

Term of Reference (ToR)

Consultancy Services for Completion of Aquifer Mapping in Five Basin Water Boards, Upgrading the National Groundwater Information System, and Development of an Online Groundwater Licensing and Permitting Portal

(Lake Nyasa, Lake Rukwa, Ruvuma, Lake Tanganyika, and Lake Victoria)

1.0 Introduction

The Government of Tanzania, in collaboration with the World Bank, is implementing the Sustainable Rural Water Supply and Sanitation Program (SRWSSP, Phase II, 2025–2030). This transformative program builds on earlier phases of the Rural Water Supply and Sanitation Program (RWSSP) and represents a major step toward achieving universal access to safe water and sanitation services in line with Tanzania’s Development Vision and Sustainable Development Goal 6 (SDG 6).

Groundwater is a strategic resource supporting domestic water supply, agriculture, livestock, industry, and climate resilience, particularly in semi-arid and drought-prone areas. Previous aquifer mapping initiatives have been completed in Wami-Ruvu, Pangani, Rufiji, and Internal Drainage Basins. However, the remaining five Basin Water Boards still lack comprehensive hydrogeological coverage and integrated groundwater management systems.

The SRWSSP Phase II, under the Water Resources Management Component, intends to strengthen groundwater resources management through completion of aquifer mapping in five Basin Water Boards, enhancement of groundwater monitoring systems, upgrading of the National Groundwater Information System, and development of an Online Groundwater Licensing and Permitting Portal. The five basins include Lake Nyasa Basin Water Board; Lake Rukwa Basin Water Board; Ruvuma Basin Water Board; Lake Tanganyika Basin Water Board; and Lake Victoria Basin Water Board.

The assignment will support:

- Completion of national aquifer mapping coverage;
- Development of groundwater and water quality atlases;
- Optimization of groundwater monitoring networks;
- Upgrading of the National Groundwater Geodatabase;
- Modernization of groundwater licensing and permitting processes;
- Strengthening institutional capacity for sustainable groundwater management.

2.0 Objectives of the Consultancy

2.1 Overall Objective

To strengthen groundwater resources management in Tanzania through completion of aquifer mapping in five target Basin Water Boards, enhancement of groundwater monitoring systems, upgrading of the national groundwater information system, and modernization of groundwater licensing and permitting processes.

2.2 Specific Objectives

The consultancy shall:

- i. Assess groundwater availability, aquifer productivity, water quality status, and historical groundwater trends using available records and targeted investigations;
- ii. Review and optimise groundwater monitoring networks in the five target Basin Water Boards;
- iii. Conduct hydrogeological investigations and prepare groundwater and water quality maps and atlases for the five target Basin Water Boards;
- iv. Review, upgrade, update and operationalize the National Groundwater Geodatabase;
- v. Develop an online groundwater licensing and permitting system integrated with national water information systems;
- vi. Strengthen institutional capacity through practical knowledge transfer, mentoring, and on-the-job training.

3.0 Scope of the Consultancy

The Consultant shall undertake technical, institutional, and digital systems interventions to support sustainable groundwater management in the five target Basin Water Boards.

The assignment shall build upon previous national aquifer mapping initiatives and existing groundwater databases developed under earlier projects, including review and enhancement of the existing national groundwater geodatabase, harmonization of methodologies, and completion of national aquifer coverage.

The scope of work shall include:

- i. Review and upgrade of the National Groundwater Geodatabase System;
- ii. Optimization of groundwater monitoring networks;
- iii. Groundwater assessment, aquifer characterization and preparation of groundwater and water quality maps atlases through fieldwork, exploratory drilling, and hydrogeological analysis;
- iv. Capacity building and knowledge transfer;
- v. Development of an Online Groundwater Licensing and Permitting System.

4.0 Detailed Tasks

Task 1: Review of Existing Information and Upgrade of the National Groundwater Geodatabase System

Building on these Government efforts on several hydrological and water quality studies throughout the country, including earlier aquifer mapping projects which created a national groundwater geodatabase. The Consultant will review, update, and expand this existing geodatabase. The goal is to create a unified and fully operational national groundwater information system. The Consultant shall ensure that the upgraded National Groundwater Geo-information System is fully interoperable with the proposed Online Groundwater Licensing and Permitting System and the Water Resources Information System (WRIS).

The Consultant shall also collect and assess all available groundwater monitoring data from existing national and basin-level monitoring networks, including historical groundwater level, abstraction, and water quality records, even where such records are incomplete or discontinuous, with the objective of reconstructing historical groundwater conditions and trends to the extent possible.

The Consultant shall also review and utilise relevant remote-sensing and earth observation datasets, including but not limited to rainfall estimates, land use/land cover, evapotranspiration, GRACE-derived storage change where applicable, lineament analysis, and other spatial datasets that can strengthen groundwater resource assessment, recharge interpretation, and drought vulnerability analysis.”

The Consultant shall:

- Review and audit the current geodatabase, including its structure, datasets, metadata, standards, and functionality.
- Update and improve the geodatabase by adding new datasets, correcting errors, and filling identified gaps.
- Standardise data formats and quality control protocols, making sure they match national systems like WRIS .
- Improve the ability to share data and scale the system, allowing for integration with basin-level databases and future data sources.
- Include new data collected from field investigations during this consultancy.

All existing datasets, such as SADC Hydrogeological Maps (2010) IWRM&D studies, and remote sensing products, will be added to the updated system to ensure consistency and completeness.

Outputs:

- i. Updated National Groundwater Geodatabase;
- ii. Database documentation and metadata;

- iii. Recommendations for long-term maintenance, governance, and sustainability of the system.

Task 2: Optimization of Groundwater Monitoring Networks

As demand for groundwater rises in domestic, agricultural, and industrial sectors, it is essential to strengthen groundwater-monitoring networks for sustainable resource management. The Consultant shall review and improve groundwater-monitoring networks in the five Basin Water Boards using lessons learned from existing systems.

Activities shall include:

- Identifying spatial, temporal, and technical gaps in current networks
- Defining monitoring goals (e.g., trend analysis, drought monitoring, abstraction control, water quality checks)
- Develop and document a clear monitoring rationale and optimisation criteria for the network, taking into account the purpose of monitoring (e.g., longterm trend analysis, drought early warning, abstraction management, water quality surveillance, recharge monitoring, and protection of strategic aquifers), hydrogeological setting, aquifer type, groundwater use intensity, vulnerability, and operational feasibility
- Designing better monitoring systems, including new locations, instruments (e.g., loggers, probes, telemetry), and data procedures.
- Estimating costs for capital investment requirements for the expansion and upgrading of monitoring stations, including long-term operations and maintenance needs.

The review and optimisation of the groundwater monitoring network shall consider the spatial distribution, representation of aquifer types, monitoring frequency, depth coverage, instrumentation, functionality, data transmission, and operational sustainability. The Consultant shall first establish explicit monitoring objectives and optimisation criteria to guide network design and prioritisation.

Outputs:

- i. Groundwater Monitoring Network Assessment Report;
- ii. Optimized groundwater monitoring network design;
- iii. A costed framework covering both capital investments for network optimisation/expansion and annual O&M costs to guide long-term monitoring and sustainability.

Task 3: Groundwater Assessment and Aquifer Characterization

The Consultant shall undertake a comprehensive groundwater assessment across the five Basin Water Boards to improve understanding of aquifer systems, groundwater potential, recharge conditions, groundwater quality, and vulnerability. The work will build on current datasets and earlier mapping results, while also addressing key data gaps through targeted field investigations.

The assessment will make use of available borehole data, complemented by a few exploratory/test drillings where necessary. Selected exploratory boreholes will be developed into permanent monitoring/observation wells. The precise siting of these boreholes will be based on geophysical survey investigations conducted by the Consultant and informed by the results of Task 2 on the optimisation of the groundwater monitoring network, so as to ensure the selected boreholes also contribute to the long-term basin monitoring objectives outlined below.

Key activities shall include:

- Geophysical investigations;
- Borehole logging and pumping tests;
- Groundwater level monitoring and field measurements;
- Targeted exploratory boreholes where justified by hydrogeological evidence and approved by the Client.
- Water quality sampling and analysis including major ions, salinity, fluoride, nitrate, trace elements, and contaminants. Combine hydrochemical data with aquifer systems.
- Aquifer Analysis and Modelling - Identify strategic aquifers based on demand-supply dynamics and risks. Develop conceptual groundwater models. Assess recharge, storage, flow, and drought vulnerability. Suggest areas that need more detailed numerical modelling.
- Mapping and Risk Analysis - Create maps showing groundwater potential, water quality, and vulnerability. Produce maps of groundwater drought and water scarcity. Identify areas prone to pollution and environmental risks.

The Consultant shall ensure compliance with environmental, occupational health and safety, and community safeguard requirements.

Outputs:

- i. Basin groundwater assessment (quality and quantity) reports;
- ii. Groundwater and water quality atlases;
- iii. Interactive digital atlas linked to national database and WRIS platform;
- iv. Recommendations for exploratory drilling and aquifer development.

Task 4: Capacity Building and Knowledge Transfer

The Consultant shall implement a practical capacity-building and knowledge-transfer program integrated within project implementation. The goal is to equip staff from the Ministry of Water Tanzania, Basin Water Boards, and other relevant institutions with the skills and confidence they need to manage groundwater investigations, monitoring systems, and data platforms on their own after the consultancy ends.

Training areas shall include:

- Hydrogeological investigations and monitoring;

- Geophysical surveys and interpretation;
- Groundwater Management Information System, Database and GIS operations;
- Licensing and regulatory systems;
- Groundwater resource assessment and planning;
- Institutional knowledge transfer.

Training shall mainly be conducted through on-the-job mentoring, joint fieldwork, coaching, and practical demonstrations.

Outputs:

- i. Capacity Building Plan;
- ii. On-the-job training sessions and mentoring reports;
- iii. Operational manuals and SOPs, quick-reference guides, and maintenance procedures.
- iv. Training and mentoring reports documenting participants, skills transferred, activities completed, and progress made.
- v. Final knowledge-transfer and handover report.

Task 5: Development of Groundwater Management Information System and Online Licensing Portal

The Consultant shall design, develop, test, and operationalize a Groundwater Management Information System and Online Groundwater Licensing and Permitting Portal for the Ministry of Water Tanzania and Basin Water Boards.

The system shall:

- Support online permit applications and approvals;
- Manage groundwater abstraction and drilling permits;
- Integrate with WRIS, MAJIS, and the National Groundwater Geodatabase;
- Support GIS-based permit verification and compliance monitoring;
- Include dashboards, reporting tools, and audit trails;
- Support role-based user access and data security;
- Include backup and recovery procedures.

Outputs:

- i. Functional Groundwater Management Information System;
- ii. Online Groundwater Licensing and Permitting Portal;
- iii. System documentation and user manuals;
- iv. User acceptance testing and operational handover;
- v. Minimum six-month technical support period after commissioning.

5.0 Deliverables and Schedule of Payment

The Consultant shall deliver a comprehensive set of technical outputs, systems, reports, and capacity-building products that support sustainable groundwater management in Tanzania. All deliverables shall be prepared to professional standards and submitted in formats agreed with the Client, including editable digital copies, GIS datasets, maps, databases, and final publishable reports.

The Consultant shall provide the following key deliverables:

- i. Inception Report;
- ii. Baseline Assessment Report;
- iii. Groundwater Monitoring Network Optimization Report;
- iv. Geophysical Investigation Reports;
- v. Exploratory Drilling and Hydrogeological Investigation Reports;
- vi. Updated National Groundwater Geodatabase;
- vii. Online Groundwater Licensing and Permitting Portal;
- viii. Groundwater and Water Quality Atlases; National Groundwater and Water Quality Atlas integrating outputs from all basin studies and previous national initiatives.
- ix. Basin-Level Atlases for the five target Basin Water Boards
- x. Capacity Building and Knowledge Transfer Reports;
- xi. Draft Final Consultancy Report;

Final Consultancy Report with complete datasets and handover documentation. A final report incorporating comments from the Client and stakeholders, including all revised technical content and complete annexes.

All deliverables shall be submitted in both editable electronic and PDF formats together with GIS datasets, maps, metadata, databases, and supporting technical documentation.

6.0 Deliverables Schedule

Report No.	Report Description	Hard Copies	Due (Months from Commencement)	Date from	Payment % of Contract price
1	Draft Inception Report	7	0.5		
2	Final Inception Report	15	1.0		5
3	Draft Baseline Assessment Report	7	2.5		
4	Final Baseline Assessment Report	15	3.0		5
5	Groundwater Monitoring Network Optimization Report	15	4.0		
6	Draft Geophysical Survey Report	7	5.0		
7	Final Geophysical Survey Report	15	5.5		

Report No.	Report Description	Hard Copies	Due (Months from Commencement)	Date from	Payment % of Contract price
8	Draft Exploratory Drilling & Hydrogeological Investigation Report	7	7.0		10
9	Final Exploratory Drilling & Hydrogeological Investigation Report	15	7.5		10
10	Updated National Groundwater Geodatabase, Manuals and Handover Package	15	8.0		
11	Draft Groundwater Management Information system and Online Groundwater Licensing and Permitting Portal	7	8.5		10
12	Final Groundwater Management Information system and Online Groundwater Licensing and Permitting Portal Operationalized	7	9.0		10
13	Capacity Building, On-the-Job Training and Knowledge Transfer Report	10	9.5		10
14	Draft Basin & National Groundwater and Water Quality Atlas (Print + Digital)	7	10.0		10
15	Final Basin & National Groundwater and Water Quality Atlas (Print + Digital)	15	10.5		20
16	Draft Final Consultancy Report	7	11.5		
17	Final Consultancy Report with Complete Data Package	15	12.0		20

Notes:

- All due dates are calculated from the official commencement date of the consultancy contract.
- Draft reports shall be submitted for review and comments prior to finalization.
- Electronic copies shall include editable formats, PDF reports, GIS layers, databases, maps, and associated metadata.
- The final consultancy report shall consolidate all outputs, comments received, annexes, atlases, training documentation, and handover materials.
- Where necessary, the Consultant may submit interim technical memoranda or progress notes to support timely decision-making by the Ministry of Water Tanzania.

7.0 Duration of the Assignment

The consultancy assignment shall be implemented over a period of twelve (12) months from the commencement date.

8.0 Reporting and Implementation Arrangements

The Consultant shall report to the Ministry of Water through the Director of Water Resources, who shall serve as the Contract Manager.

The Consultant shall coordinate closely with:

- Basin Water Boards;
- Ministry ICT Units;
- Water quality laboratories;
- Planning and water resources management units;
- Relevant stakeholders and institutions.

The assignment shall be implemented under a lump-sum consultancy contract. Consultant is responsible for delivering all agreed outputs within the approved budget and timeline.

Regular progress review meetings shall be conducted with the Client during implementation.

9.0 Obligations of the Client and Consultant

The Client shall:

- Provide available reports, datasets, and relevant documentation;
- Facilitate access to project sites and stakeholders;
- Designate counterpart staff for coordination and knowledge transfer;
- Review and provide comments on submitted deliverables;
- Provide strategic guidance and oversight.

All data, systems, software configurations, maps, databases, and documentation developed under the consultancy shall become the property of the Client.

The Consultant shall:

- Be fully self-sufficient with respect to accommodation, office facilities, communications, office supplies, equipment, insurance, and transport required for the execution of the assignment.
- Ensure permanent presence in Tanzania during the assignment, with the project team based in Dodoma (and mobilized to the basins as required).

- Provide qualified personnel and required equipment;
- Ensure effective execution of all tasks within the approved timeline;
- Maintain professional, ethical, environmental, and safety standards;
- Ensure effective knowledge transfer to counterpart staff;
- Maintain confidentiality of project information;
- Transfer all source code, databases, reports, GIS files, manuals, and related materials to the Client upon completion.

10.0 Expertise and Qualification Requirements

The consulting firm shall demonstrate experience in:

- National or basin-scale aquifer mapping and groundwater resource assessment;
- Hydrogeological investigations in complex geological terrains, including fractured basement, sedimentary, volcanic, and alluvial aquifer systems;
- Design and supervision of geophysical surveys and exploratory drilling programmes, including boreholes exceeding 100 metres depth;
- Establishment and optimisation of groundwater monitoring networks;
- Development, upgrading, and management of groundwater geodatabases and web-enabled GIS platforms;
- Groundwater quality assessment, hydrochemistry, and environmental risk mapping;
- Delivery of institutional capacity building through practical knowledge transfer and on-the-job training.

Experience in Tanzania or similar hydrogeological settings will be an added advantage. Consultant shall also demonstrate successful completion of similar assignments and the capacity to mobilize multidisciplinary expertise required for timely delivery of this consultancy.

The preferred firm/consortium shall provide a multidisciplinary team comprising, at minimum, the following key experts. Equivalent qualifications may be considered where clearly justified by experience.

11.0 Key Professional Staff

The Consultant shall provide a multidisciplinary team including, but not limited to:

Team Leader / Senior Hydrogeologist or Hydro-Geophysicist

- MSc or higher in Hydrogeology, Geophysics, Geology, Water Resources Engineering, or related field;
- Minimum 10 years of relevant experience; including at least five (5) years in groundwater assessment, aquifer mapping, or hydrogeological investigations;
- Demonstrated experience leading multidisciplinary consultancy teams;
- Proven skills in project management, quality assurance, stakeholder engagement, and technical reporting;

- Strong understanding of groundwater governance and institutional coordination.

Senior Hydrogeologist / Drilling Engineer

- Master's degree in Hydrogeology, Geosciences, Civil Engineering, Water Resources Engineering, or equivalent.
- Minimum of ten (10) years of relevant experience in groundwater investigations, drilling supervision, and well construction
- Demonstrated experience in preparing drilling specifications, Bills of Materials (BoMs), contractor supervision, and quality control;
- Practical experience in pumping tests, borehole development, and aquifer performance evaluation.

Senior Geophysicist

- Degree in Geophysics, Geology, Applied Physics, or related field;
- Minimum of fifteen (15) years of overall professional experience, including at least seven (7) years in groundwater-related geophysical investigations;
- Demonstrated experience in design, implementation, and interpretation of geophysical surveys for groundwater exploration;
- Proficiency in modern survey techniques such as resistivity, electromagnetic, seismic, magnetic, geo-radar, and borehole geophysics;
- Ability to integrate geophysical data with hydrogeological models.

GIS Specialist/Remote Sensing Specialist

- Degree in GIS, Geoinformatics, Geography, Surveying, Computer Mapping, or related discipline;
- Minimum of ten (10) years of professional experience in spatial database design, GIS analysis, and cartographic production;
- Demonstrated expertise in hydrogeological mapping, spatial modelling, remote sensing applications, drought mapping, and web GIS platforms;
- Experience integrating rainfall, land use, topography, environmental, and groundwater datasets into decision-support systems.

Groundwater Modeller / Senior Hydrogeologist

- Advanced qualification in Hydrogeology or Water Resources;
- Experience in conceptual and numerical groundwater modelling.
- Advanced degree in Hydrogeology, Water Resources Engineering, Civil Engineering, or related discipline;
- Minimum of eight (8) years of relevant professional experience in groundwater modelling and quantitative hydrogeology;
- Demonstrated experience in conceptual and numerical groundwater models, recharge estimation, sustainable yield assessment, and groundwater balance studies;

- Experience in drought vulnerability, abstraction scenarios, and aquifer management planning.

Water Quality Specialist / Hydrochemist

- Advanced degree in Chemistry, Environmental Chemistry, Hydrochemistry, Water Quality, or related discipline;
- Minimum of ten (10) years of relevant experience in groundwater and water quality investigations;
- Practical experience in laboratory and field-based sampling, QA/QC systems, and interpretation of hydrochemical data;
- Experience with groundwater contaminants such as salinity, fluoride, nitrate, trace elements, heavy metals, and bacteriological indicators.

Database / Licensing Portal System Developer

- Degree in Computer Science, Information Systems, Software Engineering, or related discipline;
- Minimum five (5) years relevant experience in database systems, egovernment platforms, licensing portals, or workflow systems;
- Demonstrated experience in GIS-enabled systems, dashboards, interoperability, cybersecurity, user access control, and web application development;
- Experience developing public sector digital service platforms will be an added advantage

Instrumentation / Telemetry Specialist

- Degree or professional qualification in Electronics, Instrumentation, Hydrometric Systems, Engineering, or related field;
- Minimum of five (5) years of relevant experience in installation and configuration of monitoring equipment;
- Experience with groundwater loggers, telemetry systems, GSM/satellite communications, sensors, calibration, and troubleshooting;
- Experience supporting real-time environmental monitoring systems preferred

12.0 Additional Staffing Considerations

The Consultant is encouraged to include appropriately qualified Tanzanian professionals within the team to strengthen local participation, contextual understanding, and sustainable capacity development. Additional short-term specialists may be proposed where necessary (e.g., environmental specialist, training specialist, database administrator, data analyst, or field coordinator).

The Consultant shall ensure continuity of key personnel throughout the assignment. Replacement of key experts shall require prior approval of the Client and shall only be permitted with experts of equal or higher qualifications and experience.

13.0 Staffing Plan

	S/NO	Position	Indicative Input (Man-Months)
	1	Team Leader (Senior Hydrogeologist or Hydro-Geophysicist)	12
	2	Senior Hydrogeologist / Drilling Engineer	8
	3	Senior Geophysicist	5.5
	4	GIS / Remote Sensing Specialist	4
	5	Groundwater Modeller	4
	6	Water Quality Specialist / Hydrochemist	4
	7	Database / Licensing Portal Developer	2
	8	Instrumentation / Telemetry Specialist (Short term specialist)	0.5
		Total	40

14.0 General Requirements

All experts shall possess strong technical reporting, communication, and teamwork skills. The Consultant is encouraged to include qualified Tanzanian professionals to strengthen local participation and institutional sustainability. Preference will be given to firms and experts with prior experience in Tanzania or similar hydrogeological and institutional settings.

All experts shall also be expected to contribute to structured knowledge transfer through mentoring, joint fieldwork, technical coaching, and preparation of practical operational guidance for Client staff.