains operational, cost-effective, and safe for long-term community use. Preventive tasks minimize system wear, while corrective actions ensure timely response to failures. The Water User Committee (WUC), supported by local technicians and MoWRD, will oversee maintenance, supported by a trained borehole attendant and periodic external servicing contracts.

Annex 3: Drilling and Pump System Technical Specifications

The Contractor must assume full responsibility, for all purposes of civil or criminal law, for the execution of the service and will be solely responsible for the interventions entrusted to it, the materials used and the means and tools provided for this purpose, both directly and indirectly.

The Client reserves the right to control all interventions in the various phases of execution. However, it is understood and agreed that all control interventions, without distinction, may never and in any way lead to liability for the Client, that is, the presence on site of the Client's coordination and surveillance personnel, the sharing of the type of intervention and the acceptance of the materials do not limit or reduce the full and unconditional liability of the Contractor.

All equipment, fixtures, installations and tools supplied by the Contractor must meet high technological characteristics, be of the best brands and comply with the national or international standards, or in their absence, with the rules of good execution, both for the quality of the raw materials, and for the manufacturing methods, dimensions, tolerances, acceptance tests and for anything else provided for by the current technical; they must, in any case, be suitable to replace the existing ones.

Therefore, the Contractor must provide the Client in advance with the technical specifications of the equipment and materials that are the object of each individual supply, the name of the suppliers and the location of their production plants, submitting the technical specifications and any certifications of tests and inspections for approval.

Each equipment must have, at the time of delivery, the following technical documentation:

1) n.1 copy of the maintenance manual;

2) n.1 copy of the corresponding catalogue sheet indicating the technical assembly characteristics;

The Company must, at any time, guarantee to the Client the execution of all tests and inspections on the supplies, deemed necessary and appropriate, both in the factory and on site.

The Client has the discretionary right to reject supplies deemed unsuitable, globally or for individual batches and also to order the replacement of the supplier, without the Contractor being able to claim any right to compensation or reimbursement for this.

All charges and expenses for the tests and inspections requested by the Client, without exception, and the charges related to the supplies (transport and packaging), are included and fully borne by the Contractor.

All supplies are guaranteed for two years from the date of installation.

11 Mobilization

Mobilization shall consist of the transport of all, necessary manpower, drilling rig, tools, casing pipes and construction materials to the drilling site. Demobilization shall consist of clean-up work and operations including, but not limited to those necessary to the removal of personnel, equipment, and incidentals from the project site.

The Contractor shall also mobilize all the necessary materials such as water for drilling, drilling chemicals fuels etc, which are required during the progress of the works.

12 Drilling

The drilling is carried out up to a depth in the interval 400-500 m. However, the borehole can be stopped by the contracting authority and finalized also at a depth lower than 400 m with no claim of any compensation. The contracting authority will appoint a supervisor for the drilling operations, who will be responsible, on behalf of MoWRD, for all activities related to drilling, completion of works and subsequent pumping tests. At the end of the drilling operations the supervisor will decide on the basis of the drilling logs, water quality etc. if to finalize the borehole or to abandon it, thus cancelling all the remaining operations with no claim of any compensation by the contractor.

The contracting Authority supervisor should possibly be a geologist or a person with wide experience of boreholes drilling supervision.

<u>The drilling site is near Qoolbulale village, Marodijeex region, in the area included between the coordinates are: 8.895° N, 44.422° E and 8.912° N, 44.460° E.</u>

13 Expected Lithology and Water Levels

The material expected during the drilling is constituted by sand, silt and shales. It is not expected crystalline basement up to 600 m, but in case the basement is found the drilling shall stop after penetrating 10 m in it.

Groundwater is not expected up to 250-350 m of depth.

14 Drilling Methodology and Use of Additives

The drilling shall be executed with the only methodology of rotary with mud circulation, to face hole wall collapses, frequently occurring in the area. The use of bentonite and or foam is requested on the base of specific conditions. The diameter of the drilling tools shall be suitable for the installation of 8” casing plus an annular space of 3” around the casing for the gravel pack installation, therefore no less than 14”.

15 Centralizer

Borehole casings and screens shall be fitted into the open hole with centralizers placed at intervals of 20 m. Centralizers shall be made by plastic material or iron and of an approved design which does not hinder the installation of either gravel, backfill or cement seal.

16 Sampling

Samples from the cutting are taken each 2 meters, put in small transparent plastic bag and the depth interval to which the sample refers is written with black indelible ink marker. The samples are stored in a wooden or plastic box with small wooden dividing panels on which the depth is written with the same indelible markers. The wooden boxes are stored in a shadowy location and always available to the drilling supervisor.

17 Activity Recording

On a field book are registered all the operations done while drilling, including the drilling time per pipe length interval, the lithology, including grain size for sand, the drilling diameter, the use of temporary casing (and its diameter), each start and interruption of the operations, any machinery breakdown or hole collapse, possible losses of circulation. It is requested to compile daily forms with all the data above described. In the notes shall be reported also the supposed or verified presence of water with the depth at which the water income occurred.

18 Gravel Pack and Piezometric Pipe

The gravel pack is made by quartz/feldspar type, selected rounded grains of diameter 3 - 5 mm maximum. The size is mandatory given the expected presence of fine deposits (fine sand and silt). Coarser gravel grains allow the passage into the hole of such deposits.

Before pouring the gravel pack, a piezometric pipe of 1” in U-PVC is installed in the annular space up to the half of the last (deepest) screened casing section. A maximum depth of 500 m is expected.

The gravel pack is washed to remove small particles then gradually inserted into the annular space around the casing. Its volume is measured before pouring. Verify the consistency between the theorical volume and the measured volume. Record the volume poured for the drilling report.

During the borehole development by air and pumping gravel pack will be added as per need.

19 Casing

The casing shall be in PVC 8” to allow the installation of a pump with 6“diameter. The expected length is 300 m for the blind casing and 200 m for the screened sections. The screens are slotted 1-1.5 mm to allow a yield of 99-109 liters/minute per meter, open, with minimum thickness wall of 13,4 mm.

20 Borehole Development

Borehole development shall be limited to jetting, air lifting and over-pumping methods only. Any damage caused by development procedures shall be rectified by the Contractor to the supervisor's satisfaction. Not less than 12 hours of development pumping will be carried out.

21 Pumping Test

The pumping test is performed with a pump suitable for yields up to 5 l/s with a head of 400 m and 8" of diameter. The contractor shall provide, beyond the pump and the generator, a gate valve, a flowmeter, a piezometric probe or dipmeter (up to 500 m of length) and a calibrated EC-meter for the measurement of electrical conductivity. The EC-meter is calibrated on a standard solution of known conductivity, before the start of drilling operations. Field forms are supplied for each type of test. The test is followed by the drilling supervisor or by a person appointed by him/her.

The activity consists of 3 different tests, preceded by a test of one hour to verify the reasonable yield range of the borehole.

- Step Test: it is performed by 4 steps at growing yields, at ¼, ½, ¾ of the maximum expected yield. The last step is done at the maximum yield. The time of pumping for each step is 1 hour. The passage to each next step is done without intermediate recovery. After the last step is concluded, a recovery phase of 2 hours measurements is done. During the test, readings of the water level are taken in the time intervals indicated on the step test form. Flowmeter readings, EC and temperature are measured at the start of each step and in the last minute of the last step.

- Constant rate test: once the recovery from step test is completed at 100%, a constant rate test of 72 hours is performed. The yield is selected by the drilling supervisor, on the base of the results of the step test and specifically at a yield of ¾ of the critical yield. During the test, readings of the water level, of the flowmeter, of EC and temperature are taken in the time intervals indicated on the step test form. It is recommended to verify the pump yield each 12 hours calculating the time necessary to fill a 200 litres drum by stopwatch. No generators stops are admitted, in case a stop occurs to the generator, the test shall restart from time 0, after a full recovery of the water level. Before the end of the test a sample of 5 litres of water is taken for chemical analyses.

- Recovery: as soon as the pump is shut the recovery measurements start following the timing of the recovery form. The recovery is followed for a maximum of 10 hours or up to 95% of the whole draw-down is recovered by the water level.

22 Hole Protection

The annular space between the open hole and the PVC lining shall be filled to a depth of at least 2,0 m with a cement concrete to form the support base.

23 Report

The drilling report is written by the contractor and contains:

- Contractor data, driller name, start and end of the drilling operations, equipment brand and type.
- Site name, village name and coordinates, taken by GPS
- All data regarding methodology, additives use, drilling diameters and intervals of utilization, casing and screen diameters and intervals.
- Short history of the operations, including breakdowns, collapses, change of drilling diameters, dates, etc.
- Log of the drilling time per pipe length interval.
- Stratigraphic log approved/written by the drilling supervisor, with pictures of significant samples for each lithological unit (no more than 5-7 pictures). In the log are indicated the verified/supposed main water incomes.
- Drawing of the casing/screen column of the annular space refilling, and of the diameters used during the drilling.
- Gravel pack description and pictures.
- Description of the development activity, with significant water levels variations.
- Complete description of the pumping test equipment, dates, times and full tables and graphs with data measured during each test.

24 Submersible Centrifugal Pump and Riser Pipe General Standards

- Pumps should be multistage, centrifugal type, Vertical directly coupled to wet type submersible motor for Pumping ground water from deep wells.
- Pump Sets must comply with the latest E.U and I.S.O. standards.
- Manufacturer authorization letter, Certificates of compliance, and ISO or other certificate should be submitted along with bid offer.
- Suitable diameter of each pump/motor over the cable for use in 8 inch diameter Well Casing.

25 Pump Performance

- Pump performance curves should be indicated and clearly seen.

- Duty point flow rate and head for each pump must be within application range recommended by manufacturer.

- Guaranteed Pump efficiency at design flow should be equal or greater than 65%.

- Actual pump operational point should be between 110-80% of BEP (Best Efficiency Point).

- NPSH required should be less than 4m.

26 Pump Construction Material

- Impellers should be made of abrasion resistant bronze or stainless steel; statically and dynamically balanced.

- Main pump body should be made of corrosion resistant, Zinc free, closely grained cast iron or casted stainless steel.

- Pump shaft, coupling, suction grid & retaining valves should be made of stainless steel(SS310 /SS316 or higher class SS).

- Non-returning valve with Strainer incorporated with the pump.

- Pump tightening bolts and lock nuts should be made of stainless steel.

27 Submersible Electronic Motors

All motors shall be of a make approved by the Engineer and shall be suitable for operating from the specified power supply. Motors shall comply in all respects with the relevant parts of BS 4999 and BS 5000, and shall be designed to run at high power factor and efficiency at the prescribed plant duty.

Motors shall be three phase, squirrel cage, induction type, continuously rated for the heaviest specified duty, totally enclosed and suitable for operation on the electricity supply and determined by the Contractor in relation to the power requirements, ambient temperature, altitude and normal working conditions of the mechanical plant offered.

The starting (locked rotor) current of any motor shall not exceed 6 times the full load operating current; Motor starting torque shall be at least 120% of the pump torque requirements throughout the starting sequence. Motors shall be capable of running backwards at rated speeds under backflow conditions without damage to the motor.

In addition to the requirements of BS 5000, the motors shall be capable of satisfactory operation with a frequency variation of = 5% above or below the normal frequency of 50 Hz.

The design of the motor shall be adequate in all respects for the number of starts per hour required when the pumping plant is in normal operation. Where an insulation Class is specified the requirements of BS 4999 shall be met. The limit of temperature rise shall be for the appropriate Class of insulation quoted. Class F insulation shall be provided, but with Class B temperature rise limitations.

Motors shall be fitted with locating type bearings and/or heavy type thrust bearings at the non-drive end and roller type bearings at the drive and according to the type of motor offered, but all bearings shall be of adequate proportions and design suitable for the particular application, and shall have ample capacity all allow the pump to operate for short periods with the discharge valve closed.

Details of the bearing types being proposed, grease, oil, shall be submitted for all vertical motors together with details of the grease lubricated bearings for horizontal split case motors.

The motors shall be built of high-grade components and materials in accordance with the best practice for the type of plant offered.

Motors 5 kW and above shall be fitted with temperature sensitive thermistors embedded in the motor to control a winding over-temperature relay mounted in the control cubicle. Each motor shall have at least 3 thermistors. The thermistors shall be suitable for connection to a monitoring unit in the motor control circuit to provided protection against winding failing due to overheating. The motor starters shall trip in the event of high winding temperature being experienced.

The motors shall be capable of delivering 10% in excess of the maximum power absorbed by the equipment being driven. The motors, where practicable, are to be selected to provide an element of commonality, thus flexibility in use at each site, particularly dosing pump motors.

Only ISO standard roller and/or ball grease lubricated bearings shall be fitted.

The grease lubrication shall be applied using hydraulic type nipples, which are freely accessible, without, and dismantling, or otherwise piped out to a readily accessible location.

"Sealed for life" bearings shall not be used.

Continuously rated anti-condensation heaters shall be installed in all motors above 5 kW that are to be installed or in damp or cold environments. They shall be sized by the supplier to suit the motor frame size.

Heaters shall be located within the motor so that the heat dissipated does not damage the insulation of any of the windings or associated cables.

Terminals boxes shall be separated from the frame and shall be reversible to allow cable entry at the top, bottom or either side, suitable for cable glands required. Terminal mountings shall be arranged such that the motor supply wiring can be disconnected without disturbing its internal connections.

The end of each winding shall be brought out to a separate terminal, connecting links being provided to facilitate interconnection of individual terminals.

A diagram of connections shall be fixed inside the terminal box cover, which shall be provided with watertight, oil resisting gaskets.

Where motor anti-condensation heaters are fitted additional terminals and a separate cable gland entry shall be provided. A warning label on the terminal box cover shall be provided stating" WARNING, LIVE HEATER TERMINALS, ISOLATE BEFORE REMOVING COVER".

Plates shall be fixed on each motor, giving the following information:

BS No______________________ Manufacturer______________________

Serial No______________________ Insulation Class______________________

Frequency______________________ No. of Phases______________________

Motor kW______________________ Voltage______________________

Current at FL______________________ Speed______________________

Vertical spindle motor units rated in excess of 5 kW shall be fitted with a at the upper thrust bearing to shut down the motor in the event of the thermocouple bearing temperature exceeding a recommended value. Details shall be provided for approval.

Motor that are water-cooled shall include suitable protection to safeguards against lack of water flow.

Where required by the specified operation system, motor circuits shall include the suitable rated rotary off, manual or automatic switches.

28 Control Panel and Starter

<u>Pump functioning must be under inverter connection to guarantee soft start and stop</u>

- Control panel with TPN (Triple pole and neutral) switch with selector from Main On/Off, the power from Generator and A.C., replaceable fuses, phase indicator, voltmeter, ammeter and starter.
- Manufacturer's standard automatic type starter of suitable amperage with provision for lay ampere setting and automatic restarting when the water level goes up to a safe level.
- Automatic protection for over loading.
- Water level monitoring Relay for dry run protection.
- All incorporated and assembled in lockable painted steel box.

29 Additional Equipment

- Water level monitoring system to prevent pump from running dry, suitable for lowering on the specified bore-hole diameter vulcanized 2 electrodes with single insulated and flexible wire length equal to pump head.
- PVC cable clamp kit.
- One pairs of pump clamp with bolts and nuts for 4 inch pipe diameter, unless specified
- Pressure gauge.
- Submersible cables of proper length for each pump
- One cable jointing kit with quick drying epoxy resin compound
- Control panel.
- Strainer
- Non-Return Valve (Check Valve) incorporated with pump.

30 Technical Information Required

- Copies of Installation and Operation Manuals in English, for each pump.
- Pump discharge and total head.
- Complete pump performance curves at duty point and at different heads and discharge
- Pump HP

- Pump efficiency at 0.8 power factor
- Number of stages, total length of pump, and motor
- Pump diameter, motor diameter Over submersible cable
- Outlet connection diameter.
- Type of impeller
- Impeller, pump shaft motor and pump casing material
- Size of submersible cable
- Make and type of starter.
- Control panel box full details
- Impeller vane thickness, number of vane, vane angle at inlet and outlet diameter of a typical stage
- Other relevant information

31 Riser Pipes

Riser pipe should be in galvanized steel, minimum inside diameter 4'' with minimum thickness 5mm and minimum yield stress 235 N/mm2.

The installation of non-return valve located at 10m from the delivery mouth of pump and a further non-return valve every 50 m of pipeline.

The Contractor, under his own responsibility, may propose riser pipes with different technical characteristic with greater performance in terms of structural and hydraulic functioning.

In any case the contractor is always obliged to issue a structural technical report about the fitness of the riser pipes installed, in accordance with the final installation diagram and the technical characteristics of the submersible pump installed.

Annex 4: Gender-Based Violence and Sexual Exploitation, Abuse, and Harassment Policy

The Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH) Prevention and Response Action Plan for the Horn of Africa Groundwater for Resilience Project in Somaliland outlines the risks, mitigation measures, and accountability mechanisms to address SEA/SH within the project. The key elements of the policy are outlined below.

Key Elements of the Policy

Identified SEA/SH Risks in the Project

High Vulnerability of Women and Girls: Existing data shows 96% of women in Somaliland have undergone Female Genital Mutilation (FGM) and over 70% have faced some form of domestic violence.

Risk of SEA/SH within Project Activities: Increased risk for women in labor-intensive roles**,** community decision-making exclusion, and power asymmetries that could lead to sexual exploitation or abuse in hiring and service access.

Project-Related Conflict: Poorly designed water points or exclusion from resource allocation could increase tensions, particularly among pastoralists, displaced persons (IDPs), and host communities.

Prevention and Mitigation Measures

Code of Conduct (CoC) for Workers and Contractors: All staff, contractors, and workers must sign a Code of Conduct (CoC) prohibiting SEA/SH; CoC must be translated into Somali and explained in training sessions; Violations will lead to strict disciplinary actions, including termination.

Establishment of Grievance Mechanisms (GM) for SEA/SH Cases: A confidential reporting system will be created to protect survivors; GM operators will receive specialized training on SEA/SH case management; Survivors will be referred to medical, psychosocial, and legal services as needed.

Referral Pathways and Survivor Support Services: Mapping of GBV service providers (hospitals, shelters, psychosocial support) will be completed before construction begins; Stakeholders will be informed of where to seek help, ensuring safe and confidential referrals.

Community Awareness and Sensitization: Gender-sensitive engagement with women's groups, youth, and marginalized communities to discuss SEA/SH risks and reporting mechanisms; Development of Information, Education, and Communication (IEC) materials in local languages to promote a zero-tolerance SEA/SH environment.

Capacity Building for Contractors and Government Officials: Training for PIU, contractors, and labor supervisors on gender-sensitive labor practices; Inclusion of SEA/SH risk mitigation in procurement documents and contractor bidding requirements.

Accountability and Monitoring Mechanisms

SEA/SH Grievance Mechanism (GM) to be separate from general complaints to allow for survivor-centered handling.

Contractor Compliance Monitoring: The PIU will review contractors' GBV response frameworks quarterly.

Regular Stakeholder Consultations to ensure project workers and communities understand their rights and reporting options.

SEA/SH Incident Reporting to the World Bank within 24 hours of receiving a complaint.

Annex 5: Chance Find Procedure

1. Introduction

This *Chance Find Procedure* was developed Federal Government of Somalia for the proposed Horn of Africa Ground Water for Resilience Project (GW4R) in accordance with the World Bank's ESS8-cultural heritage. A *chance find* is any unanticipated discovery or recognition of cultural heritage. Chance finds occur during the construction phase of a project. Such finds include the discovery of a single artifact, an artifact indicating the presence of a buried archaeological site, human remains, fossilized plant or animal remains or animal tracks, or a natural object or soil feature that appears to indicate the presence of archaeological material. A chance find procedure is included in relevant procurement documents and instructions to contractors. The procedure covers discovery of artifacts in the soil or underwater. A chance find procedure is not a substitute for pre-construction surveys and analyses.

2. Purpose of the chance find procedure

The *Chance Find Procedure* is a project-specific procedure that outlines actions required to prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

3. Scope of the chance find procedure

This *chance find procedure* covers the identification, notification, documentation, and management of *chance find* in accordance with national laws and, where applicable, internationally accepted practice. This procedure is applicable to all activities conducted by the personnel, including contractors, that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. Procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

4. Induction/Training

All personnel, especially those working on earth movements and excavations, are to be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

5. Chance find procedure

If any person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

i. Stop construction activities;
ii. Delineate the discovered site area;
iii. Secure the site to prevent any damage or loss of removable objects. In case of removable antiquities or sensitive remains, a full-time guard should be present until the responsible authority takes over;
iv. Notify the responsible foreman, who in turn should notify the GW4R project SPIU and NPCU, who will then notify World Bank and local authorities responsible for cultural heritage (within less than 24 hours);
v. The significance and importance of the findings will be assessed according to various criteria relevant to cultural heritage including aesthetic, historic, scientific or research, social and economic values;
vi. Decision on how to handle the finding will be reached based on the above assessment and could include changes in the project layout (in case of finding an irrevocable remain of cultural or archaeological importance), conservation, preservation, restoration or salvage;
vii. Implementation of the decision concerning the management of the finding;
viii. Construction work can resume only when permission is given from the respective authorities, NPCU and World Bank after the decision concerning the safeguard of the heritage is fully executed;
ix. In case of delay incurred in direct relation to archaeological findings not stipulated in the contract (and affecting the overall schedule of works), the contractor may apply for an extension of time. However, the contractor will not be entitled for any kind of compensation or claim other than what is directly related to the execution of the archaeological findings works and protections.

Annex 6: Community Engagement Report

Ministry of Water Resources Development

Republic of Somaliland

Groundwater for Resilience Project

Qool-Buulale

Community Engagement Report

Environmental and Social Impact Assessment (ESIA) Mission

Date: February 17, 2025

Location: Qoolbuulale Village, Salahley District in Maroodijeeh Region

Prepared by: Hodan Ahmed Aden

SL -GW4R Social and Community Development Specialist

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Introduction

On February 17, 2025, the Groundwater for Resilience (GW4R) Project Implementation Unit (PIU), in collaboration with Hydronova Consultants, conducted an initial community engagement session in Qoolbuulale village. The visit aimed to introduce the project's objectives, clarify the roles and responsibilities of both the Salahley Municipality and the Qoolbuulale community, and gather baseline environmental and social data through Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs).

The consultation session was attended by 132 community members, including 28 women, demonstrating broad and inclusive community participation. No distinct minority groups or Internally Displaced Persons (IDPs) were identified during the session. Although approximately ten households from the Gabooye clan, historically recognized as a minority reside in Qoolbuulale, they are now considered fully integrated into the broader community and are no longer regarded as a distinct minority group.

The Environmental and Social (E&S) team has conducted an update session with the Qoolbulale community, focusing specifically on women. This was done through a separate meeting addressing GBV/SEAH and GRM, and informed them there will be awareness, training and the appointment of a female local focal point. During this session, the team thoroughly explained the project, ensuring that women gained a comprehensive understanding of the entire project, including its SEAH/GBV and GRM components.

Additionally, members of the Qoolbuulale community residing on the Ethiopian side also participated in the consultation. There are no cross-border restrictions between Somaliland and Ethiopia in this area, allowing for free movement and engagement. Both sides of the community have access to key public services, including schools, maternal and child health (MCH) centers, and police stations.

Objectives of the Community Engagement Session

- To provide awareness of SEAH/GBV with GRM and female focal point.
- To raise awareness about upcoming activities and outline the role of the community.
- To present the goals, scope, and planned activities of the Groundwater for Resilience (GW4R) Project to the Qoolbuulale community.
- Discuss the role of women in managing water points.
- To outline and discuss the respective roles and responsibilities of the Salahley Municipality and the local community in the implementation of the project.
- To gather essential environmental and social information through Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs), which will inform project planning and safeguard measures.
- To strengthen collaboration between residents on both sides of the SomalilandEthiopia border, leveraging their shared water access to public services and social ties.

- To discuss the establishment of a Village Development Committee (VDC) for managing the water source for sustainability.
- To ensure broad and inclusive engagement, including women and community members from both the Somaliland and Ethiopian sides of Qoolbuulale.

Summary of the Discussion

- **Stakeholder Engagement with Local Authorities:**
The PIU held meetings with Salahley municipal officials including the Mayor, Director of Social Affairs, council members, and the Water Agency Manager to present the project and secure their support. Local authorities expressed strong commitment to facilitating the project's implementation.

- **Community Mobilization and Support:**
Municipal officials accompanied the PIU to Qoolbuulale to help mobilize the community. They encouraged residents to support the project and emphasized the voluntary donation of land if infrastructure is located on private property.

- **Inclusive Community Participation:**
A community-wide consultation session was conducted with 132 participants, including 28 women, showcasing inclusive involvement. Both Somaliland and Ethiopian residents of Qoolbuulale participated, and no minority groups or IDPs were identified as separate entities, indicating full social integration.

- **Dedicated Women's Engagement Session:**
A focused session with 28 women (including businesswomen and housewives) highlighted the role of the **Alla-Aamin Women Association** and the community's support for girls' education. Women reported no discrimination and noted high enrollment in local Islamic studies.

- **Existing Water Management System:**
Qoolbuulale has a structured Water Management Committee (3 women, 4 men) managing a seasonal dam and kiosks. They maintain financial accountability through vouchers and a cashier system. Water is sold based on affordability and access method (trucks vs. kiosks).

- **Community Readiness for Infrastructure:**
The community expressed strong support for the deep well project and showed willingness to install household connections and pay for water services based on tap meter usage demonstrating readiness for sustainable service delivery.

Community Feedback and Concerns

- During the community engagement session, the residents of Qoolbuulale, supported by Salahley municipal officials, expressed strong enthusiasm for the GW4R project, particularly appreciating its goal of improving water access through the planned borehole. Community members including elders, youth, and women welcomed the initiative and demonstrated willingness to provide land access for project infrastructure, emphasizing the importance of local ownership and cooperation. Women participants highlighted the positive social impact of the **Alla Aamin Women Association** and reported full integration of minority groups without discrimination. The community also showcased their organized water management system, expressing readiness to adopt household water connections and pay for services through tap meters, reflecting both their commitment and capacity to sustainably manage water resources.

Key Outcomes

- **Stakeholder Commitment and Support:**
- During the consultation meeting, local government officials, including the Mayor, Director of Social Affairs, and the Salahley Water Agency Manager, expressed strong support for the project. They emphasized their commitment to contributing actively to the project's implementation, particularly regarding the responsibilities of the Salahley Municipality.
- **Community Mobilization and Sensitization:**
- Following the meeting, municipal officials helped mobilize and sensitize the local community in Qoolbuulale. This effort encouraged residents to support the project and facilitated voluntary land donation for infrastructure installation, ensuring community cooperation for the project's success.
- **Inclusive Women's Engagement:**
- A separate session with 28 women from Qoolbuulale, including businesswomen and housewives, highlighted the active role of local development organization in promoting social development and girls' education. The session also reinforced the integration of minority groups, such as the Gabooye clan, into the broader community, with no discrimination reported, women has requested deliver water to the village so that they connect their household and ready tariff payment.
- **Water Management and Community Readiness:**
- The existing Water Management Committee in Qoolbuulale, which oversees a seasonal dam, demonstrated an effective financial management system and a willingness to expand water services, including the installation of household water connections. The community expressed readiness to pay for water services, further indicating their commitment to sustainable water access, fortunately a skilled operator has been hired by for Qoolbulale dam which has valuable for source sustainability.

Figure 1: Community members in the engagement session

Minutes of the Meeting

The PIU (Project Implementation Unit) team provided a comprehensive briefing on the purpose of the visit and emphasized the importance of active participation from local authorities and community as well. In response, all stakeholders expressed their strong commitment to supporting the project, particularly in their relation portion from implementation activities.

Following the meeting, the municipal officials accompanied the team to Qoolbuulale, where they helped mobilize and sensitize the local community. They encouraged residents to support the successful implementation of the project and emphasized the need for community members to voluntarily provide access to land if the project infrastructure is located on privately owned property.

The PIU team also engaged directly with various community groups in Qoolbuulale, including elders, youth, women, and other stakeholders. The community warmly welcomed the project, which involves the drilling of a deep well intended to meet the growing water demand of residents on both the Somaliland and Ethiopian sides of the border.

Women's Engagement Session

A Separate focused session 28 women members was held with women from Qoolbuulale, comprising a mix of businesswomen and housewives. Approximately 80% of the women in the area are enrolled in afternoon Islamic Studies classes, teaches by a local teacher from a formerly marginalized minority group (Gabooye clan). It is noteworthy that minority communities in Qoolbuulale are now fully integrated into the broader society, and no forms of discrimination were reported.

During the session, women highlighted the role of a local development organization, *Ala Aamin Women Association*, which actively advocates for girls' education and other social development activities. They reported that there are no cross-border restrictions between Somaliland and Ethiopia, and both communities have a key service on their side, including schools, MCH, and police stations.

Water Management and Access

The Qoolbuulale community has exixted Water Management Committee, which oversees the existing seasonal dam that supplies water to the village through kiosks and to the surrounding rural and pastoralist communities through animal troughs and additional kiosks at the dam site. The committee consists of seven members—three women and four men with structured financial management system, including the use of vouchers and a designated cashier.

Water delivered via water trucks is sold at a rate of $13.50 per cubic meter, while households accessing water from the village kiosks pay between $2 and $5 per household, depending on their ability to pay.

Community members also expressed their readiness to install household water connections and commit to paying for the services as measured by individual tap meters.

Key Discussions and Agreements:

- Land donation will be discussed after borehole identified by Hydronova and got knowing the exactly location to particularly discuss owner/owners.
- The GW4R team explained the project scope and objectives and community well understood project objectives and scop.
- Community members were encouraged to take an active role in monitoring and managing the future water infrastructure.
- The need for urgent action to drill a new borehole was requested by the community.
- The GW4R E&S team completed KIIs and FGDs for the ESIA process.
- The community expressed readiness to donate land for the project, with elders confirming their willingness to relocate if necessary.
- The village agreed to establish a more inclusive VDC and form a water management committee after the borehole is drilled to ensure long-term sustainability.

Conclusion and Next Steps

Conclusion

- The field visit to Salahley Municipality and Qoolbuulale village served as a significant milestone in the stakeholder and community engagement process for the Groundwater for Resilience (GW4R) Project. The active participation of local government officials, community leaders, and residents underscored strong support for the project. The collaborative efforts between the PIU, Salahley Municipality, and the Qoolbuulale community were instrumental in mobilizing the community, sensitizing them about the project's objectives, and fostering a sense of ownership and commitment. The inclusive approach, particularly in engaging diverse groups such as women and formar minority communities, highlighted the project's potential to address the water needs of both Somaliland and Ethiopian communities while promoting social cohesion and equitable development.

Next Steps

- **Follow-up Consultations:** Continue engaging with the community through regular follow-up consultations, ensuring that any emerging concerns are addressed and the community remains informed and involved throughout the project's lifecycle.
- **Land Access Agreements:** Work with community members and local authorities to formalize agreements regarding land access for project infrastructure, ensuring voluntary consent and minimizing potential conflicts.
- **Water Management and Infrastructure Planning:** Collaborate with the existing Water Management Committee to design and implement infrastructure that meets the growing water demand, including the drilling of the deep well and the expansion of water distribution systems to ensure equitable access for all community members.
- **Capacity Building:** Provide training for the Water Management Committee and other key stakeholders to ensure effective management and sustainability of water resources, including financial management, water distribution, and maintenance of infrastructure.
- **Monitoring and Evaluation:** Establish a monitoring and evaluation system to track the progress of community engagement activities, water management, and infrastructure development, with regular feedback loops to the community to ensure the project's success and sustainability.

9. Annexes Attendances

Community/Stakeholder Engagement Meetings

Attendance Sheet

Investment Type: ESIA

Village: Pawal — Bulaale

District: SalaxLay

Region: madhodi — JeeX

Meeting Dates:

From: 17/2/2025 To: 18/2/2025

Meeting 1: .... Date: ....

Meeting 2: .... Date: ....

Meeting 3: .... Date: ....

Meeting 4: .... Date: ....

Meeting 5: .... Date: ....

Meeting 6: .... Date: ....

Attendance Sheet

SN	Name	Sex	Group/ Org.
1.	muse Xaashi Jibaal	m	elder
2.	Xasan Guhaad Cilmi	m	Youth
3.	Cilraxman Cawil Cllaali	m	Youth
4.	Clraxman Cllaali	m	Youth
5.	Sadam Cllaali Guuleed	m	Youth
6.	muxumed Xasan Cawad	m	elder
7.	muuse Ibraahim ismail	m	elder
8.	muuse maxamed Jamac	m	elder
9.	Nasir maxamed Xasan	m	Youth
10.	maxamed Cilmi asal	m	elder
11.	Abdi ismail Cumar	m	elder
12.	Abdi Casis dahir Jamac	m	Youth
13.	Xasan Guhaad Cilmi	m	elder

SN	Name	Sex	Group/ Org.
14.	Cabdiraxmaan Cawil Cabdilaahi	m	Youth
15.	Cabdi Casiis Jees Cabdi	m	elder
16.	maxamed Cismaan Yuusuf	m	elder
17.	Khalid Ismail Cali	m	elder
18.	maxamed Cabdi Yuusuf	m	Youth
19.	Mawliid maxamed Nur	m	Youth
20.	maxamed Cumar Ismail	m	Youth
21.	fasal maxamed Ibrahim	m	elder
22.	maxamed nur maxamed	m	elder
23.	Khadar Naasir Cismaan	m	Youth
24.	maxamed sheekh Cali	m	Youth
25.	Cabdi Casiis Koosaar Jamac	m	Youth
26.	Nasir maxamed Cabdi	m	Youth

SN	Name	Sex	Group/ Org.
27.	Mukhtaar Asad Aadan	m	Youth
28.	Mukhtaar Abdi Cusmaan	m	Youth
29.	Nasir Cabdi Ismail	m	Youth
30.	C/shakur Cusman Cilmi	m	Youth
31.	C/gani Axmed Maxamed	m	Youth
32.	Garaad Xirsi Cilmi	m	Youth
33.	Maxamed Dahir Jamac	m	Youth
34.	Ibraahim Axmed Digaale	m	Youth
35.	Shaafic Abdi Ismail	m	Youth
36.	Ismail Cumar Xasan	m	Youth
37.	Jim Caale Cawad Cliaali	m	Youth
38.	Maxamed Axmed Cabdi	m	elder
39.	Maxamed Cilmi Julad	m	elder

SN	Name	Sex	Group/ Org.
40.	maxamed Axmed Cilmi	m	elder
41.	Yaasir maxamed Ibraahim	m	elder
42.	Garaad Axmed	m	Youth
43.	Xasan Axmed	m	Youth
44.	Carafaad maxamed	m	Youth
45.	Cirraxmaan ud cilmi	m	Youth
46.	Nasir Axmed maxamed	m	elder
47.	sadaam maxamed xasan	m	eldor
48.	farxaan Axmed Xirsi	m	elder
49.	fasal Ibraahim Ismacil	m	elder
50.	Koos cAllaahi Aadan	f.	women
51.	muna Nuur Yuusuf	f	women
52.	Sabad Xirsi maxamed	f.	Youth

SN	Name	Sex	Group/ Org.
53.	Koos faarax Xasan	f	Youth
54.	Suleekha ~~deef~~ caynaan	F	Youth
55.	fadumo Jamac Cilmi	F.	Youth
56.	Koos Abdi Axmed	F	women
57.	Hinda Axmed Cali	F	women
58.	Asma Asad Axmed	F.	Youth
59.	Rooda Xasan Xirsi	F.	Youth
60.	warda Maxamed	F.	Youth
61.	Rooda Axmed Xasan	F.	Youth
62.	Abdi maxamed guuleed	m	elder
63.	Abdi laahi Axmed	m	Youth
64.	AbdiNasir Cuse	m	Youth
65.	Idiris maxamed diriye	m	elder

SN	Name	Sex	Group/ Org.
66.	maxamed Xuseen Xirsi	m	elder
67.	Sakariye Xuseen	m	elder
68.	Yaxaye Xuseen	m	youth
69.	Cl Xakiin maxamed Yaasiin	m	youth
70.	maxamed Ibraahin hayle	m	youth
71.	Clcastis cismaan dalal	m	youth
72.	Abdi Xasan waali	m	youth
73.	farxaan mustafe	m	youth
74.	Abdi Jamac maxamed	m	elder
75.	Jibriil Jamac Axmed	m	elder
76.	S.Ali maxamud calmi	m	elder
77.	mahad Ibraahim	m	youth
78.	Abdi Xasan Abdi	m	youth

SN	Name	Sex	Group/ Org.	F
79.	Abdiraashid Jamac cali	m	elder	
80.	Axmed koosaar Jamac	m	elder	
81.	Axmed cumar Jamac	m	Youth	
82.	mawliid maxamed cabdi	m	Youth	
83.	maxamed muxumed Awcabdi	m	Youth	
84.	Ifraax xasan Axmed	F	Youth	
85.	Ayaan ismaciil maxamed	F	Youth	
86.	Carafaad maxamed Ibrahim	m	Youth	
87.	Asma iid calmi	F	youth	
88.	Najma bixii cumar	F	Youth	
89.	Farxaan ibraahim ismail	M	Youth	
90.	Jamaal xasan cawil	m	elder	
91.	Cabdicasiis xuseen xirsi	m	Youth	

SN	Name	Sex	Group/ Org.
92.	Carafaad Axmed Caagane	m	Youth
93.	Salmaan ismaaciil Jamac	m	Youth
94.	Su daysi sayid cabdi	m	Youth
95.	maxamed Nasir cabdi	m	Youth
96.	Farxaan mawliid Xasan	m	Youth
97.	mustafe cabdi ibraahim	m	Youth
98.	muse maxamed Jamac	m	elder
99.	cabdi badel	m	Youth
100.	Isra ismaacuul Jamac	F	Youth
101.	Ixsaan ismaacuul Jamac	F	Youth
102.	marwa maxamed Badel	F	Youth
	Sagal cabdi	F	woman
103.	Sagal cabdi muxumed	F	Youth

SN	Name	Sex	Group/ Org.
104.	Axlaan Ismaacil Jama	F	Youth
105.	Asma Xuseen Xirsi	F	Youth
106.	Jamaad Ibraahim diriye	F	Women
107.	Udo Abdi Ibraahim	F	Youth
108.	Shacaban Axmed Xasan	F	Youth
109.	Muna caydiid Jibaale	F	Youth
110.	Mawliid rooble ismail	m	elder
111.	Cabdilaahi Jamac Axmed	m	elder
112.	muuse Aadan Axmed	m	elder
113.	Cabdi Cismaan cali	m	elder
114.	Yuusuf Iimaan Nasir	m	elder
115.	Axmed cilmi Xirsi	m	elder
116.	Xus maxamed X. Aw cali	m	elder

SN	Name	Sex	Group/ Org.
117.	Jaamac Yasin Askar	m	elder
118.	Cali Xirsi maxamuud	m	elder
119.	Cismaan Axmed digaale	m	elder
120.	Cabdiraxman maxamed farax	m	Youth
121.	farxiya muuse dahir	F	Youth
122.	Abdiwahab maxamed Axmed	m	Youth
123.	muuse maxamed hamme	m	elder
124.	Khadar dahir Axmed	m	Youth
125.	Aw dahir aw maxamed	m	elder
126.	Siciid maxamud Jaamac	m	Youth
127.	maxamed Ibraahim haybe	m	elder
128.	Cabdinasir cismaan	m	elder
129.	mahad maxamed cilmi	m	Youth

Annex 7: Construction Investment Report

PREPARED FOR:

Republic of Somaliland, Ministry of Water Resources Development

Groundwater for Resilience Project (GW4R)

'Abaar-Tir'

Provision of Continuous Backstopping Engineering Services

Task 5 - Deliverable D7

Construction Investment Report
Qoolbulale Site, Maroodi Jeeh Region, Somaliland

Submission Date: April 2025

PREPARED BY:

Groundwater for Resilience Project (GW4R)

'Abaar-Tir'

Provision of Continuous Backstopping Engineering Services

Task 5 - Deliverable D7

Construction Investment Report

Qoolbulale Site, Maroodi Jeeh Region, Somaliland

Submission Date: April 2025

PREPARED BY:

HydroNova
INNOVATING WATER PROSPERITY

Terre Solidali

Summary of Intervention

Objective

This Construction Investment Report (CIR) seeks to assist the Somaliland State in determining whether a borehole near the village of Qoolbulale, located in Maroodi Jeeh, is feasible. The report is based on project site selection criteria and a joint feasibility evaluation of the proposed site by PIU staff and backstopping engineers. Detail geophysical work, community discussions, and an assessment of alternative enhanced supply options are all part of the project. The report serves as the foundation for deciding where to invest.

Intended Result

The site for the new borehole was selected due to its proximity to the communities and the fact that the nearest borehole is approximately 30 kilometers away, as the area urgently needs a reliable water source to support residents during the dry season when traditional water storage structures run dry. The investment proposal includes the construction of a new borehole capable of pumping enough water to meet up to 70% of the community's water needs for both humans and livestock during the 150-day dry period without rain, when the community cannot rely on surface water storage, providing also a buffer to support additional beneficiaries in the event of community growth.

Proposed Activities

The proposed investment is subdivided into three components:

1. **Construction of the borehole.** The proposed structure will be 500 meters deep and will be able to pump about 32,400m^3 of water during the dry season. The drilling of the borehole will cost an estimated US$ 212,690.00.
2. **Construction of the ancillary structures.** The borehole will be supplemented by a pumping system, an elevated water tank, a kiosk, and animal troughs. Finally, the proposed water system is completed by a watchman house (with RO and UV system) and a power generation system (PV system). These additional infrastructures will cost an estimated US$ 234,571.75. The photovoltaic system required to operate the pumping system represents a significant investment. Although it has been fully designed and it is considered in the cost-benefit analysis, it may be implemented at a later stage, depending on the final budget allocation. The borehole can operate using the diesel generator included in the pumping system design.
3. **Construction of the pipeline** to the community with the installation of 2 kiosks in order to provide water directly to the village. The cost of this installation is estimated to be $71,385.74, bringing the total investment to **$518,647.49.**
4. **Operation and Maintenance Costs.** Once constructed, the water project will regularly incur in several normal and extraordinary costs estimated in the range of **US$ 41,743 / year**. This value is primarily determined by the diesel supply needed for the generator's operation during the hours when sunlight is insufficient to power the photovoltaic panels.

The construction will be divided into two separate section: the first one of the drilling and the second for the construction of the appurtenant structures. This final section can require some modifications based on the results of the drilling.

Location

Name and Coordinates

Qoolbulale site (Latitude: 8.9029° - Longitude: 44.4424°), located about 85 kilometers southeast of the capital city of Hargeisa, is one of the sites the government of Somaliland has considered to be developed under the GW4R Project.

Village / City

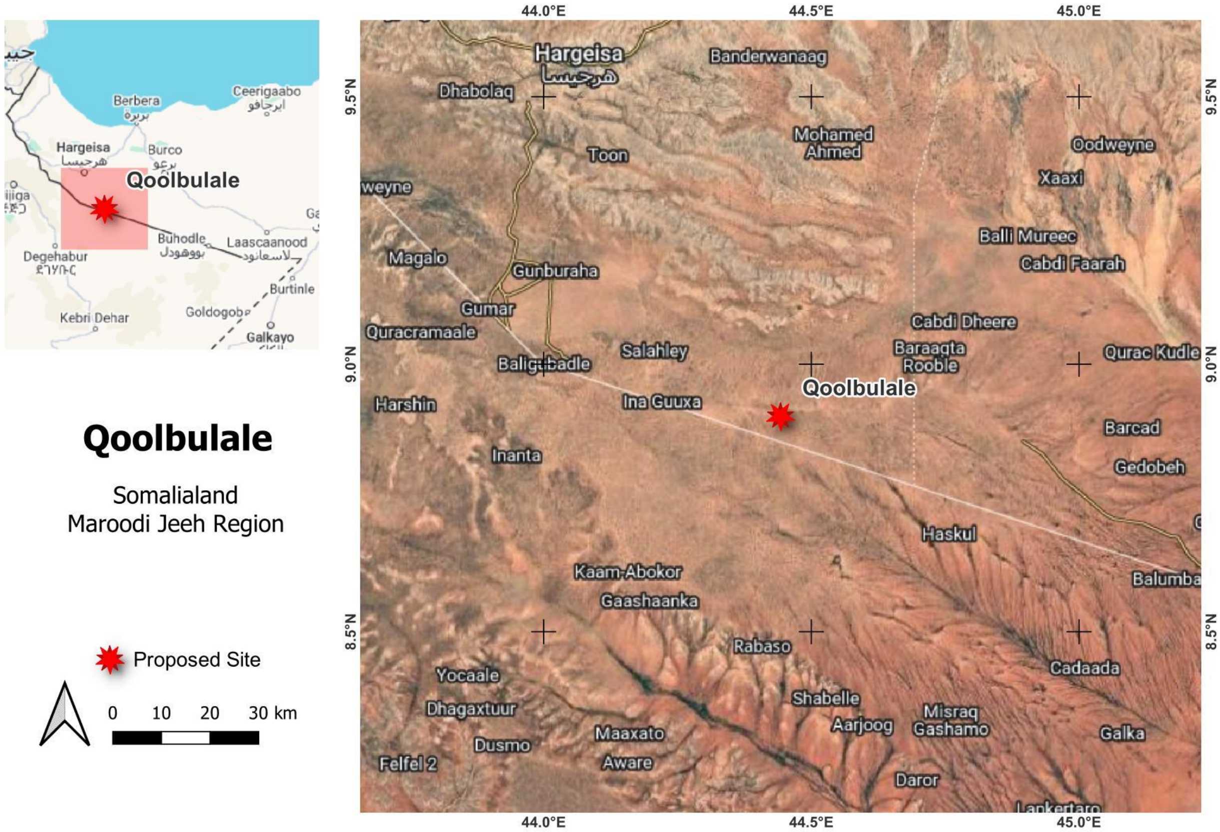


Figure 45: Qoolbulale Site - Location map

The communities within the project area, located along the border between Somaliland and Ethiopia, face an acute water shortage due to limited groundwater resources. This strategic location will attract a substantial number of beneficiaries, including not only nearby Somali communities but also populations from neighboring Ethiopia. While the borehole's water quality is expected to be relatively low, it will serve as an essential resource during the dry season, when traditional surface water sources (such as berkads, balleys, and haffir dams) become depleted, leaving communities dependent on groundwater for critical needs like livestock watering and washing. Therefore, the cost-benefit analysis presented in this report is conservative, considering that the borehole's value extends beyond the immediate locality, supporting numerous communities during the dry season.

Additionally, with the closest borehole situated 30 km away, the new water point will significantly contribute to the hydrogeological knowledge of the region, offering critical data that will aid future drilling projects and improve resource management in this currently understudied area.

Map

The new borehole will bring relief to all nearby communities, addressing the widespread need for reliable water access in the region. By providing a steady water supply, it is expected to benefit not only the primary community but also surrounding areas that face similar water shortages. Therefore, the needs of these neighboring communities have been included in the analysis of beneficiaries, ensuring that the project effectively supports all who will rely on this essential resource.

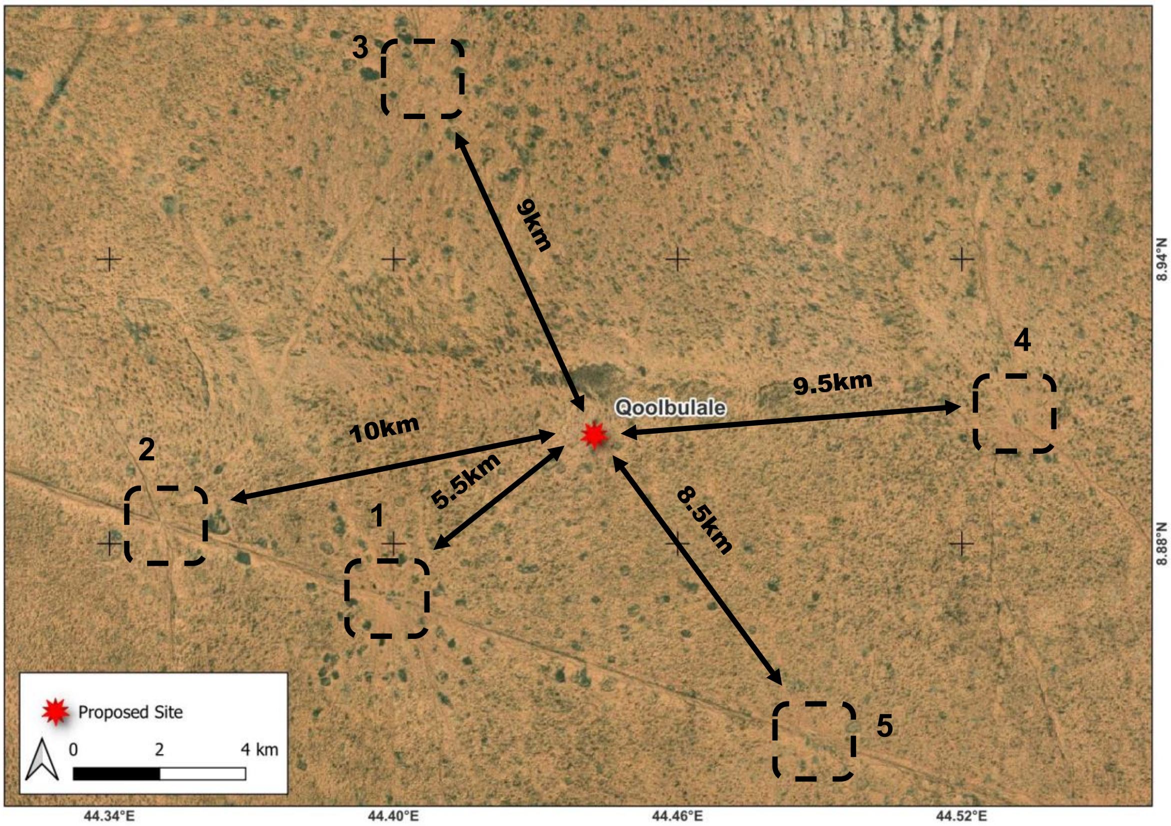


Figure 46: Aerial View of the proposed location for the water structure and the distance with the closest communities

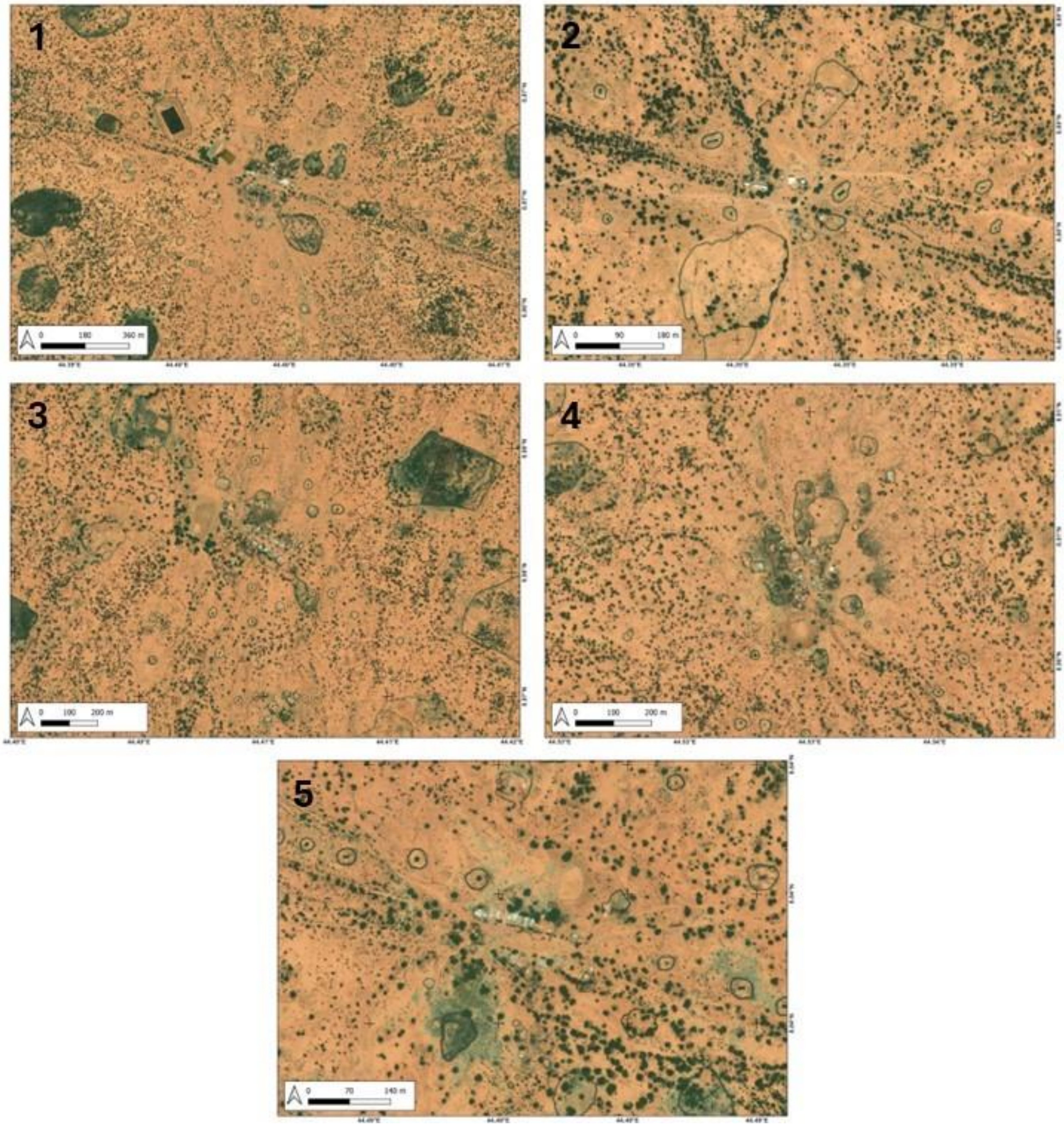


Figure 47: Satellite images of the closest communities to the new water point location

Delivery Targets

Volume

Number of Beneficiaries

The estimation of beneficiaries for the newly constructed water infrastructure was derived by the socio-economic survey done by the PIU and the satellite imagery, allowing for a detailed assessment of surrounding population densities. It was also possible to identify the predominant economic activities in the area, distinguishing between farming and nomadic practices based on visible land use patterns. An average number of livestock per household was considered to characterize the community water needs.[5]

The analysis considered the villages that would benefit from the new water point, that have been previously presented in this report, home to approximately 700 households that rely mainly on pastoralism and approximately 250 nomadic families that rely on water availability at the site during the dry season. Livestock, including camels, goats, cattle and donkeys play a significant role in the local economy, with varying numbers in each category.

Table 40: Number of beneficiaries estimation

	Community households	Nomadic families	Camels	Sheep	Goats	Cattles	Donkeys
Beneficiaries	700	250	1,256	9,420	10,048	1,884	628

Water Availability

The community's main water sources are berkads, balleys, and haffir dams, located near the villages. These sources rely on surface runoff during the rainy season to store water for use in the dry season. Although surface water generally has low electrical conductivity, it carries high contamination risks. The reliability of these sources depends on both rainfall and the amount of water stored.

When these sources are insufficient, communities rely on water trucking from distant boreholes, which often provides lower-quality water with high salinity.

[5] The estimates of average livestock numbers per household were derived from the study "Impact of Climate Change on Agricultural Production in Marodijeh and Gabiley Regions (Somaliland)." The analysis synthesizes data from various local agricultural surveys and expert consultations to ensure accuracy in the context of regional livestock management practices.

Figure 48: Water structures in the area of interest: haffir, balley and berkads in the community

Water Demand

The analysis revealed that pastoralism is integral to the community's livelihoods. Agriculture is not practiced.

Daily consumption quantities are calculated based on the estimated number of liters for each consumer type[6] and are presented in the following three tables.

Table 41: Estimation of the water demands by villagers and nomadic pastoralists.

[6] These figures are estimated based on two main sources of literature: Coppock et al. 1988 and Erik Nissen-Petersen (2006): Water for Arid Land (Danida). Hofkes (1983) emphasized that livestock in semi-arid areas require approximately 20-30 liters per Tropical Livestock Unit (TLU), with each TLU having a live weight of 250 kg. Thus, camels have a TLU of 1.6, beef cattle (as opposed to dairy cattle) have a TLU of 0.8, and sheep and goats have a TLU of 0.1. The water demand figures have been rounded to the nearest multiple of 10 for ease of reference.

Type of Villager	HH Size	Number of HH		Total Number of People (H)	Unitary Water Consumption [L/D/H]	Total Water Consmption [MC/D]
		Share	Number			
Agro-Pastoralists (i.e. livestock and crop land)	7.0	5%	35	245	25	6.1
Farmers (i.e. crop land only)	7.0	5%	35	245	25	6.1
Nomadic Pastoralists	7.0	26%	250	1,750	25	43.8
Pastoralists (i.e. livestock only)	7.0	49%	343	2,401	25	60.0
Village Household	7.0	15%	105	735	25	18.4
					Total Water Need for Villagers	134.4

Table 42: Estimation of the water demand for livestock

Type of Livestock	Average Number of Livestock per HH	Total Current Number of Livestock	Total Additional Livestock that the Project can Support	Unitary Water Consumption [L/D/H]	Total Water Consmption [MC/D]
Camels	2.0	1,256	0	30	37.7
Sheep	15.0	9,420	0	5	47.1
Goats	16.0	10,048	0	3	30.1
Cows	3.0	1,884	0	24	45.2
Other	1.0	628	0	25	15.7
				Total Water Need for Livestock	175.8

Finally, if the proposed water structure had to -alone- satisfy the demand for the entire drought season (150 days) for all water users, the water requirement would be approximately **46,539m^3** or **310m^3/day**.

Water Balance

Based on the hydrogeological analysis conducted for the new borehole study and considering the presence of a deep, permanent aquifer, the new water point will conservatively pump approximately 5l/s. This equates to about 32,400m^{3}of water over a 150-day dry season, assuming 12 hours of pumping each day (as per international best practices) . It means that the proposed structure will provide water to the 70% of the community's needs for people and livestock throughout the dry season.

It is important anyway, to recognize that in Somaliland, it is common for communities to not follow international standards, with water being pumped for over 12 hours a day, often running up to 20-24 hours, impacting on the pump durability.

Moreover, it should be noted that future projections of water demand are of limited relevance at this stage, as the new borehole will not be able to meet even the current demand. Future demand projections should only be considered if additional water points are constructed to supplement the existing supply.

Capacity and Quality

The new borehole is expected to tap into the Yesomma Sandstones aquifer, with water likely available at a depth between 250 and 350 meters. The expected water yield ranges from 12-18 m^3 per hour, though the quality may vary from slightly brackish to strongly brackish (electrical conductivity from 2,500 to over 4,000 µS/cm). While this may limit its use for drinking, the borehole remains valuable for livestock and other essential activities, especially during the dry season when surface water sources are unavailable.

However, precise values for both water quality and yield can only be confirmed after drilling.

Service and Access

Currently, the community relies on water trucking during the dry season when traditional storage sources, such as berkads, balleys and haffir dams, dry up. During these periods, the cost of water[7] can reach up to $13.5 per cubic meter, creating a significant financial burden on households. This high cost reflects the scarcity of accessible water in the area and underscores the necessity of establishing a borehole to provide a more consistent and affordable water source, especially for essential needs during dry months.

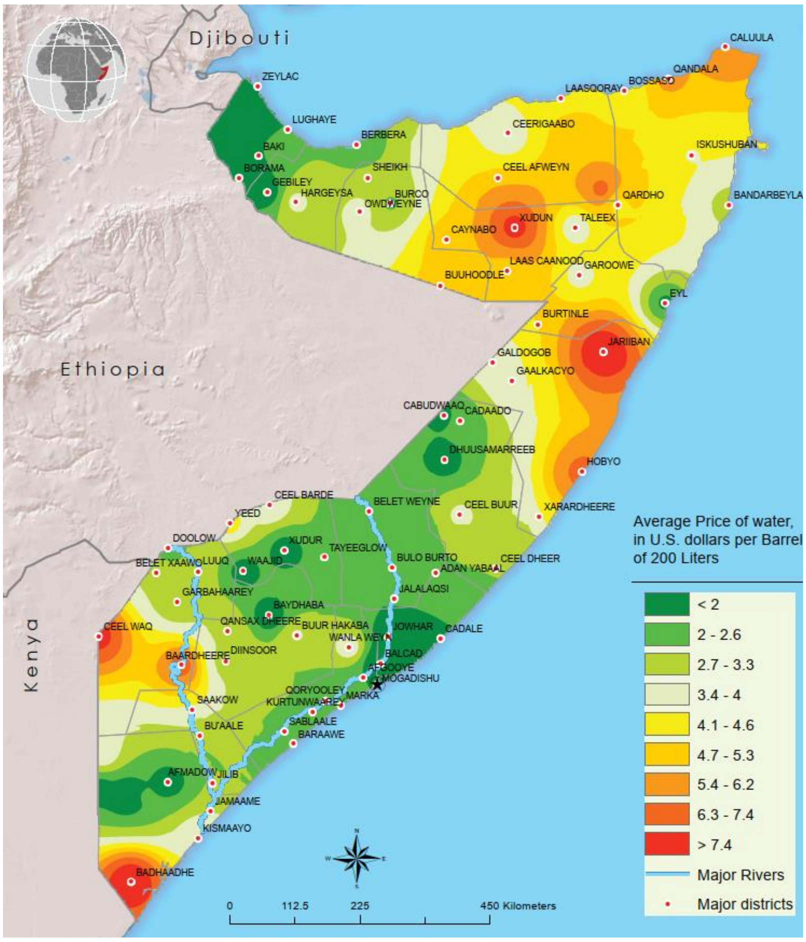


Figure 49: Average price of water reported by WASH Cluster Somalia in April 2021

7 Somalia WASH Cluster, Somalia: Monthly Water Price Updates (as of 14th April 2021). The study analyzes water costs during the dry season in various areas of Somalia.

Cost

The cost of the proposed structure is summarized as follows:

Cost of the borehole drilling	US$ 212,690.00
Cost of the appurtenant structures	US$ 234,571.75
Cost of the pipeline	US$71,385.74
Total Cost	**US$ 518,647.49**

In addition to these initial investments, it will be necessary to allocate an estimated US$ 41,743 / year to operate and maintain the structure.

Data and Information

This construction investment report provides extensive analyses on hydrology, geology and the natural environment surrounding the proposed project site. The main report provides a high-level summary of the details included in four separate annexes. Specifically:

- Annex 1 provides the details of the hydrogeological characterization.
- Annex 2 provides the details of the hydrological analyses including climate change.
- Annex 3 provide the details of the proposed community engagement plan.

A summary of these sections is provided below.

Hydrology and Climate

The precipitation patterns in the area of interest were analyzed using satellite data from the Tropical Rainfall Measurement Mission (TRMM), which was compared and validated against data from ground weather stations provided by SWALIM.

The local precipitation estimates were derived from the nearest TRMM data to the site, revealing an average of 261 mm per year over 22 years. Rainfall peaks typically occur in April/May and September/October, with a dry period lasting from November to March.

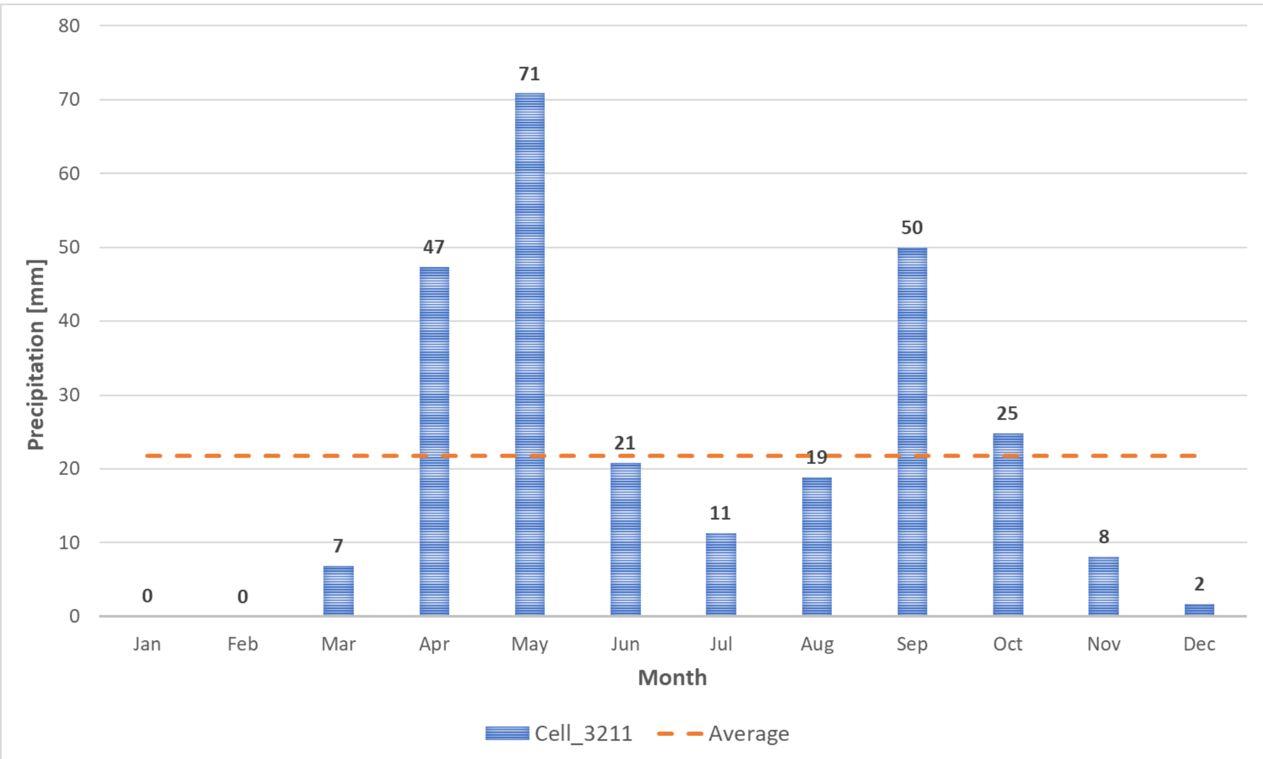


Figure 50: Average cumulative monthly rainfall data of the cell 3211 of the TRMM database (1998-2019)

Projections from the Climate Change Knowledge Portal indicate a slight increase in precipitation in the region, particularly under the conservative SSP5-8.5 scenario. These changes are not expected to significantly worsen local water issues. Additionally, the maximum number of consecutive dry days is projected to slightly decrease, suggesting that the new water point will adequately meet the community's needs in the future.

Hydrogeology and Geophysical Characterization

The survey area, located approximately 46 km ESE of Bali Gubadle village, is underlain by two primary geological units, both covered by a thin layer of alluvial-aeolian deposits from the Quaternary period. The Yesomma Sandstones, a Cretaceous continental formation composed of quartz-rich sandstones and siltstones, extend over much of the Haud Plateau, typically reaching thicknesses greater than 400 meters. In the study area, these sandstones unconformably overlie the Precambrian Undifferentiated Basement, a complex of crystalline rocks found at depths exceeding 500 meters. The Precambrian Basement outcrops along the border and across the northern edge of the Haud Plateau, with depths in nearby areas ranging from less than 100 meters to over 350 meters.

Hydrogeologically, the aquifer is primarily located within the sandy deposits of the Yesomma Formation. In the study area, the static water level is expected to lie between 250 and 350 meters below ground level, with potential borehole yields ranging from 10 to 15 m^3/hour. The water quality in the area remains uncertain, but moderate salinity levels have been recorded at some sites, while others exhibit poor water quality. The geophysical survey, which included 15 Vertical Electrical Soundings (VES), identified distinct subsurface resistivity patterns. These patterns suggest the presence of sandy layers in the Yesomma Formation, which have the potential to host an aquifer, although the boundaries of these layers can be difficult to define.

The VES data revealed two main resistivity patterns, suggesting that the subsurface layers are predominantly sandy, with resistivity values ranging from 10 to 31 Ωm. This indicates that the Yesomma Formation, especially in the northern section of the survey area, contains sandy deposits that are conducive to groundwater storage. The Precambrian Basement lies at depths ranging from 300 to 600 meters, with resistivity values of approximately 500 Ωm. While the basement itself is impermeable, the overlying sand-rich layers in the Yesomma Formation show the potential to contain groundwater, with the aquifer most likely located between 250 and 350 meters depth.

The results of the geophysical survey and borehole data suggest that the northern part of the survey area is the most promising for drilling. This area, characterized by higher resistivity values in the Yesomma Formation, indicates a greater likelihood of encountering sandy layers suitable for aquifer development. The recommended drilling depth is between 400 and 500 meters, where the potential saturated section is expected to be at least 100 meters thick. These findings, combined with the available data from nearby areas, support the conclusion that groundwater extraction is feasible in the northern part of the study area. However, the exact water quality remains uncertain and will need further investigation during drilling. Overall, the study recommends focusing drilling efforts in the northern section of the survey area, where conditions are most favorable for successful groundwater exploration.

Proposed Intervention

The proposed water project includes the drilling of a new borehole, with a pumping system, an elevated water tank, a kiosk, and animal troughs. Finally, the proposed water system is completed by a watchman house (with RO and UV system), a power generation system (PV system) and toilets.

Both the RO and UV systems are designed exclusively for human consumption and, for this reason, are connected only to the kiosk.

The photovoltaic system required to operate the pumping system represents a significant investment. Although it has been fully designed and it is considered in the cost-benefit analysis, it may be implemented at a later stage, depending on the final budget allocation. The borehole can operate using the diesel generator included in the pumping system design.

Considering the large number of livestock that will arrive at the site in search of water, the animal troughs must be constructed at more than 80 meters apart from each other and at an adequate distance from other nearby structures to guarantee their integrity.

More than that a pipeline is considered in order to provide water to the community.

The following images depict the layout of the proposed alternative. The following sections go into greater detail about the components.

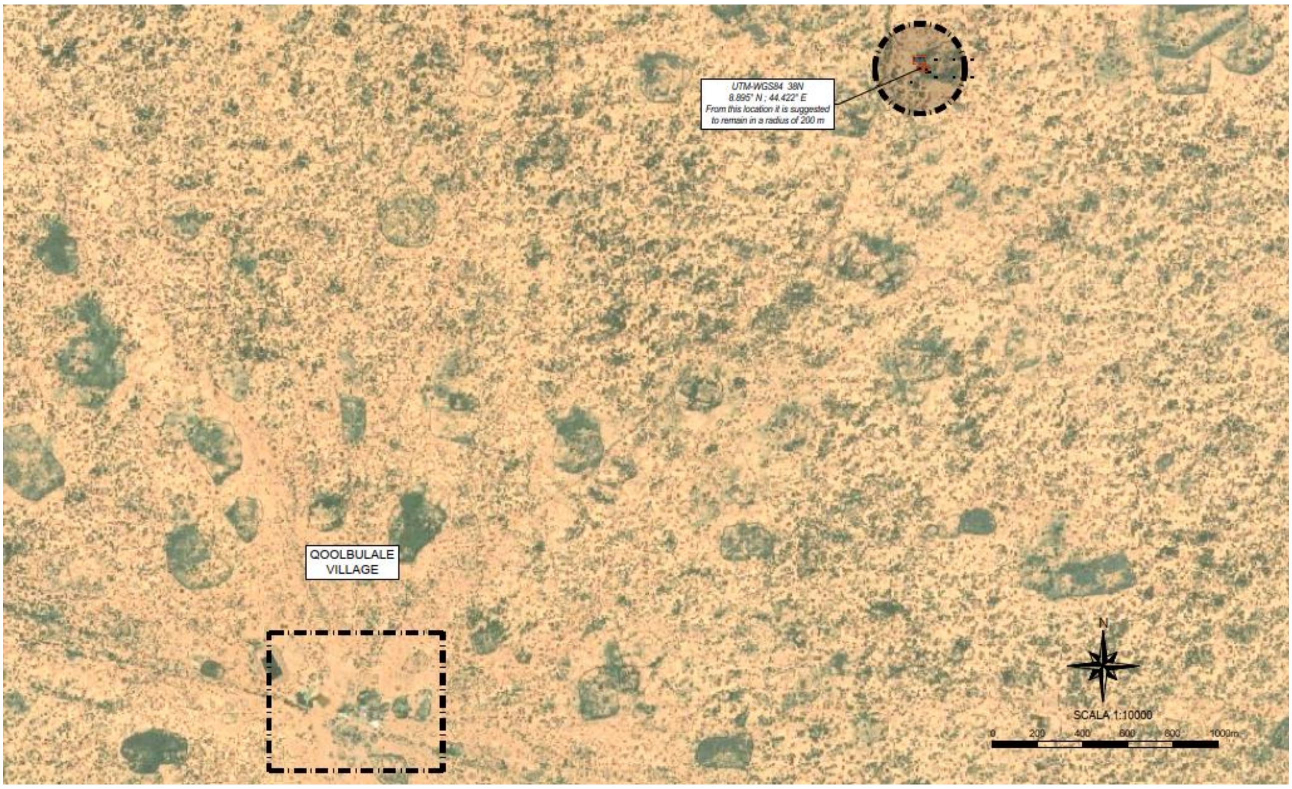


Figure 51: General planimetry view of the proposed water structure

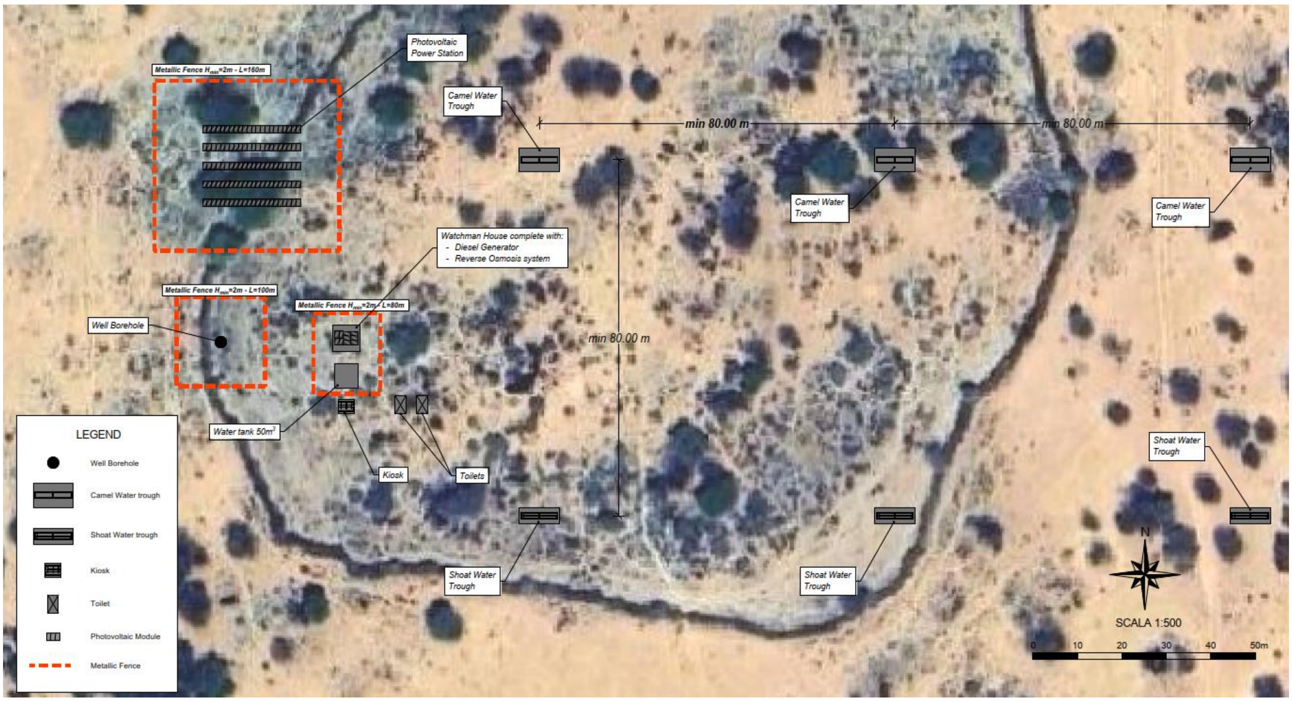


Figure 52: Layout view of the proposed water structure

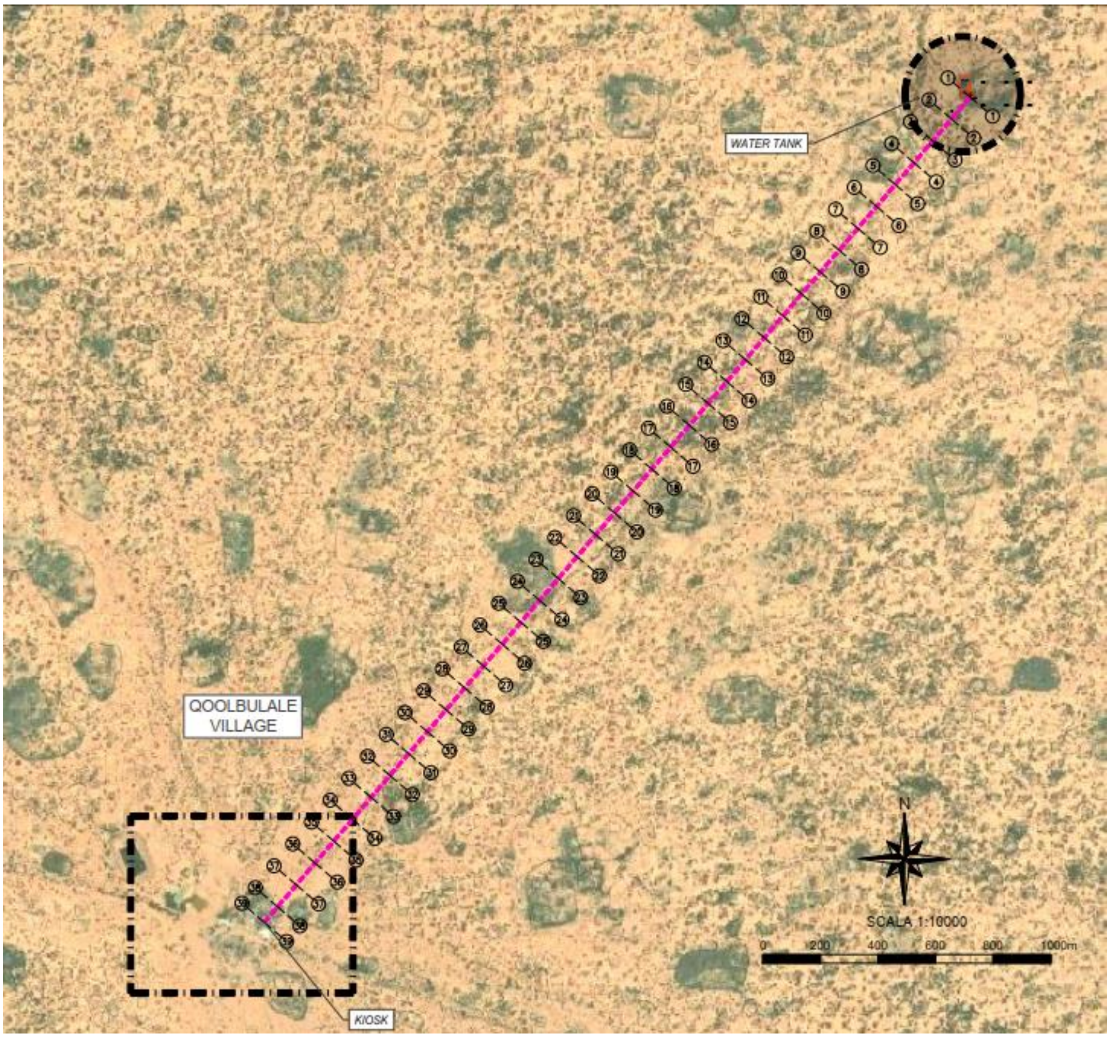


Figure 53: General pipeline plan

Capital Expenditures

A preliminary estimate of the costs involved for the drilling (including overhead and labor costs) of the proposed borehole are provided in the table below.

Table 43: Preliminary estimate of the total capital investments required for the drilling of the borehole

ITEM	DESCRIPTION	UNIT	QUANTITY	RATE (USD)	AMOUNT (USD)
Drilling, Casing and construction work of a borehole up to 500m of depth					
2.1	Mobilization and demobilization of all drilling equipment (incl. transportation of rig, compressors, materials and crew/personnel to and from site and setting up and dismantling of equipment).	Ls	1.00	$4,000.00	$4,000.00

Complete Drilling work up to 500m depth of 14" diameter borehole well and installation of 8'' (ø 203 mm) casings blind and screens. Include the unit rate for all necessary works, installation of service casing, materials and equipment such as disposal of excavated materials; supply water for drilling; taking any remedial measures to overcome caving in, or over drilling to accommodate sloughed material, drilling fluid, bentonite for sealing/grounding, fuel and water.					
2.2	Drilling by 14" diameter: 0-500 m. Using Rotary with mud drilling method	m	500.00	$260.00	$130,000.00
2.3	Sampling (at 2m interval) and storage of representative drill samples (incl. driller's log)	No.	250.00	$5.00	$1,250.00
Well construction and Casing					
2.4	Supply and installation of 203 mm (8"), minimum wall thickness 13.4 mm (R12.5) blind casing, selected and approved by the supervisor *(provisional)*. This will be a re-measurable cost.	m	300.00	$50.00	$15,000.00
2.5	Supply and installation of 203 mm (8"), wall thickness 13.4 mm (R12.5) screened pipe, 1,0-1.5 mm slotted and give a minimum open area of 10% selected and approved by the supervisor *(provisional)*. This will be a re-measurable cost.	m	200.00	$60.00	$12,000.00
2.6	Supply and install centralizer approved by the supervisor.	unit	50.00	$45.00	$2,250.00
2.7	Supply and install 1" U-PVC pipes for piezometric measurement in the annular space	m	480.00	$1.50	$720.00
2.8	Supply and installation of well-graded gravel pack filter material (of siliceous rock resistant to weathering and rounded) 3-5 mm	Cum	65.00	$180.00	$11,700.00
2.9	Installation of inert backfill material above the gravel packing / bentonite seal to 10 m bgl.	Ls	1.00	$2,000.00	$2,000.00
2.10	Supply and installation of Bentonite / cement seal at approved depth above the gravel pack (sanitary sealing), for 10 meters	Ls	1.00	$500.00	$500.00
2.11	Cement grout between the inner casing and the outer surface casing (including 2.00mX2.00mX0.60m well neck protective concrete slab casting in place). The upper face of this concrete slab must be minimum 30cm above the ground elevation and the the surrounding area, for a radius of almost 50m, must be adequately leveled so that surface runoff water is directed away from the wellhead to areas distant from it. This is all intended to prevent the formation of water pools after heavy rainfall or floods	unit	1.00	$600.00	$600.00
2.12	Install a standard well cap made of steel, as per Engineer's approval	No	1.00	$500.00	$500.00

2.13	Clear site of all drilling remains and debris including backfilling and leveling of mud pits, drains, temporary structures, etc.	Items	1.00	$500.00	$500.00
Borehole Development					
2.14	Borehole development through jetting, air lifting or over-pumping until clear sediment-free water is attained	hr	12.00	$450.00	$5,400.00
Test Pumping . Test pumping will include 4 step draw down and constant discharge test for 48 hrs and recovery test. This will include installation, removal of test pumping equipment, water level observations and draw down measurements and water analysis. NB: the pump is suitable for yields up to 5 l/s with a head of 500 m					
2.15	Supply, mobilize, set-up and install test pumping equipment as necessary and dismantle when completed.	Unit	1.00	$4,000.00	$4,000.00
2.16	Perform step draw-down/ recovery testing under the supervisor's instruction as necessary	steps	4.00	$500.00	$2,000.00
2.17	Perform constant-discharge test and full recovery test under the supervisor's instruction as necessary.	hr	48.00	$100.00	$4,800.00
Geophysical Logging					
2.18	This item covers the geophysical logging to be conducted immediately after the completion of drilling, and before any subsequent design activities. The objective of the geophysical logging is to provide detailed subsurface data for the interpretation of geological formations, aquifer properties, and other parameters required for the design phase. The item includes: - Mobilization of geophysical logging equipment to the site. - Calibration and testing of the geophysical tools and equipment. - Performing comprehensive geophysical logging for the well drilled, including (but not limited to) resistivity, gamma ray, neutron porosity, sonic, density, and other applicable logs. Use appropriate logging methods and tools based on the type of formation, expected depths, and project requirements. - Data collection from the well bore at specified intervals as per project specifications or as indicated by the engineer. - Record and store all data in digital format for further analysis. -Preliminary analysis of the raw geophysical data collected. - Report summarizing the data, with interpretation of geological formations, hydrogeological properties, and other necessary	L.S.	1.00	$4,000.00	$4,000.00

	parameters. - Provide recommendations for design based on geophysical results. - Demobilization removing geophysical logging equipment from the site once the logging and data collection are completed. Ensure proper disposal of any waste or materials generated from the process. This should serve as a comprehensive item for the geophysical logging task, including the necessary activities and deliverables. The item is comprehensive of minimum 4 water quality tests according to the engineer indication.				
Borehole Safety					
2.19	Supply and installation of a fence (around borehole) with a minimum height of 2.00 m made with galvanized and plasticized wire mesh in the color chosen by the engineer with rhomboidal mesh of mm. 50x50, fixed to the upper and lower galvanized and plasticized wires, with a diameter of 2.8 mm, and to an adequate number of intermediate wires, complete with blades and T-shaped of mm. 40x40 in galvanized and plasticized steel, performed in a workmanlike manner and according to the indications of the engineer, on prefabricated concrete plinths with dimensions of 30x30 / 14x14 cm and H = 48 cm with appropriate hole, for housing the columns, gate and access door. The minimum fence perimeter must be at least 80m around water tank and watchman structures	L.S.	1.00	$3,500.00	$3,500.00
TOTAL COST OF BOREHOLE DRILLING					$204,720.00
	Note: the quantities mentioned in the BoQ, above, are to be understood as indicative and may be modified during the				

	execution of the works as instructed by Supervisor's Representative				

Cost of the Appurtenant Structures

In addition to the construction of the borehole, we suggest adding several appurtenant structures which includes pumping system (powered by a photovoltaic field) connected to a new water tank located in the proximity of the watchman house. One kiosk and animals throughs will also be added to the intervention.

The costs required for the implementation of the appurtenant structures are summarized in the following table:

Table 44: Preliminary estimate of the total capital investments required for the construction of the appurtenant structures.

No	Item	Number	Unit Cost [US$]	Total Cost [US$]
1	General Items	1.00	$ 7,970.00	$ 7,970.00
2	Water pumping, RO & UV treatment	1.00	$ 46,200.00	$ 46,200.00
3	Water Tank	1.00	$ 21,756.83	$ 21,756.83
4	Construction of one Kiosk with 6 tabs	1.00	$ 503.87	$ 503.87
5	Construction animal water troughs for Camels/Catles	3.00	$ 5,829.70	$ 17,489.10
6	Construction animal water troughs for Goats and Sheep	3.00	$ 3,788.50	$ 11,365.50
7	WatchMan House	1.00	$ 11,817.96	$ 11,817.96
8	Diesel & Domestic PV Generators	1.00	$ 19,500.00	$ 19,500.00
9	Photovoltaic Field	1.00	$ 90,000.00	$ 90,000.00
10	Public Toilet	2.00	$ 3,984.24	$ 7,968.48
			TOTAL COST OF PROJECT	**$ 234,571.75**

Cost of the Pipeline

A new pipeline is considered in order to provide water directly to the village with the installation of two new kiosks.

The costs required for the installation are summarized in the following table:

Table 45: Preliminary estimate of the total capital investments required for the installation of the pipeline.

No	Item	Number	Unit Cost [US$]	Total Cost [US$]
1	General Items	1.00	$ 5,670.00	$ 5,670.00
2	Construction of Aqueduct/Pipeline	1.00	$ 64,708.00	$ 64,708.00
3	Construction of one Kiosk with 6 tabs	2.00	$ 503.87	$ 1,007.74
			TOTAL COST OF PROJECT	**$ 71,385.74**

Operation and Maintenance

The chapter provides guidelines for the operation and maintenance of the borehole and its essential components. Boreholes require consistent monitoring of mechanical parts such as the pump, casing, and piping, as well as routine water quality testing. Although daily maintenance is minimal, quarterly checks on pump efficiency and seasonal inspections on the casing and connections are recommended to ensure optimal functionality. Each inspection should document the status of equipment, note any wear, and include photos to identify material changes or performance concerns.

Water quality testing should also be conducted periodically, as borehole water quality can vary due to environmental changes or usage patterns. Maintenance logs should detail the condition of components, along with any repairs made, including before-and-after photos. Keeping thorough inspection and repair records will support effective long-term maintenance, as it enables the tracking of part performance over time and helps forecast future maintenance needs. This proactive maintenance approach will sustain borehole operation, ensuring reliable water access for the community.

Specific Recommendations

Operation and Maintenance (O&M) of a groundwater source or wellfield includes all the tasks needed to keep the system functional. O&M includes regular tasks such as replacement of worn parts, refuelling, servicing, cleaning and monitoring, as well as dealing with irregular breakages, outages and malfunctions. Long-term, successful O&M needs suitably skilled and motivated personnel and depends in turn on a set of institutional and organizational systems.

This O&M manual is a guide to assist water supply managers, technical staff, plant operators, water practitioners and others to manage groundwater infrastructure. O&M activities ensure that the infrastructure delivering potable water to consumers is always operational. The information in this manual is derived from International Standards and best practices

The following is the operation and maintenance procedures that the community should regularly employ at the proposed borehole and its appurtenant structures.

Community Involvement: Skilled personnel and joint community management are recommended for effective monitoring and maintenance of the dam. Strengthen community capacity for management.

Management Committee: Form a management committee based on location and revenue capacity, with a minimum size of five members and gender balance.

Water Treatment: Ensure water is properly treated before human use. Extensive community training and awareness campaigns are required.

Borehole Operation and Maintenance

O&M tasks for boreholes include, monthly:

- Routine Inspection: Regularly inspect the borehole casing for signs of corrosion or damage, and address any issues promptly.
- Water Quality Testing: Conduct periodic water quality tests to ensure the water meets health standards, focusing on contaminants that may affect the aquifer.

- Preventive Sealing: Ensure proper sealing at the surface to prevent surface water infiltration and contamination.
- Water level measurements to establish if there is a decline
- Abstraction volumes to establish if there is a decline
- Keep away livestock from the well by fencing it off and ensuring the fence is always intact
- Repair any holes developing around the well
- Ensure that there is no stagnant water near the well by filling the depressions/holes
- Always keep the surroundings tidy

Pumps Operation and Maintenance

The submersible borehole pump is made up of several centrifugal pump chambers, each with its own impeller, stacked on top of each other. These are called stages and the more stages a pump has, the greater the height it can pump to. The size of the stages and the impellers governs the volume of water that can be pumped.

With an automatic electrical submersible pump, the operator must check the settings and correct operation of the pump control and pump protection systems.

This would typically include the operation timer, no-flow switch, and pressure cut off switch, and can include electrical components like variable speed drives, soft starters, phase failure protection relays, overload and underload protection relays.

On each visit:

- Check condition all electrical connections and wires
- Check that all three phases of power supply have power
- Visual check for dangerous electrical connections or wires
- Check nuts, bolts and screws (tighten if necessary)
- Check water level in borehole
- Record in logbook (hours run, flow meter, water pressure, water level)
- Start pump
- Check pipework for leaks
- Check that the water meter is turning, if not stop pump, investigate and repair the problem.
- Measure and record flow rate

Weekly

- Clean inside and outside of pump station

Every 4 months (or every 1000 hours of service)

- Check that the pressure cut out is operating
- Check that the no flow switch is working
- Inspect electrical connections, instrumentation, and pump protection relays and wiring
- Check the pump by measuring pressure, groundwater level and flow, and compare with the pump curve

Regular recording of the following parameters allows the operator to identify when the pump performance is deteriorating and is an early warning of potential pump problems.

- Motor hour meter
- Power drawn for an electric motor
- Flow meter – volume of water pumped
- Flow rate measurement
- Water pressure
- Groundwater levels

If the pump stops working the records of these parameters are especially useful for identifying the trends and specifying the problem with the pump. The following procedure can be followed for site investigation of a non-functioning

Water Tank Operation and Maintenance

Cracks of any size in masonry mortar must be carefully investigated by an engineer. Structural cracks often require professional investigations to determine the cause and appropriate method of repair. For that, it is not allowed to make changes or in any case compromise the integrity of the structures for any reason. . It is necessary to periodically check any anomalies, such as the presence of lesions, swelling, hollows, cracks, disintegration, In case of ascertained anomaly, a qualified technician must be consulted as soon as possible for extraordinary maintenance.

Conditions that may necessitate ordinary maintenance tasks or repair actions include efflorescence and other stains, spalling, deteriorating mortar joints, interior moisture damage and mold growth. Once one or more of these conditions becomes evident, the origin of the problem should be determined and action taken to correct both the cause and the visible effect of the condition.

After investigating all possible contributors, the actual cause(s) of distress conditions may be determined through the process of elimination. Often the source will be self-evident, as with deteriorated and missing materials; however, in instances such as improper flashing or differential movement, the source may be hidden and determined only through building diagnostics. In any case, it is suggested to first visually inspect for a self-evident source before performing a more extensive investigation.

Table 46: Possible causes of masonry destress

Possible Causes of Masonry Distress

Observed Condition	Potential Cause of Condition								
	Incompletely filled mortar joints	Missing or clogged weeps	Plant growth	Deteriorated or torn sealant	Capillary rise	Missing or damaged flashing	Differential movement	Previous acid cleaning	Previous sandblasting
Cracked units	✓		✓				✓		
Spalled units	✓	✓		✓	✓	✓	✓		
Deteriorated mortar	✓	✓	✓		✓	✓	✓	✓	✓
Biological growth	✓	✓	✓	✓	✓	✓			
Efflorescence	✓	✓		✓	✓	✓		✓	
Moisture-related stains	✓	✓		✓	✓	✓			
Corrosion of concealed materials	✓	✓		✓	✓	✓		✓	
Damaged interior finishes	✓	✓		✓	✓	✓	✓		

The engineer, after inspection, can evaluate if the following ordinary specific maintenance can be performed:

- Removing Efflorescence (white deposits on the brick surface left when moisture carrying dissolved salts evaporates). Use solutions specifically manufactured to remove efflorescence from brickwork. Improper cleaning procedures such as insufficient prewetting, insufficient rinsing and strong chemical concentrations may cause additional staining, etched mortar joints and increase moisture penetration in brickwork. Stains caused by improper cleaning are not water soluble but can be removed by proprietary cleaners. To avoid improper applications of proprietary cleaners, it is imperative that the manufacturer's instructions be carefully followed.
- Sealant Replacement: Missing or deteriorated sealants in and between brickwork and other materials such as windows, doorframes and expansion joints may be a source of moisture penetration. The sealant joints in these areas should be closely observed to identify areas where the sealant is missing or was installed but has deteriorated, torn or lost elasticity. Deteriorated sealants should be carefully removed and the opening cleaned of all existing sealant material. The clean joint should then be properly primed and filled with an appropriately sized backer rod (bond breaker tape if the joint is too small to accommodate a backer rod) and a full bead of high-quality, elastomeric sealant compatible with adjacent materials. Sealant manufacturers should be consulted for the applicability and suitability of their sealants for expansion joint applications.
- Plant Removal Certain types of plant growth may contribute to moisture penetration. To effectively remove ivy and similar plants, the vines should be carefully cut away from the wall. Avoid pulling the vines away from the wall, as this could damage the brickwork. After cutting the ivy, the shoots will remain. These shoots are embedded in the wall and should be left undisturbed until they dry, shrivel and turn dark. This usually takes

two to three weeks. Care should be taken not to allow the suckers to rot and oxidize, as doing so can make them difficult to remove without damaging the wall surface. Once these shoots become dry, they can be removed with a stiff fiber brush and laundry detergent. Chemicals or acids should not be used to remove them, as this increases the risk of damaging or staining the wall.

Where the masonry blocks are loose, they should be carefully removed from the surface of the masonry, set to one side and the condition of the exposed material should be assessed. Where a number of blocks in one area are loose, it is possible that their condition reflects a problem in the area behind them and the condition of this whole area should be assessed before the surface masonry is put back in place. Where it is found that the material behind the masonry is in good condition, the masonry blocks should be stitched back into place. The blocks should be set flush with the surrounding blocks, not proud or inset in order to reduce the pressures acting on them.

Watchman House Operation & Maintenance:

Masonry walls and structures

Generally cracks in masonry walls get localized at weak sections such as door and window openings, stair case wall etc. In external walls of a building generally shrinkage cracks run down wards from window sill to plinth level. On the upper story they run from window sill to the lintel level of a lower story.

Shrinkage cracks in masonry could be minimized by adopting following measures:

a) Avoiding the use of rich cement mortar of 1:3 in the masonry. Preferably weak mix of 1:6 should be used,

b) Plaster work should not be carried out till masonry has properly dried out after curing and has under gone most of its initial shrinkage.

Masonry work should be done with weak composite cement lime and sand mortars of 1:1:6, 1:2:9 or 1:3:12 proportion. These mixes being weak will have lesser tendency to crack due to shrinkage in individual masonry unit. The shrinkage to a great extent will get accommodated in the mortar itself.

Where the masonry blocks are loose, they should be carefully removed from the surface of the masonry, set to one side and the condition of the exposed material should be assessed. Where a number of blocks in one area are loose, it is possible that their condition reflects a problem in the area behind them and the condition of this whole area should be assessed before the surface masonry is put back in place. Where it is found that the material behind the masonry is in good condition, the masonry blocks should be stitched back into place. The blocks should be set flush with the surrounding blocks, not proud or inset in order to reduce the pressures acting on them.

Although this is not an entirely sympathetic option as far as appearance is concerned, it has the advantage of being relatively quick and inexpensive whilst at the same time achieving a good and thorough infill and bond within the gap. Coloured cements can be used for colour matching to the adjacent masonry, if desired.

Electric system (Photovoltaic modules) Operation & Maintenance

One of the most valuable techniques for identifying existing problems and preventing future problems is to walk the site and conduct a thorough visual and hands-on inspection of the PV system components. These inspections should be conducted at regular intervals, and personnel should use checklists developed for these periodic maintenance activities to ensure that the inspections are thorough and complete.

At least once a year, O&M personnel should conduct a general and detailed inspection and a of the PV installation site.

PV system General site annual inspection:

During this inspection, technicians should:

- ensure roof penetrations are watertight, if applicable;
- ensure roof drainage is adequate, roof drains are not clogged, and confirm that there are no signs of water pooling in the vicinity of the array;
- check for vegetation growth or other new shade items such as a satellite dish;
- check for ground erosion near the footings of a ground mount system;
- confirm proper system signage is in place;
- confirm appropriate expansion joints are used where needed in long conduit runs;
- confirm electrical enclosures are only accessible to authorized personnel, are secured with padlocks or combination locks, and have restricted access signage;
- check for corrosion on the outside of enclosures and the racking system;
- check for cleanliness throughout the site—there should be no debris in the inverter pad area or elsewhere;
- check for loose hanging wires in the array;
- check for signs of animal infestation under the array.

PV system Detailed Visual Inspection

The installation should be inspected regularly for issues that impact the physical integrity or performance of the PV system. A visual inspection should include the following actions:

- Inspect the inverter/electrical pad to make sure it does not show excessive cracking or signs of wear. The inverter should be bolted to the pad at all mounting points per the manufacturer installation requirements. Depending on the size, location, and accessibility of the system to unqualified personnel, the inverters, combiner boxes, and disconnect switches should require tools or have locks to prevent unauthorized access to the equipment.
- Look for warning placards including arc flash or PPE requirements for accessing equipment. Be sure to comply with all warning placards. If no placards are present, or if some placards are missing, make a note of it and install the missing placards during the maintenance visit.
- Inspect PV modules for defects that can appear in the form of burn marks, discoloration, delamination, or broken glass.
- Check modules for excessive soiling from dirt buildup or animal droppings.
- Ensure that the module wiring is secure and not resting on the roof, hanging loose and exposed to potential damage, bent to an unapproved radius, or stretched across sharp or abrasive surfaces.
- Inspect racking system for defects including rust, corrosion, sagging, and missing or broken clips or bolts.
- If sprinklers are used to spray the array, check that the water is free of minerals (demineralized) as these minerals can cause gradual performance degradation.
- Inspect conduits for proper support, bushings, and expansion joints, where needed.

- In roof-mounted systems, check the integrity of the penetrations.
- In ground-mounted systems, look for signs of corrosion near the supports.
- Open combiner boxes and check for torque marks on the connections. Torque marks are made when lugs have been tightened to the proper torque value. Ideally they are applied during initial installation, but if not, the technician can mark the lug after torquing during a maintenance visit. A proper torque mark is made with a specialized torque marking pen. The mark is a straight line through the lug and the housing. Over time, if the line separates between the lug and the housing, it shows that the lug has moved and needs to be re-torqued. Look for debris inside the boxes and any evidence of damaging water intrusion. Look for discoloration on the terminals, boards, and fuse holders.
- Open the door to the disconnect(s) and look for signs of corrosion or damage. Check to make sure the cabinet penetrations are properly sealed and there is no evidence of water ingress. Check for torque marks on the terminals.
- Perform a visual inspection of the interior and exterior of the inverter. Look for signs of water, rodent, or dust intrusion into the inverter. Check for torque marks on the field terminations.
- If a weather station is present, ensure that the sensors are in the correct location and at the correct tilt and azimuth. A global horizontal irradiance sensor should be flat, and a plane of array irradiance sensor should be installed to the same pitch and orientation as the array. Irradiance sensors should be cleaned to remove dirt and bird droppings.

Only qualified personnel must work on PV installations. Safety is a serious concern when servicing PV installations. Safety considerations require that qualified personnel use properly rated equipment and be trained for servicing the higher voltage systems. Qualified personnel should always work in teams of two people when working on live equipment. In addition, on a given jobsite, there should always be at least two qualified persons trained.

Not all installations have appropriate signage, and qualified persons must be trained to recognize potential hazards with or without signage present.

Kiosk and Shoats/Camel Water Trough Operation & Maintenance

Due to the large number of cracks or damages observed in these components of the structure, the repair and rehabilitation of such members assumes greater importance.

The exposed surface of concrete and reinforcement are coated with a primer compatible with the repair system. The primer can be applied by rolling it on the surface with a paint roller and allowed to harden. The primer coat on the reinforcement provides it an additional protection against corrosion. After the primed surface has hardened adequately, it becomes impervious to moisture and could remain protected from environmental effects.

Costs of Operating and Maintaining the Water Project

The cost for operating and maintaining the proposed borehole and the appurtenant structures, sums up to an estimated US$ 41,743 / year. This value is primarily determined by the diesel supply needed for the generator's operation during the hours when sunlight is insufficient to power the photovoltaic panels. The details of the activities and cost included in the regular and extraordinary maintenance are presented below.

Table 47: Investments required for Operating and Maintaining the water project

Element Type	Ordinary/extraordinary Operation&Maintenance	Description	Frequency (n°/year)	U.M.	Unit cost (US $)	QTY (U.M.)	Yearly Single Items Cost (US$)	Yearly Cost Per Group (US$)	Yearly Total Cost (US$)
Well & Pump	*Ordinary O&M*	Diesel supply for the operation of the generator, for 12 out of the 20-hour daily operation during the dry season (150 days)	1	L.S.	30000		$30,000		
		Conduct periodic water quality tests to ensure the water meets health standards, focusing on contaminants that may affect the aquifer	4	L.S.	250		$1,000		
		Ensure proper sealing at the surface to prevent surface water infiltration and contamination	2	L.S.	250		$500		
		Water level measurements to establish if there is a decline and Abstraction volumes to establish if there is a decline	2	L.S.	500		$1,000		
		Ensuring the fence is always intact, Repair any holes developing around the well	4	L.S.	100		$400		
		Ensure that there is no stagnant water near the well by filling the depressions/holes	4	L.S.	100		$400		
		Always keep the surroundings tidy	4	L.S.	50		$200		
		Remove the unsound concrete into protective concrete slab, apply a	0.2	L.S.	350	-	$70		

		protective coating to the reinforcement steel, cleaning and applying repair mortar							
	Extraordinary O&M	Overhaul pump, valves and other electromechanically components, if any	0.5	L.S.	1000	-	$500	**$34,070.00**	**$35,184.00**
Water Tank	*Ordinary O&M*	If there's water in the aquifer but nothing inside the well, excavation and repair of filter drain	0.2	L.S.	3500	-	$700		
		Control settlements, cracks, exposure of reinforcement steel bars and any other alteration visible in the structure	1	L.S.	100	-	$100		
	Extraordinary O&M	Cleaning and removal of trees, bushes and grasses from nearest area to the structure	1	L.S.	250	-	$250		
		Removed loosen masonry blocks and replace them with a new ones.	0.2	m^3	70	1	$14		
		Replace any deteriorated sealants	0.2	L.S.	250	-	$50	**$1,114.00**	**$1,114.00**
WatchMan House	*Ordinary O&M*	If there's water in sand dam but nothing inside the well, excavation and repair of filter drain	0.2	L.S.	3500	-	$700		
		Control settlements, cracks, exposure of reinforcement steel bars and any other alteration visible in the structure	1	L.S.	100	-	$100		
		Visual inspection of PV system discovering issues that impact the physical integrity or performance	1	L.S.	100	-	$100		

		Clean PV panels according with manufactures' indications and washing products	1	L.S.	250	-	$250		
	Extraordinary O&M	PV system inspection and check by qualified personnel	0.5	L.S.	400	-	$200		
		Removed loosen masonry blocks and replace them with a new ones.	0.2	m^3	70	1	$14		
		Replace any deteriorated sealants	0.2	L.S.	250	-	$50	**$1,414.00**	**$36,598.00**
Kiosk and Shoats/Camel Water Trough	*Ordinary O&M*	Remove the unsound concrete, apply a protective coating to the reinforcement steel, cleaning and applying repair mortar	0.2	L.S.	350	-	$70		
		Control settlements, cracks, exposure of reinforcement steel bars and any other alteration visible in the structure	1	L.S.	100	-	$100		
	Extraordinary O&M	Check and repair taps or other minor hydraulic device that can be damaged by users	1	n°	25	6	$150		
		Appling to the exposed surface of concrete and reinforcement steel bar a compatible primer	0.5	L.S.	250	-	$125	**$445.00**	**$37,043.00**
Photovoltaic System	*Ordinary O&M*	Control settlements, cracks, exposure of reinforcement steel bars and any other alteration visible in the concrete foundation. Control integrity of aluminum support of each panel.	1	L.S.	1000	-	$1,000		

		Visual inspection of PV system discovering issues that impact the physical integrity or performance	1	L.S.	200	-	$200		
		Clean PV panels according with manufactures' indications and washing products	1	L.S.	2500	-	$2,500		
	Extraordinary O&M	PV system inspection and check by qualified personnel and substitute one or more panels if necessary or other electric component of the system	1	L.S.	1000	-	$1,000	**$4,700.00**	**$41,743.00**
								Total	**$41,743.00**

Brine Management Considerations for Reverse Osmosis Systems

In the event that post-drilling assessments indicate the necessity of installing a Reverse Osmosis (RO) system, it would be important to develop a proper plan for managing the significant amount of wastewater generated by the treatment process. Given the project's location in a remote desert area, far from any marine discharge options, conventional disposal methods are not viable, and any solution would require substantial investments that would significantly impact the overall project budget.

One possible approach is the use of evaporation ponds, leveraging the region's high temperatures and solar radiation to naturally evaporate water, leaving behind concentrated salts. However, this method presents several challenges:

- Land Requirements: Large surface areas would be needed to accommodate continuous brine discharge.
- Construction and Maintenance: The need for impermeable liners to prevent groundwater contamination would add significant costs.
- Salt Management: Over time, accumulated salts would require removal and disposal, adding further logistical burdens.

An alternative option, Zero Liquid Discharge (ZLD), would completely eliminate liquid waste by further concentrating the brine until only solid salts remain. However, ZLD systems are highly energy-intensive and involve complex treatment stages, making them technically challenging and financially unrealistic for a project of this scale.

Another potential disposal method is deep well injection, which involves pumping brine into deep underground formations that can safely contain the wastewater. While this solution may seem viable in theory, the primary challenge is not just cost but rather the lack of geological data confirming the presence of a suitable deep aquifer or rock formation capable of safely hosting the brine. Without reliable hydrogeological studies, there is no certainty that a suitable injection site exists, and identifying one would require extensive subsurface exploration, which is currently beyond the scope of this project.

Overall, implementing a proper brine disposal strategy could increase project up to 50%, making it a major budgetary concern. Other disposal methods, such as repurposing brine for industrial use, are also impractical due to the lack of demand in the region. Given these constraints, if an RO system becomes necessary, external funding or partnerships with organizations specializing in sustainable desalination solutions should be explored to address the problem.

Cost-Benefit Analysis

The total investment required for the implementation of the proposed project is summarized in the following table:

Table 48: Summary of capital expenditures required for the entire project.

No	Item	Number	Unit Cost [US$]		Total Cost [US$]	
1	General Items	1.00	$	7,970.00	$	7,970.00
2	Borehole drilling	1.00	$	204,720.00	$	204,720.00
				TOTAL COST OF PROJECT	**$**	**212,690.00**

No	Item	Number	Unit Cost [US$]		Total Cost [US$]	
1	General Items	1.00	$	7,970.00	$	7,970.00
2	Water pumping, RO & UV treatment	1.00	$	46,200.00	$	46,200.00
3	Water Tank	1.00	$	21,756.83	$	21,756.83
4	Construction of one Kiosk with 6 tabs	1.00	$	503.87	$	503.87
5	Construction animal water troughs for Camels/Catles	3.00	$	5,829.70	$	17,489.10
6	Construction animal water troughs for Goats and Sheep	3.00	$	3,788.50	$	11,365.50
7	WatchMan House	1.00	$	11,817.96	$	11,817.96
8	Diesel & Domestic PV Generators	1.00	$	19,500.00	$	19,500.00
9	Photovoltaic Field	1.00	$	90,000.00	$	90,000.00
10	Public Toilet	2.00	$	3,984.24	$	7,968.48
				TOTAL COST OF PROJECT	**$**	**234,571.75**

No	Item	Number	Unit Cost [US$]		Total Cost [US$]	
1	General Items	1.00	$	5,670.00	$	5,670.00
2	Construction of Aqueduct/Pipeline	1.00	$	64,708.00	$	64,708.00
3	Construction of one Kiosk with 6 tabs	2.00	$	503.87	$	1,007.74
				TOTAL COST OF PROJECT	**$**	**71,385.74**

Based on the capital costs required for building the proposed water project and the comparison between water demand and water availability, a cost-benefit analysis for the proposed solution is summarized in the following table.

Table 49: Summary of the key numbers of the Cost/Benefit analysis

C/B ANALYSIS				
N	**Name of Site**	Qoolbulale		
1	Type of Intervention	Borehole		
2	Total Extractable Amount of Water daily	m^3		216
3	Total Water Needs daily	m^3		310
4	**Capital Investments**	**US$**	**$**	**518,647.49**
5	*Rehabilitation of the Well*	*US$*	*$*	*212,690.00*
6	*Construction of Appurtenant Structures*	*US$*	*$*	*234,571.75*
7	*Construction of Pipeline*	*US$*	*$*	*71,385.74*
8	Capital Cost per m^3 of water Produced considering a 20-years lifespan	US$	$	0.86
9	Percentage of water needs covered	%		70%
10	Number of people the dam can serve annually	n		3,743
11	Capital cost per person	US$	$	138.58
12	Fixed Annual Cost (CAPEX)	*US$*	*$*	*17.32*
13	Variable Annual Cost (OPEX)	*US$*	*$*	*11.15*
14	**Total annual costs**	**US$**	**$**	**28.48**
15	**Unit Cost per m3 of water**	**US$/m3**	**$**	**2.53**
16	Average Cost per m3 of water sold by water trucks	US$/m3	$	13.50

Based on the above, the proposed borehole, with an extractable volume of 216m^3/day and a capital cost of **US$518,647.49**, will provide support to 70% of the total basic local needs (human + livestock) considering a constant yield. The raw water cost for this borehole is therefore estimated to be ((US$518,647.49 + 41,743 * 20)/ (216 m^3/day * 365 * 20) = US$0.86 per cubic meter considering a 20-years lifespan of the borehole and the maintenance needed. The capital cost of the borehole and appurtenant structures is estimated at (US$518,647.49/ 3,743) = US$138.58 per person. The proposed water project is assumed to have a lifespan of 20 years with fixed annual costs of US$17.32 per person per year, and a recurrent cost of US$11.15 per person per year. The total recurrent and fixed annual costs of the borehole are therefore estimated to be US$28.48 per person[8].

If people reduce their water usage in the dry season to 25 litres per day and increase that amount to 35 litres in the rainy season, we can estimate the annual water demand of one person to be 11,275 litres/year or 11.3 m^3/year[9].

The unit cost for the proposed water project would therefore be **US$2.53 per cubic meter of water**[10]. According to the Somalia WASH Cluster, in the area, communities pay up to $13.50 per cubic meter for water used for washing, cooking,

[8] Annual depreciation rate of the infrastructure is linear at (((518,647.49/ 20 years)/ 518,647.49) *100) = 5.0% per year. The interest rate is assumed to be fixed at 7.5% per year. Hence the fixed costs for the water project will be (7.5% + 5.0%) = 12.5% of $138.58, which is $17.32 per person per year. The recurrent annual cost for operating and maintaining the borehole and appurtenant structures are approximately US$ 41,743 per year. The annual cost, divided by the number of people served by the proposed structure, gives a recurring cost of $11.15 per person per year. Hence a total annual cost of (US$17.32 + $11.15) is US$28.48 per person.

[9] ((25 litres*150 dry season days) + (35 litres*215 days)) = 11,275 litres per person per year.

[10] The unit cost of water is estimated by dividing the annual capital costs by the annual water demand ($28.48 / 11.3m^3) = US$ 2.53 per cubic meter.

and livestock during the dry season. Based on this information, the construction of the proposed project would bring significant benefit to the village.

Conclusions and Recommendations

Qoolbulale site (Latitude: 8.9029° - Longitude: 44.4424°), located about 85 kilometers southeast of the capital city of Hargeisa, is one of the sites the government of Somaliland has considered to be developed under the GW4R Project.

The surrounding communities are home to approximately 700 households that rely primarily on livestock and approximately 250 nomadic families that rely on water availability at the site during the dry season. Livestock, including camels, goats, cattle and donkeys play a significant role in the local economy, with varying numbers in each category.

The site for the new borehole was selected due to its proximity to the communities and the fact that the nearest borehole is approximately 30 kilometers away, as the area urgently needs a reliable water source to support residents during the dry season when traditional water storage structures run dry.

In addition to the construction of the borehole, we suggest adding several appurtenant structures which includes pumping system (powered by a photovoltaic field) connected to a new water tank located in the proximity of the watchman house. One kiosk and animals throughs will also be added to the intervention. More than that a pipeline will be added to provide water directly to the community.

The implementation of the borehole and all the appurtenant structures with the pipeline installation is estimated to be US$518,647.49 to which an additional US$ 41,743 should be added in support of operation and maintenance activities.

The cost-benefit analysis presented in this report has shown that the village and the nearby communities of nomadic pastoralists would benefit for the construction of the water structure and all the appurtenant structures. In such scenario the unitary cost per cubic meter of water will be **US$2.53** which is lower than the average price villagers pay during drought years (when the cost of one cubic meter of water used for the animals can be as high as US$13.5/$m^3$).

Annex 1 – Hydrogeological Investigations

Geological Frame

The survey area is located near the border, approximately 46 km ESE of Bali Gubadle village. The regional geology consists of two primary geological units covered by a thin layer of alluvial-aeolian deposits from the Quaternary period:

- **Yesomma Sandstones (Cretaceous)**: The Yesomma formation (Ky) is a continental unit composed of variegated quartz-rich sandstones and siltstones, primarily of fluvial-lacustrine origin. This unit extends over most of the Haud Plateau, typically reaching thicknesses of over 400 meters. In key tectonic trenches, such as the Nugal Valley and Xood Trench, this unit lies unconformably on Jurassic limestones. However, no data currently confirm the presence of Jurassic limestones in the border area near the study region. It is assumed that in the study area, the Yesomma Sandstones lie directly and, once again, unconformably on the basement rock.
- **PRB (Precambrian Undifferentiated Basement)**: This is a complex of crystalline rocks, ranging from intrusive to metamorphic, that formed part of the ancient African Shield. It outcrops along the border between the Awdal and Marodijeex regions and at the northern edge of the Haud Plateau. The PRB has been encountered in most of the drill sites in the Marodijeex region, where its depth varies from less than 100 meters at Tog Wajale to over 350 meters in the Salaxley-Balli Gubadle area. In the study area, it is estimated to lie at depths exceeding 500 meters, although no drilling data exists for the area from Bali Gubadle towards the southeast. At Balidhiig, the PRB was not found, indicating it lies at a depth greater than 460 meters.

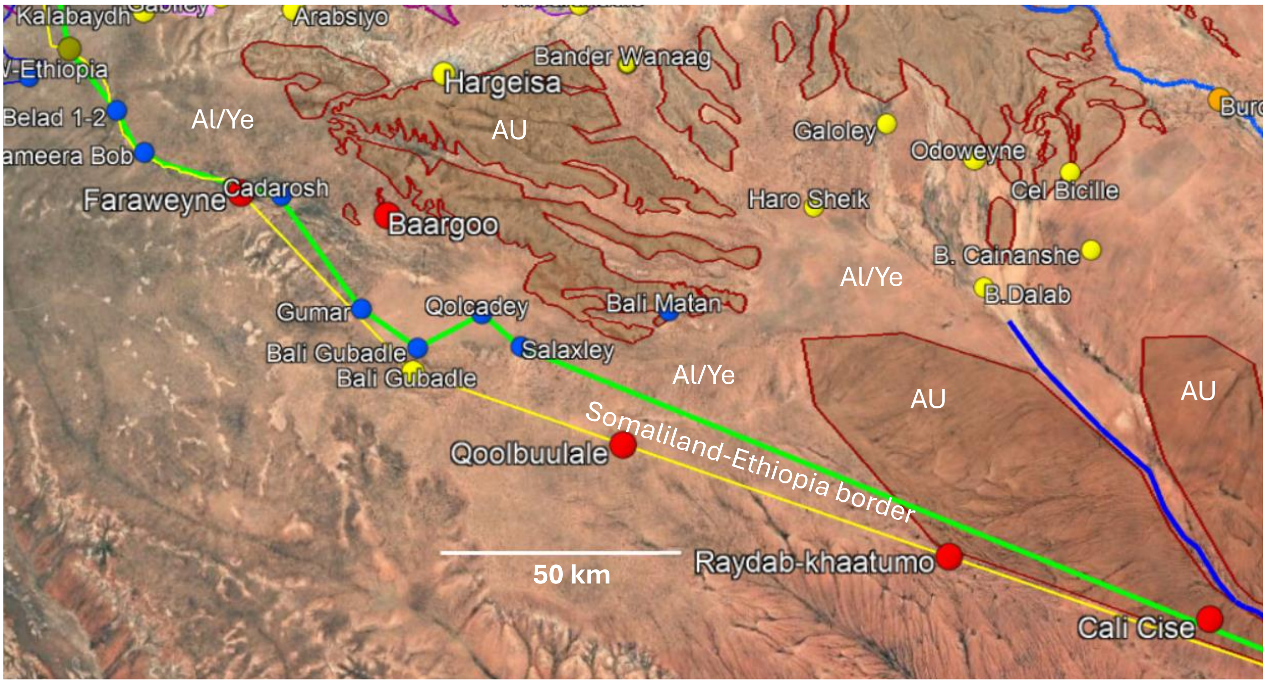


Figure 54: Geological map of South Somaliland – Al/Ye: Yesomma Sandstone, with alluvial cover – AU: Auradu Limestones – yellow line: border – green line: cross-section (fig.2) – blue/green points: boreholes – red points: project proposed sites – map modified by Abate et Al (1994)

The Auradu limestones, though visible on the map, are absent in the Qoolbulale area. The closest, very small outcrops of these limestones are located near Salaxley.

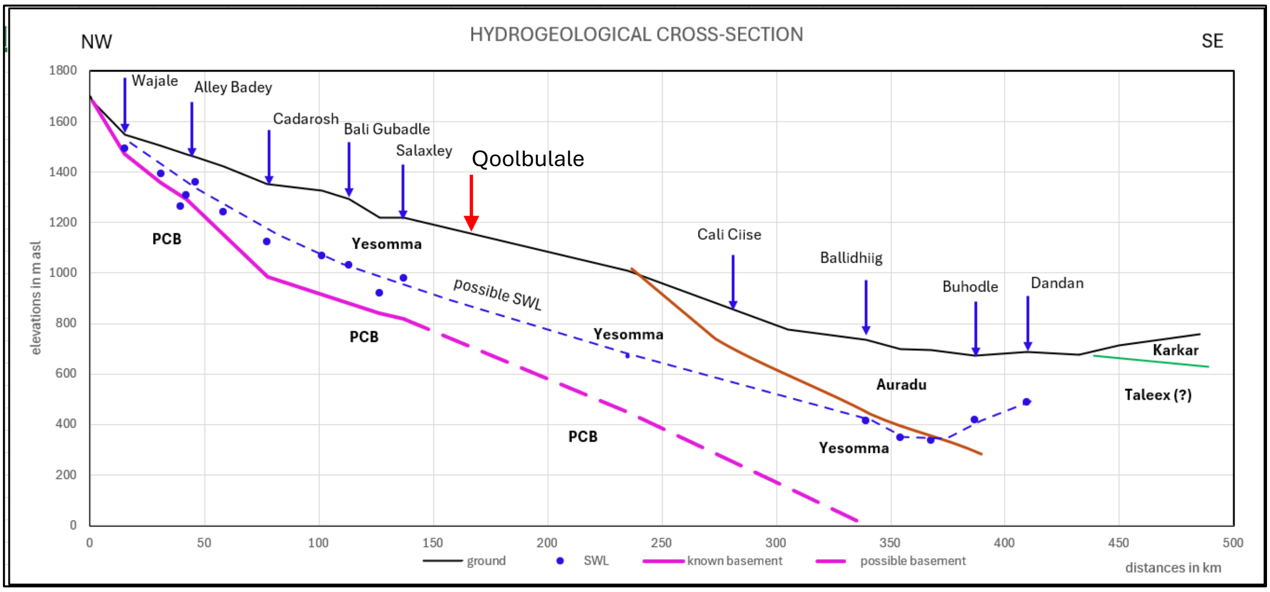


Figure 55: Hydrogeological cross-section along the Somaliland Ethiopia border

Hydrogeology

Along the border from Tog Wajale to Balidhiig, the aquifer is located within the sandy deposits of the Yesomma Formation. In the Marodijeex section, extending up to Salaxley, the static water level (SWL) lies close to the basement top, and the saturated section of the Yesomma Formation rarely exceeds 50 meters in thickness. As a result, the yields of drilled boreholes seldom exceed 10 m^3/hour. This limited yield may also be attributed to the abundance of fine deposits within the Yesomma Formation, the challenging drilling conditions, inadequate completion of some boreholes, and the restricted yield of submersible pumps that require significant power to lift water from depths of 200-300 meters.

Water quality measurements taken with an EC meter in July indicate medium-quality water (2,300-3,000 µS/cm) in the area from Geed Belad to Wadabarish and in the Bali Gubadle borehole. In contrast, water quality is poor in Gumar, Salaxley, and Shanshacade, and at Balidhiig it was not measurable, nor was it assessed during pumping tests.

According to this assessment, the aquifer in the study area is expected to lie within the Yesomma Formation, where sandy layers are predominant. The SWL is anticipated to be between 250 and 350 meters, with potential yields reaching 10-15 m^3/hour. However, the water quality in this specific area remains unknown.

The following table provides a summary of borehole data collected by the Ministry of Water Resources Development (MoWRD), listed in the SWALIM database, and reviewed during a field mission in July 2024. The mission inspected boreholes near the border, starting from Tog Wajale—where three new boreholes have recently been drilled—and continuing to Shanshacade and Balidhiig in Togdher. Unfortunately, most boreholes were temporarily closed due to heavy rains that had filled local valleys, which the population preferred as a water source. At some sites, no personnel were available to provide information on yield, daily pumping duration, or other operational data, and it was also not possible to collect water samples for EC measurement. However, the field geologist confirmed the presence of Precambrian basement (PCB) fragments near the boreholes, indicating that the basement had been reached during drilling.

Table 50: boreholes location and hydraulic parameters – PVB: Precambrian Basement

name	Latitude	Longitude	Depth	SWL	DWL	pump depth	Yield	pump time	Yield	EC	Status	Lithology
	decimal degree		m	m bgl	m bgl	m	m3/hr	hours	m3/day	µS/cm		
Tog-wajale 1	9.63330	43.36373	180	68.7		abandoned					not working	
Tog-wajale 2	9.63736	43.35383	180	67		155	12	3	36	3700	Active	
Tog-wajale 3	9.64334	43.40393	180	66.5		138	14	new		4650	new	PCB frag.
Tog-wajale 4	9.63769	43.38407	218	65	72	145	27	new		4500	new	PCB frag.
Tog-wajale 5	9.63481	43.37925	210	65	70	148	26	new		5457	new	PCB frag.
Geed Belad 1	9.48774	43.42720	144	sealed		232	3.5	0-23		2550	Active	
Geed Belad 2	9.48531	43.42803	160	sealed		146	2.5	0-23	10	2620	Active	
Walixdoor	9.42022	43.46156	216	174		210	10	0-18		2370	Active	PCB frag.
Dameera Bob	9.40679	43.48204	250	sealed		180	15	0-23			Active	PCB frag.
Cadaroosh	9.32703	43.74477	377	sealed		310	13.5	18		2800	Active	PCB frag.
Wadabarish	9.20625	43.79685	326	sealed		305	4			3020	not working	PCB frag.
Gumar	9.11774	43.90090	340	sealed	260	280	3	3	10	3600	Active	PCB frag.
Baligubadle	9.04583	44.00847	360	sealed		300	13	3	50	2790	Active	
Qolcadey	9.11047	44.12960	360	sealed		damage					not working	
Salaxley	9.05532	44.20271	400	300		362	11	5	55	4080	Active	
Salaxley new	9.06256	44.19918	400	borehole under completion. Drilling samples label (depth) not readable								
Balidhiig	8.37452	45.90854	462	320	No	370	11				not working	PCB frag.
Shanshacade	8.64969	45.95254	360	182		315	15	3	45	5010	Active	

Table 51: Location and hydraulic parameters of the boreholes along Somalia-Ethiopia border

name	Latitude	Longitude	Elevation	Depth (m)	SWL	Pump depth	Yield	pump time	Draw-Down	DWL	AqH//SCL	T	K	EC	Recovery 90%	Ye/PCB depth		Main Aquifer	Year	Agency	Region
	decimal degree		m asl	m	m bgl	m	m^3/hr	hours	m	m bgl	m	m^2/day	m/day	µS/cm	min	m					
Tog Wajale	9.60065	43.33477	1555	84	57		2.5	dried up								77	PCB	YE	2003	Africa 70	Marodijeex
Wado Godka	9.54815	43.42520	1530					abandoned for water salinity										YE	2005	Africa 70	Marodijeex
Geed Belad 1	9.48531	43.42803	1508	160	130		8.7	23						2450				YE	2005	Africa 70	Marodijeex
Geed Belad 2	9.48774	43.42720	1505	162	112		12.9	12	13.35	129	33	1.2E+02	3.6E+00		50	148	PCB	YE	2006	COSOB Co.	Marodijeex
Walixdoor	9.42010	43.46150	1480	216	150													YE	2019	SWALIM	Marodijeex
Dameera Bob 1	9.40679	43.48204	1471	200/212	>150/80	188	12/7							2870				YE	2005/14	A70/SWALIM	Marodijeex
Dameera Bob 2	9.40650	43.48180	1467	230	200				22									YE	2019	SWALIM	Marodijeex
Alley Badey	9.38700	43.51370	1459	180	100		7											YE	2014	SWALIM	Marodijeex
Wado Makail	9.35944	43.61015	1422	265	180		4											YE	2019	SWALIM	Marodijeex
Fararweyne	9.33240	43.66869	1401	270	245		4		12					2570	3			YE	2019	SWALIM	Marodijeex
Cadaroosh	9.32800	43.74579	1374	377	232.5	300	16	24	23	46.65	242	1.4E+02	2.4E+01		10	368	PCB	YE	2021	MoWRD	Marodijeex
Wadabarish	9.20602	43.79650	1384	300	225		16							3020				YE	2019	SWALIM	Marodijeex
Gumar	9.11774	43.90090	1327	340	257	300	9	72	3.45	260.5	41			1730	40			YE	2018	MoWRD	Marodijeex
Qolcadey 2	9.11047	44.12960	1223	376	300-330		4	7	2					3170	4			YE	2017	TS/SWALIM	Marodijeex
Qolcadey 1	9.08800	44.19152	1198	340	300			abandoned for low yield										YE	2019	TS/SWALIM	Marodijeex
Salaxley	9.05014	44.20447	1200	390	240		12	8						3300				YE	2022	SWALIM	Marodijeex
Bali Matan	9.11882	44.48454	1426	460	430		5	20						3160				YE	2022	SWALIM	Marodijeex
Balidhiig	8.37452	45.90854	736	462	320	370	18	24	3	323	80	4.2E+02	2.9E+00		10	306	YE	YE	2022	MoWRD	Togdheer
Shanshacade	8.64969	45.95254	784	395	183	370	12	24	122	305	146	3.1E+00	1.5E-02		70			AU	2022	MoWRD	Togdheer
Coodanle	8.33506	46.04233	700	350	320		8	5						1670					2022	SWALIM	Togdheer
Xadhadhanka	8.29970	46.15640	696	360	333		16	24	not working in 2019 for problem to pump										2019	SWALIM	Togdheer
Qori Lugud	8.56011	46.23796	741	354	176		16	12						1360					2022	SWALIM	Togdheer
Shangalli	8.28255	46.31196	656	398	239		18	12						3830					2022	SWALIM	Togdheer
Buhodle 3	8.25550	46.31960	672	350	270	12	16	24											2022	SWALIM	Togdheer
Buhodle 2	8.24664	46.32216	672	400	252	380	14.4	24	47	298.55	75.4	1.6E+01	1.04E-01	n.a.	240	397	YE	AU +YE	2021	MoWRD	Togdheer
Qararrooyin	8.22000	46.35600	660	360	270																Togdheer
Dandan	8.25140	46.52950	683	370	200	200	16	12						4280					2019	SWALIM	Togdheer

data source	MoWRD	SWALIM	COSOB Co.	Africa 70	TS
red color	dried or abandoned or temporarily not working				

AqH//SCL	aquifer thickness/filters lenght
Ye/PCB	Yesomma/Precambrian basement

VES Survey

The survey was conducted with 15 Vertical Electrical Soundings (VES) using an AB/2max of 1,000 meters from September 10th to 14th, 2024. The VES layout was generally oriented between 100° and 130° E, in a direction roughly parallel to the border, with a few deviations due to accessibility constraints. VES 1 was conducted near Salaxley to correlate the current survey with a previous survey performed in the Salaxley area in 2007 by Africa 70, whose data are available.

In 2007, two additional surveys were conducted along a cross-section from Hargeisa airport to the border near Salaxley (denoted as "ton") and in the vicinity of Bali Gubadle (denoted as "BAG"). A preliminary re-interpretation of these datasets was undertaken to assess the regional geophysical model.

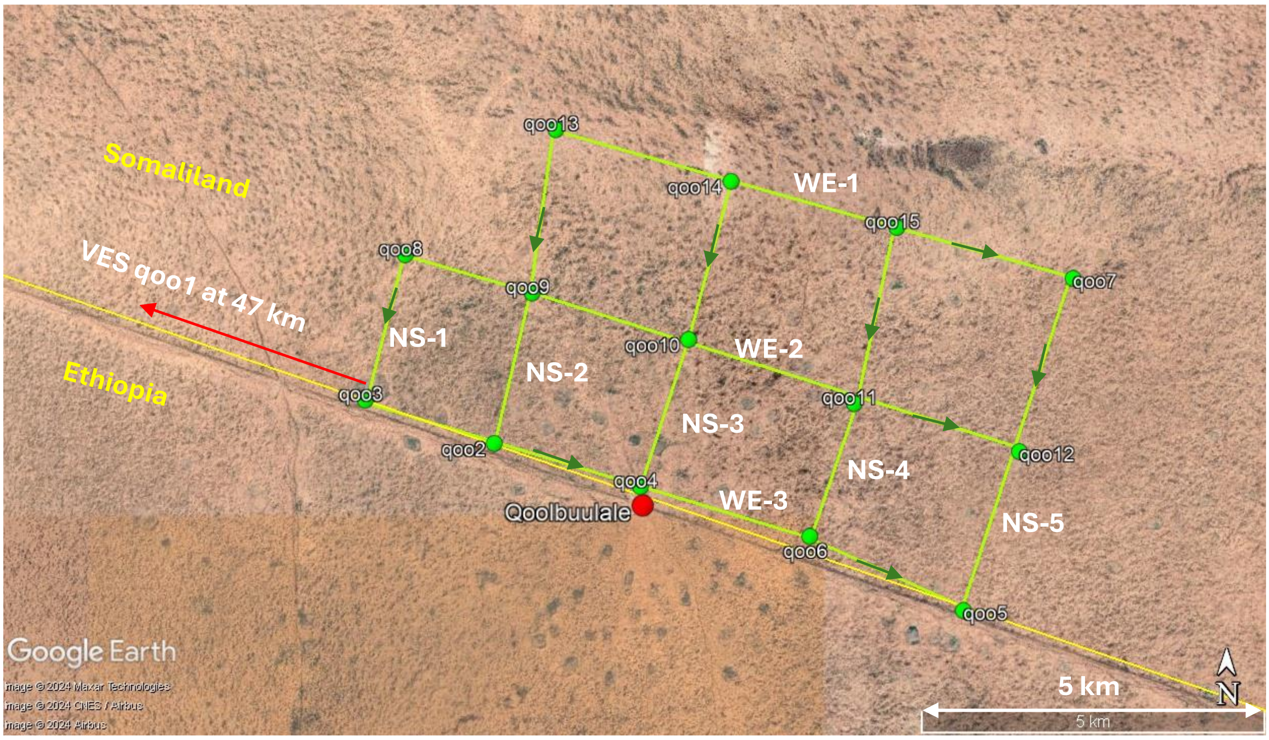


Figure 56: VES and cross-sections positions (green points and lines) – green arrows: cross-section direction – white letters: cross-section name – yellow line: Ethiopia – Somaliland border

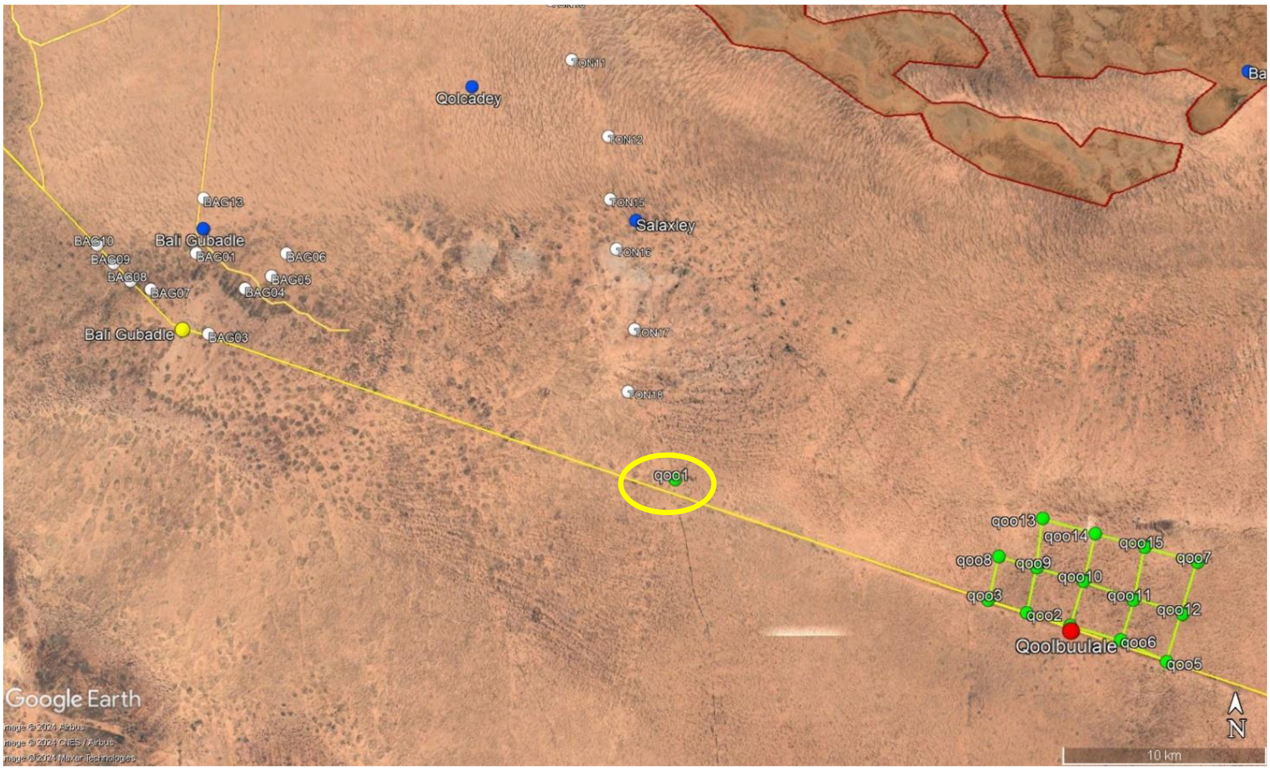


Figure 57: VES of the Qoolbulale survey (green points) and of previous surveys (white points) – yellow ellipse: VES qoo1 of the present survey - blue points: active boreholes

The following cross-section "ton_03" shows the location and depth of a new borehole drilled near Salaxley, reaching a depth of 390-400 meters. This borehole likely terminated upon encountering the Precambrian Basement, as evidenced by basement fragments scattered around the site (though no drilling log is available). It is clear from the data that the basement unit is characterized by resistivity (Rho) values around 500 Ωm. Near Salaxley, the resistivity of the overlying deposits, which belong to the Yesomma Sandstones, is below 15 Ωm, indicating a high clay content. The declared yield for this borehole is 10 m^3/h.

The cross-section "baligud_02" depicts the Bali Gubadle borehole, precisely located at VES "bag02." The VES data suggest the basement lies at a depth of 420 meters, while the borehole reached 360 meters. Although no basement fragments were found near this borehole, an estimation error of 60 meters in basement depth is considered acceptable in this type of investigation. The VES interpretation indicates that the resistivity of the deposits above the basement is 19 Ωm, and the borehole's reported yield is 13 m^3/h.

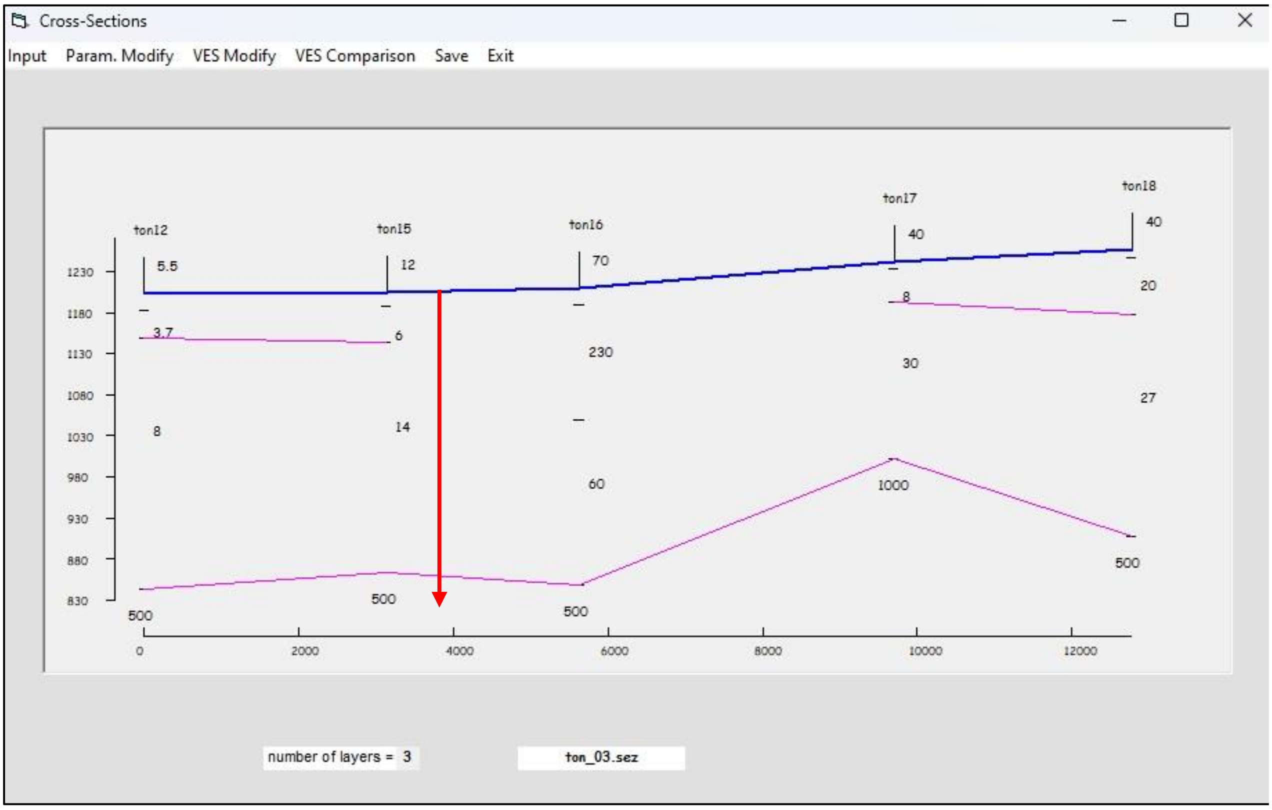


Figure 58: Cross-section ton_03 and Salaxley borehole location (red arrow)

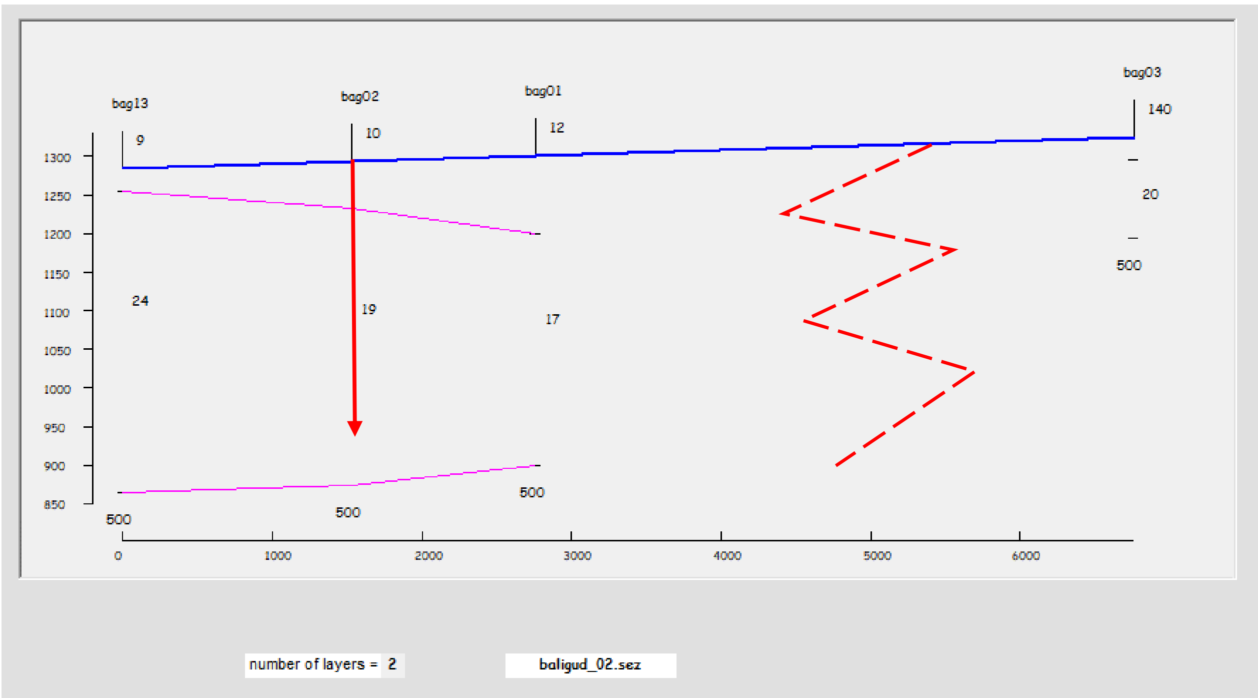


Figure 59: Cross-section baligud_02 and Bali Gubadle borehole location (red arrow) -red dashed line: possible geological unconformity

The summary of the data review for the Bali Gubadle-Salaxley area is as follows:

- **Validation of Interpretative Model**: The interpretative model used in previous surveys is largely confirmed by recent drilling results.
- **Yesomma Formation Deposits**: The Yesomma Formation deposits, which have resistivity values between 10 and 20 Ωm, generally yield low water productivity. However, this low yield could also be influenced by the challenges of drilling at depths greater than 300 meters.
- **Basement Depth**: The basement rock is consistently found at depths of 350-400 meters, as estimated by VES interpretations, though these estimations may overstate depth by approximately 15%.

This interpretative model is likely applicable to the Qoolbulale area as well, based on its presumed geological uniformity with the Salaxley area.

In the Qoolbulale area, 14 VES soundings were performed along three cross-sections aligned WNW-ESE.

The VES data exhibit two main resistivity patterns, indicating distinct subsurface structures:

6. **Type 1 VES (e.g., qoo10)**: This pattern, illustrated on the left in the following figure, reveals two minor shallow layers, followed by a resistive layer with a resistivity of 60 Ωm (indicated by a yellow arrow). Beneath this is a conductive layer with a resistivity of 25 Ωm (blue arrow), followed by a deep, highly resistive layer with a resistivity of 500 Ωm (red arrow).
7. **Type 2 VES (e.g., qoo15)**: In this pattern, after a minor shallow layer, there are two semi-resistive layers with resistivity values between 25-31 Ωm (orange and blue arrows), followed by a deep, highly resistive layer with a resistivity of 500 Ωm (red arrow).

These resistivity patterns suggest fairly homogeneous subsurface characteristics across the study area.

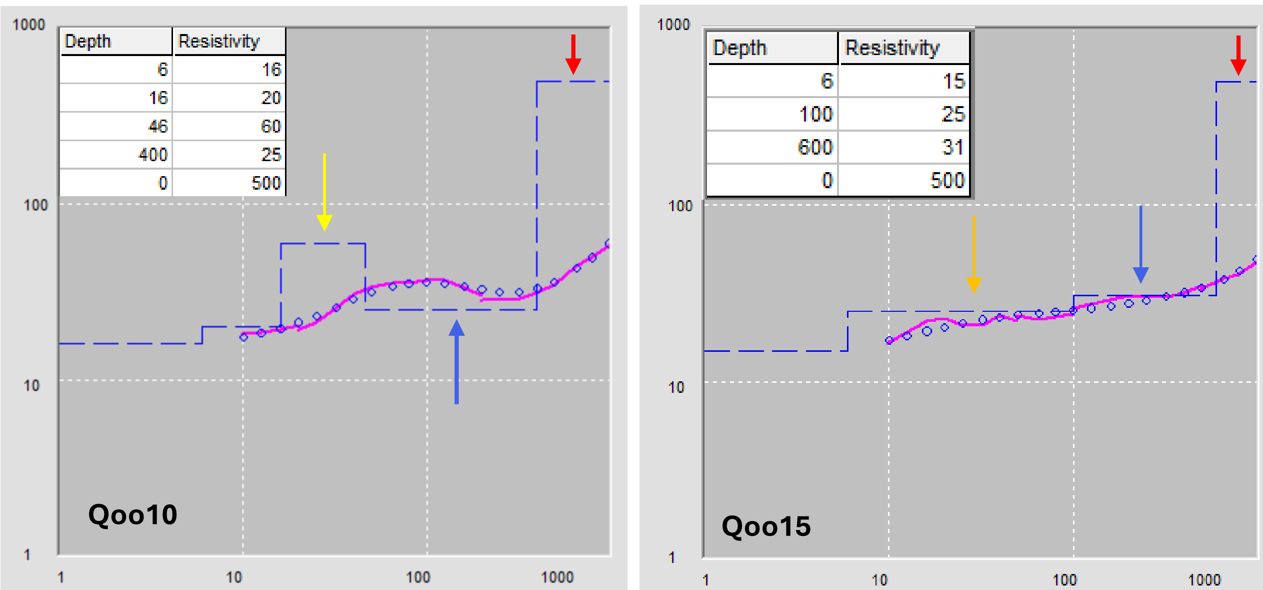
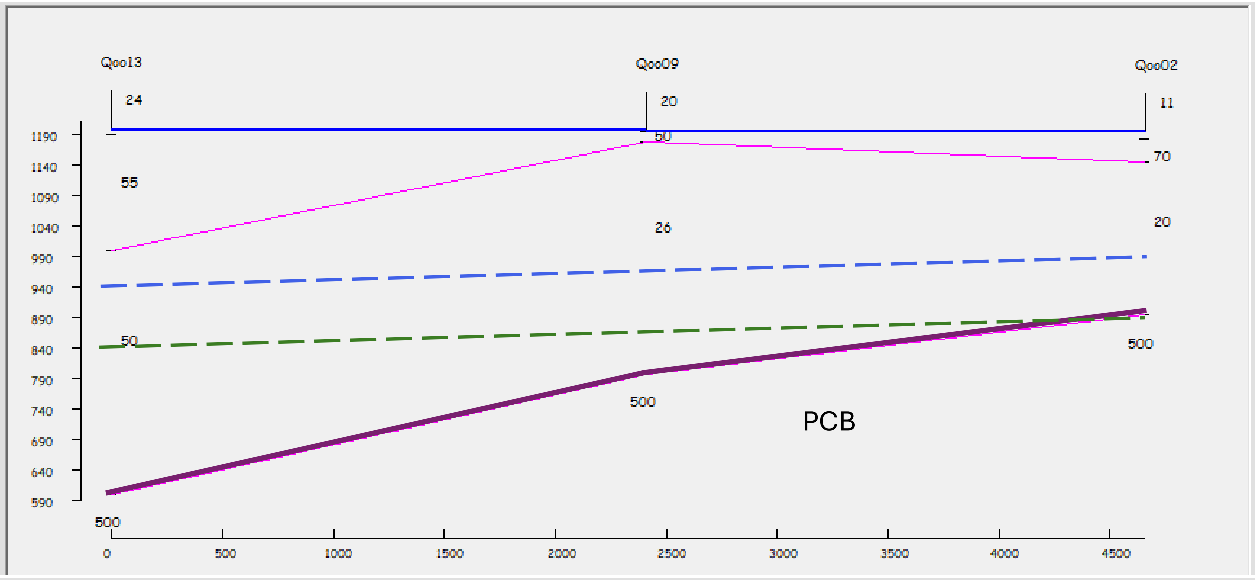


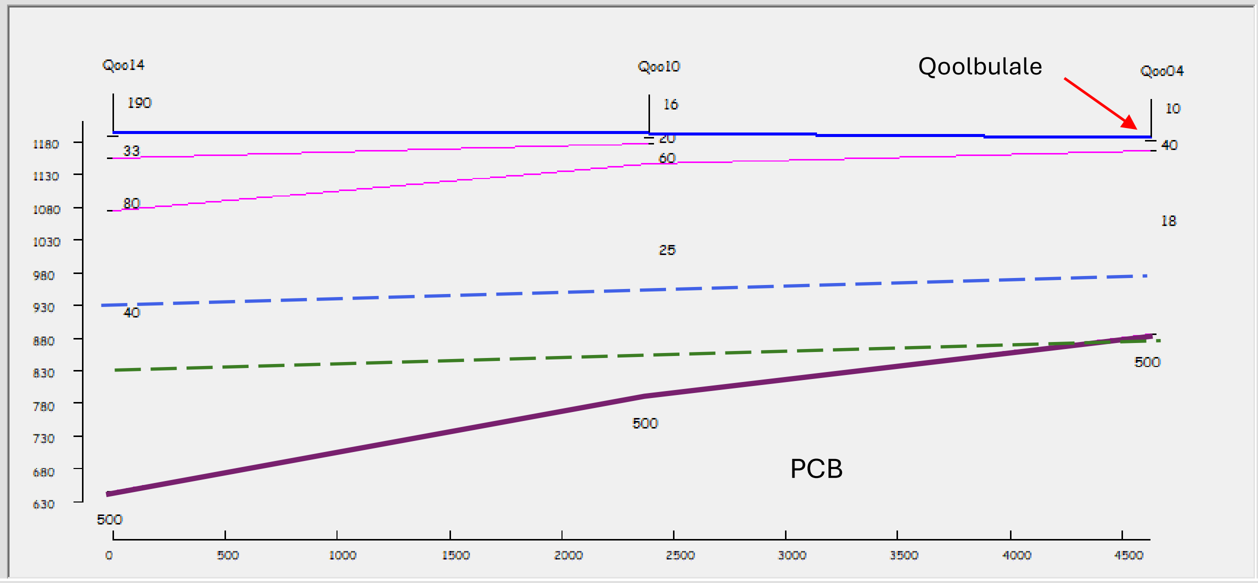
Figure 60: Comparison between different VES patterns – the dashed blue lines show the interpretative model (see the data in the rectangle in the upper left corners); the blue circles simulate field values from the model; the violet lines show the field resistivity data

The two VES models, though appearing quite different, show minimal difference in the resistivity values of the conductive layer at depth, which is where the aquifer is anticipated. The primary difference in the VES curves is the depth of the highly resistive layer: in the left VES, this layer lies at around 400 meters, whereas in the right VES, it reaches 600 meters.

Based on this interpretation, four primary resistivity units have been identified:

- Top Unit: This is a thin layer, generally less than 10-20 meters thick, with highly variable resistivity values ranging from 10 to 200 Ωm. These variations suggest a mix of loose alluvial and aeolian deposits, from sandy to clay-rich materials. In several VES profiles (e.g., VES qoo-10 in Figure 7), this unit is composed of two minor sub-layers.
- Shallow Unit: This second unit consists of two resistivity value groups, combined as one unit due to their similar position. The first group, with resistivity values of 50-100 Ωm, likely represents sandy deposits extending to depths greater than 100 meters. The second group, with resistivity values between 20 and 50 Ωm, indicates a higher clay content. Both layers are part of the Yesomma Formation and lie above the regional water table, so they are considered dry.
- Deep Semi-Resistive Unit: This third unit, with resistivity values between 20 and 50 Ωm (dropping to 18 Ωm in one case), extends to depths ranging from 300 to 600 meters, reaching down to the Precambrian basement. This unit is consistently detected across all VES profiles, confirming its continuity and depth. It is attributed to the Yesomma Formation and is thought to contain predominantly sandy deposits. This unit has the potential to host the aquifer below depths of 250-300 meters.
- Bottom Resistive Unit: The deepest unit, with a resistivity estimated at around 500 Ωm, is consistently detected at depths between 300 and 600 meters. This unit corresponds to the Precambrian basement (PCB). The basement depth decreases gradually from NNE to SSW, meaning it is shallower closer to the border. The NS-oriented cross-sections (see Figure 8) and the Precambrian basement isobath map illustrate this trend. Additionally, these cross-sections show a possible regional piezometric surface, beginning at depths of 250 to 350 meters in the highest northern section of the surveyed area (NNE) and rising by 20-30 meters toward the southern edge (SSW), where the village is located.


Qoo13
Qoo09
Qoo02
24
20
11
55
50
70
26
20
50
500
500
PCB
500
1190
1140
1090
1040
990
940
890
840
790
740
690
640
590
0
500
1000
1500
2000
2500
3000
3500
4000
4500


Qoo14
Qoo10
Qoolbulale
Qoo04
190
16
10
33
20
60
40
80
18
25
40
500
500
PCB
500
1180
1130
1080
1030
980
930
880
830
780
730
680
630
0
500
1000
1500
2000
2500
3000
3500
4000
4500

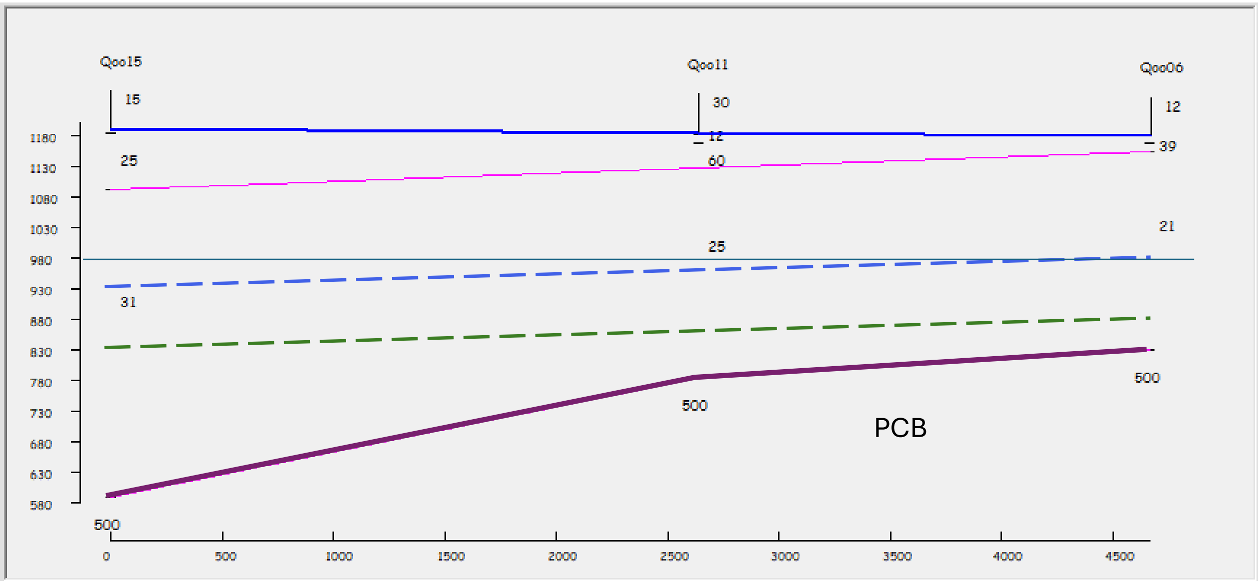

Qoo15
Qoo11
Qoo06
15
30
12
12
25
60
39
21
25
31
500
500
PCB
500
1180
1130
1080
1030
980
930
880
830
780
730
680
630
580
0
500
1000
1500
2000
2500
3000
3500
4000
4500

Figure 61: Cross-sections NS-2, 3 and 4, NS oriented – dark violet line: expected Precambrian Basement – dashed blue line: minimum expected depth of the regional SWL – green dashed line: maximum expected depth of the regional SWL

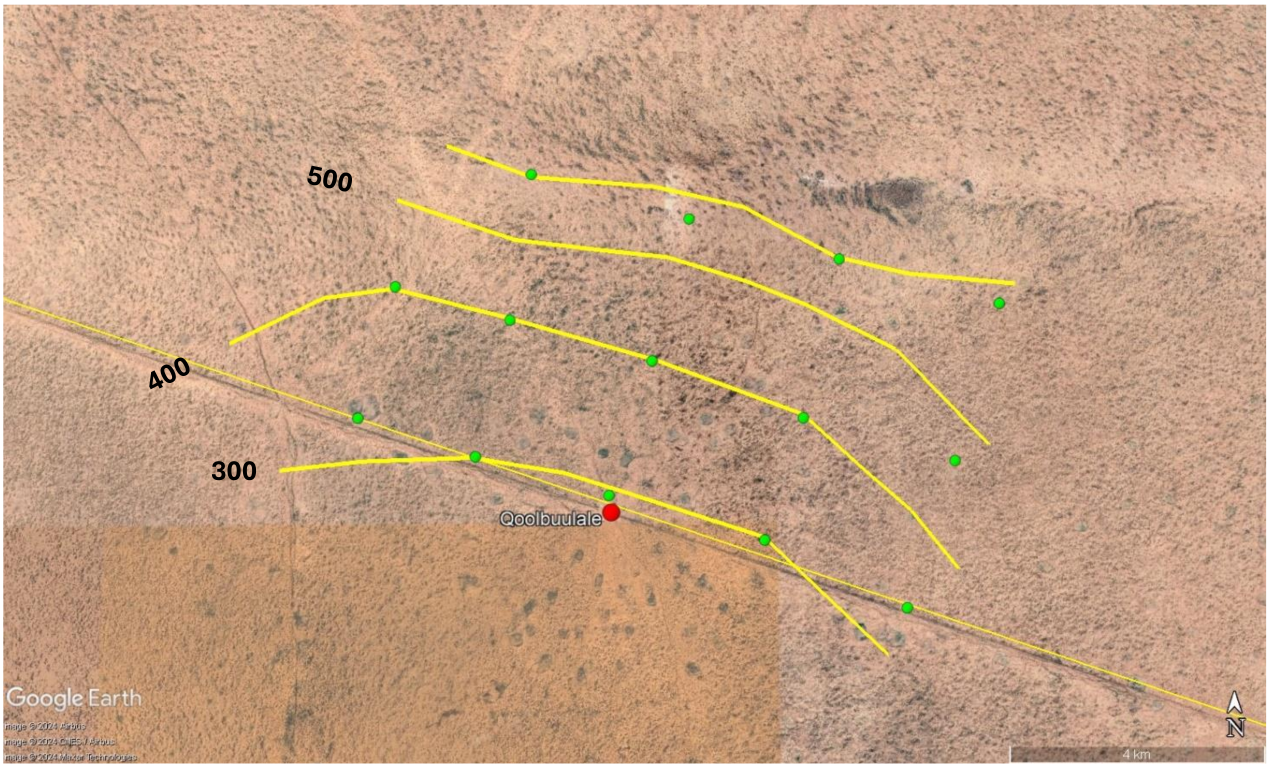


Figure 62: Map of the basement isobaths; values in meters bgl

The geophysical survey results reveal that the Precambrian basement lies at depths of 300-600 meters, sloping downward from the border towards the inner part of the area to the NNE.

Currently, there is no direct data on the depth of the aquifer in the study area. Available data is extrapolated from boreholes located approximately 30 km WNW (Salaxley), northward (Bali Matan), and 175 km ESE (Balidhiig). The limited data includes a standing water level (SWL) of 320 meters at Balidhiig, with other SWL values derived from various sources (SWALIM, borehole operators) with uncertain accuracy. SWL values in these boreholes vary from 250 to 320 meters below ground level (bgl), reaching 400 meters at Bali Matan. Therefore, it is reasonable to estimate an SWL range of 250 to 350 meters. Although the reliability of the Bali Matan data is uncertain, it is likely that the basement slopes downward from the border toward the center of the plateau, suggesting that the water table may also follow this descending pattern. This basement slope has been confirmed by the VES survey conducted in the Qoolbulale area.

In the previous cross-sections, a slight downward trend has been applied to the potential piezometric surface from the border and village area toward the inner plateau (NNE). This descent of the water table impacts the thickness of the potential saturated section. In two out of three sections near the border, the regional water level, under a pessimistic scenario, may lie below the basement surface, which would imply the absence of an aquifer. Accessing water along that section of the border would require three favorable conditions:

8. The VES interpretation must be accurate, and the basement must not be slightly higher than VES data suggests, as observed at Bali Gubadle and Gumar.
9. The true depth of the water level aligns with the more optimistic assumptions.
10. The slope of the piezometric surface is no shallower than the assumed gradient.

For these reasons, the area to the NNE is indicated as more favorable for drilling. A borehole reaching 400-500 meters in this area would likely encounter a saturated section of at least 100 meters, even in a worst-case scenario.

An additional factor supporting the NNE area as the most suitable for drilling is that the deep section of the Yesomma Formation in this area has higher resistivity values than in other VES cross-sections. The iso-resistive contour lines (in Ωm) of the Yesomma Formation, based on VES data, indicates the NNE area's suitability for aquifer exploration.

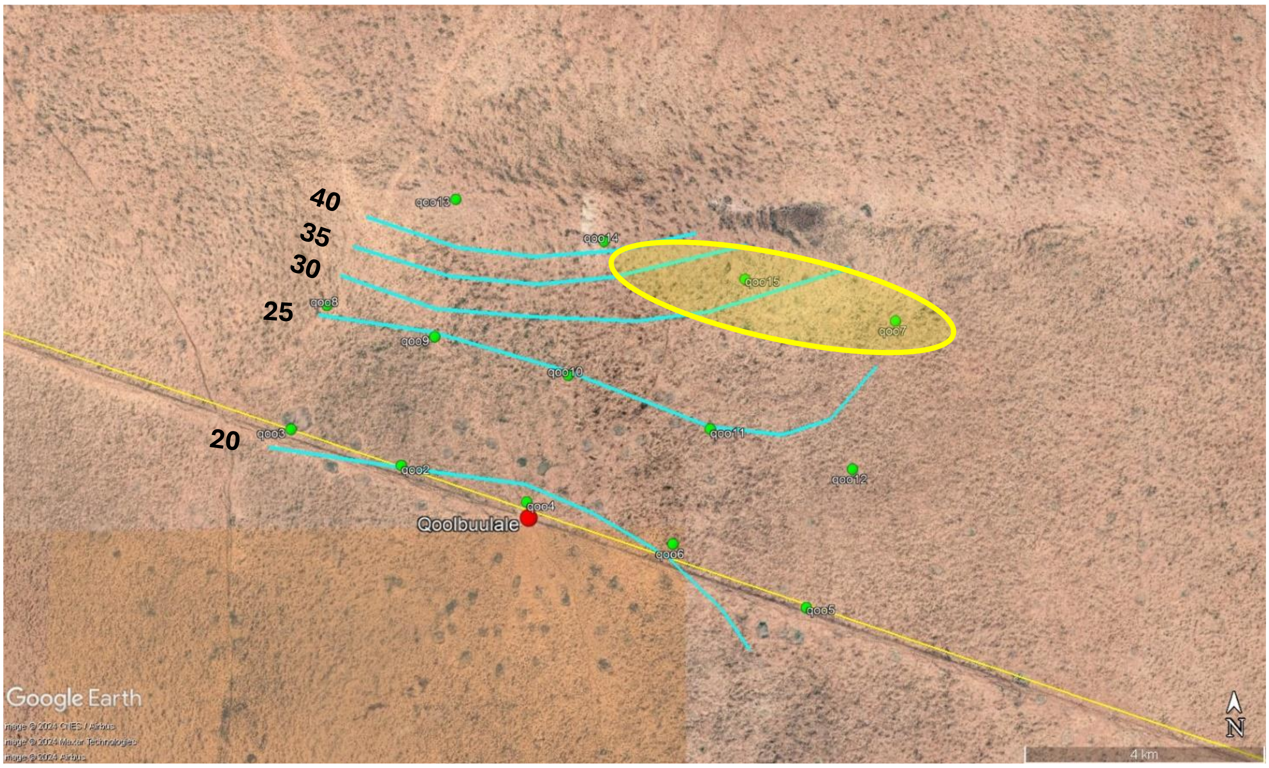


Figure 63: Map of the resistivity contour lines (cyan color) in the deepest section of the Yesomma Fm (possible aquifer) – values in Ωm – yellow ellipse: area selected for drilling

In the previous map is shown also the area considered more suitable for new drillings. A depth of 500 m is suggested with mud circulation and diameter > 16''.

The geophysical survey carried out in the Qoolbulale area was interpreted with the help of previous surveys, re-examined at the light of next drillings. The results are synthesized below.

- The applied methodology (VES Schlumberger with AB/2 =1,000 m allowed the investigation of the subsoil up to a depth of 600 m.
- The VES detected with good precision and a narrow margin of error the interface between Yesomma Fm and the PCB, that ranges between 300 and 600 m, dropping from the border area toward NNE.

- The resistivity of the possible aquifer, located in the sandy fractions of the Yesomma Sandstones, increases from the border toward NNE, indicating a growth of sandy component.
- It is suggested to locate the drilling as it is shown in the map above, avoiding the lowest values that indicate a consistent clayey component, mostly near border, and the highest ones at the NW corner of the area, because high values could indicate a cemented fraction of the Yesomma Fm. For this reason, the area indicated is located around VES 07 and 15 where *Rho* values range between 25 and 31 Ωm and the basement is at depth > 500 m.
- The depth of the aquifer and of the piezometric surface is unknown, because is not detectable only by the *Rho* values, because the nearest boreholes are at 30-50 km and the data of the pumping tests are not available. Anyway, the estimate is in the range of 250-350 m.
- The drilling is located in the area included between the coordinates: 8.895° N, 44.422° E and 8.912° N, 44.460° E. The coordinates of the first point is chosen anyway due to the proximity to the Qoolbulale community.
- The drilling shall have a depth between 400 and 500m, shall be executed with mud circulation and drilling tools diameter > 16 '', to allow the insertion of 10" casing and a pump of 8" of diameter.

VES Data and Graphs

Table 52: VES coordinates

VES	Latitude	Longitude	elevation
Qoo01	987730	414510	1248
Qoo02	981260	431778	1193
Qoo03	981874	429885	1196
Qoo04	980646	433915	1186
Qoo05	978890	438630	1173
Qoo06	979944	436390	1180
Qoo07	983711	440246	1187
Qoo08	983991	430445	1202
Qoo09	983448	432311	1197
Qoo10	982785	434608	1192
Qoo11	981870	437036	1185
Qoo12	981188	439452	1181
Qoo13	985840	432638	1199
Qoo14	985099	435221	1195
Qoo15	984437	437660	1190

Table 53: VES field data

VES n.	01	
Site:	Ina-igare	
Date:	14-Sep-24	
Azimuth	0	
Elevation:	1248	
Latitude	987730	
Longitude	414510	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	32.87
12.5	1	22.73
16	1	17.22
20	1	17.05
20	5	17.67
25	5	17.02
32	5	15.35
40	5	15.83
50	5	15.16
50	10	15.98
65	10	16.13
80	10	15.93
100	10	16.02
100	25	15.5
125	25	15.4
160	25	16.6
200	25	18.6
200	50	17.9
250	50	18.8
320	50	18.8
400	50	19.8
500	50	23.3
500	100	27.5
660	100	30.1
800	100	33.6

VES n.	02	
Site:	Qoolbulale	
Date:	14-Sep-24	
Azimuth	110	
Elevation:	1193	
Latitude	981260	
Longitude	431778	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	12.15
12.5	1	12.75
16	1	13.70
20	1	15.67
20	5	15.82
25	5	16.64
32	5	20.37
40	5	21.97
50	5	23.87
50	10	23.64
65	10	31.94
80	10	32.56
100	10	35.61
100	25	35.6
125	25	36.6
160	25	35.2
200	25	32.7
200	50	31.6
250	50	30.3
320	50	29.8
400	50	32.7
500	50	35.8
500	100	36.6
660	100	46.8
800	100	53.4
1000	100	62

VES n.	03	
Site:	Qoolbulale	
Date:	14-Sep-24	
Azimuth	107	
Elevation:	1196	
Latitude	981874	
Longitude	429885	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	20.37
12.5	1	22.34
16	1	24.27
20	1	26.14
20	5	24.62
25	5	26.33
32	5	25.80
40	5	27.61
50	5	30.48
50	10	30.88
65	10	33.05
80	10	34.04
100	10	36.85
100	25	36.7
125	25	34.5
160	25	31.7
200	25	31.2
200	50	31.0
250	50	29.6
320	50	29.2
400	50	31.2
500	50	35.8
500	100	38.1
660	100	43.5
800	100	46.5
1000	100	53

VES n.	04	
Site:	Qoolbulale	
Date:	10-Sep-24	
Azimuth	100	
Elevation:	1186	
Latitude	980646	
Longitude	433915	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	18.44
12.5	1	21.85
16	1	23.63
20	1	25.07
20	5	25.92
25	5	26.09
32	5	29.41
40	5	28.95
50	5	30.09
50	10	29.78
65	10	27.93
80	10	25.04
100	10	22.08
100	25	21.2
125	25	20.4
160	25	18.7
200	25	19.8
200	50	21.0
250	50	23.6
320	50	25.7
400	50	29.7
500	50	34.2
500	100	35.4
660	100	44.8
800	100	48.5
1000	100	54

VES n.	05	
Site:	Qoolbulale	
Date:	13-Sep-24	
Azimuth	110	
Elevation:	1173	
Latitude	978890	
Longitude	438630	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	20.22
12.5	1	18.05
16	1	17.74
20	1	15.67
20	5	14.83
25	5	14.95
32	5	15.44
40	5	16.13
50	5	17.65
50	10	17.04
65	10	17.62
80	10	18.11
100	10	18.66
100	25	18.3
125	25	22.5
160	25	23.5
200	25	25.7
200	50	25.2
250	50	25.3
320	50	29.8
400	50	35.6
500	50	42.8
500	100	39.6
660	100	46.8
800	100	53.4
1000	100	59

VES n.	06	
Site:	Qoolbulale	
Date:	13-Sep-24	
Azimuth	115	
Elevation:	1180	
Latitude	979944	
Longitude	436390	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	12.49
12.5	1	13.24
16	1	13.70
20	1	13.60
20	5	14.08
25	5	15.36
32	5	16.04
40	5	17.07
50	5	18.35
50	10	19.00
65	10	21.71
80	10	22.86
100	10	22.08
100	25	23.4
125	25	19.5
160	25	17.4
200	25	18.6
200	50	19.9
250	50	21.9
320	50	24.8
400	50	29.2
500	50	35.8
500	100	36.6
660	100	44.1
800	100	50.5
1000	100	56

VES n.	07	
Site:	Qoolbulale	
Date:	12-Sep-24	
Azimuth	140	
Elevation:	1187	
Latitude	983711	
Longitude	440246	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	16.98
12.5	1	20.34
16	1	21.19
20	1	28.71
20	5	30.22
25	5	33.95
32	5	38.67
40	5	44.43
50	5	45.10
50	10	46.26
65	10	46.13
80	10	51.06
100	10	51.00
100	25	53.1
125	25	43.2
160	25	36.9
200	25	31.2
200	50	32.0
250	50	33.0
320	50	31.4
400	50	31.2
500	50	31.9
500	100	30.9
660	100	36.8
800	100	41.6
1000	100	47

VES n.	08	
Site:	Qoolbulale	
Date:	11-Sep-24	
Azimuth	108	
Elevation:	1202	
Latitude	983991	
Longitude	430445	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	29.64
12.5	1	30.73
16	1	29.80
20	1	30.77
20	5	29.99
25	5	31.67
32	5	33.58
40	5	36.62
50	5	36.54
50	10	37.25
65	10	34.15
80	10	30.48
100	10	29.39
100	25	28.9
125	25	27.4
160	25	26.7
200	25	25.5
200	50	24.0
250	50	23.0
320	50	26.4
400	50	30.7
500	50	36.5
500	100	37.7
660	100	46.1
800	100	53.4
1000	100	61

VES n.	09	
Site:	Qoolbulale	
Date:	11-Sep-24	
Azimuth	100	
Elevation:	1197	
Latitude	983448	
Longitude	432311	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	28.71
12.5	1	32.24
16	1	36.97
20	1	37.04
20	5	36.99
25	5	37.28
32	5	38.35
40	5	38.99
50	5	36.47
50	10	34.68
65	10	30.52
80	10	29.98
100	10	30.32
100	25	27.6
125	25	27.5
160	25	27.0
200	25	26.7
200	50	25.2
250	50	25.3
320	50	27.3
400	50	32.7
500	50	37.3
500	100	40.3
660	100	48.1
800	100	56.4
1000	100	64

VES n.	10	
Site:	Qoolbulale	
Date:	10-Sep-24	
Azimuth	98	
Elevation:	1192	
Latitude	982785	
Longitude	434608	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	18.41
12.5	1	18.73
16	1	19.23
20	1	20.31
20	5	19.24
25	5	21.05
32	5	25.52
40	5	30.97
50	5	33.43
50	10	33.93
65	10	35.77
80	10	35.82
100	10	37.32
100	25	37.2
125	25	37.3
160	25	34.1
200	25	30.2
200	50	28.7
250	50	28.5
320	50	29.2
400	50	31.2
500	50	35.0
500	100	35.1
660	100	44.8
800	100	49.5
1000	100	59

VES n.	11	
Site:	Qoolbulale	
Date:	12-Sep-24	
Azimuth	130	
Elevation:	1185	
Latitude	981870	
Longitude	437036	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	19.11
12.5	1	16.61
16	1	15.34
20	1	15.67
20	5	16.82
25	5	17.66
32	5	18.64
40	5	21.92
50	5	26.05
50	10	28.88
65	10	31.75
80	10	35.53
100	10	34.21
100	25	36.1
125	25	35.6
160	25	33.3
200	25	33.9
200	50	32.4
250	50	32.4
320	50	31.1
400	50	33.6
500	50	38.1
500	100	39.2
660	100	47.5
800	100	53.4
1000	100	65

VES n.	12	
Site:	Qoolbulale	
Date:	13-Sep-24	
Azimuth	132	
Elevation:	1181	
Latitude	981188	
Longitude	439452	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	11.66
12.5	1	12.22
16	1	13.62
20	1	14.54
20	5	14.37
25	5	14.48
32	5	15.38
40	5	19.30
50	5	22.63
50	10	21.87
65	10	24.56
80	10	27.71
100	10	28.77
100	25	31.9
125	25	33.7
160	25	35.3
200	25	36.9
200	50	34.3
250	50	34.9
320	50	33.9
400	50	34.6
500	50	34.2
500	100	33.6
660	100	37.4
800	100	40.6
1000	100	47

VES n.	13	
Site:	Qoolbulale	
Date:	11-Sep-24	
Azimuth	106	
Elevation:	1199	
Latitude	985840	
Longitude	432638	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	25.85
12.5	1	26.83
16	1	31.20
20	1	33.91
20	5	31.24
25	5	34.33
32	5	34.33
40	5	34.04
50	5	35.07
50	10	38.68
65	10	44.32
80	10	46.02
100	10	49.45
100	25	49.5
125	25	53.3
160	25	53.7
200	25	54.4
200	50	55.0
250	50	56.5
320	50	57.7
400	50	59.4
500	50	62.2
500	100	61.4
660	100	64.8
800	100	68.3
1000	100	75

VES n.	14	
Site:	Qoolbulale	
Date:	10-Sep-24	
Azimuth	91	
Elevation:	1195	
Latitude	985099	
Longitude	435221	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	134.87
12.5	1	125.64
16	1	90.36
20	1	67.06
20	5	56.34
25	5	46.99
32	5	39.42
40	5	37.21
50	5	37.87
50	10	40.19
65	10	44.26
80	10	52.05
100	10	53.80
100	25	53.6
125	25	54.9
160	25	55.2
200	25	56.4
200	50	55.0
250	50	55.8
320	50	56.8
400	50	56.4
500	50	59.1
500	100	59.9
660	100	59.5
800	100	62.3
1000	100	70

VES n.	15	
Site:	Qoolbulale	
Date:	12-Sep-24	
Azimuth	120	
Elevation:	1190	
Latitude	984437	
Longitude	437660	
AB/2	**MN/2**	**Resistivity**
m	m	ohm x m
10	1	16.56
12.5	1	18.88
16	1	22.03
20	1	22.69
20	5	22.68
25	5	20.70
32	5	20.71
40	5	23.85
50	5	22.00
50	10	23.68
65	10	22.29
80	10	23.16
100	10	24.10
100	25	26.2
125	25	27.3
160	25	29.3
200	25	30.9
200	50	30.5
250	50	30.2
320	50	30.4
400	50	31.7
500	50	35.0
500	100	33.6
660	100	38.1
800	100	40.6
1000	100	48

Table 54: VES interpretation

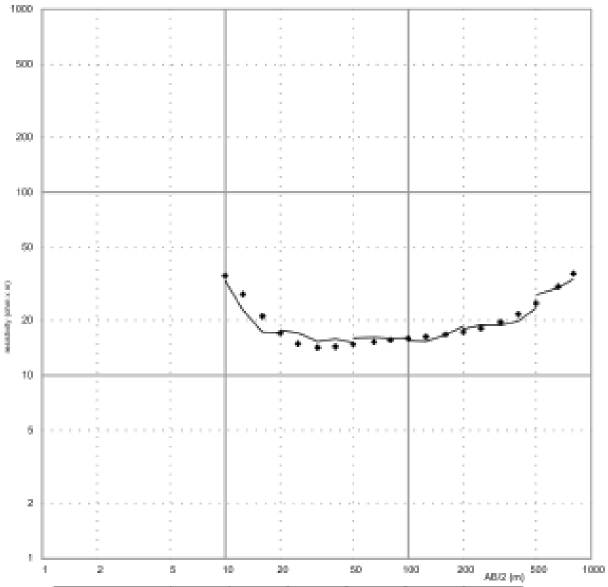
VES	num of	layer 1		layer 2		layer 3		layer 4		
	layers	depth 1	rho 1	depth 2	rho 2	depth 3	rho 3	depth 4	rho 4	depth
Qoo01	4	5	60	17	11			350	16	
Qoo02	4	12	11	50	70			300	20	
Qoo03	4	14	20	60	47			370	22	
Qoo04	4	3.5	10	20	40			300	18	
Qoo05	5	7	24	22	11	120	20	400	35	
Qoo06	4	14	12	27	39			350	21	
Qoo07	4	7	13	33	100			530	25	
Qoo08	4	10	30	40	39			390	23	
Qoo09	4	4	20	20	50			400	26	
Qoo10	5	6	16	16	20	46	60	400	25	

Qoo11	5	4	30	17	12	58	60	400	25
Qoo12	5	8	10	37	20	100	70	470	21
Qoo13	4	10	24	200	55			600	50
Qoo14	5	6.5	190	40	33	120	80	550	40
Qoo15	4	6	15	100	25			600	31

layer 1 2-3	Alluvial Yesomma	dry sand or compact sandstones p ≥ 100 Ωm
		very dry sand 40 < p < 70 Ωm
		clayey top deposits 3 < p <30 Ωm
layer 4	Yesomma	sandy-clayey deposits p < 25 Ωm
		sandy deposits 25 ≤ p < 40 Ωm
		sandy deposits p ≥ 40 Ωm (uncertain lithology)
layer 5	PCB	Precambrian crystalline basement p =500 Ωm
notes	the depth of the layer 5 is considered infinite	
	possible aquifer expected below 250 m	

project GW4R VES Qoo01

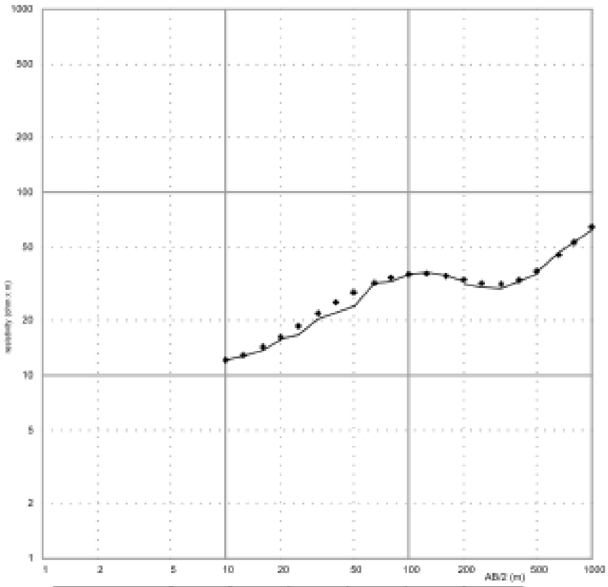
site Qoolbulale elevation 1248 m



layer	1	2	3	4	5	
resistivity	60	11	16	500		ohm x m
thickness	5.0	12	333			m

project GW4R VES Qoo02

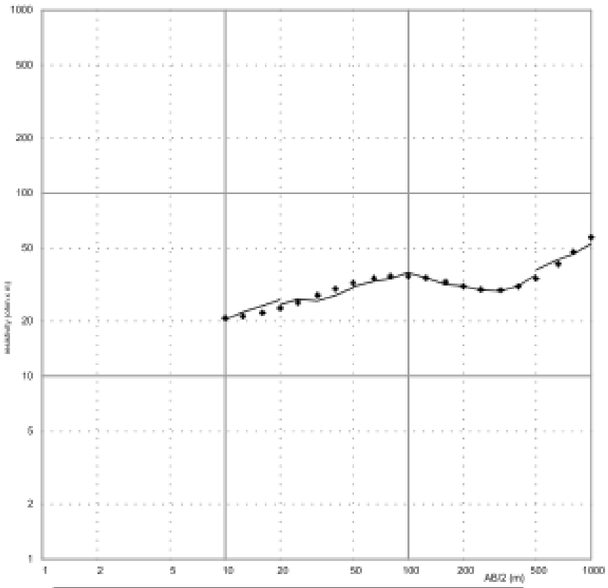
site Qoolbulale elevation 1193 m



layer	1	2	3	4	5	
resistivity	11	70	20	500		ohm x m
thickness	12	38	250			m

project GW4R VES Qoo03

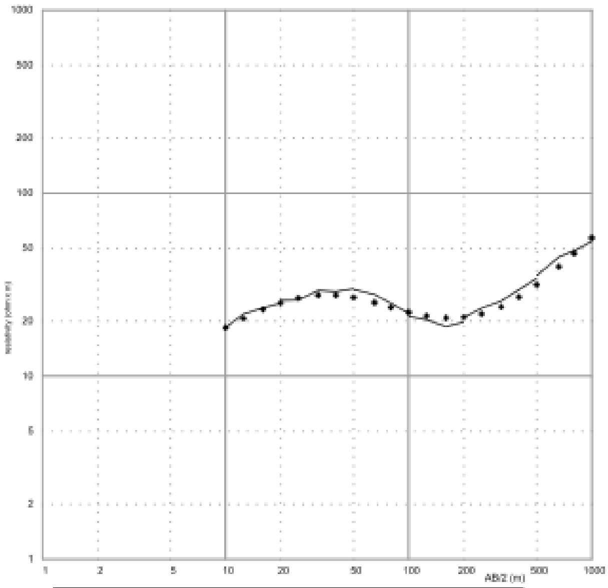
site Qoolbulale elevation 1196 m



layer	1	2	3	4	5	
resistivity	20	47	22	400		ohm x m
thickness	14	46	310			m

project GW4R VES Qoo04

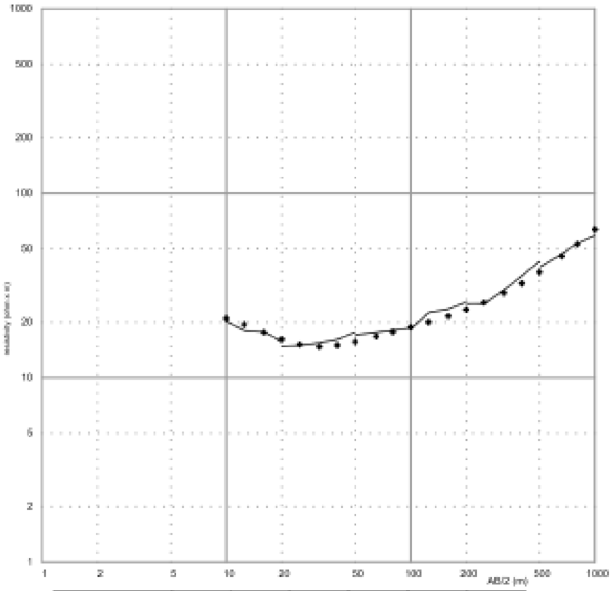
site Qoolbulale elevation 1186 m



layer	1	2	3	4	5	
resistivity	10	40	18	500		ohm x m
thickness	3.5	16.5	280			m

project GW4R VES Qoo05

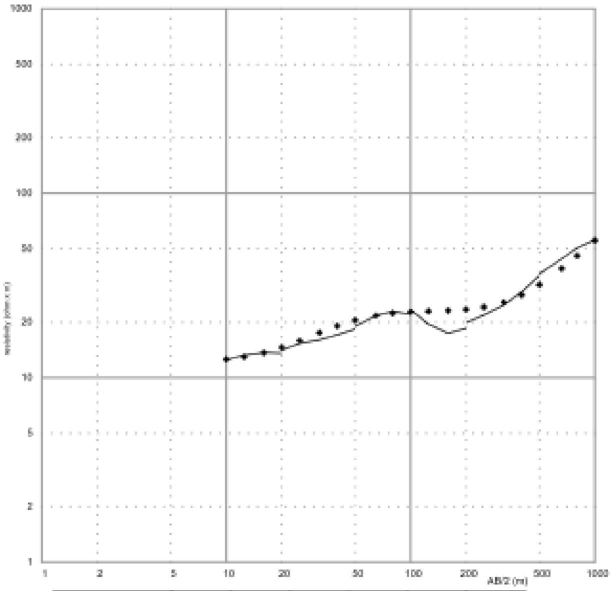
site Qoolbulale elevation 1173 m



layer	1	2	3	4	5	
resistivity	24	11	20	35	500	ohm x m
thickness	7.0	15	98	280		m

project GW4R VES Qoo06

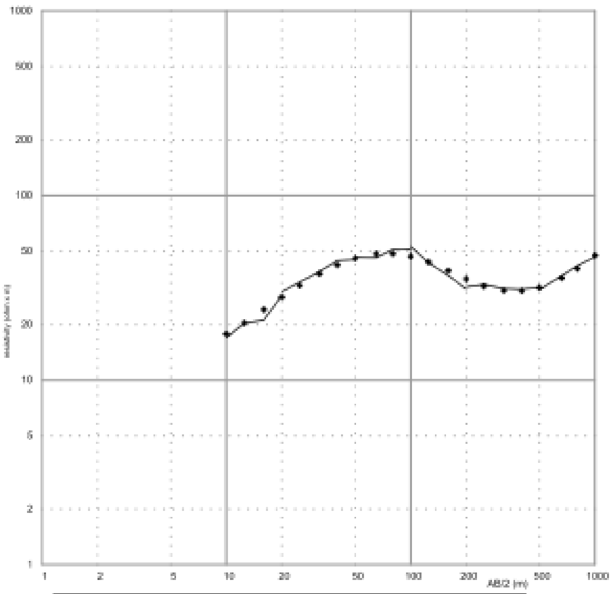
site Qoolbulale elevation 1180 m



layer	1	2	3	4	5	
resistivity	12	39	21	500		ohm x m
thickness	14	13	323			m

project GW4R VES Qoo07

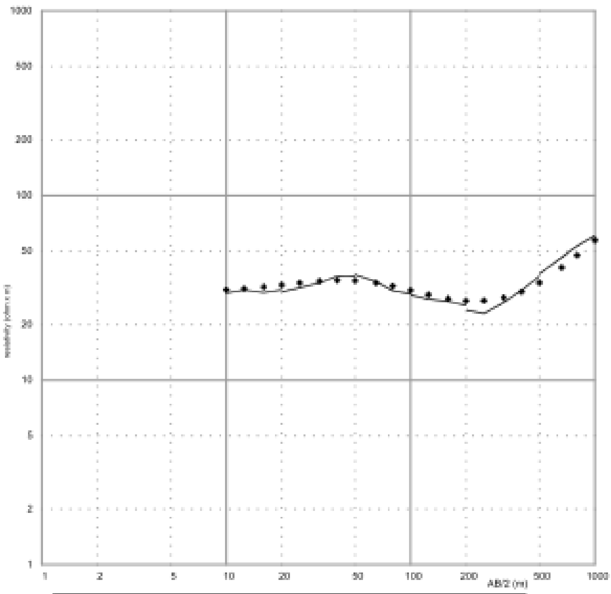
site Qoolbulale elevation 1187 m



layer	1	2	3	4	5	
resistivity	13	100	25	500		ohm x m
thickness	7.0	26	497			m

project GW4R VES Qoo08

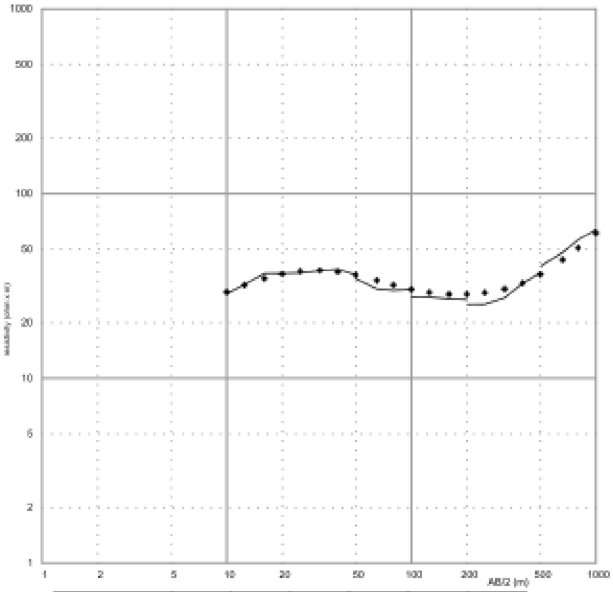
site Qoolbulale elevation 1202 m



layer	1	2	3	4	5	
resistivity	30	39	23	500		ohm x m
thickness	10	30	350			m

project GW4R VES Qoo09

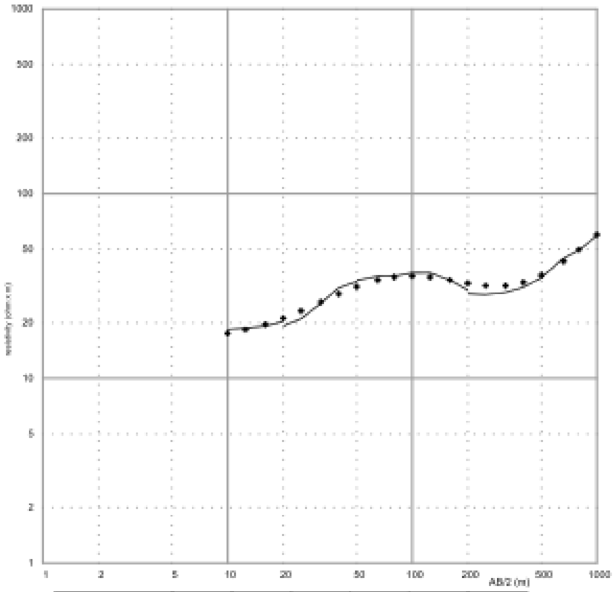
site Qoolbulale elevation 1197 m



layer	1	2	3	4	5	
resistivity	20	50	26	500		ohm x m
thickness	4.0	16	380			m

project GW4R VES Qoo10

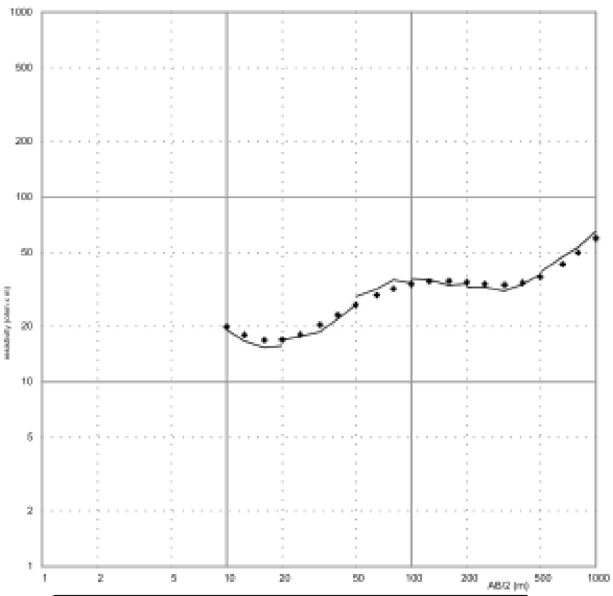
site Qoolbulale elevation 1192 m



layer	1	2	3	4	5	
resistivity	16	20	60	25	500	ohm x m
thickness	6.0	10	30	354		m

project GW4R VES Qoo11

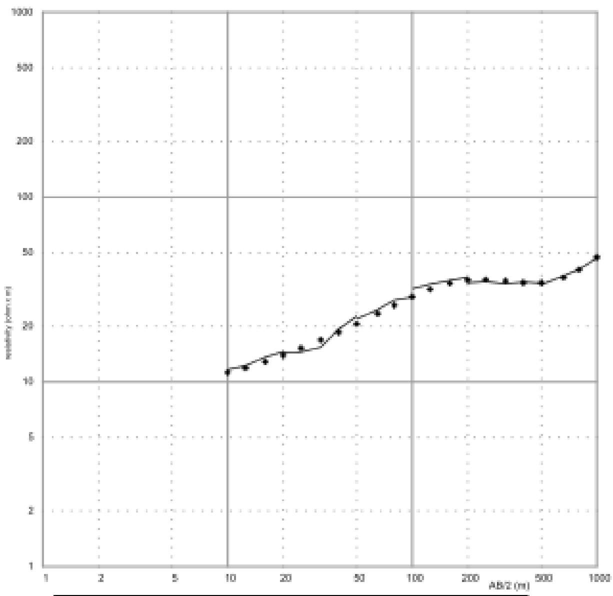
site Qoolbulale elevation 1185 m



layer	1	2	3	4	5	
resistivity	30	12	60	25	500	ohm x m
thickness	4.0	13	41	342		m

project GW4R VES Qoo12

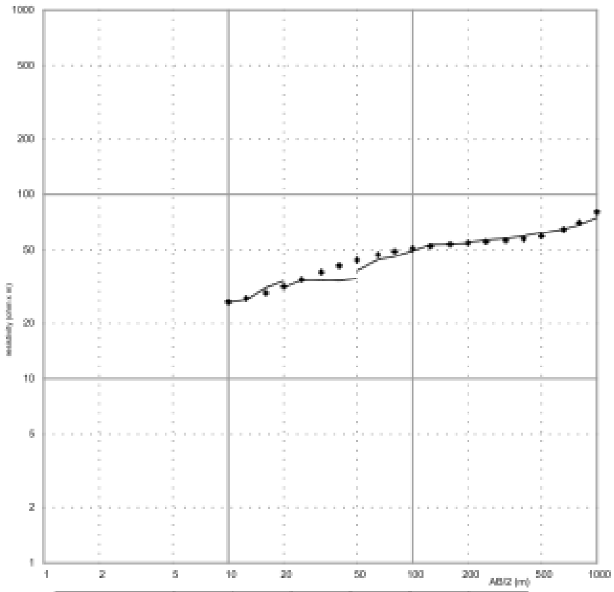
site Qoolbulale elevation 1181 m



layer	1	2	3	4	5	
resistivity	10	20	70	21	500	ohm x m
thickness	8.0	29	63	370		m

project GW4R VES Qoo13

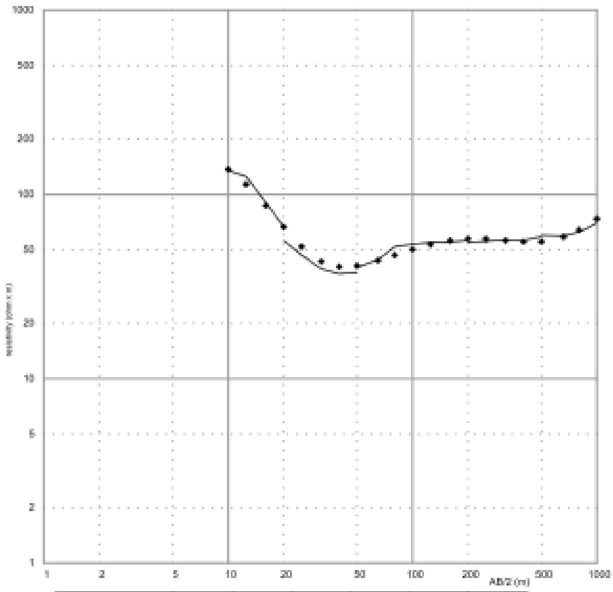
site Qoolbulale elevation 1199 m



layer	1	2	3	4	5	
resistivity	24	55	50	500		ohm x m
thickness	10	190	400			m

project GW4R VES Qoo14

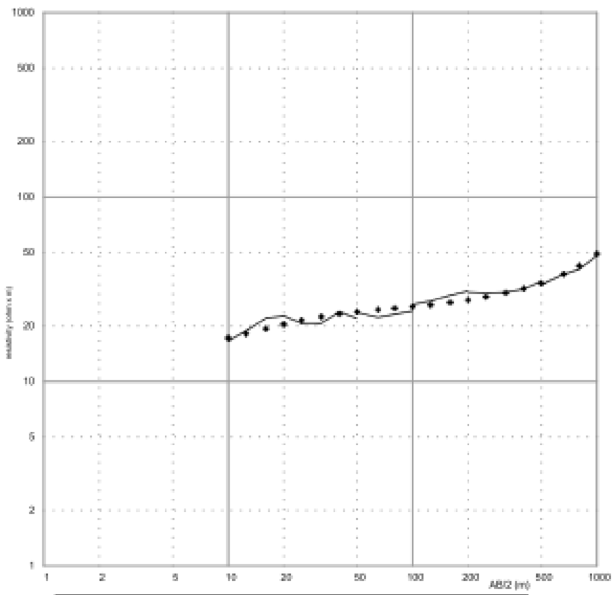
site Qoolbulale elevation 1195 m



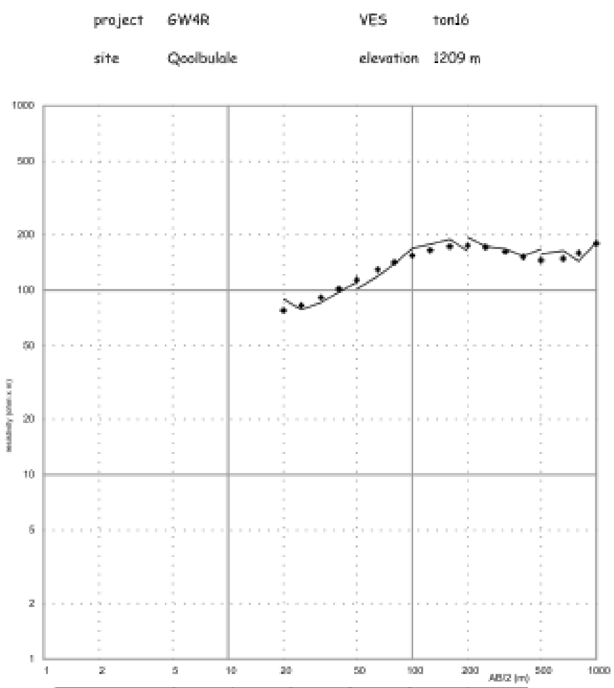
layer	1	2	3	4	5	
resistivity	190	33	80	40	500	ohm x m
thickness	6.5	33.5	80	430		m

project GW4R VES Qoo15

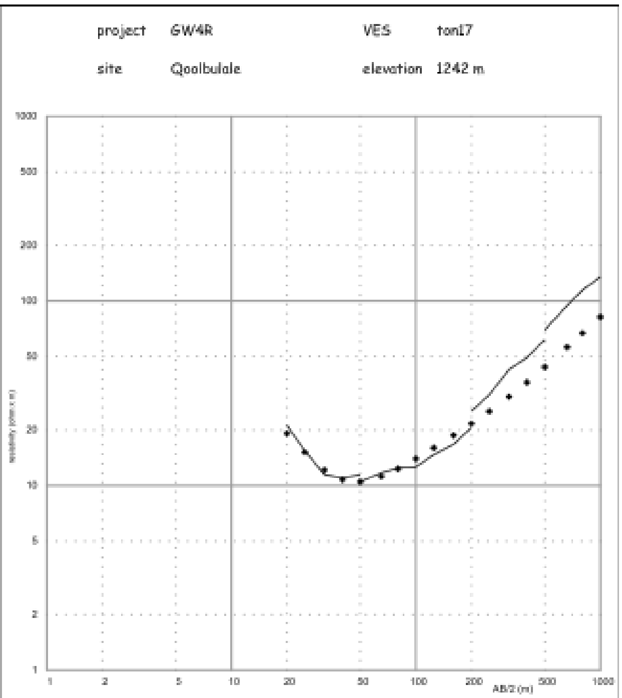
site Qoolbulale elevation 1190 m



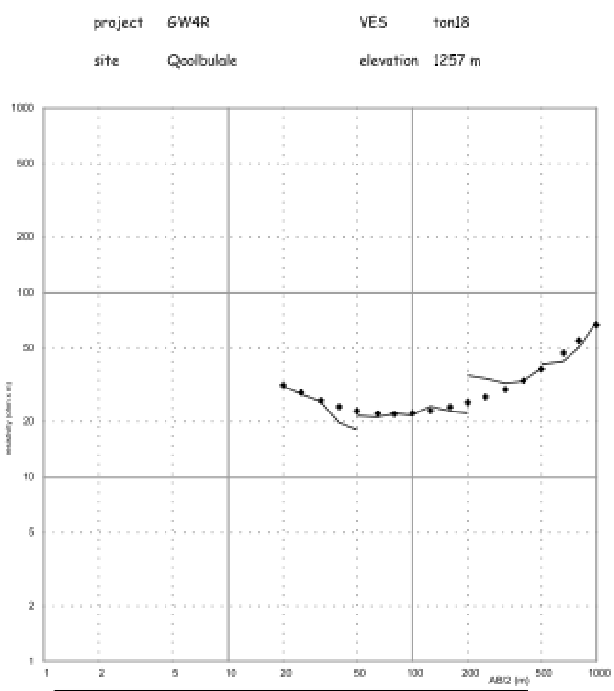
layer	1	2	3	4	5	
resistivity	15	25	31	500		ohm x m
thickness	6.0	94	500			m



layer	1	2	3	4	5	
resistivity	70	230	50	500		ohm x m
thickness	20	140	160			m



layer	1	2	3	4	5	
resistivity	40	8.0	30	1000		ohm x m
thickness	8.0	42	190			m

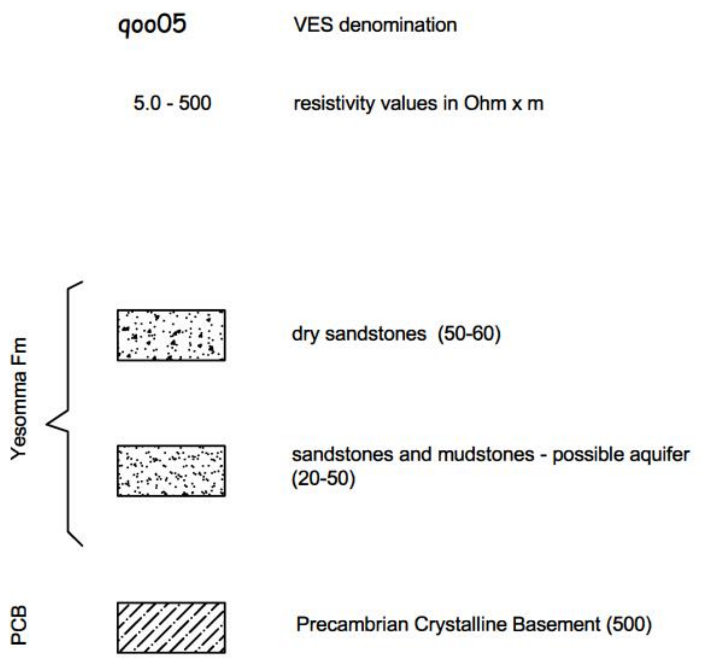


layer	1	2	3	4	5	
resistivity	40	20	27	500		ohm x m
thickness	10	70	270			m

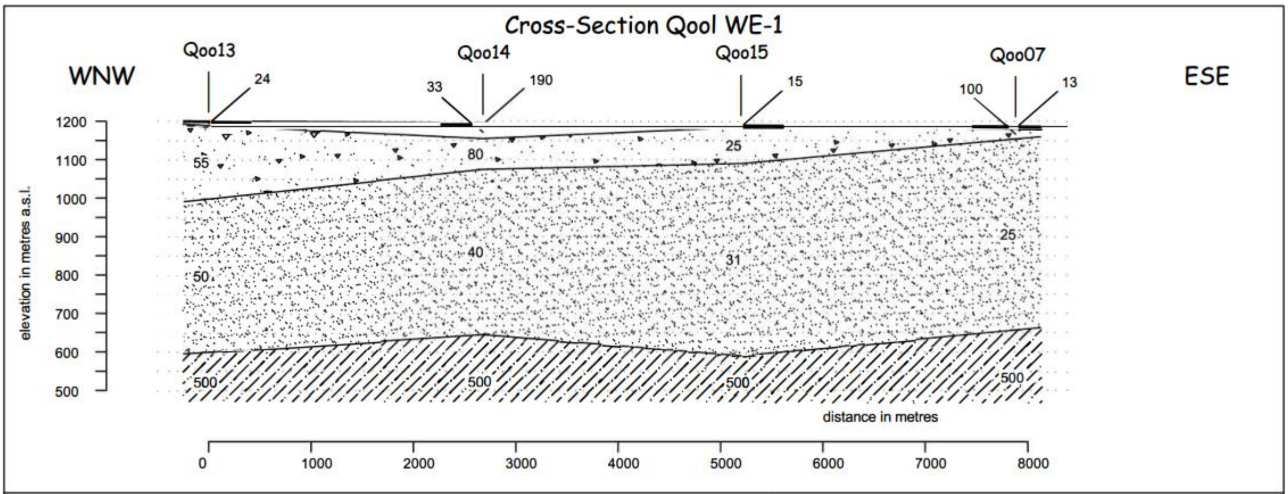
Figure 64: VES graphs

Resistivity Cross-Sections

Legend



qoo05
VES denomination
5.0 - 500
resistivity values in Ohm x m
Yesomma Fm
dry sandstones (50-60)
sandstones and mudstones - possible aquifer (20-50)
PCB
Precambrian Crystalline Basement (500)


Cross-Section Qool WE-1
WNW
ESE
Qoo13
Qoo14
Qoo15
Qoo07
24
33
190
15
100
13
55
80
25
50
40
31
25
500
500
500
500
elevation in metres a.s.l.
1200
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1000
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600
500
distance in metres
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3000
4000
5000
6000
7000
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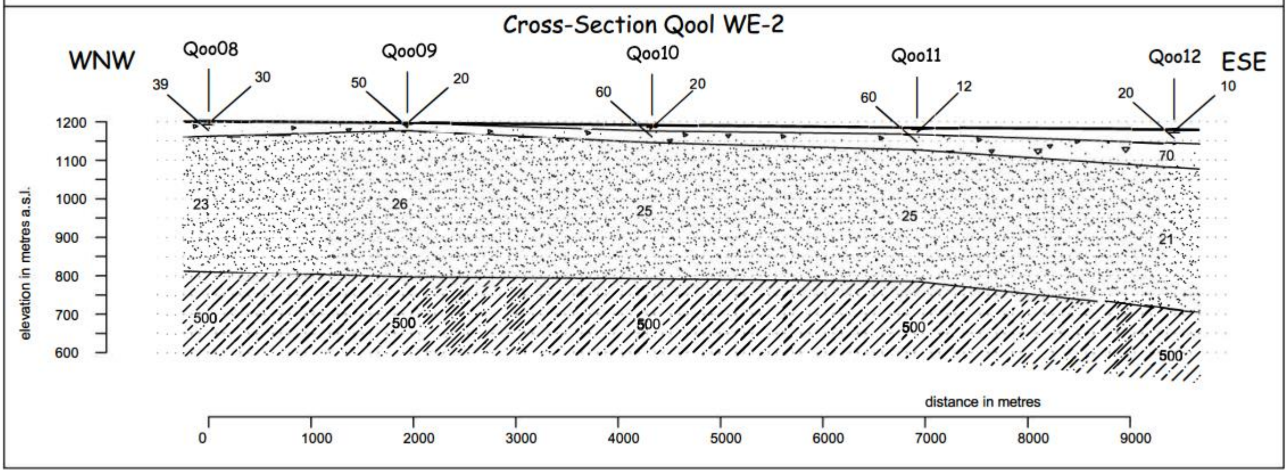
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WNW
ESE
Qoo08
Qoo09
Qoo10
Qoo11
Qoo12
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30
50
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60
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12
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10
70
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26
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elevation in metres a.s.l.
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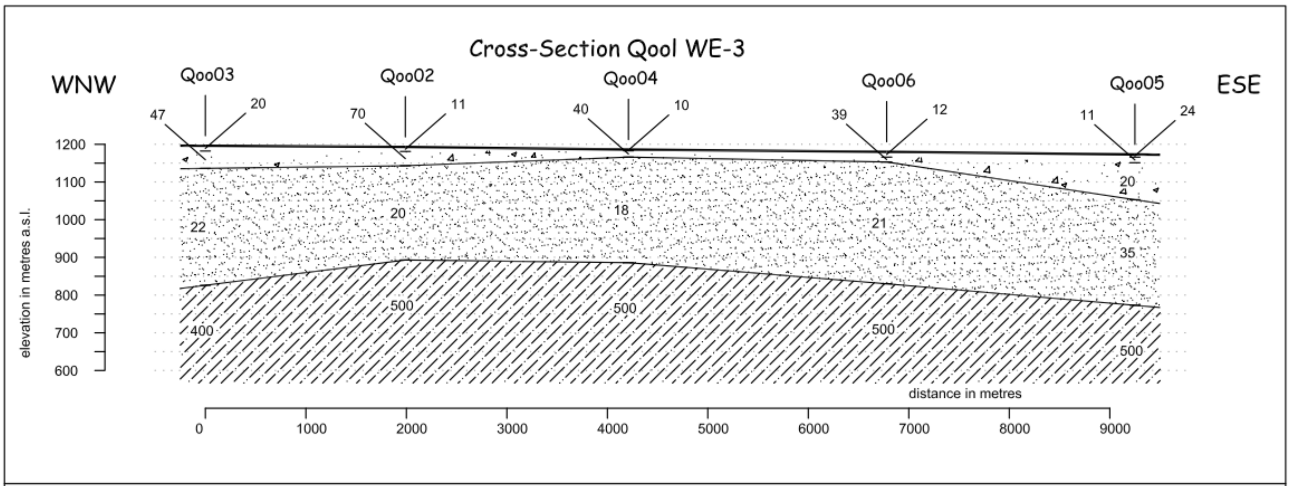
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WNW
ESE
Qoo03
Qoo02
Qoo04
Qoo06
Qoo05
47
20
70
11
40
10
39
12
11
24
elevation in metres a.s.l.
1200
1100
1000
900
800
700
600
22
20
18
21
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distance in metres
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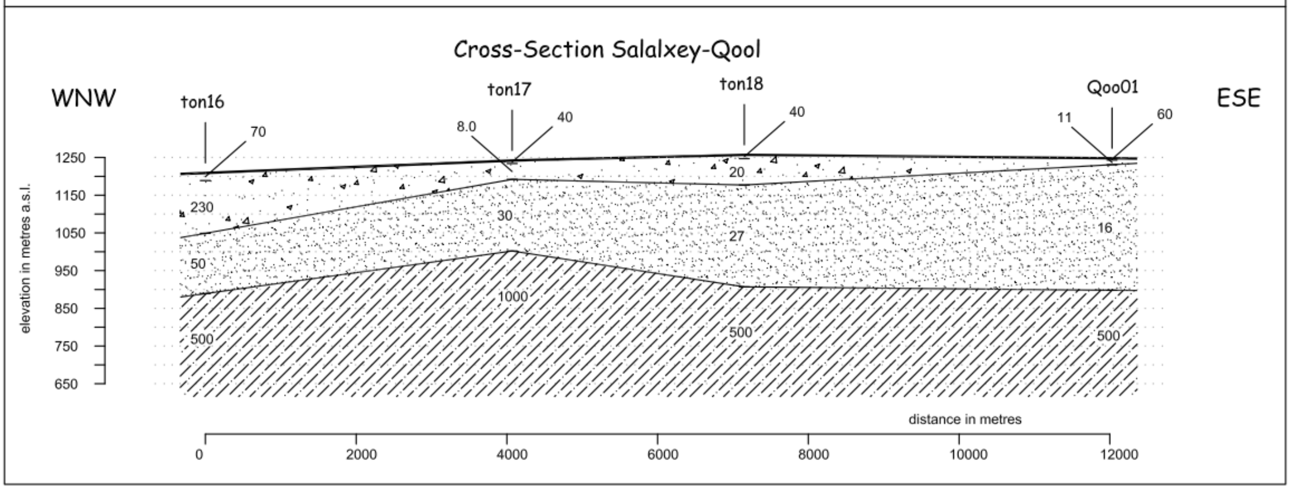
Cross-Section Salalxey-Qool
WNW
ESE
ton16
ton17
ton18
Qoo01
70
8.0
40
40
11
60
elevation in metres a.s.l.
1250
1150
1050
950
850
750
650
230
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500
distance in metres
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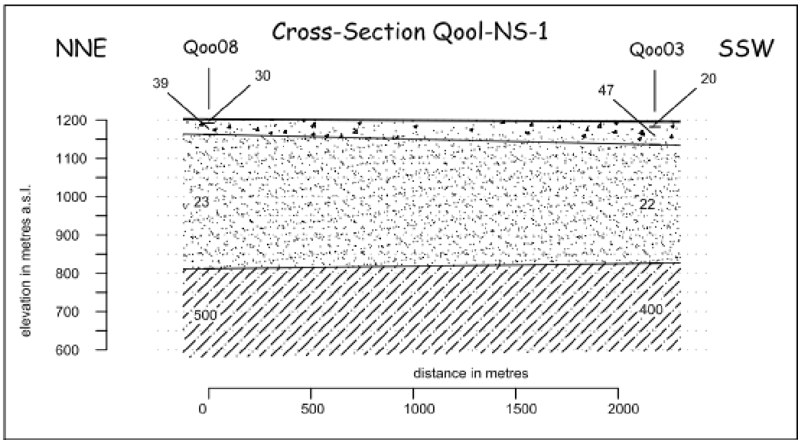
4000
6000
8000
10000
12000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NNE
SSW
Qoo08
Qoo03
39
30
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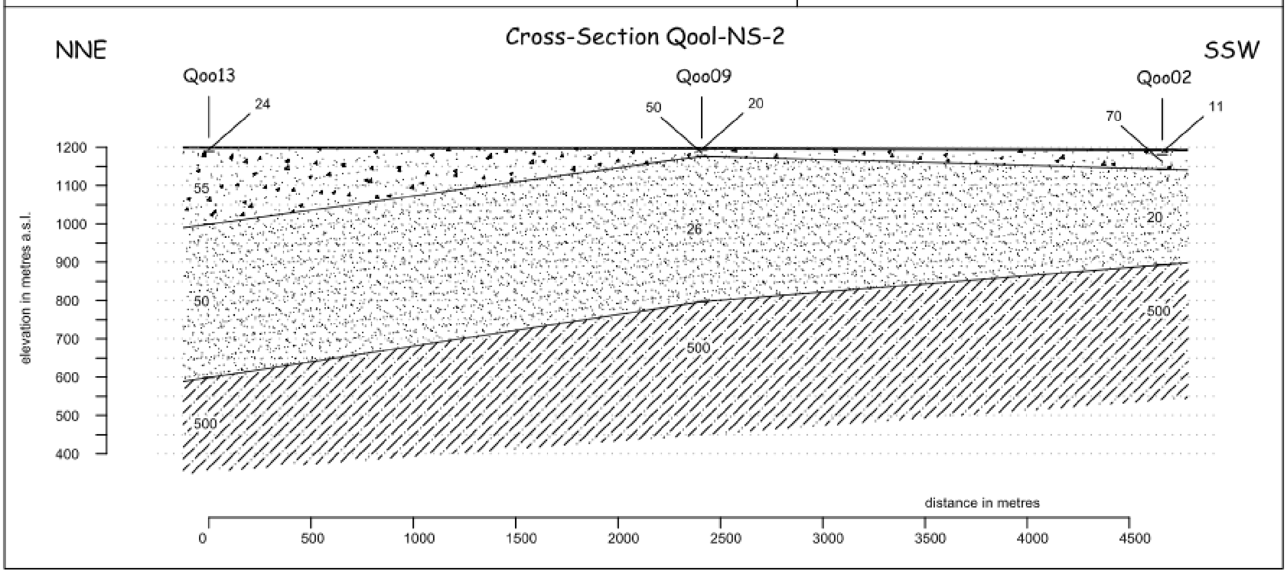
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Qoo09
Qoo02
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elevation in metres a.s.l.
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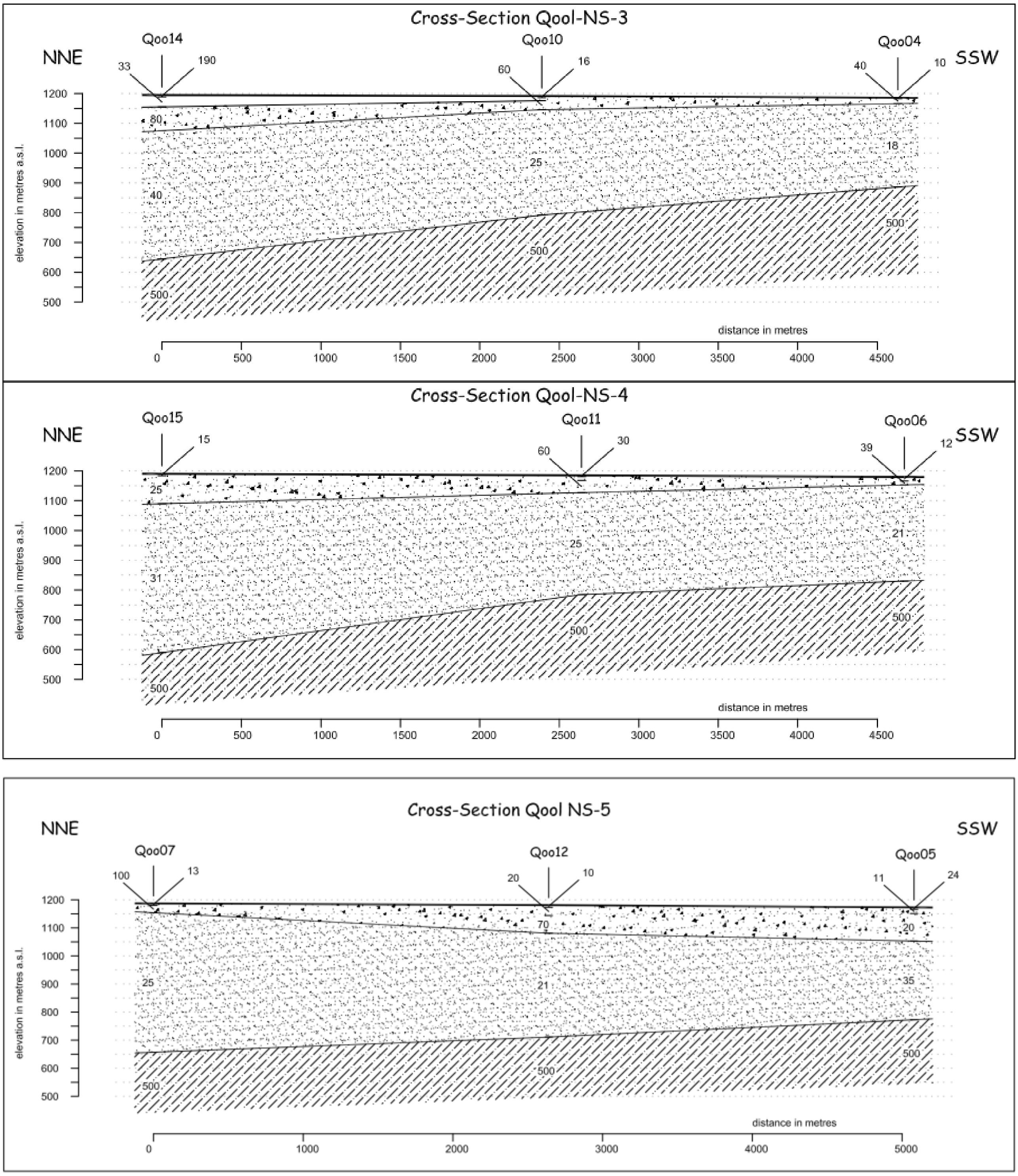

Figure 65: Resistivity cross-sections

Drilling and Pump System Technical Specifications

The Contractor must assume full responsibility, for all purposes of civil or criminal law, for the execution of the service and will be solely responsible for the interventions entrusted to it, the materials used and the means and tools provided for this purpose, both directly and indirectly.

The Client reserves the right to control all interventions in the various phases of execution. However, it is understood and agreed that all control interventions, without distinction, may never and in any way lead to liability for the Client, that is, the presence on site of the Client's coordination and surveillance personnel, the sharing of the type of intervention and the acceptance of the materials do not limit or reduce the full and unconditional liability of the Contractor.

All equipment, fixtures, installations and tools supplied by the Contractor must meet high technological characteristics, be of the best brands and comply with the national or international standards, or in their absence, with the rules of good execution, both for the quality of the raw materials, and for the manufacturing methods, dimensions, tolerances, acceptance tests and for anything else provided for by the current technical; they must, in any case, be suitable to replace the existing ones.

Therefore, the Contractor must provide the Client in advance with the technical specifications of the equipment and materials that are the object of each individual supply, the name of the suppliers and the location of their production plants, submitting the technical specifications and any certifications of tests and inspections for approval.

Each equipment must have, at the time of delivery, the following technical documentation:

1) n.1 copy of the maintenance manual;

2) n.1 copy of the corresponding catalogue sheet indicating the technical assembly characteristics;

The Company must, at any time, guarantee to the Client the execution of all tests and inspections on the supplies, deemed necessary and appropriate, both in the factory and on site.

The Client has the discretionary right to reject supplies deemed unsuitable, globally or for individual batches and also to order the replacement of the supplier, without the Contractor being able to claim any right to compensation or reimbursement for this.

All charges and expenses for the tests and inspections requested by the Client, without exception, and the charges related to the supplies (transport and packaging), are included and fully borne by the Contractor.

All supplies are guaranteed for two years from the date of installation.

Mobilization

Mobilization shall consist of the transport of all, necessary manpower, drilling rig, tools, casing pipes and construction materials to the drilling site. Demobilization shall consist of clean-up work and operations including, but not limited to those necessary to the removal of personnel, equipment, and incidentals from the project site.

The Contractor shall also mobilize all the necessary materials such as water for drilling, drilling chemicals fuels etc, which are required during the progress of the works.

Drilling

The drilling is carried out up to a depth of 500 m. However, the borehole can be stopped by the contracting authority and finalized also at a depth lower than 400 m with no claim of any compensation. The contracting authority will appoint a supervisor for the drilling operations, who will be responsible, on behalf of MoWRD, for all activities related to drilling, completion of works and subsequent pumping tests. At the end of the drilling operations the supervisor will decide on the basis of the drilling logs, water quality etc. if to finalize the borehole or to abandon it, thus cancelling all the remaining operations with no claim of any compensation by the contractor.

The contracting Authority supervisor should possibly be a geologist or a person with wide experience of boreholes drilling supervision.

<u>The drilling site is near Qoolbulale village, Marodijeex region, in the area included between the coordinates are: 8.895° N, 44.422° E and 8.912° N, 44.460° E.</u>

Expected Lithology and Water Levels

The material expected during the drilling is constituted by sand, silt and shales. It is not expected crystalline basement up to 600 m, but in case the basement is found the drilling shall stop after penetrating 10 m in it.

Groundwater is not expected up to 250-350 m of depth.

Drilling Methodology and Use of Additives

The drilling shall be executed with the only methodology of rotary with mud circulation, to face hole wall collapses, frequently occurring in the area. The use of bentonite and or foam is requested on the base of specific conditions. The diameter of the drilling tools shall be suitable for the installation of 8” casing plus an annular space of 3” around the casing for the gravel pack installation, therefore no less than 14”.

Centralizer

Borehole casings and screens shall be fitted into the open hole with centralizers placed at intervals of 20 m. Centralizers shall be made by plastic material or iron and of an approved design which does not hinder the installation of either gravel, backfill or cement seal.

Sampling

Samples from the cutting are taken each 2 meters, put in small transparent plastic bag and the depth interval to which the sample refers is written with black indelible ink marker. The samples are stored in a wooden or plastic box with small wooden dividing panels on which the depth is written with the same indelible markers. The wooden boxes are stored in a shadowy location and always available to the drilling supervisor.

Activity Recording

On a field book are registered all the operations done while drilling, including the drilling time per pipe length interval, the lithology, including grain size for sand, the drilling diameter, the use of temporary casing (and its diameter), each start and interruption of the operations, any machinery breakdown or hole collapse, possible losses of circulation. It is requested to compile daily forms with all the data above described. In the notes shall be reported also the supposed or verified presence of water with the depth at which the water income occurred.

Gravel Pack and Piezometric Pipe

The gravel pack is made by quartz/feldspar type, selected rounded grains of diameter 3 - 5 mm maximum. The size is mandatory given the expected presence of fine deposits (fine sand and silt). Coarser gravel grains allow the passage into the hole of such deposits.

Before pouring the gravel pack, a piezometric pipe of 1" in U-PVC is installed in the annular space up to the half of the last (deepest) screened casing section. The pipe shall reach the depth of 20 m above the lower edge of the screened section, the expected maximum length is 430 m.

The gravel pack is washed to remove small particles then gradually inserted into the annular space around the casing. Its volume is measured before pouring. Verify the consistency between the theorical volume and the measured volume. Record the volume poured for the drilling report.

During the borehole development by air and pumping gravel pack will be added as per need.

The procedure which can be considered for the installation method of the gravel pack is the following, as soon as the casing is lowered in the borehole with centralized, the driller has to:

- Start diluting the bentonite gradually.
- Inset the selected and washed siliceous bentonite (calculating in advance the necessary volume,
- "Starting from the bottom" carry out an air jetting taking care not to damage the screens. The air jetting in this phase has the scope to lower the gravel pack.
- Check the level of the gravel pack, add if necessary.
- When the target level has been reached, carry out a second air lifting and final check of the gravel level.

Important to highlight that the quality of the work depends significantly on the skill of the driller and the procedures applied. Particular attention must be given to the size and shape of the gravel pack, which must be rounded and provide sufficient space between the casing and the borehole walls; its selection requires approval from the site engineer.

If the gravel pack fails to reach the bottom of the well, sand intrusion will occur during both well development and subsequent pumping tests. In such cases, standard practice dictates withholding payment for the borehole, with the deduction based on the number of meters affected by clogging or sand infiltration. It is also not uncommon for well screens to sustain damage during development, leading to further sand intrusion. The expertise of the site engineer is therefore critical in overseeing these operations and ensuring proper execution.

Casing

The casing shall be in PVC 8" to allow the installation of a pump with 6"diameter. The expected length is 300 m for the blind casing and 200 m for the screened sections (the important length is due to unclean sandstones, lack of information in stratigraphic logs, and uncertainty about SWL depth and aquifer thickness, so to avoid the risk of losing the aquifer with a shorter section). The screens are slotted 1-1.5 mm, with an open area of 7% to allow a yield of 99-109 liters/minute per meter, open, with minimum thickness wall of 13,4 mm. The casing has a radial pressure resistance of 20 kg/cm², a tensile strength of 6 TPN, and threads rated for 3000 kg.

Borehole Development

Borehole development shall be limited to jetting, air lifting and over-pumping methods only. Any damage caused by development procedures shall be rectified by the Contractor to the supervisor's satisfaction. Not less than 12 hours of development pumping will be carried out.

If the drilling contractor has drilled with the bentonite mud direct circulation technique, after an initial well purging phase with the airlift tool, at least 2.0 m³ of metaphosphate solution at the concentration recommended by the manufacturer of the same product should be injected into the borehole at the sump level. After the injection of the solution, the borehole must remain at rest for at least 72 hours, after which the purging operations shall resume.

Data logging

During drilling, geophysical logging shall be performed to provide real-time data on the subsurface strata. This data is critical for identifying lithological variations and the location of water-bearing zones. Specific attention shall be given to identifying relatively coarse sand strata where freshwater aquifers are more likely to be present.

The logging process will include measurements for parameters such as resistivity, gamma-ray (to distinguish between different lithologies), and natural radioactivity to identify water-bearing formations. The data will guide the placement of screens, ensuring they are positioned in optimal locations, particularly in areas with fresh water and coarse sand strata.

More than that, water quality parameters such as temperature, electrical conductivity (EC), and pH shall be logged. When using mud circulation, the high conductivity of the mud/foam may affect the accuracy of EC measurements, making it challenging to detect changes that indicate the presence of a brackish aquifer. To ensure reliable monitoring, an EC meter shall be available on-site for regular measurements throughout the drilling and testing phases.

Pumping Test

The pumping test is performed with a pump suitable for yields up to 5 l/s with a head of 500 m and 6" of diameter. The contractor shall provide, beyond the pump and the generator, a gate valve, a flowmeter, a piezometric probe or dipmeter (up to 500 m of length) and a calibrated EC-meter for the measurement of electrical conductivity. The EC-meter is calibrated on a standard solution of known conductivity, before the start of drilling operations. Field forms are supplied for each type of test. The test is followed by the drilling supervisor or by a person appointed by him/her.

The activity consists of 3 different tests, preceded by a test of one hour to verify the reasonable yield range of the borehole.

- Step Test: it is performed by 4 steps at growing yields, at ¼, ½, ¾ of the maximum expected yield. The last step is done at the maximum yield. The time of pumping for each step is 1 hour. The passage to each next step is done without intermediate recovery. After the last step is concluded, a recovery phase of 2 hours measurements is done. During the test, readings of the water level are taken in the time intervals indicated on the step test form. Flowmeter readings, EC and temperature are measured at the start of each step and in the last minute of the last step.
- Constant rate test: once the recovery from step test is completed at 100%, a constant rate test of 48 hours is performed. The yield is selected by the drilling supervisor, on the base of the results of the step test and specifically at a yield of ¾ of the critical yield. During the test, readings of the water level, of the flowmeter, of EC and temperature are taken in the time intervals indicated on the step test form. It is recommended to verify the pump yield each 12 hours calculating the time necessary to fill a 200 litres drum by stopwatch. No generators stops are admitted, in case a stop occurs to the generator, the test shall restart from time 0, after a full recovery of the water level. Before the end of the test a sample of 5 litres of water is taken for chemical analyses.
- Recovery: as soon as the pump is shut the recovery measurements start following the timing of the recovery form. The recovery is followed for a maximum of 10 hours or up to 95% of the whole draw-down is recovered by the water level.

Test of verticality

A verticality test shall be conducted upon completion of drilling to ensure that the borehole deviation remains within acceptable limits. The borehole shall not deviate by more than 3° from the vertical at any point along its depth, unless otherwise specified by project requirements.

The test shall be performed using an appropriate downhole survey method, such as a plumb line, gyroscopic survey, or borehole deviation probe. The results of the verticality test shall be recorded and documented. If the borehole exceeds the allowable deviation, corrective measures shall be considered to ensure the proper installation and operation of the pump.

Water quality test

Upon completion of the borehole, comprehensive water quality testing shall be conducted to assess its suitability for use. The analyses shall include, but are not limited to, pH, electrical conductivity (EC), temperature, total dissolved solids (TDS), and major chemical constituents (such as calcium, magnesium, sodium, potassium, chloride, sulfate, bicarbonate, and nitrate). Additional microbiological testing may be required depending on site conditions and intended water use.

Water samples shall be collected following standard sampling procedures to prevent contamination and ensure accurate results. Chemical analyses shall be carried out by designated laboratories, and results shall be compared against applicable national and international water quality standards to determine the suitability of the borehole for its intended purpose.

Hole Protection

The annular space between the open hole and the PVC lining shall be filled to a depth of at least 2,0 m with a cement concrete to form the support base.

Report

The drilling report is written by the contractor and contains:

- Contractor data, driller name, start and end of the drilling operations, equipment brand and type.
- Site name, village name and coordinates, taken by GPS
- All data regarding methodology, additives use, drilling diameters and intervals of utilization, casing and screen diameters and intervals.
- Short history of the operations, including breakdowns, collapses, change of drilling diameters, dates, etc.
- Log of the drilling time per pipe length interval.
- Stratigraphic log approved/written by the drilling supervisor, with pictures of significant samples for each lithological unit (no more than 5-7 pictures). In the log are indicated the verified/supposed main water incomes.
- Drawing of the casing/screen column of the annular space refilling, and of the diameters used during the drilling.
- Gravel pack description and pictures.
- Description of the development activity, with significant water levels variations.
- Complete description of the pumping test equipment, dates, times and full tables and graphs with data measured during each test.

Submersible Centrifugal Pump and Riser Pipe General Standards

- Pumps should be multistage, centrifugal type, Vertical directly coupled to wet type submersible motor for Pumping ground water from deep wells.
- Pump Sets must comply with the latest E.U and I.S.O. standards.
- Manufacturer authorization letter, Certificates of compliance, and ISO or other certificate should be submitted along with bid offer.
- Suitable diameter of each pump/motor over the cable for use in 8 inch diameter Well Casing.

Pump Performance

- Pump performance curves should be indicated and clearly seen.
- Duty point flow rate and head for each pump must be within application range recommended by manufacturer.
- Guaranteed Pump efficiency at design flow should be equal or greater than 65%.
- Actual pump operational point should be between 110-80% of BEP (Best Efficiency Point).
- NPSH required should be less than 4m.

Pump Construction Material

- Impellers should be made of abrasion resistant bronze or stainless steel; statically and dynamically balanced.
- Main pump body should be made of corrosion resistant, Zinc free, closely grained cast iron or casted stainless steel.
- Pump shaft, coupling, suction grid & retaining valves should be made of stainless steel(SS310 /SS316 or higher class SS).
- Non-returning valve with Strainer incorporated with the pump.
- Pump tightening bolts and lock nuts should be made of stainless steel.

Submersible Electronic Motors

All motors shall be of a make approved by the Engineer and shall be suitable for operating from the specified power supply. Motors shall comply in all respects with the relevant parts of BS 4999 and BS 5000, and shall be designed to run at high power factor and efficiency at the prescribed plant duty.

Motors shall be three phase, squirrel cage, induction type, continuously rated for the heaviest specified duty, totally enclosed and suitable for operation on the electricity supply and determined by the Contractor in relation to the power requirements, ambient temperature, altitude and normal working conditions of the mechanical plant offered.

The starting (locked rotor) current of any motor shall not exceed 6 times the full load operating current; Motor starting torque shall be at least 120% of the pump torque requirements throughout the starting sequence. Motors shall be capable of running backwards at rated speeds under backflow conditions without damage to the motor.

In addition to the requirements of BS 5000, the motors shall be capable of satisfactory operation with a frequency variation of = 5% above or below the normal frequency of 50 Hz.

The design of the motor shall be adequate in all respects for the number of starts per hour required when the pumping plant is in normal operation. Where an insulation Class is specified the requirements of BS 4999 shall be met. The limit of temperature rise shall be for the appropriate Class of insulation quoted. Class F insulation shall be provided, but with Class B temperature rise limitations.

Motors shall be fitted with locating type bearings and/or heavy type thrust bearings at the non-drive end and roller type bearings at the drive and according to the type of motor offered, but all bearings shall be of adequate proportions and design suitable for the particular application, and shall have ample capacity all allow the pump to operate for short periods with the discharge valve closed.

Details of the bearing types being proposed, grease, oil, shall be submitted for all vertical motors together with details of the grease lubricated bearings for horizontal split case motors.

The motors shall be built of high-grade components and materials in accordance with the best practice for the type of plant offered.

Motors 5 kW and above shall be fitted with temperature sensitive thermistors embedded in the motor to control a winding over-temperature relay mounted in the control cubicle. Each motor shall have at least 3 thermistors. The thermistors shall be suitable for connection to a monitoring unit in the motor control circuit to provided protection against winding failing due to overheating. The motor starters shall trip in the event of high winding temperature being experienced.

The motors shall be capable of delivering 10% in excess of the maximum power absorbed by the equipment being driven. The motors, where practicable, are to be selected to provide an element of commonality, thus flexibility in use at each site, particularly dosing pump motors.

Only ISO standard roller and/or ball grease lubricated bearings shall be fitted.

The grease lubrication shall be applied using hydraulic type nipples, which are freely accessible, without, and dismantling, or otherwise piped out to a readily accessible location.

"Sealed for life" bearings shall not be used.

Continuously rated anti-condensation heaters shall be installed in all motors above 5 kW that are to be installed or in damp or cold environments. They shall be sized by the supplier to suit the motor frame size.

Heaters shall be located within the motor so that the heat dissipated does not damage the insulation of any of the windings or associated cables.

Terminals boxes shall be separated from the frame and shall be reversible to allow cable entry at the top, bottom or either side, suitable for cable glands required. Terminal mountings shall be arranged such that the motor supply wiring can be disconnected without disturbing its internal connections.

The end of each winding shall be brought out to a separate terminal, connecting links being provided to facilitate interconnection of individual terminals.

A diagram of connections shall be fixed inside the terminal box cover, which shall be provided with watertight, oil resisting gaskets.

Where motor anti-condensation heaters are fitted additional terminals and a separate cable gland entry shall be provided. A warning label on the terminal box cover shall be provided stating" WARNING, LIVE HEATER TERMINALS, ISOLATE BEFORE REMOVING COVER".

Plates shall be fixed on each motor, giving the following information:

BS No______________________ Manufacturer______________________

Serial No_____________________ Insulation Class_____________________

Frequency_____________________ No. of Phases_____________________

Motor kW_____________________ Voltage_____________________

Current at FL_____________________ Speed_____________________

Vertical spindle motor units rated in excess of 5 kW shall be fitted with a at the upper thrust bearing to shut down the motor in the event of the thermocouple bearing temperature exceeding a recommended value. Details shall be provided for approval.

Motor that are water-cooled shall include suitable protection to safeguards against lack of water flow.

Where required by the specified operation system, motor circuits shall include the suitable rated rotary off, manual or automatic switches.

Control Panel and Starter

<u>Pump functioning must be under inverter connection to guarantee soft start and stop</u>

- Control panel with TPN (Triple pole and neutral) switch with selector from Main On/Off, the power from Generator and A.C., replaceable fuses, phase indicator, voltmeter, ammeter and starter.
- Manufacturer's standard automatic type starter of suitable amperage with provision for lay ampere setting and automatic restarting when the water level goes up to a safe level.
- Automatic protection for over loading.
- Water level monitoring Relay for dry run protection.
- All incorporated and assembled in lockable painted steel box.

Additional Equipment

- Water level monitoring system to prevent pump from running dry, suitable for lowering on the specified bore-hole diameter vulcanized 2 electrodes with single insulated and flexible wire length equal to pump head.
- PVC cable clamp kit.
- One pairs of pump clamp with bolts and nuts for 4 inch pipe diameter, unless specified
- Pressure gauge.
- Submersible cables of proper length for each pump
- One cable jointing kit with quick drying epoxy resin compound
- Control panel.
- Strainer
- Non-Return Valve (Check Valve) incorporated with pump.

Technical Information Required

- Copies of Installation and Operation Manuals in English, for each pump.

- Pump discharge and total head.
- Complete pump performance curves at duty point and at different heads and discharge
- Pump HP
- Pump efficiency at 0.8 power factor
- Number of stages, total length of pump, and motor
- Pump diameter, motor diameter Over submersible cable
- Outlet connection diameter.
- Type of impeller
- Impeller, pump shaft motor and pump casing material
- Size of submersible cable
- Make and type of starter.
- Control panel box full details
- Impeller vane thickness, number of vane, vane angle at inlet and outlet diameter of a typical stage
- Other relevant information

Riser Pipes

Riser pipe should be in galvanized steel, minimum inside diameter 4'' with minimum thickness 5mm and minimum yield stress 235 N/mm2.

The installation of non-return valve located at 10m from the delivery mouth of pump and a further non-return valve every 50 m of pipeline.

The Contractor, under his own responsibility, may propose riser pipes with different technical characteristic with greater performance in terms of structural and hydraulic functioning.

In any case the contractor is always obliged to issue a structural technical report about the fitness of the riser pipes installed, in accordance with the final installation diagram and the technical characteristics of the submersible pump installed.

Annex 2 – Hydrology and Climate

Rainfall Analysis

The assessment of precipitation in the area of interest is essential for identifying local rainfall patterns that may indicate the water availability and water needs of the population. For this analysis, data from ground weather stations provided by SWALIM and remotely sensed data from GPM (Global Precipitation Measurement) and TMPA (TRMM Multisatellite Precipitation Analysis) using TRMM (Tropical Rainfall Measurement Mission) data will be utilized. The available ground monitoring network alone cannot be expected to fully represent the area's diverse precipitation patterns, so remotely sensed data will complement these observations. GPM and TRMM, a joint mission of NASA and the Japan Aerospace Exploration Agency launched in 1997 to monitor rainfall for weather and climate studies, offer precipitation data at a 3-hour interval with a 0.25° x 0.25° spatial resolution. This dataset will be analyzed to assess its capability to accurately represent local precipitation compared to data from weather stations.

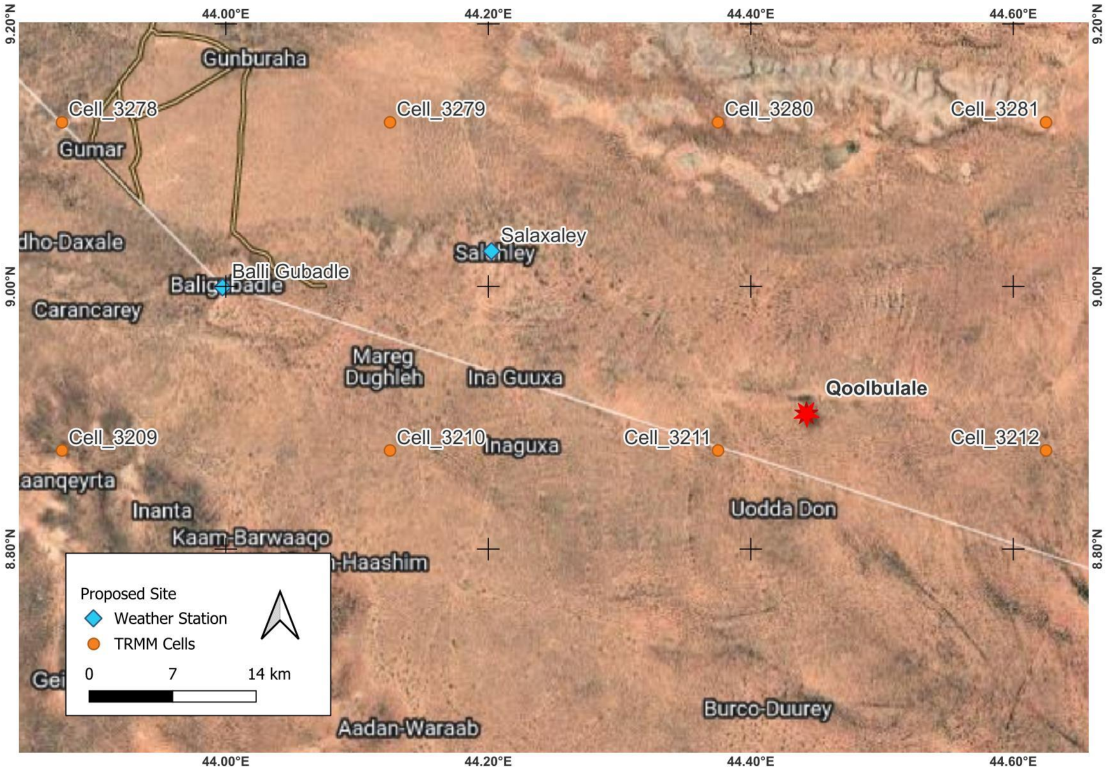

Figure 66: Location of the closest weather station and TRMM cell compared to the location of the site

An analysis was performed on the TRMM dataset, comparing the Balli Gubadle station (the closest with the longest series of data) with the closest TRMM cell available (3209 in the map above). The comparison of the two datasets considered both the monthly pattern and the average yearly values. As shown below, the analysis demonstrates a quite good correlation between the two records, with similar monthly patterns and a ratio between the average annual rainfall of the two-time series of 0.9 (this means that, on average, there is less than 10% difference between the recorded data and those provided by TRMM).

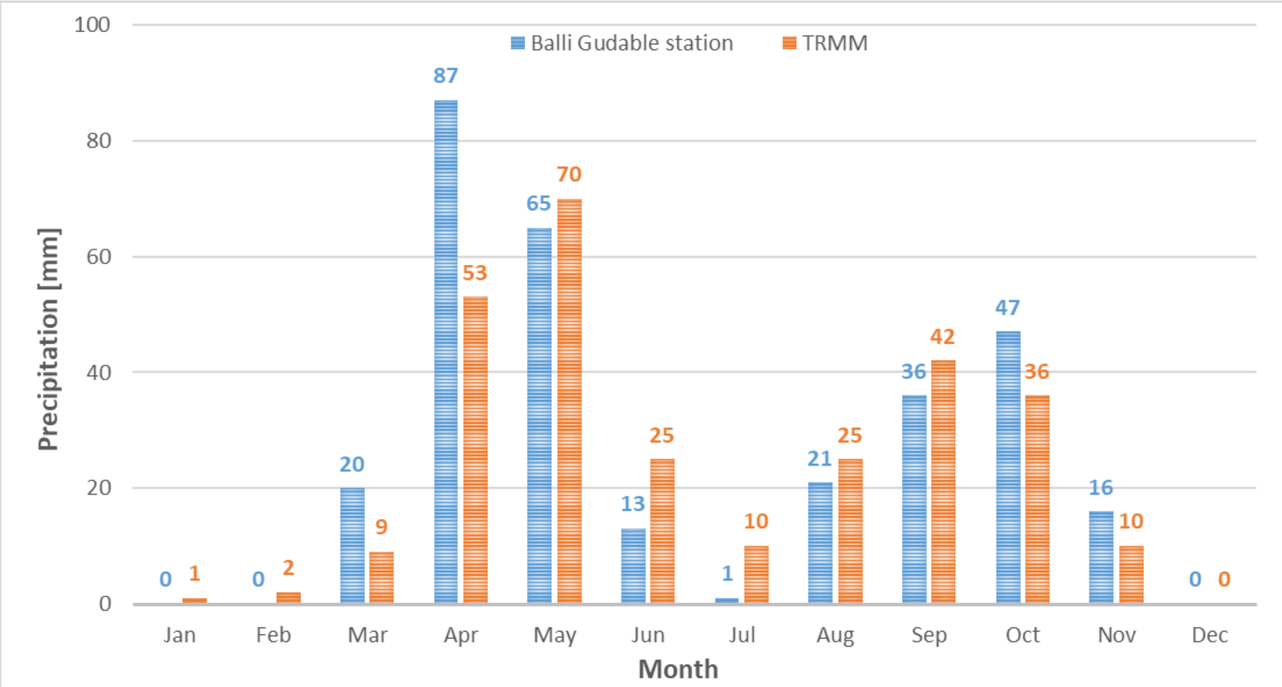

Figure 67: Average cumulative monthly rainfall data comparison between the Balli Gubadle weather station and the closest TRMM cell

Table 55: Comparison between the average cumulative annual rainfall between the Balli Gubadle weather station and the closest TRMM cell in mm

Weather Station	TRMM	Ratio
306	283	0.9

Given the distance between Balli Gubadle weather station and the location of the proposed site (about 50 km) and the satisfactory match between TRMM data and ground observed data, the TRMM dataset can be employed since it is assumed to be more representative of the rainfall in the area of interest, it provides data every 3 hours and has a longer series of data.

TRMM dataset is available for a total of 22 years. According to such records, average rainfall precipitation is 261 mm/year. The following figure shows the extent of the annual precipitation records.

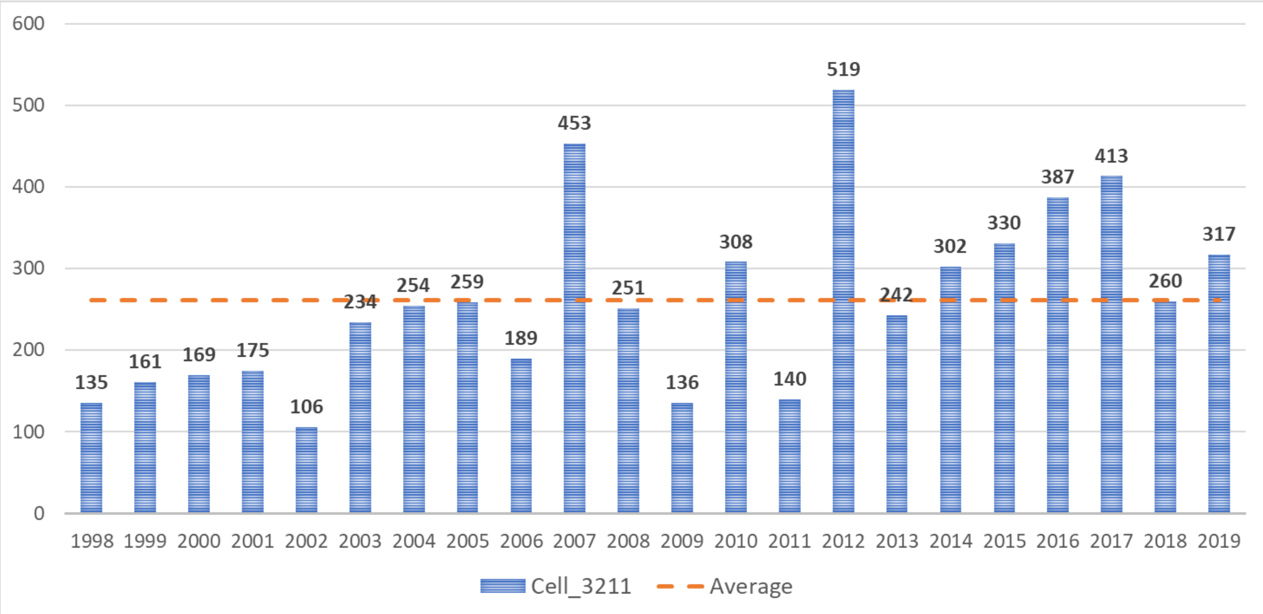

Figure 68: Cumulative yearly rainfall data of the cell 3211 of TRMM database

From the data available the average cumulative monthly was calculated and the average trend is presented below.

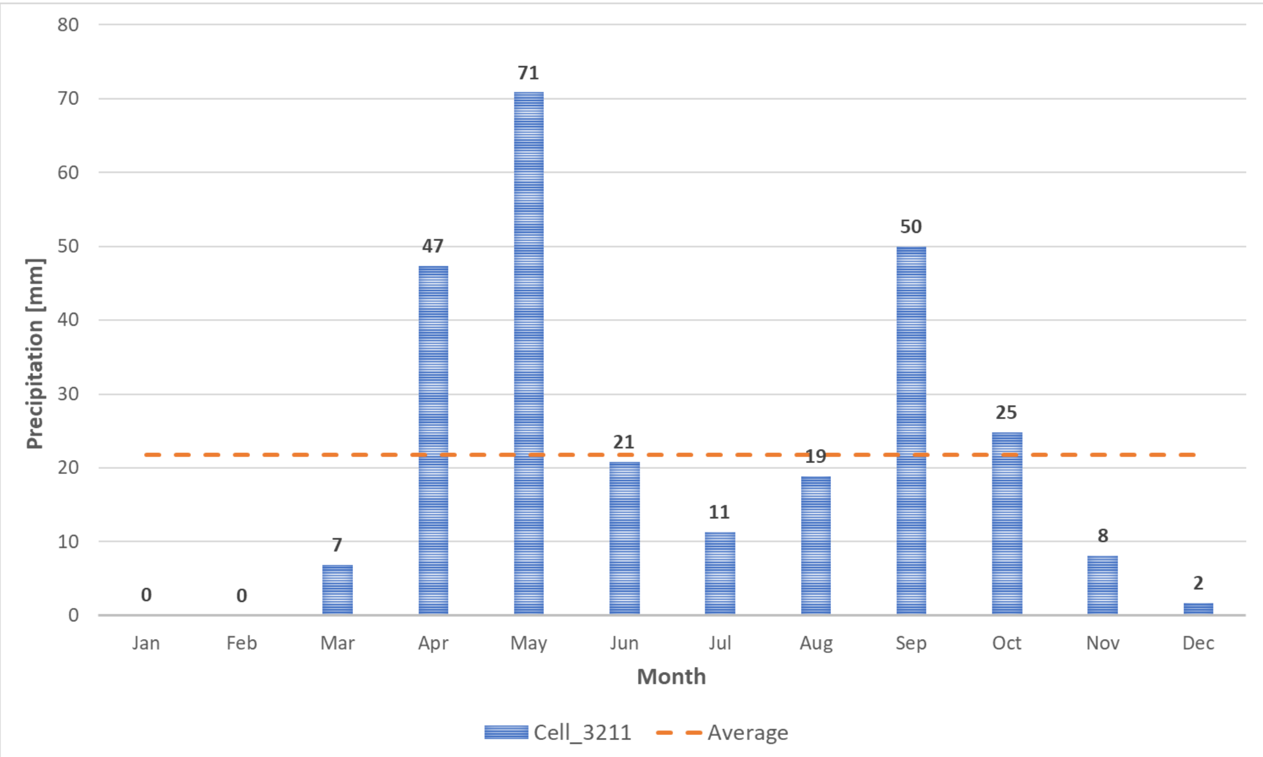

Figure 69: Average cumulative monthly rainfall data of the cell 3211 of the TRMM database (1998-2019)

According to the data, the rainfall peaks usually occur during the months of April/May and during September/October. The very dry period extends from November to March.

Flooding analysis

As part of the precipitation analysis, it is crucial to assess the potential impact of rainfall on flooding risks within the project area. By analyzing the topography, it is possible to determine whether the selected site is prone to water accumulation, which could compromise the functionality of the planned structures.

For this assessment, contour lines were extracted using the Copernicus 30m Digital Terrain Model (DTM) to identify potential depressions or confirm whether the area's topography allows for proper water drainage during rainfall events.

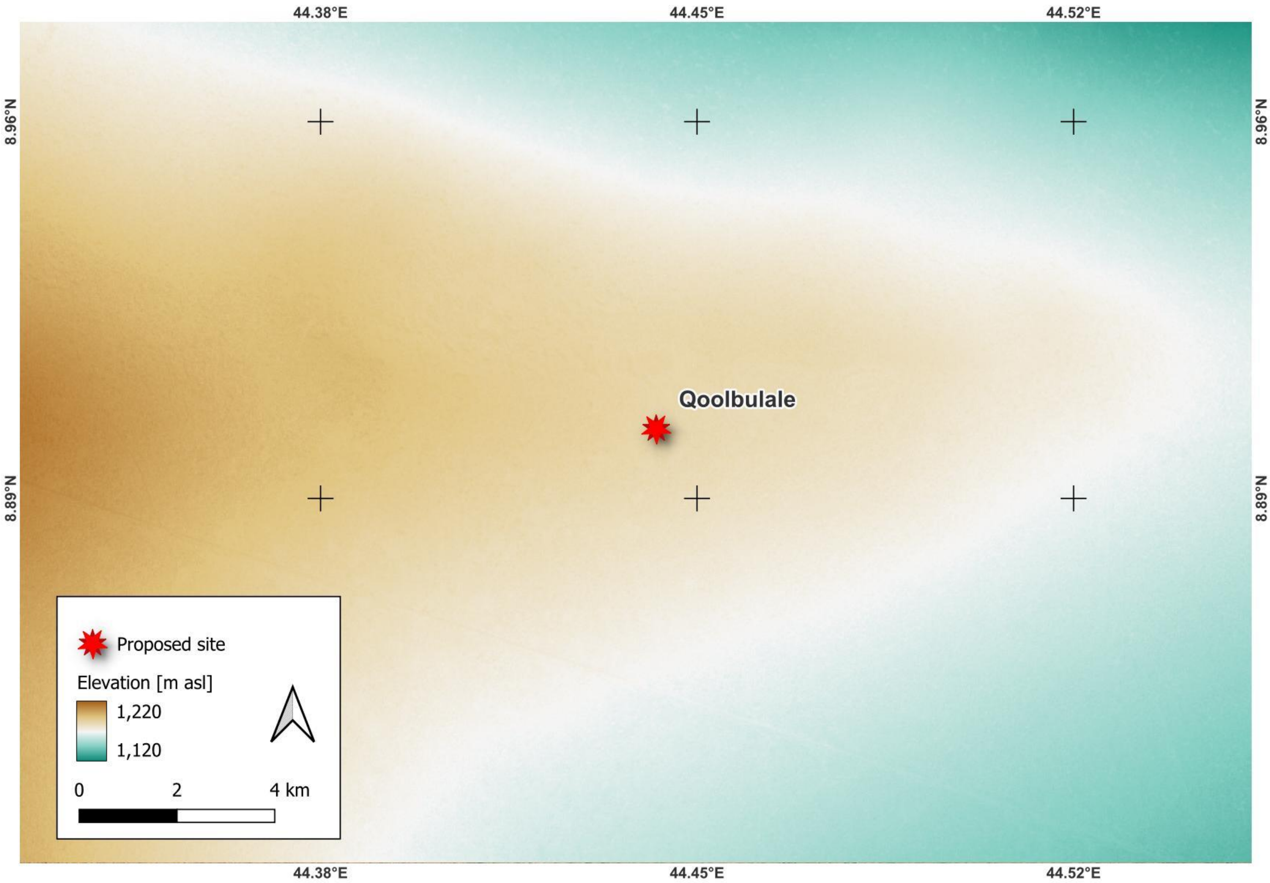

Figure 70: DEM in the proposed area of interest

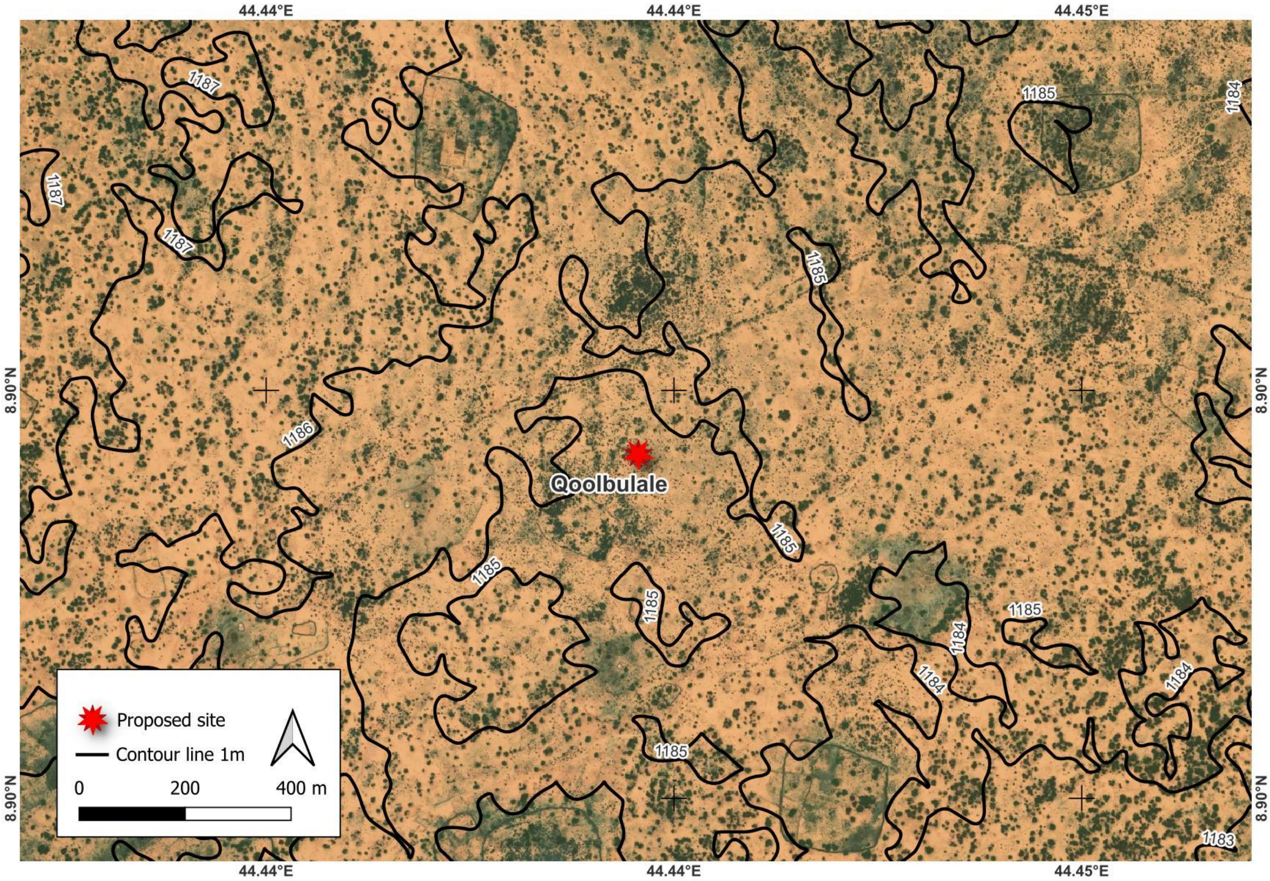

Figure 71: Contour lines in the proposed area of interest

As shown in the figures above, the site is located on a watershed divide, ensuring that it is not situated on a flow path. Furthermore, on a smaller scale, the terrain appears flat, with no issues of water accumulation or flooding.

However, it is essential to emphasize the importance of proper site preparation during construction. Measures such as clearing the area and ensuring that heavy machinery operations do not create water stagnation issues are crucial. Additionally, efforts should be made to restore, or ideally improve, drainage conditions through appropriate earthworks and site grading at the completion of the works.

Climate Change

The evaluation of climate change impacts on the project site is crucial for accurately estimating changes in water demand and needs during the dry season over the long term, ensuring the project’s future viability.

The analysis of the climate change presented follows the data of the Climate Change Knowledge Portal[11]. The site presents Somalia's projected climate and offers CCKP's complete suite of indicators for in-depth analysis into future climate

[11] https://climateknowledgeportal.worldbank.org/country/somalia/climate-data-projections

scenarios and potential risks due to changing climates. Data can be investigated as either the projected mean or anomaly (change) and is presented spatially, as a seasonal cycle, time series, or heat plot, which shows seasonal change over long-term time horizons. Data can be analyzed as annual or seasonal and it is possible to select different projected climatology and emission scenarios, or Shared Socioeconomic Pathways (SSPs). SSPs are meant to provide insight into future climates based on defined emissions, mitigation efforts, and development paths.

Indicators can be investigated either as a multi-model ensemble or by individual model. Multi-model ensembles represent the range and distribution of the most plausible projected outcomes of change in the climate system for a selected SSP, while individual models can help to better understand variability across projected climates.

Climate projection data is modeled data from the global climate model compilations of the Coupled Model Inter-comparison Projects (CMIPs), overseen by the World Climate Research Program. Data presented is CMIP6, derived from the Sixth phase of the CMIPs. The CMIPs form the data foundation of the IPCC Assessment Reports. CMIP6 supports the IPCC's Sixth Assessment Report. Projection data is presented at a 1.0º x 1.0º (100km x 100km) resolution.

Climate Change Impacts on Average Precipitation Pattern

According to the Climate Change Knowledge Portal, the projection of precipitation changes in Somaliland appears to highlight a small increase in precipitation throughout the year, most likely due to a slight increase in the intensity of the extreme event.

The precipitation percent change anomaly in the Woqooyi Galbeed region is shown below for the most conservative SSP5-8.5 scenario.

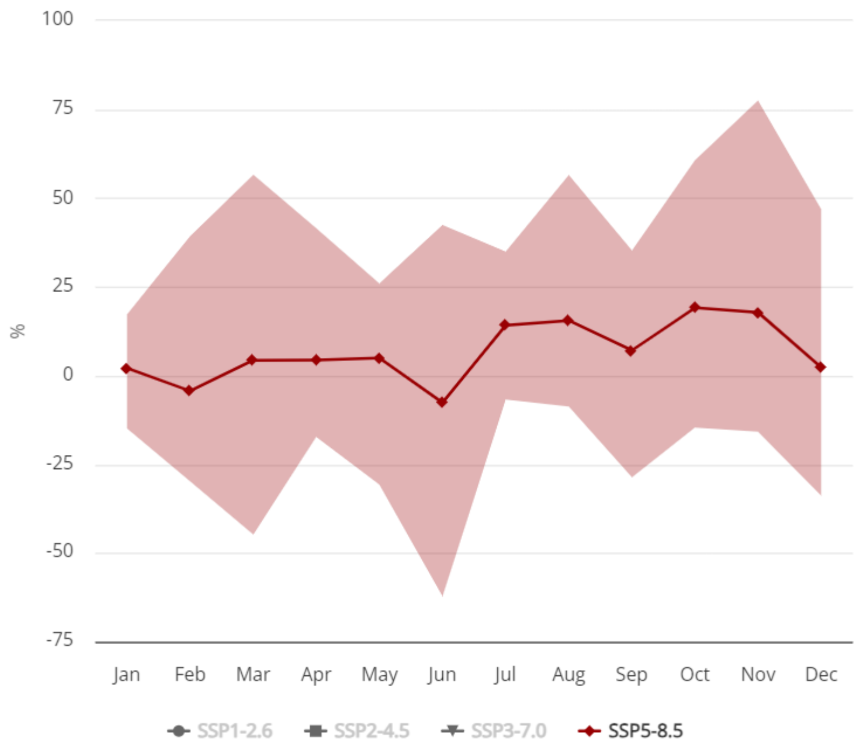

Figure 72: Projected precipitation percent change for 2020-2039 Woqooyi Galbeed region, Somaliland; (reference period: 1995-2014), SSP5-8.5, Multi-Model Ensemble

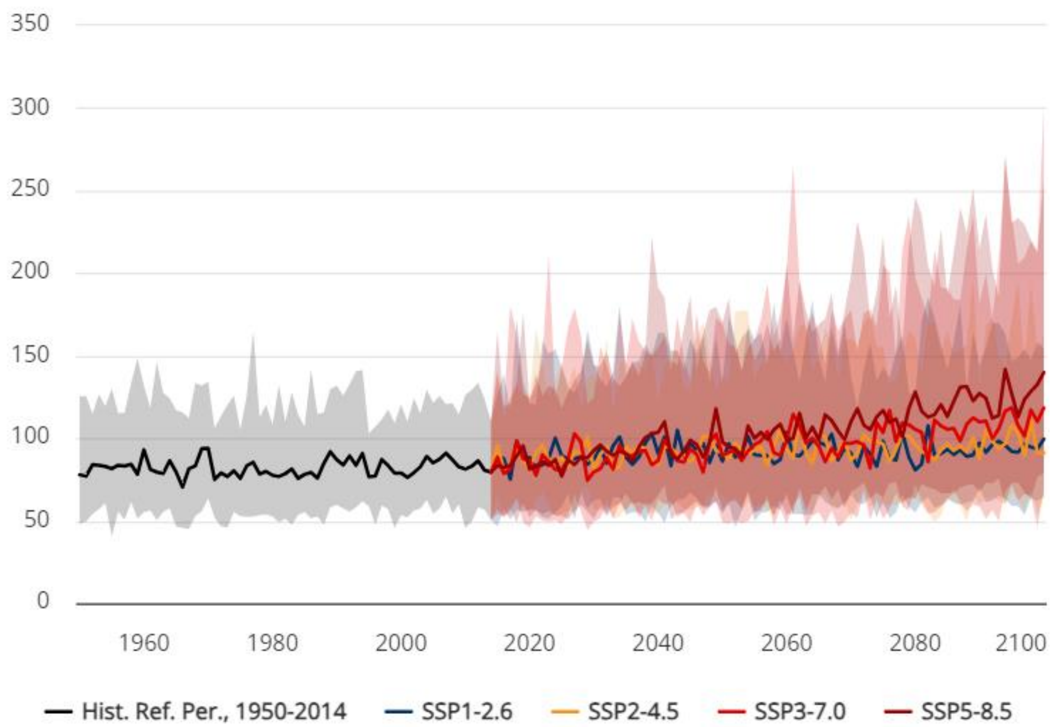

Figure 73: Projected precipitation percent change Woqooyi Galbeed, Somaliland; (ref. period: 1995-2014), Multi-Model Ensemble

From the graphs above it is possible to understand that in the long term a little increase in the precipitation, mainly in the July-November period, is expected. As a result, the water issues faced by the community are unlikely to intensify significantly due to climate-related shifts in precipitation. This stability in rainfall patterns suggests that the new water point will continue to meet community needs.

Climate Change Impacts on Dry Periods

This analysis focuses on the impacts of climate change on water availability for the community, particularly by examining the projected maximum number of consecutive dry days. As dry periods extend due to shifts in climate patterns, consecutive days without rainfall can place substantial pressure on local water resources. By evaluating this critical metric, we aim to understand how prolonged dry spells may affect water availability and the resilience of water supply systems in the community. This approach enables the development of proactive strategies for water management that address potential risks associated with extended dry periods in a changing climate.

Below is presented the projected maximum number of consecutive dry days for the worst-case scenario of SSP5-8.5.

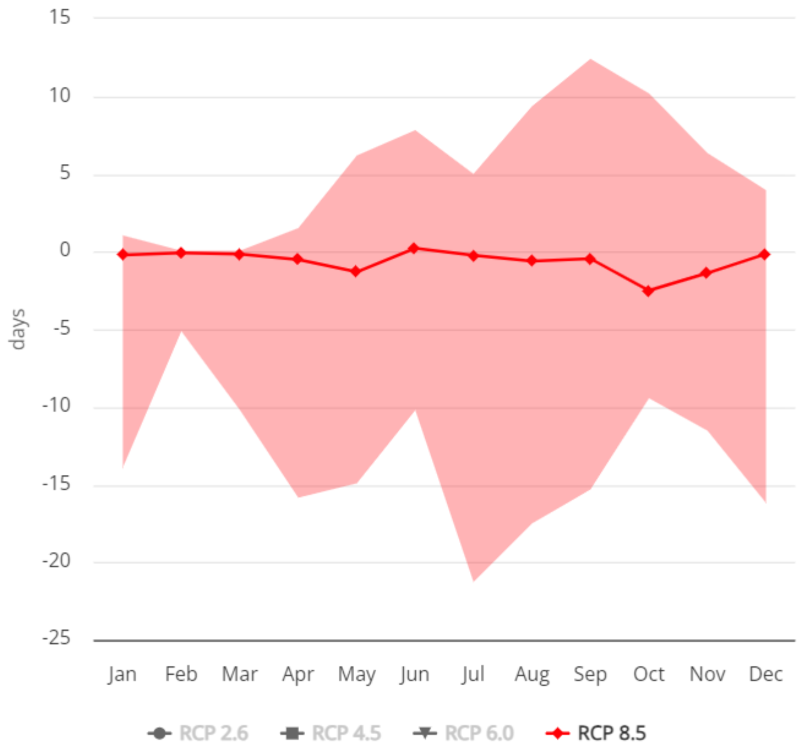

Figure 74: Projected max number of consecutive dry days anomaly for 2020-2039 Woqooyi Galbeed region, Somaliland; (reference period: 1986-2005), SSP5-8.5, Multi-Model Ensemble

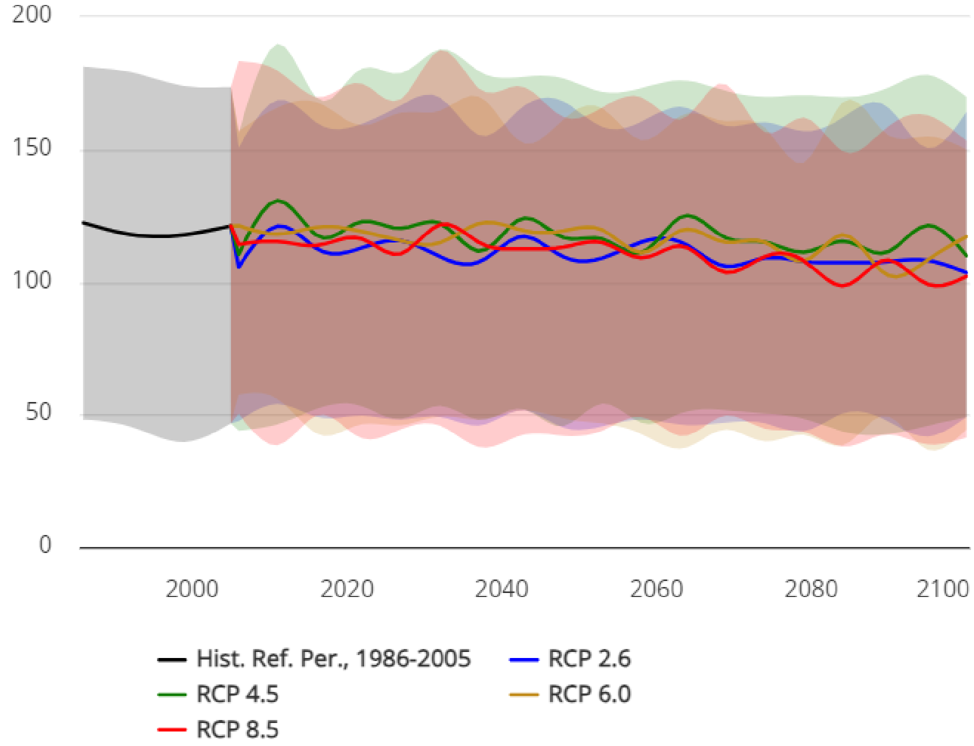

Figure 75: Projected max number of consecutive dry days Woqooyi Galbeed region, Somaliland; (ref. period: 1986-2005), Multi-Model Ensemble

The analysis for the maximum number of consecutive dry days is roughly zero in the projection for the next 20 years, with a trend that highlights a shortening of the dry season, indicating that the new water point will provide sufficient water supply even in the future. This stability in dry periods suggests that the community will have reliable access to water resources, ensuring that the water point will effectively meet both current and anticipated future needs without significant strain.

Furthermore, the data suggests that prolonged drought events are unlikely to increase in frequency over the next two decades. This reinforces the long-term reliability of the new water point, as climate-driven reductions in water availability are not expected to pose a significant challenge.

However, while climate projections indicate stability in dry periods, another factor to consider is the potential increase in demand due to the presence of the new water point itself. The availability of a reliable water source may attract additional beneficiaries, leading to a rise in consumption. At present, the water point is capable of meeting approximately 58% of the total water demand, assuming a 12-hour daily pumping schedule in line with international standards. Any significant increase in demand would exceed the current system's capacity, making the design and construction of additional water points essential to ensure sufficient supply for the growing number of users, in case of positive results of this first one.

Annex 8: Site Waste Management Plan (SWMP) for Qoolbulale Borehole Project

Purpose and Scope

The Site Waste Management Plan (SWMP) provides a structured approach to the identification, minimization, handling, storage, transport, and disposal of all waste generated at the site during the site preparation, drilling, and construction phases of the project. It applies to both hazardous and non-hazardous waste, in order to:

- Protect soil, water, and air quality;
- Reduce health and safety risks to workers and communities;
- Comply with national environmental regulations and the ESMP;
- Support responsible, traceable waste handling and disposal.

Key Waste Streams

Waste Type	Typical Source	Classification
Drill Cuttings	Rock and soil fragments brought up by the drilling process	Non-hazardous
Spent Drilling Mud	Water-based fluid used during drilling	Non-hazardous (WBM), may contain residual additives
Used Oil / Lubricants	Generator and rig maintenance	Hazardous
Fuel Residues and Spills	Diesel storage and refueling areas	Hazardous
Solid Domestic Waste	Workers' camps, packaging, food waste	Non-hazardous
Plastic and Packaging	Materials for pipes, pumps, equipment	Non-hazardous (recyclable)
Sanitary Waste (if latrines used)	Worker sanitation areas	Potentially hazardous

Roles and Responsibilities

- **Contractor's ESHS Officer**: Develops, updates, and implements the SWMP. Oversees training and daily supervision.
- **All Site Workers**: Comply with waste segregation, disposal protocols, and reporting of spills.
- **PIU Safeguards Team**: Reviews the SWMP, conducts inspections, and verifies records.
- **MoECC (Regulator)**: May inspect storage and disposal practices in line with national standards.

Waste Handling and Management Procedures

a. Waste Minimization

- Select low-waste drilling techniques (e.g., efficient mud circulation).
- Order materials in precise quantities to reduce surplus and packaging waste.
- Reuse drilling mud where feasible before disposal.

b. Segregation and Labeling

- Separate waste into hazardous, non-hazardous, and recyclable categories at source.
- Use labeled containers or pits for each waste type.
- Never mix used oil, muds, or sanitary waste with general solid waste.

c. Temporary Storage

- Designate a fenced, lined Waste Storage Area (WSA) away from the borehole and community.
- Store:
    - **Hazardous waste** in sealed drums or secondary-containment trays;
    - **Used oil** in clearly labeled drums on impermeable surfaces;

- **Cuttings and muds** in lined pits, protected from runoff or overflow.

d. Treatment and Disposal

- **Drill cuttings and muds**: Dry in evaporation pits, then backfill on-site in non-sensitive areas.
- **Used oil and lubricants**: Store for collection by an approved handler; or, safeguard and coordinate disposal with MoECC.
- **Solid domestic waste**: Where no licensed disposal facility is available within a practical radius, the contractor shall implement controlled burial of non-hazardous solid waste, using lined and covered pits, sited and managed according to World Bank EHS Guidelines and approved by the PIU and MoECC. If a licensed landfill or collection system becomes available, waste shall be diverted there.
- **Sanitary waste**: Use sealed pit latrines or septic tanks with proper siting and decommissioning.

Spill Prevention and Response

- Place spill kits (absorbents, gloves, shovels) at fuel storage, refueling, and maintenance areas.
- Conduct weekly inspections for leaks or improper storage.
- Train workers on spill containment and reporting procedures.

Waste Tracking and Documentation

- Maintain a Waste Register with quantities, types, and disposal dates for all waste streams.
- Log any incidents, including spills, improper disposal, or community complaints.
- Submit monthly waste reports to the PIU Safeguards Team.

Monitoring and Improvement

- Include waste handling indicators in contractor performance audits.
- Use inspection checklists during weekly site visits.
- Revise the SWMP as needed in response to:
    - New waste streams,

- Monitoring results,
- Incident investigations,
- Regulatory guidance.

Conclusion

The Site Waste Management Plan is a critical tool for ensuring that the borehole project protects human health and the environment. It must be fully integrated into the Contractor's ESMP (C-ESMP) and reflect both national requirements and the project-specific mitigation measures outlined in the ESIA/ESMP.

Annex 9: Emergency Response Plan (ERP)

Qoolbulale Borehole Project, Togdheer Region, Somaliland

Objective

The purpose of this ERP is to:

- Protect workers, nearby communities, and the environment from serious harm,
- Ensure rapid, coordinated, and effective response to emergency situations,
- Comply with World Bank ESF requirements and national HSE obligations,
- Minimize damage to property and interruption to project activities.

Scope

The ERP applies to all project phases during which site-based activities take place, specifically:

- Site clearance and preparation
- Drilling and well development
- Pump and tank installation
- Early commissioning and handover

It applies to all personnel (contractor, subcontractors, consultants, community workers) and extends to interactions with local stakeholders and environments.

Anticipated Emergency Scenarios

Emergency Type	Description	Severity
Fuel or oil spill	Diesel leak during refueling, storage failure	Moderate
Fire or explosion	Ignition of fuel near generator or storage drum	High

Emergency Type	Description	Severity
Equipment-related injury	Crush, entanglement, or fall during lifting or rig operation	High
Drilling mud overflow	Lined pit breach or improper management during circulation	Low
Medical emergency	Heat stroke, fracture, or acute illness on site	Moderate
Conflict or intrusion	Unauthorized access or community conflict	Moderate
Extreme weather	Flash flood or high winds damaging structures or disrupting access	Moderate
Sanitary hazard	Latrine or greywater system overflow or contamination	Low

Roles and Responsibilities

Role	Responsibility
Site Emergency Coordinator	Lead on-site response, decision-making, communication with external parties (MoWRD, MoECC)
Contractor's ESHS Officer	Maintain readiness, conduct drills, inspect emergency supplies, lead root cause analysis post-event
All Supervisors / Team Leads	Account for workers, activate alarms, secure equipment, ensure evacuation routes are used
First Aid Officer	Administer immediate aid, stabilize injured person, communicate with health facilities
Watchman / Security Guard	Secure perimeter, control site access during and after the emergency

Emergency Preparedness Measures

- Site layout must clearly show:
    - Emergency assembly point
    - Location of firefighting equipment and spill kits
    - Storage areas for fuel, oil, and chemicals
- Minimum supplies per site:
    - 2 fire extinguishers (ABC-rated)
    - 2 spill containment kits (absorbent pads, gloves, plastic sheeting)
    - 1 stocked first-aid kit with wound care and emergency medications
- Communication tools:
    - Radio or mobile phone with airtime backup
    - Emergency contact list posted in Somali and English
- Training:
    - Induction for all workers on emergency procedures
    - Fire response and spill drill every 30 days
    - Toolbox talks every week covering rotating risks (e.g., fuel handling, weather)

Response Procedures

A. Fire or Explosion

- Activate alarm (shout or use whistle)
- Shut off fuel supply and evacuate to assembly point
- Use fire extinguishers if safe to do so

- Contact local authorities and PIU focal point immediately

B. Fuel/Oil Spill

- Stop source of spill
- Use spill kit to contain and absorb
- Remove contaminated soil and store in sealed bags for safe disposal
- Record spill in incident log; notify PIU if >10 liters

C. Medical Emergency

- Remove victim from danger
- Apply first aid
- Transport to nearest health facility (Burco hospital or designated clinic)
- Complete incident report within 24 hours

D. Drilling Mud Overflow

- Isolate area
- Repair pit liner or create temporary berm
- Remove contaminated material if needed
- Report and photograph for records

E. Community Conflict or Access Incident

- Notify Site Emergency Coordinator
- Avoid confrontation
- Engage community liaison or VDC focal point

- Temporarily halt work until resolved

F. Severe Weather

- Cease work during lightning, high wind, or flash floods
- Secure equipment
- Evacuate if necessary; reassess site before resumption

Incident Reporting and Follow-up

- All incidents must be recorded in the Incident Logbook maintained by the ESHS Officer.
- High-severity events (injury, environmental release, fire) must be reported to:
    - MoWRD PIU within 24 hours,
    - MoECC if environmental harm occurred,
    - World Bank task team leader, if applicable.
- A Corrective and Preventive Action Report (CAPA) must be completed for each significant incident.

Community Involvement and Communication

- Emergency contact numbers shared with Village Development Committee (VDC).
- At least one community meeting held during mobilization to explain emergency signals and procedures.
- A community liaison officer designated to relay emergency updates if any off-site impacts occur.

Conclusion

This Emergency Response Plan must be incorporated into the Contractor's Environmental and Social Management Plan (C-ESMP), reviewed by the PIU and supervising engineer, and tested through simulation drills. It is a living document and will be updated based on site conditions, incidents, or regulatory guidance.

Annex 10: Voluntary Land Donation Documents

PRIVATE VOLUNTARY LAND DONATION FORM FOR THE SL GW4R PROJECT

ITEM	DESCRIPTION
Sub-project name:	Qoolbuule Borehole
Sub-project description:	Drilling borehole with required infrastructure (caretaker room, engine room, toiles, kiosk, water tank, solar panels with respective fencing etc) and pipeline route from the borehole to the village.
Project Location:	**Qoolbuulale**
GPS coordinates of land required:	**8.895° N, 44.422° E**
Private land legal owner and relatives consulted:	1. Mustafe Cumar Xandule 2. Hinda Bilaal Xandule 3. Jamaad Ibraahin Diiriye 4. Basra Bilaal Xandule

Please attach the community minutes and summary safeguards report explaining how the requirements for use of land for this sub-project have been met.

TERMS OF THE AGREEMENT

As discussed, in on *15/06/2025.* with all owners and family members of the owner. We the legal owner confirm that the following issues were discussed and we are in unanimous agreement.

1. That "We, the land owners who have provided the land mentioned above, hereby confirm that we provided this land, which is being used for GW4R project of drilling borehole with required infrastructure (caretaker room, engine room, toiles, kiosk, water tank, solar panels with respective fencing etc) and pipeline route from the borehole to Qool-Bulale village to close water to community. We confirm that we donated this land voluntarily, with full awareness and understanding.
2. We were consulted and are aware of the design and location of the infrastructure and understand the impacts that this may have on the surrounding area e.g., access paths, gathering of livestock and people, influx of households, grazing patterns,
3. We understand that we can refuse the use of this land for the activity;
4. The amount of land being donated for the borehole is minor and will not reduce the remaining land area below that required to maintain anyone's livelihood at current levels (300mx300m);
5. No household relocation is involved;

1

6. The donors of the land will benefit directly from the project; and
7. The land set aside for the investment may be made public land and no one is claiming individual ownership, and no alternative claims will be made later on the land.
8. We have all agreed unanimously that the project implementation should continue.
9. The land is donated/identified as a public property in consultation owners of the land.
10. All owners and regular users of the land agreed to this investment and donation of the land without coercion, manipulation, or any form of pressure on the part of public or traditional authorities.
11. The land is free from encumbrances or encroachment and is not claimed by any individual and its ownership is not contested.

We the legal owner of the land: (____________________________,

_____Date___________________________,________________________________,

Confirm the above information to be true and that we have resolved to abide by ALL terms of this agreement. (Please attach minutes of the community meeting including the signed attendance sheet and photos of the meeting).

No.	Name	Village/Location	ID/No./Phone number	Date	Signature
1.	Mustafe Cumar Xandule	Qoolbuulale	063 4086126	16/06/2025	
2.	Hinda Bilaal Xandule	Qoolbuulale	063 4130724	16/06/2025	
3.	Jamaad Ibraahin Diiriye	Qoolbuulale	063 6187381	16/06/2025	
4.	5. Basra Bilaal Xandule	Qoolbuulale	063 8914823	16/06/2025	

Agreed/ **Witnessed on this by:**

1. **District Administrator**

Name	ID/No./cell number	Date	Signature& Stamp
Eng. Maxamed Cabdi Haaroye	063 7198809	16/06/2025	MAYARKA DEGMADDA SALAXLEY / MAYOR OF SALAHLEY DISTRICT

2. District representative of Ministry of Water Resource Development:

Name	ID/No./cell	Signature & Stamp
Maxamuud Gahayr Cilmi	063 4403597	

MAAMULKA DEGMADA SALAHLEY ★ MAAMULAHA WASAARADA H. KHAYRAADKA BIYAHA

MAAYARKA DEGMADDA SALLAHLEY ★ MAYOR OF SALAHLEY DISTRICT

3

JAMHUURIYADA SOMALILAND
WASAARADA CADDAALADA
XAFIISKA NOOTAYADA SHIDE

REPUBLIC OF SOMALILAND
MINSTARY OF JUSTICE
SHIDE PUBLIC NOTARY

Xafiiska nootaayadu waxa uu ku yaala Saldhiga Qudhac dheer ka soo hor jeedkiisa ama la xidhiidh 4410690 4485833

Date:-16/06/2025

REF.XNSHSH/317/2025

Hargeysa

KU:CIDAY KHUSAYSO

UJEEDO:-CADEYN AHNA BIXIN DHUL DHAN 300MX300M

Maanta oo ay taariikhdu tahay **16/06/2025** Waxa Xafiiska Nootayadda sharciga ah ee shide public notary ka hor dhacay **CADEYNTA** , kuna qodobaysan sidan hoos ku xusan, isla markaana ay saxeexeen dhamaan dhinacyada hoos ku xusan .

Anaga oo ah mulkiilayaasha dhulka ku yaala deegaanka QoolBulale Ee degmada Salaxley waxa aanu halkan ka cadeynaynaa anaga oo miyir iyo maanba qabna in dhulkaa laga hirgalinayo ceel biyoodka **{Riiga}** oo cabirkiisu yahay **300mx300m** Aanu bixinay una hibeynay si looga hir geliyo dhismaha ceel biyoodka iyo dhamaan inkaaniyaadka la socda ceelka sida **{qolka waashmaanka, qolka mashiinka, solarta, taangiga, kiyooska, laba suuli iyo lix dar oo ay xooluhu ka cabayaan iyo waxii kale ee looga baahdo dhameystirka shaqada celka}** iyada oo si cad loo qeexayo masuuliyadaha labada dhinac.

1. Anagoo ah mulkiilayaasha dhulka ku yaalla tuulada Qoolbulale ee Degmada Sallaxley, waxaanu halkan ku caddeynaynaa inaanu dhulkan si mutadawacnimo ah ugu hibeynay ceel biyoodka Qoolbulale iyo adeegsiga arimaha loo qorsheeyay ee kor ku xusan, Sidaas darteed, waxaanu si rasmi ah ugu wareejinay dhulkan **Wasaaradda Horumarinta Khayraadka Biyaha**, anagoo si buuxda u oggol oo miyirqabna, islamarkaana aanay jirin cid nagu qasabtay bixinta dhulkaasi.
2. Waxaan ognahay naqshadda iyo goobta ay ku dhacayaan ceelka iyo kaabayaasha la dhisayo, waxaanan fahansanahay saameynta ay ku yeelan karto deegaanka, sida waddooyinka laga gali karo ee xoolaha iyo dadku isugu imaanayaan iyo hab-raaca daaqsinka.
3. Waxaan fahamsanahay inaanu xaq u leenahay in aan diidi kareynay isticmaalka dhulkan ee ujeedada mashruuca.
4. Cabirka dhulka aan hibeyneyno waa mid yar, mana saameynayo baaxadda dhulka hadhay ama nolosha cidkale dhulkaas oo dhan **300mx300m**.
5. Majiraan qoysas daganaa goobta mashuruuca laga fulinayo oo la bara kicinayo.
6. Dadka dhulka hibeynaya si toos ah ayay uga faa'iideysanayaan mashruuca.
7. Dhulka loo asteeyey maalgelinta waxaa laga dhigayaa hanti dadweyne; cid gaar ah ma sheeganayso lahaansho iyo dacwad kalena lama keeni doono mustaqbalka.
8. Dhammaantayo waxaan siwadajir ah u go'aansanay in fulinta mashruuca la sii wado.
9. Dhulka waxaa loo aqoonsaday hanta dadweyne iyada oo lala tashaday mulkiilayaasha dhabta ah.
10. Dhammaan mulkiilayaasha iyo dadka si joogto ah u isticmaala dhulkan waxay si xor ah, iyaga oo aan la qasbin, u oggolaadeen maalgelinta iyo hibeynta dhulkan.
11. Dhulku waa xor oo mulkiilayaashii waxay u bixiyeen si mashruuca looga fuliyo, mana jirto cid sheeganaysa iyo muran ku saabsan lahaanshihiisa.

SHIDE PUBLIC NOTARY
MOB:063-4410690

MAGACYADA MULKIILAYAASHA BIXIYAY DHULKAA IYO SAXEEXOODA

1. Mustafe Cumar Xandule Tell:-063-4086126____________________

2. Hinda Bilaal Xandule Tell:-063-4130724____________________

3. Jamaad Ibraahim Diiriye Tell:-063-6187381____________________

4. Basra Bilaal Xandule Tell:-063-8914823____________________

MAGACYADA MARAGYADA GHOOB JOOGA AH IYO SAXEEXOODA

5. Caaqil Shaqale Caaqil Cumar Cabdi Tell:-063-4482732____________________

6. Maxamuud Gaheyr Cilmi Tell:-063-4403597____________________

. CADAYNTA XAFIISKA NOOTAYADA

Xafiiska Nootayada SharcigaEe Shide Notary,waxa uu cadaynayaa in qoraalkan cadeynta ahi ka hor dhacay loona wada akhriyay labada dhinac si taxadarleh.

KHAALID MUUSE SHIDE

SARKAALKA XAFIISKANOOTAAYADDA SHARCIGA AHEE SHIDE

PUBLIC NOTARAY

SHIDE NOTARY ★MOB:063-441069

بسم الله الرحمن الرحيم

JAMHUURIYADDA SOMALILAND

Wasaarada Cadaalada Samaliland

Xafiiska Nootaayada Sharciga Ah Ee Joofle Public Notary

Email: Joofle10@gmail.com. And Contact Tell: 063-4487022/063-4763491 Sallaxley-.

REF:- X_JPN/107/2025 TAARIIKHDA:- 16/06/2025

UJEEDO:- HESHIIS DHEX MARAYA GUDDIGA HORUMARINTA TUULADA QOOLBULALE IYO WASAARADDA HOUMARINTA KHAYRAADKA BIYAHA JSL.

Heshiiskan waxa uu ka dhexeeyaa Guddiga Horumarinta Tuulada Qoolbulale ka dib in halkan loogu yeedhayo "Guddiga") iyo Wasaaradda Horumarinta Khayraadka Biyaha Ujeeddada heshiiskan waa in la fududeeyo hirgelinta mashruuca Abaartire ee Qoolbulale laga hirgalindoono gaar ahaan qabtiisa biyo-gelinta ee tuulada Qoolbulale, iyadoo si cad loo qeexayo masuuliyadaha iyo dammaanadaha labada dhinac.

Anaga oo ah Guddiga Horumarinta Tuulada Qoolbulale waxaanu halkan ku damaanad qaadaynaa in dhulka uu mari doono beebka biyaha ee ka imanaya ceelka ilaa Tuulada iyo goobaha laga samayndoono kiyoostooyinka ee Tuulada dhexdeeda.

Dhulkan ayaa ku yaala tuulada Qoolbulale ee Degmada Sallaxley ayaa loo qorsheeyay istimcaalo arimaha kor ku xusan. Sidaas darteed waxaanu ku wareejinay dhulkaasi Wasaaradda Horumarinta Khayraadka Biyaha, anagoo miyirkayaga qabna cid nagu qasabtayna aanay jirin ayaanu saxeexnay.

Saxeexa Guddida Horumarinta Deegaanka

1- Muuse Halac Jaamac Guddoomiye (4015015)__________
2- Deeq Cabdi Xayd Guddoomiye ku-xigeen(4236672)__________
3- Muuse Xasan Diiriye Xoghaye
4- Sayid-Cali Aw-Maxamuud Cilmi Xubin(4405621)__________
5- Cismaan Axmed Xasan Xubin(4727891)__________
6- Muuse Aadan Axmed Xubin(7988853)__________

WAKIILKA WASAARADDA:-MAXAMUUD GAHAYR CILMI (4403597)

Aigoo ah Isuduwaha Wasaarada Horumarinta Khayraadka Biyaha ee Degmada Sallaxley oo ka wakiil ah Wasaarada Biyaha waxaan cadaynayaa in Heshiiskan iyo qodobadiisaba aan aqbalay isla markaasna aanu fulin doono wixii Wasaaradda khuseeya.

Isuduwaha Wasaarada Biyaha Sallaxlety

Heshiiskan waxa lagu Hor saxexay Xafiiska Nootaayada Sharciga ah ee joofle Public Notary

Heshiiskan waxa ay labada dhinac ku saxeexayaan oggolaansho buuxa iyo faham guud oo ku saabsan dhammaan qodobbada kor ku xusan.

Xafiiska Nootayada Joofle Public Notary Waxuu Cadaynayaa In heshiiskani sare Ku Xusani Hortiisa Ka dhacay Dhinacyaduna Isku Waafaqeen

MAXAMED SH.CALI IBRAAHIM
SARKAALKA NOOTAAYADA SHARCIGA AH EE JOOFLE PUBLIC NOTARY

Annex 11: Social Summary Report

Social Summary Report for Abaartire Projects (max 5 pages)

For

Qoolbulale Village New Borehole Salahlay District, Maroodijeeh Region

Draft

February 27st, 2025

Annex 1 of ESMP: Social summary report for Abaar Tire sub-projects (max 5 pages). Please attach community engagement minutes, voluntary land donation/agreement documentation, screening form

Proposed sub-project: SalahleyVillage/district/state: Salalay Total no. of households who will use the water point_700HH.

Other than technical selection, why was this site chosen for new compared to other sites (need/distance/challenge with nearest to water point/inclusion etc)

Qoolbulale faces acute water scarcity, with the community primarily relying on a few privately owned berkads and a recently constructed seasonal haffir dam located near the village. Water from the haffir dam is distributed through kiosks one situated within the village and another at the dam site to serve both local residents and surrounding rural communities. However, these sources are seasonal and often insufficient to meet year-round demand. During the dry season, additional water is transported by trucks from alternative sources such as Salahley, located approximately 35 kilometers away. These trucks supply water to Qoolbulale and surrounding localities in dry season. The community comprises around 700 settled households and approximately 250 nomadic households, resulting in a substantial and continuous demand for water due to the current inadequate water. Access to water is critical for sustaining livestock and ensuring economic stability. Qoolbulale situates on the border between Ethiopia and Somaliland, effectively dividing the village into two sides, both sides have key infrastructure like schools, MCH, and police station. Despite the political boundary, since inhabits are same clan there is no restricted movement across the border which makes Qoolbulale an exemplary candidate for a cross-border groundwater initiative.

Overview of the project location and key features within 200m of works (to understand impacts): The proposed site for drilling the borehole and constructing associated infrastructure including animal troughs, a water tank, a caretaker's room, and a solar power system is located approximately 4.5 kilometers north of Qoolbule. While there is no formal road directly leading to the site, it remains accessible. The land, situated within Qoolbulale, is privately owned; however, the landowners have expressed strong support for the development initiative and have voluntarily donated a 300m x 300m plot for the project. In addition, the local community committee has committed to donating any land required for the installation of water distribution pipelines to the village, allowing engineers to carry out designs and installations in accordance with technical specifications. There are currently no existing structures, reservoirs, or barkads within the designated 300m x 300m project area. The proposed borehole site falls within the corner of a **life-fenced** boundary owned by a local resident; however, the demarcated land has not been structured or cultivated. While charcoal production is **present** in other parts of the broader Qoolbulale community, the project site is distinguished by its naturally preserved vegetation, including trees and shrubs, which the landowners actively protect from deforestation. There are no internally displaced persons (IDPs) or unintegrated minority groups residing in the vicinity. Although several Gabooye households are present in the village, they are fully integrated into the community. Members of these households are actively engaged in social and economic life, serving as teachers, mosque Imam, and entrepreneurs—such as teashop and shop owners—demonstrating a high level of social inclusion and community cohesion in any social dynamics.

Key stakeholders and how they were consulted and engaged for the proposed sub-project activities to ensure broad agreement, ownership and risk identification and mitigation

Stakeholder group	Influence in the sub-project	Interest	How were they consulted? (Separate meetings)	How many consulted from that group?	Were there challenges to their engagement?	Key concerns and how they will be addressed
Women	High influence	They are highly interested in construction of new borehole	Attended general consultation meeting and separate meeting even visited their business places or homes to acquire water related information.	28 members	There is only one kiosk in village and there is not household connection due to the limited of quantity of water	**They mentioned that:** ✓ Qoolbulale has a functional Water Management Committee contains 3 female and 4 male members underscoring both their commitment and capacity to manage water resources sustainably. ✓ A dedicated focus group discussion was conducted with 28 women from Qoolbuulale, including both businesswomen and housewives but their broader involvement in formal community leadership and decision-making processes remains limited. ✓ The session revealed that approximately 80% of the women in the area are actively participating in

						afternoon Islamic Studies classes, led by a local teacher from the **Gabooye** clan, Notably Gabooye, are now fully integrated into the broader community, with no reported instances of discrimination. ✓ The women also highlighted the positive influence of the **Alla Aamin Women Association** in promoting social inclusion and cohesion. ✓ Furthermore, the community demonstrated an organized and inclusive water management functional system. Participants expressed their willingness to adopt household connection and pay for services through tap meters. ✓ The Village Development Committee is composed entirely of five male

						members, with no female representation. ✓ Although the community has an active and functional Water Management Committee (comprising 3 women and 4 men) and a single public kiosk, there are currently no household water connections due to limitations in water quantity. **To address the concern:** ✓ Community members expressed readiness to adopt household water connections and are willing to pay for services through tap meters. ✓ Although the community has an inclusive and functional Water Management Committee capacity building for more understanding and managing is required.

						✓ Even though the current water supply does not support household connections, this project should prioritize the water distribution to the entire village. Enabling household connections will not only improve access but also increase revenue, thereby enhancing their capacity to manage the water point and contribute to operation and maintenance (O&M) costs as well.
Youth	Hight Influenced	They were highly interested	Participated general community consultation meeting	70	No	**In Qoolbulale Village and the surrounding areas, a significant number of young are engaged in charcoal production and frequent khat consumption. These activities are largely driven by the high levels of youth unemployment, which limit access to sustainable and formal job opportunities. Charcoal production, while providing**

						short-term income, contributes to environmental degradation and deforestation, raising concerns about long-term ecological impacts. **Khat consumption, on the other hand, not only diverts time and resources from productive activities but may also contribute to social and health-related challenges among the youth.** **In addition to these informal sectors, some youth have found employment as khat transporters or water tanker drivers occupations that are often unstable and lack formal protections.** **A smaller portion of the youth population works as teachers in local schools or operates their own micro-enterprises, such as mobile charging, airtime services, or small-scale farming initiatives. These self-employment efforts**

						reflect resilience and entrepreneurial spirit, but they are often hindered by limited access to capital, training, and market linkages. **To address the concern:** ✓ During the implementation of this project, the contractor should engage local unskilled labour. ✓ The Women's Association, local elders, and the district administration should conduct awareness campaigns on the harmful impacts of deforestation and khat consumption."

Customary institutions	High Influenced	They were highly interested	They support community mobilization and participated general community consultation meeting	26	No	✓ The Qoolbulale elders play a pivotal role as custodians of customary law, actively contributing to the resolution of any local disputes concerning vital resources such as grazing land, water etc. From time to time, they issue binding directives for the community, which are consistently upheld and respected. But they did not yet decide imposing a ban on charcoal production within the locality which is a distract level issue. ✓ The elders further clarified that the designated site for the borehole, related infrastructure and any pipeline route required are welcoming and committed facilitating related voluntary land donation. ✓ The expected influx is only seasonal, and they seem aware of the minimal

						possibility that an influx of pastoralists could bring either livestock diseases or cause deforestation/degradation.
Pastoralists	High Influenced	They were highly interested	They support community mobilization and participated general community consultation meeting	5 members	No	✓ **Pastoralist communities have indicated that the Qoolbulale area is managed and utilized as privately owned grazing land.** ✓ The land is primarily controlled by settled pastoralist communities who claim ownership, which inclusively

						access by other nomadic pastoralists.
Others?Minority groups				7 members participated		The Gabooye minority group makes up around **2%** of the community members is fully integrated into the community. They live together and there are no divisions that would prevent their participation in management or access to the water.
Total number of people consulted (*check from the CER*) 129						

Has there been any conflict over this land or water resources in the past? If so please describe, what measures the project will take to ensure that project does not exacerbate conflict: Although the community has indicated that there are currently no social conflicts within the village and surrounding areas, the introduction of a new water source through the World Bank-funded project particularly given the large surrounding population may lead to potential disputes over resource access and usage. In light of this, it is essential for the village elders and the community committee to enhance their awareness and preparedness. They should take proactive steps to promote inclusive dialogue, ensure equitable access, and strengthen community engagement mechanisms to prevent possible tensions and to support the sustainable and cooperative use of the new water source. it has been discussed, and they are aware that social conflict cannot be ignored in the context of water source usage by different communities and will take proactive steps to prevent/mitigate any related conflict.

1. **Has a safeguards field visit been undertaken to the site?** Yes, **Date of visit:** Yes, **Date of visit:** 17/02/2025, Visited **PIU members:** Abdirashiid Ahmed, Hodan Ahmed, Ramla Ali, Huda Ibrahim **Title of visiting:** S&E Team**.**

2. **Will the ESMP be incorporated into the contract for the works and is a safeguards compliance report required before payment?** Yes__

Type of land required for sub-investment and documentation:

a. Government land	Title deed/confirmation document attached?	N/A
b. Community land	Voluntary land donation form and community minutes attached?	Attached
c. Private land	Voluntary land donation form and conversion document attached?	It is private land where land owners announced that this location is for water project and signed private voluntary land donation document with notary. Additionally, pipeline route from Borehole to Village is community land where there is neither cultivation land nor structures therefore, Village Development Committee signed community land Voluntary Donation Notary documents.

3. <u>**Land Agreement:**</u>

a) **How many people own, live on or regularly use the land where the project will be implemented (including those who might use it as a drought fall back area)?** Family owns the land while family members collectively signed land donations documents. **And how many agreed to the use of this land for this public facility?** All family member representatives were agreed that site is to be used as a public water point.

b) Explain how the requirements have been met (and attach minutes, land agreement form and signed participants list):

Requirements for voluntary land donation	**Explanation and evidence**
1. The land required to meet technical project criteria must be identified in conjunction with the affected community?	**Yes,** the site was discussed and mutually agreed upon with the landowners (one family), who have voluntarily donated and signed a Voluntary Land Donation agreement, which has been approved by the Salahley District administration
2. What are the likely impacts of proposed activities on donated land and how were these explained to the community?	**Community members were informed through consultation meetings, additionally, it was informed the possibility of** soil degradation at the site and efforts that will be made to raise awareness among the contractor and water point users.
3. Area of land compared to area owned (no more than 10 percent of the area of any holding can be donated). %	The land voluntarily donated is quite less than 10%.
4. How will the users and occupiers of the land benefit from this sub-project?	The borehole is supposed to supply water to the all residents and nomadic as well, and there are no inhabitants on this project site.
5. What are the conditions of benefiting from this sub-project – connection fees, service charges etc.	The determination of the water service charge will be carried out through a collaborative process involving community elders, Village Development Committee (VDC), Water Management Committee and the Ministry of Water, and the district local government. In setting the tariff, key considerations will include the

	community's willingness and ability to pay. Once the tariff is officially established, all community members will be required to water service charge accordingly. In separate women consultation meeting household connections had been requested and paid their commitment to pay the bill and existing water management committee convinced their fair and transparent connection fee management thought water management detailed model, manual and capacity building is essential to provide.
6. How was the community made aware that refusal was an option and confirmed in writing that they are willing to proceed with the donation? (e.g. at the consultation and in the voluntary land donation document)	During consultation E&S team explained community can decide whether they have willingness to voluntarily donation the land or denied options.
7. What evidence is there that the act of donation was undertaken without coercion, manipulation, or any form of pressure on the part of public or traditional authorities (e.g. photos/videos of community consultation etc.)?	Broad community consultations were carried out to ensure agreement on the location of the upcoming water project and to promote inclusive land use by both communities, whether from Somaliland or the Ethiopian side additionally all related photo and videos attached to ESIA and CER.
8. Do all the users and occupants of this land understand that by donating this land it may be gazetted as public land	Yes, The landowners donated the borehole site with the understanding that it would become designated public property and provided written consent through signed documentation.
9. How was it explained that they have a right to compensation for land and the available	During the community consultation meeting, it was clearly communicated

compensation options (in-kind compensation, land for land compensation or cash compensation, and the implications of cash compensation?	that if the voluntarily donated land exceeds 10% of an individual's total landholding, the landowner is entitled to compensation. Additionally, community members were informed that land donated as voluntary, and they have the right to refuse to donate their land without facing any form of coercion or penalty.
10. Were monetary or non-monetary benefits or incentives requested as a condition for the donation and were these provided?	Owner is one of the beneficiaries.
11. How do you know that the land being donated will not reduce the remaining land area to a level below that required to maintain the donor's livelihood at current levels and will not require the relocation of any household?	Land owner and local committee confirmed that family have large land and E&S team observed and confirmed it and confident that there will be no attempt to reclaim the land in future.
12. Will any structures be moved or any access to land be limited as a result of the sub-project (describe structures and locations)?	There is no any structure in the assigned at the project site.
13. If so, how will they be compensated/facilitated and/or their livelihoods restored?	N/A
14. How was consent provided by all individuals occupying or regularly using the land?	Consultations on the project site were carried out with all community representatives.
15. Was there anyone who did not give agreement and why?	No
16. How was it established that the land to be donated was free of encumbrances or encroachment and was it registered in an official land registry?	N/A
17. All users and occupants of the land have genuinely understood (in local language with sufficient time) and agreed that all conditions	Yes

for land agreement have been met (refer to consultations above and attach minutes).	

4. **GRM: Has the GRM process and contact information for focal points been disseminated to the community? If so, how and to whom (numbers and groups). If not, when will this be done?**

   Initial awareness-raising on the Grievance Mechanism (GM) has been conducted with the community. However, once the drilling borehole contract awarded and the site is handed over to the contractor, it is crucial to initiate a new round of awareness efforts regarding the GM for both community members and the contractor's staff. During this educational and training phase, a female volunteer will be designated as the focal point for Gender-Based Violence (GBV) and the prevention of Sexual Exploitation, Abuse, and Harassment (SEAH). This focal person will receive specialized training on how to use communication channels such as landlines, hotlines, and email to connect with the responsible Project Implementation Unit (PIU) personnel.

5. **GBV/SEAH: Has awareness been carried out on GBV, service providers and confidential survivor centric GBV complaints mechanism? If so, how and to whom (numbers and groups). If not, when will this be done?**

   Gender-Based Violence (GBV) and Sexual Exploitation, Abuse, and Harassment (SEAH) awareness and training will be provided to both the contractor's staff and the VDC, including selective community members when the contract is signed. This aims to raise awareness about all GBV/SEAH related issues and emphasize the prohibition and zero tolerance for any violations against women and children.

6. **Sustainable management: Who will manage and maintain the sub-project, and how will repairs be funded?**

   The Ministry is responsible for organizing training programs for water point operators and conducting significant repairs and replacements of costly equipment. These activities require advanced skills that may not be available within the community but are essential for the efficient functioning of the system and the long-term sustainability of water resources. The Village Development Committees (VDCs) are tasked with managing the water point and collecting water usage fees. They should actively engage in discussions with the Ministry of Water and the district administration to establish appropriate water tariffs. The collected fees are to be used for maintaining cleanliness and performing minor maintenance at the Qoolbulale water point.

7. **Describe the nearest GBV service providers for health, psycho-social and legal support (to inform the site supervisor and stakeholder in the area):**

The nearest GBV service providers for the Qoolbulale water point rehabilitation activities are in Salahey who are involved in providing GBV services to any females in the community. There will be further verification and awareness raising as the project moves forward.

Region	**Districts**	**Location**	**Service provider name**	**Type of Service**	**Focal Person**	**Designation**	**Mobile**
Region	Salahley	Salahley MCH	Shacab Area / Kood-buur	Network Against Fgc	• Ugbad • Hibo	Health worker	063-4400373 063-4411774
Maroodijeeh	Salahley	Qoolbulale	MCH	Maternity nutrition, vaccination, emergency care, and minor health concerns	Shabcaan and Ciise Nour	Health worker	063-4005639