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1. Introduction

1.1. Background

The Ministry of Water and Energy (MoWE), through the Hydrology and Basin Information Lead Executive, is mandated to plan, develop, manage, and regulate Ethiopia's water resources in a sustainable and integrated manner. Hydrological services play a critical role in water resources assessment, flood forecasting and early warning, drought monitoring, infrastructure design and operation, irrigation planning, hydropower development, and climate resilience. Given the expansion of hydrological monitoring networks and aging rating curves at many stations, there is a critical need to systematically update and validate rating curves across 400+ key stations to ensure national hydrology data reliability.

To strengthen the effectiveness, consistency, and reliability of hydrological services, MoWE intends to (i) prepare a comprehensive Concept of Operations (CONOPS) for Hydrology Services and (ii) assess and improve the reliability of river stage–discharge relationships (rating curves) at selected hydrometric stations through systematic testing, updating, and full revision where necessary.

1.2. Rationales

The assignment is driven by the following needs:

- Ensuring reliable hydrological data for national decision-making
- Addressing inconsistencies in rating curves due to morphological and hydraulic changes
- Improving operational coordination among MoWE, Basin Development Offices, and regions
- Establishing a standardized operational framework (CONOPS)
- Supporting flood forecasting, drought management, and transboundary water management
- Enhancing data governance, quality assurance, and service delivery

2. Objective

2.1.1. General objective

To enhance the operational effectiveness, data quality, and decision-support capacity of national hydrology services through clear operational guidance and improved rating curve accuracy.

2.1.2. Specific objectives

The specific objectives of the Assignment are to:

- Develop a standardized Concept of Operations (CONOPS) for Hydrology Services under MoWE.
- Assess the reliability of existing rating curves at selected hydrological gauging stations.
- Update rating curves using recent and historical discharge measurements.
- Fully revise rating curves where significant inconsistencies or changes in channel conditions are identified.
- Strengthen institutional capacity for sustainable rating curve management and quality assurance.
- Develop a prioritization framework for selecting stations based on data criticality, station condition, and risk
- Establish a scalable, repeatable methodology for mass rating curve revision applicable across diverse river basins in Ethiopia



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3. Scope and activities for the development of guidelines

The assignment consists of two interrelated components:

Component 1: Preparation of CONOPS for Hydrology Services (MoWE – Hydrology and Basin Information Lead Executive)

The consultant shall:

1. Review existing policies, strategies, guidelines, SOPs, and institutional arrangements related to hydrology services under MoWE, particularly those led by the Hydrology and Basin Information Lead Executive, Basin Development Offices (Abay, Awash, Rift Valley Lakes, Baro–Akobo, Genale–Dawa, and Tekeze), and Regional Water Bureaus.
2. Assess the current operational status of hydrological monitoring networks (surface water, groundwater, water resource information and GIS–hydrology interface).
3. Define the overall operational concept for hydrology services under the Hydrology and Basin Information Lead Executive, including:
 - Service objectives and functions
 - Roles and responsibilities of the Hydrology and Basin Information Lead Executive, Surface Water, Groundwater, GIS and Water Resources Information desks, Basin Development Offices, and Regional Water Bureaus
 - Data flow, processing, quality control, storage, and dissemination
 - Use of hydrological data for forecasting, planning, and decision-making
4. Define standard operational procedures (SOPs) for:
 - Network operation and maintenance
 - Data acquisition and validation
 - Information products and service delivery
5. Identify gaps, risks, and capacity needs (human resources, equipment, ICT, financing).
6. Propose an implementation roadmap with short-, medium-, and long-term actions.

Component 2: Rating Curve Reliability Test, Updating, and Revision.

The consultant shall:

1. Review existing stage–discharge data, rating curves, and station metadata for selected hydrological gauging stations managed by MoWE through the Hydrology and Basin Information Lead Executive and Basin Development Offices.
2. Conduct rating curve reliability analysis using:
 - Historical discharge measurements
 - Recent flow measurements
 - Statistical and hydraulic consistency checks
3. Categorize stations into priority tiers (e.g., high, medium, low) based on usage in forecasting, design, or water allocation.
4. Identify causes of rating curve instability, including:
 - Channel morphology changes
 - Sedimentation and erosion
 - Backwater effects



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- Structural or gauge reference changes
- 5. Prioritizing stations with recommended actions (update/revise/maintain)
- 6. Update existing rating curves where minor adjustments are required.
- 7. Perform full rating curve revision where major deviations are identified, including:
 - Segmentation of curves if required
 - Development of new control sections
 - Documentation of assumptions and limitations
- 8. For stations where a conventional single-valued rating curve is deemed unsuitable or unreliable due to hydraulic complexities (e.g., backwater, unstable control, hysteresis), the consultant shall:
- 9. a. Diagnose the primary cause of instability.
 - b. Propose and justify the most technically and economically feasible alternative method from an approved list (e.g., parameterized ratings, index-velocity, slope-area, hydrodynamic modeling, or continuous direct measurement).
 - c. Develop, calibrate, and validate the alternative discharge estimation model.
 - d. Clearly document the methodology, assumptions, uncertainty, and operational requirements (e.g., need for additional sensors) in the station technical report.
- 10. Define a statistically sound sampling approach for field verification to optimize resources while ensuring representativeness across 400+ stations
- 11. Validate revised rating curves and recommend monitoring and re-measurement frequency.
- 12. Develop or apply automated tools for batch processing of rating curve analysis and consistency checks.
- 13. Prepare standardized rating curve documentation and archiving formats.
- 14. Ensure updated rating curves are integrated into MoWE's hydrological database system with version control and audit trails

Component 3: Capacity building training for MOWE and Basin development office hydrologist and hydrologist technicians. on mass rating curve management

4. Methodology

The assignment shall adopt a combination of:

- Desk review of existing documents and datasets
- Field verification and flow measurement (where required)
- Statistical and hydraulic analysis
- Stakeholder consultations and technical workshops
- Alignment with WMO and international best practices

5. Deliverables of the assignment(s)

The consultant shall provide the following deliverables:

Component 1: CONOPS

1. Inception Report (work plan, methodology, and schedule)
2. Draft CONOPS for Hydrology Services



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3. Stakeholder consultation workshop report
4. Final CONOPS document incorporating comments from MoWE

Component 2: Rating Curve Assessment

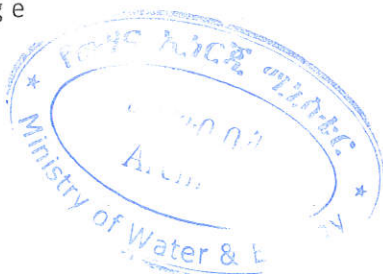
1. Rating curve assessment and reliability analysis report
2. Updated and/or revised rating curves (digital and hard copy formats)
3. Station-wise technical documentation and metadata
4. Final consolidated technical report
- 5.

All reports shall be submitted in editable (MS Word, Excel) and PDF formats.

6. Time schedule of the deliverables

The consulting firm is expected to prepare and submit separate reports for each project under the assignment at each milestone.

N/S	Deliverable	Type	Duration/week/	Cumulative in weeks
1.	CONOPS preparation			
1.1	Contract Signature			0
1.2	Inception Report (work plan, methodology, and schedule)	Draft	1	1
		Appraisal	0.5	1.5
		Final	0.5	2
1.3	Assessment of Hydrology Services	Draft	0.5	2.5
		Basin Development office visit	1	3.5
		Appraisal	0.5	4
		Final	0.5	4.5
1.4	Draft CONOPS for Hydrology Services	Draft	8	12.5
		Appraisal	1	13.5
1.5	Final CONOPS for Hydrology Services	Final	1.5	15
1.6	Validation Workshop	Appraisal	1	16
1.7	Finalized and closure of contract	Completion	2	18 (126 days)
2.	Rating Curve Development			
2.1	Rating curve assessment and reliability analysis report	Draft	5	5
		Appraisal	1.5	6.5
		Final	1	7.5
2.2	Updated and/or revised rating curves (digital and hard copy formats)	Draft	4.5	12
		Appraisal	1	13
		Final	1	14
2.3	Station-wise technical documentation and metadata.	Draft	2.5	16.5
		Appraisal	1	17.5
		Final	0.5	18



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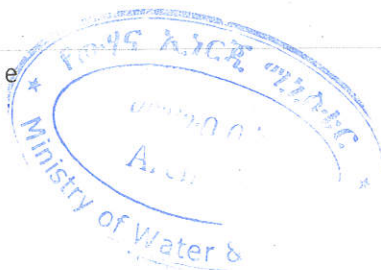
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N/S	Deliverable	Type	Duration/week/	Cumulative in weeks
2.4	Final consolidated technical report	Draft	1	19
		Appraisal	0.5	19.5
		Final	0.5	20(140 days)

7. Qualification, expertise and team composition

The consulting team shall include, at a minimum:

1. Team Leader / Senior Hydrologist (MSc or PhD, ≥ 10 years' experience)
 - Minimum MSc or above in Hydrology, water resources engineering.
 - 10 years of general water resource and Hydrological/flood and drought projects,
 - Proven a minimum of 8 (eight) years of similar experience at Hydrological service delivery and Hydrological service management;
2. Hydrometry and Rating Curve Specialist (≥ 10 years' experience)
 - Minimum MSc or above in Hydrology, Hydrometeorology and water resources engineering.
 - 10 years of general water resource and Hydrological data analysis and research flood and drought forecasting,
 - Proven a minimum of 8 (eight) years of similar experience at Hydrological management and quality control and assurance, rating curve development;
3. Hydrologist/Hydrological Data Analyst
 - Minimum BSc or above in Hydrology, Hydrometeorology and water resources engineering.
 - 8 years of general water resource and Hydrological data analysis and research flood and drought forecasting,
 - Proven a minimum of 6 (eight) years of similar experience at Hydrological management and quality control and assurance, rating curve development;
4. GIS and Data Management Specialist
 - Minimum MSc or above in GIS, Hydro informatics and Geo informatics
 - 8 years of general remote sensing and geo information activities for water resource and Hydrological data analysis and research especially for Hydrological data observation system and flood and drought forecasting,
 - Proven a minimum of 8 (eight) years of similar experience at spatial data analysis for Hydrological data quality control and quality assurance.
5. Hydrometeorologist Climatologist/ Meteorologist
 - Minimum MSc or above in Climatology, climate change, meteorology, Hydrometeorology
 - 8 (eight) year of climate and weather data analysis for hydrological data interpolation, modeling and flood and drought forecasting.



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- 6 (six) years of general water resource and Hydrological data analysis and research flood and drought forecasting,
 - Proven a minimum of 6 (six) years of similar experience at Hydrological management and quality control and assurance, rating curve development;
6. Computer science, programmer/modeler /Database expert
Minimum MSc or above in computer science.IT, computer engineering
- 8 (eight) year of climate and Hydrological database management and modeling and programing .
 - 6 (six) years of general water resource and Hydrological data analysis and research flood and drought forecasting,
 - Proven a minimum of 6 (six) years of similar experience at Hydrological database management and Hydrological data quality control and assurance.

Experience with WMO standards, MoWE hydrological systems, and similar assignments in Ethiopia or comparable contexts are an advantage.

Consultant must demonstrate experience in managing large-scale hydrometry projects (>200 stations) and using batch processing tools for rating curve analysis

The consulting team must include a specialist with proven experience in implementing alternative discharge measurement and estimation techniques (e.g., ADCP deployment, index-velocity ratings, and hydrodynamic modeling for ratings) in challenging environments

Table: No. of experts and Man-month workload

S/ N	Name of Expertise/responsibility	No of person	Man-month
1	Team Leader / Senior Hydrologist	1	5
2	Hydrometry and Rating Curve Specialist	1	4
3	Hydrologist/Hydrological Data Analyst	1	3
4	GIS and Data Management Specialist	1	2
5	Hydrometeorologist, Climatologist/ Meteorologist	1	3
6	Computer science, programmer/modeler /Database expert	1	1

8. Reporting and communication

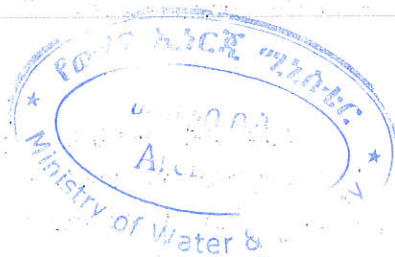
All data, reports, and outputs produced under this assignment shall be the property of the Ministry of Water and Energy (MoWE) and shall not be disclosed without prior written consent.

Client's Responsibilities (MoWE)

The Ministry of Water and Energy (MoWE), through the Hydrology and Basin Information Lead Executive, shall provide the following support to ensure effective implementation of the consultancy:

1. Institutional and Administrative Support

- Assign a **Project Coordinator / Focal Person** to manage day-to-day coordination



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- Facilitate communication with:
 - Basin Development Offices
 - Regional Water Bureaus
 - Other relevant stakeholders
- Provide official letters for **field access and stakeholder engagement**

2. Data and Information Provision

MoWE shall provide access to all available and relevant data, including:

- Hydrological time series data (stage, discharge, rainfall, etc.)
- Existing **rating curves and station metadata**
- Hydrological database systems and GIS layers
- Previous studies, reports, and technical documents
- Policies, strategies, guidelines, and SOPs

9. Logistic and budgets of the assignment

The consultant's firm is committed to covering all project costs, with the exception of workshop-related expenses. This encompasses the salaries of consultant team members, daily allowances, stationery, transportation, and materials and equipment required for in-house assignments. Additionally, the consultant's firm will bear the reimbursable costs associated with capacity building and training for 15 participants. This includes daily allowances, transportation, and other logistical requirements for the overseas component of the project.

10. Payment modality for the consultant

Payment for the consulting firm is effected in two stages as per the following modality:

- Advance payments of up to 10% upon presenting an unconditional equivalent Bank guarantee to be settled proportionally at each payment.
- On Submission of the final approved inception report and Experience Sharing Proposal: 10% of the contract amount
- On Submission of the draft guide and process report: 30% of the contract amount
- On the submission of the final accepted detail design report: 30% of the contract amount.

11. Ethical consideration

The consultants involved in developing the technical guidelines need to adhere to ethical considerations throughout the process. Some key ethical considerations are as follows:

1. **Transparency:** Ensure transparency in all aspects of the guideline development process. The methodologies, data sources, and decision-making processes are clearly communicated.
2. **Inclusivity:** Involve all relevant stakeholders in guideline development, including communities, experts, and representatives from diverse groups. The perspectives of all stakeholders should be considered.
3. **Confidentiality:** Protects sensitive information and data. Safeguard the confidentiality of individuals and organizations involved in the guideline development process.



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4. Conflict of interest: Disclose and manage any potential conflicts of interest among consultants, experts, or stakeholders involved in the development process. Ensure that personal or financial interests do not unduly influence decisions.
5. Equity: Ensure that the guidelines promote equity and do not disproportionately benefit or harm specific individuals or groups. The potential impacts on vulnerable populations are considered.
6. Quality and accuracy: Strive for high-quality, accurate, and evidence-based guidelines. Clearly, uncertainties and limitations in the available evidence are communicated.
7. Cultural sensitivity: culturally sensitive and respecting local customs, practices, and beliefs.
8. Communication and feedback: Provide opportunities for feedback and address concerns raised by stakeholders promptly.
9. Accountability: Take responsibility for the consequences of the guidelines. We would like to acknowledge and rectify errors if they were identified after the guidelines were published.



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