

Hashemite Kingdom of Jordan
Ministry Of Water and Irrigation
Jordan Valley Authority

Jordan Water Sector Efficiency Program

Loan NO. 9560-JO



Terms of Reference of Consultancy Services
For
Dam Safety Archiving, Information Management and Decision
Support System

JORDAN – AMMAN

September 2026



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Abbreviations

ACM	Asbestos- Containing Material	IEE	Initial Environmental Examination
AP	Advanced Payment	IP	Instrumentation Plan
AFD	Agence Française De Développement	IUCN	International Union for Conservation of Nature
AZE	Alliance For Zero Extinction	JO	Jordan
Client	Jordan Valley Authority	JVA	Jordan Valley Authority
Consultant	International Consulting Engineering Firm	JWSEP	Jordan Water Sector Efficiency Project
CVC	Conventional Vibrated Concrete	LMP	Labor Management Procedures
DMU	Dam Management Unit	MCM	Million Cubic Meter
DRM	Disaster Risk Management	MWI	Ministry Of Water and Irrigation
EPP	Emergency Preparedness Plan	O&MP	Operation and Maintenance Plan
ES	Environment and Social	PBC	Performance Based Conditions
ESCP	Environmental and Social Commitment Plan	PFMA	Potential Failure Mode Analysis
ESF	Environmental and Social Framework	PMU	Project Management Unit
EHSs	Environmental, Health and Safety Guidelines	QAP	Quality Assurance Plan
ESHS	Environmental, Social, Health and Safety	RCC	Reinforced Cement Concrete
ESIA	Environmental and Social Impact Assessment	RCM	Regional Climate Models
ESMF	Environmental and Social Management Framework	RF	Resettlement Framework
ESMP	Environmental and Social Management Plan	SEA	Sexual Exploitation and Abuse
ESS	Environmental and Social Standards	SEP	Stakeholder Engagement Plan
ESS1 – 10	Environmental and Social Standards From 1 – 10	SH	Sexual Harassment
GBV	Gender-Based Violence	SPD	Standard Procurement Document
GCF	Global Concessional Financing Facility	UNESCO	United Nations Educational, Scientific and Cultural Organization
GCM	General Circulation Models	US	United States
IA	Implementing Agency	WAJ	Water Authority of Jordan
IBRD	International Bank for Reconstruction and Development	WB	World Bank
ICOLD	International Commission on Large Dams		
IDA	International Development Association		



A. Project Background

Project Overview

The Jordan Valley Authority (JVA) has received funds under the Jordan Water Sector Efficiency Project (JWSEP) to support the Government's efforts to improve the efficiency of water services in Jordan. The JWSEP is financed through a US\$200m loan from the International Bank for Reconstruction and Development (IBRD Loan Number 9560-JO) and a US\$50m grant from the Global Concessional Financing Facility (GCFF TF Number TF085811) and US\$50m from the Agency Française de Développement (AFD). The JWSEP includes five components: (i) Sustainable Non-Revenue Water Reduction (US\$209m); (ii) Increased energy efficiency and reduced energy supply costs (US\$54m); (iii) Water security measures to underpin efficiency improvements (US\$27m); (iv) Institutional strengthening for water sector efficiency (US\$10m); and, (v) Contingency Emergency Response provisions to support an immediate response to an Eligible Crisis or Emergency, as needed (US\$0m). The Jordan Valley Authority has been allocated US\$18,000,000 (including AFD) for implementation of activities under Sub-Component 3.2, including US\$7,995,992 from the IBRD loan, US\$2,004,008 from the GCFF Grant and US\$8m from the AFD loan.

The JWSEP includes activities aimed at safeguarding the country's existing storage and efforts to enhance water security under Sub-Component 3.2. This includes supporting the development of tools to assess the safety of dams in Jordan and their vulnerability to climate related risks, as well as advancing the identification, prioritization and readiness of investments aimed at improving water security. This will be achieved through: (i) strengthening the national inventory and database of the country's dams; (ii) development and application of a risk and resilience indexing tool to identify and prioritize rehabilitation needs; (iii) detailed designs and supporting environmental and social assessments for priority rehabilitation projects; (iv) development and implementation of sediment management plans for prioritized dams; (v) investments in priority, no regret investments in improving the safety of dams; (vi) equipment and instrumentation to improve operations, forecasting capabilities and emergency preparedness; and (vii) Technical Assistance to strengthen the capacity for dam safety.

The JWSEP includes a number of Performance-Based Conditions (PBCs) that are intended to encourage institutional reforms. Among these is a PBC focused on operationalizing a risk and resilience indexing tool that will characterize dam safety risks in a systematic, qualitative, and relative manner in order to help evaluate and prioritize safety issues for individual dams and the portfolio of dams in Jordan. These potential risks will be quantified as deficiencies in the current physical state or condition of the dam and are weighted by their overall importance to the safety of the dam and the vulnerability and downstream hazard / consequence potential of the dam. Operationalization of the risk and resilience indexing tool will identify and prioritize dam safety measures and remedial actions, identify knowledge gaps (for example, dam records, hydrological data, instrumentation adequacy, among others) and evaluate the effects of risk reduction and dam safety enhancement measures on the overall risk profile.



The JWSEP is implemented by the Ministry of Water and Irrigation (MWI) through the Water Authority of Jordan Project Management Unit (PMU). The JVA is mandated with implementing sub-component 3.2 related activities through the Dams Studies Directorate with support from the JWSEP PMU. All activities will be in accordance with the following:

- a) The World Bank's Procurement Regulations for Investment Project Financing Borrowers, dated November 2020.
- b) The loan agreement between the Hashemite Kingdom of Jordan and the International Bank for Reconstruction and Development dated July 16, 2023 (Loan No. 9560-JO; CFF TF No. TF085811).
- c) The procurement plan approved by the World Bank in line with the Jordanian Governmental Procurement Law No. 8 for the year 2022.
- d) The Guidelines on Preventing and Combating Fraud and Corruption in projects Financed by IBRD loans and IDA Credits and Loans" dated October 15, 2006, and revised in January 2011 and as of July 1, 2016¹.
- e) The Jordanian Laws on preventing fraud and corruption².
- f) The regulation No. 69 of 2020 Environmental Classification & Licensing Regulation³.
- g) The environmental and social standards ESSs of World Bank⁴.
- h) Jordan Valley Authority related laws and regulations (Jordan Valley Authority Development law (19) 1988).⁵

JVA and Portfolio Overview

The JVA was established in 1977, became part of the MWI in 1988, and is mandated with the integrated development of the Jordan Valley, specifically the following:

- a) The development of water resources of the Jordan Valley and their utilization for purposes of irrigated agriculture, domestic and municipal uses, industry, hydropower generation and other beneficial uses. Also, the protection and conservation of these resources, and the implementation of all works related to the development, utilization, protection and conservation thereof, including:
 - Conducting studies required for evaluation of water resources including hydrological, hydro geological and geological studies, drilling of explanatory wells and installation of observation wells.
 - Planning, design, construction, operation and maintenance of irrigation projects and related structures and works of all types and purposes including dams and appurtenant works, pumping stations, reservoirs and water conveyance and

¹ Guidelines on preventing and combating fraud and corruption in projects financed by IBRD loans and IDA credits and grants:

<https://documents.worldbank.org/en/publication/documents-reports/documentdetail/551241468161367060/guidelines-on-preventing-and-combating-fraud-and-corruption-in-projects-financed-by-ibrd-loans-and-ida-credits-and-grants>

² Integrity and anti-corruption commission:

<https://www.jiacc.gov.jo/Ar/Pages/%D9%82%D8%A7%D9%86%D9%88%D9%86%D8%A7%D9%84%D9%86%D8%B2%D8%A7%D9%87%D8%A9%D9%88%D9%85%D9%83%D8%A7%D9%81%D8%AD%D8%A9%D8%A7%D9%84%D9%81%D8%B3%D8%A7%D8%AF>

³ Environmental Classification & Licensing Regulation:

https://www.moenv.gov.jo/ebv4.0/root_storage/ar/eb_list_page/%D9%86%D8%B8%D8%A7%D9%85%D8%A7%D9%84%D8%AA%D8%B5%D9%86%D9%8A%D9%81%D9%88%D8%A7%D9%84%D8%AA%D8%B1%D8%A7%D8%AE%D9%8A%D8%B5%D8%B1%D9%82%D9%85_69%D8%A8%D8%A7%D9%84%D9%84%D8%BA%D8%A9%D8%A7%D9%84%D8%A7%D9%86%D8%AC%D9%84%D9%8A%D8%B2%D9%8A%D8%A9.pdf

⁴ Environmental and Social Standards of World Bank: <https://www.worldbank.org/en/projects-operations/environmental-and-social-framework>

⁵ Jordan Valley Authority Development law (19) 1988: <https://www.mwi.gov.jo/Ar/List/%D8%A7%D9%84%D9%82%D9%88%D8%A7%D9%86%D9%8A%D9%86>

distribution networks, surface and subsurface drainage works, flood protection works, and roads and building needs for operation and maintenance.

- Soil surveys and classification, and the identification and reclamation of lands for use in irrigated agriculture, and dividing them into farm units.
 - Settlement of disputes arising from the use of water resources.
 - Organize and direct the construction of private and public wells in coordination with the Water Authority of Jordan.
 - Develop and improve the environment and the living conditions in the Jordan Valley, and implement the related works including:
 - Setting rules and regulations for areas of land on which construction of buildings is permitted, setback lines, rights of way, etc., outside towns and villages borders.
 - Development of lands planned for use as residential, industrial, agricultural and other zones.
- b) Planning, design and construction of farm roads.
- c) Development of tourism in the Jordan Valley including construction of touristic and recreational facilities.
- d) Social development of the Valley inhabitants including the establishment of private institutions in order to help them contribute to the development of the Valley and to the achievement of the development objectives.
- e) Additional development activities as requested from the Cabinet.

The JVA manages seventeen large dams in Jordan under the management of three different administrative directorates. These include: (i) the Northern Dams Directorate, which is responsible for operation, maintenance and surveillance of dams in the north of Jordan; (ii) the Southern Dams Directorate, which is responsible for operation, maintenance and surveillance of dams in the south of Jordan; and, (iii) the Dams Studies Directorate, which is responsible for studies, construction and management of dam projects⁶ (Figure 1: Dams' Directorates structure in JVA). Within each of these Directorates there are a number of departments (Table 1: Departments are managed under the directorates).



⁶ JVA organizational structure:

https://www.mwi.gov.jo/AR/List/%D8%A7%D9%84%D9%87%D9%8A%D9%83%D9%84_%D8%A7%D9%84%D8%AA%D9%86%D8%B8%D9%8A%D9%85%D9%8A

Figure 1: Dams' Directorates structure in JVA

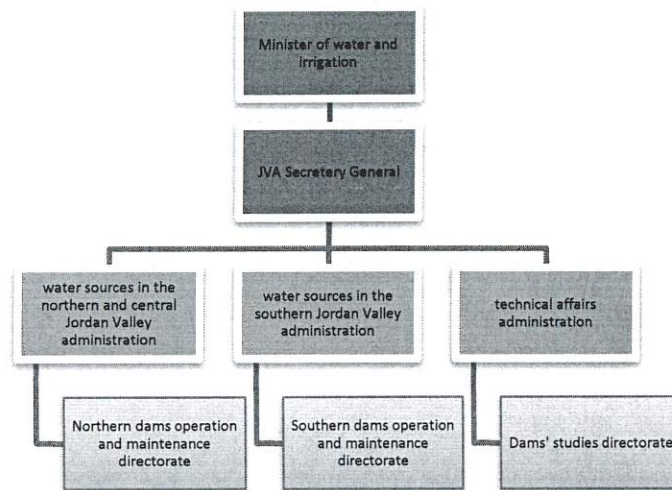


Table 2: Departments are managed under the directorates

Directorate	Departments
Northern dams operation and maintenance directorate	karamah
	king Talal
	Kufranjeh
	Kufreen
	Wadi_Arab
	Wadi_shuib
	Wehdeh
	Zeglab
	Maintenance
	Dam safety and surveillance
Southern dams operation and maintenance directorate	Fedan
	Ibn Hammad
	Karak
	Lujoun
	Mujib
	Rahma
	Tunour
	Wala
	Zarqa_maain
	Maintenance
	Dam safety and surveillance
Dams' studies directorate	Studies of dams
	Supervision and construction of dams
	Follow-up of dams



Figure 2: Location of Dams in Jordan

TOR Refinement and Adjustments

The present Terms of Reference (TOR) are indicative and may be subject to further refinement, and modification, based on the feedback, recommendations, methodologies, and technical approaches received through proposals.

B. Objectives of Consultancy Services

1. The objective of this assignment is to design, develop and operationalize an archiving, information management and decision support system for dam safety that can encompass the full lifecycle of dams in the portfolio. This includes the following main tasks:

1. Inception Phase
2. Current State Analysis
3. Employer's Requirements Definition
4. Data and Information Management System
5. Asset Management System
6. Decision Support System



7. Preparation of Bidding documents and Completion

C. Scope of the Assignment

The Services under these Terms of Reference are proposed to be carried out following the tasks as indicated below.

Task 1: Inception Phase

The Consultant shall deliver an inception report which serves as the foundational roadmap and alignment document produced during the initial mobilization phase of the consultancy contract.

Its primary purpose is to bridge the gap between the high-level Terms of Reference (ToR) in the contract and the practical, on-the-ground execution of the project. The Inception Report key content should be the following:

Section	Key Content
1. Introduction & Background	Brief recap of the contract, objectives, and administrative setup.
2. Review of ToR & Context	Initial findings from stakeholder interviews, site visits, and preliminary data review.
3. Technical Methodology	Detailed engineering, management, or analytical approaches to be used.
4. Work Plan & Schedule Update	Gantt charts, activity sequencing, and critical milestones.
5. Team Deployment & Org Chart	Staffing allocations, reporting lines, and counterpart coordination.

Task 1: Inception Phase Deliverables

- Draft Inception Report for approval of Employer
- Final Inception Report after approval of Employer



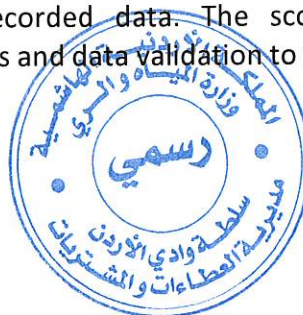
Task 2: Current State Analysis

The Consultant shall undertake a comprehensive review of the existing archiving, information and decision support systems currently being used within JVA and the Ministry of Water and Irrigation. The Consultant will identify both manual and digital systems, assess their effectiveness, and map out

how data flows between departments. The analysis will also examine the accessibility, security, and reliability of these systems, highlighting any redundancies or inefficiencies.

The Consultant will carry out the following tasks:

- a. Paper Records of Assets: A detailed inventory of all paper-based data, information and asset records shall be conducted. The Consultant shall evaluate the condition, organization, and accessibility of these records. Based on this assessment, a digitization strategy shall be developed, including scanning, indexing, metadata tagging, and secure digital storage.
- b. Data Inventory and Analysis: The Consultant shall review existing data sources (historical data, real-time monitoring data, maintenance logs, etc.).
- c. Data Recovery and Curation Plan: the Consultant shall develop and implement a plan for the secure migration of data from existing systems and paper records, ensuring that the new system integrates seamlessly with existing platforms, and that data mapping and validation are conducted thoroughly.
- d. Quality Assurance Procedures: The Consultant shall establish protocols for the ongoing maintenance of digital records, including defining procedures for updates, audits, version control, and quality assurance to ensure that the archive remains accurate and reliable over time.
- e. Availability of Information Management Systems: The Consultant shall assess the systems used to monitor the availability and operational status of assets. This includes evaluating how data is captured, archived, and accessed. The aim is to propose improvements that support real-time tracking and ensure that available records are integrated into the new system.
- f. Availability of Asset Management Systems: The Consultant shall assess the systems used to monitor the availability and operational status of assets. This includes evaluating how data is captured, archived, and accessed. The aim is to propose improvements that support real-time tracking and ensure that available records are integrated into the new system.
- g. Identification and Development Systems: The Consultant shall evaluate how the data related to the identification and development of dams are currently archived and managed. The goal is to identify opportunities for integration with the proposed system to ensure seamless data flow and eliminate duplication.
- h. Maintenance and Fixation of Assets: The Consultant shall assess the current practices for archiving operational data, recording preventive and corrective maintenance, the traceability of maintenance history, and the availability of performance data, to be linked to the new system and suggests improvements for documentation and tracking in order to understand how operations and maintenance activities are documented and archived.
- i. Data Accuracy and Asset Surveys: The Consultant shall evaluate the accuracy and completeness of asset, operational and maintenance data. This includes identifying discrepancies between physical assets and recorded data. The scope also includes recommending protocols for periodic asset surveys and data validation to maintain high data integrity over time.



Task 2: Current State Analysis Deliverables

- Draft Current State Assessment Report
- Stakeholder workshop: conduct workshop with stakeholders to present objectives, gather specific needs and high-level expectations.
- Final Current State Assessment Report

Task 3: Employer's Requirements Definition

The Consultant shall carry out an assessment to define the objectives, purpose and requirements and specifications of the three modules three systems (data and information management, asset management and decision support systems), based on the following tasks:

- Stakeholder Definition:** The Consultant shall carry out a stakeholder analysis to identify users, including dam owners and operators, hydromet services, disaster risk management and emergency service agencies.
- Inventory.** The Consultant shall carry out an inventory of existing systems and data sources, including the current IT infrastructure supporting data storage and archiving, SCADA/telemetry, dam instrumentation, hydromet networks, reservoirs operations, webGIS, decision support tools, dispatch systems (e.g., hydrological forecasting, flood risk visualization) and catalogues, including any national or regional platforms to be integrated.
- Database and System Architecture Design.** The Consultant shall design a data model for storing and managing dam safety information, including tables for inspections, monitoring data, and incident reports, and the system architecture for supporting all existing systems and data sources.
- Functional Requirements.** The Consultant shall define the functional requirements, including documenting user roles, monitoring and alerts, analytics and dashboards, reporting (including regulatory and safety), data cataloguing and discovery, and interfaces for external systems.
- Integration Requirements.** The Consultant shall define the requirements for ensuring interoperability and integrating with the other systems, including, but not limited to, geographic information systems (GIS), SCADA, sensors, water allocation, vendor management, Enterprise Resource Planning, human resources, financial management, among others.
- Technical Requirements.** The Consultant shall define the technical requirements and specifications, including the IT infrastructure requirements, system compatibility, security, scalability, and integration with existing systems, in a format that can be easily incorporated into standard World Bank compliant procurement documents.
- Cybersecurity and Risk Management.** The Consultant shall carry out a risk assessment and define a cybersecurity strategy, including encryption, access control, incident reporting and response mechanisms, and regular auditing requirements.
- Artificial Intelligence.** The Consultant shall define and design the development of AI-assisted tools for decision support, risk detection, impact maximization, task prioritization, etc.

- i. User Experience. The Consultant shall define a scalable architecture (cloud-based, on-premises, or hybrid) that supports future data growth, including, but not necessarily limited to, user stories, user interface design, develop UI/UX wireframes, mockups, and APIs focusing on usability for technical and non-technical users.

Task 3: Employer's Requirements Definition

- Draft Employer's Requirements and Technical Specifications document based on the users' requirement and standards operating procedures (SOPs) as well as to include data migration specifications and plans.
- Stakeholder workshop: conduct workshop with stakeholders to present the demonstration, collect feedback, and prepare user feedback report.
- Final Employer's Requirements and Technical Specifications document.

Task 4: Data and Information Management System

The Consultant shall design a data and information management system to enable real-time and historical data acquisition from dam instrumentation and hydrometeorological networks, their safe storage, curation, and sharing that will support the safe operation, maintenance, and emergency preparedness of dams across their lifecycle and broader water resources functions.

This task, when finished, is an input system for Task 6 Decision Support System.

This will include, but not necessarily be limited to, the following tasks:

a. Data Acquisition and Information Management

- Instrumentation integration, including the design and implement of ingestion pipelines for dam safety instrumentation (piezometers, inclinometers, seepage/flow meters, strain gauges), hydro-meteorological sensors (rainfall, streamflow), and seismic sensors per instrumentation plan principles.
- Telemetry/SCADA integration, including connecting to existing and planned Remote Terminal Units (RTUs) and Programmable Logic Controllers (PLCs), and SCADA historians for operational states (gate positions, turbine status), reservoir levels, inflows/outflows, and alarms.
- External sources, including ingesting forecasts (hydrological, meteorological), satellite/remote sensing products, basin models, and third-party datasets relevant to safety and operations.
- Data acquisition services: Implement secure, resilient data collectors with buffering, retry, time synchronization, provenance tracking, and edge filtering; support event and time-series data models.

b. Information Storage and Data Management

- Design of a layered architecture including a real-time message bus (for streaming telemetry), a time-series database (sensor data), a geospatial data store (reservoirs, inundation polygons, assets), and an analytical data warehouse/data lake for historical analysis.

- Implement a system-wide catalogue with standardized metadata (sensor, station, asset, schema, units, QA/QC flags), ownership, lineage, and retention policies, support discovery for multi-agency users consistent with a national water data program ethos.
- Establish QA/QC workflows, calibration records, automated validation rules, anomaly detection, and stewardship roles; define data lifecycle (ingest, curate, archive) and audit trails.

c. Interoperability and Standards

- Design and implement APIs and data services to provide free and easily accessible water data for authorized users across agencies (WRM, DRM, hydromet, utilities), in line with national water data program principles.
- Define data models and exchange formats consistent with dam safety monitoring needs (time-series measurements, station metadata, event logs), hydrological and meteorological data, and emergency operations information (e.g., inundation maps and warning system characteristics) required by emergency preparedness plans.

d. Implementation, Integration, and Migration

- Plan and execute the data migration of legacy repositories and historical datasets into the new architecture with validation and reconciliation.
- Connect to and, where appropriate, consolidate or federate existing applications (e.g., hydrological forecasting systems, reservoir management, dispatch, webGIS, emergency management software), ensuring continuity of operations.
- Develop comprehensive test plans (unit, integration, performance, security, and user acceptance tests), including failover and disaster recovery drills.
- Deliver system architecture, data dictionary, API specifications, SOPs, and admin/user guides.

Task 4: Data and Information Management System

- Data architecture and interoperability specification; information security plan.
- Implemented data acquisition services; operational data stores and catalogues.
- API endpoints and web services; dashboards and decision-support modules.
- Integration/migration completion report; test reports and acceptance sign-offs.

Task 5: Asset Management System

The Consultant shall design an integrated Asset Management System (AMS) for the portfolio of large dams and any associated infrastructure. The AMS shall support the systematic identification, monitoring, maintenance, rehabilitation, and lifecycle management of dam assets to ensure safety, regulatory compliance, operational efficiency, and long-term asset sustainability. The AMS shall align with relevant standards (e.g., ISO 55000 series, dam safety guidelines, and applicable regulatory requirements) and support risk-based decision-making. This will include, but not necessarily be limited to, the following tasks:



a. Asset Register Development

- **Asset Identification and Hierarchy.** The Consultant shall identify and catalogue all dam-related assets, including: (i) dam structures (embankments, spillways, foundations); (ii) mechanical and electrical components (gates, valves, hoists, instrumentation); (iii) monitoring and safety systems; (iv) ancillary infrastructure (access roads, power supply, communications); and (v) develop an asset hierarchy and classification system aligned with asset criticality.
- **Asset Data Requirements.** The Consultant shall define a Hierarchical Asset Model (portfolio > dam > system > subsystem > component) and standardized attributes, including but not necessarily limited to, asset location, coordinates, manufacturer, model, serial, install date, design capacity, materials, criticality, redundancy, warranty, lifecycle stage. For each asset, the Consultant shall capture: (i) asset description and unique identifier; (ii) location and spatial data (GIS integration where applicable); (iii) design and construction details; (iv) installation and commissioning dates; (v) manufacturer/supplier information; (vi) design life and remaining useful life; (vii) criticality and risk ranking; (viii) regulatory and inspection requirements

b. Monitoring, Inspection, and Condition Assessment

- a. **Monitoring Framework.** The Consultant shall: (i) define monitoring requirements for structural, mechanical, electrical, and geotechnical assets; (ii) integrate manual inspections and automated monitoring systems (e.g., piezometers, seepage monitoring, deformation sensors); and, (iii) establish data collection, validation, and storage protocols.
- b. **Inspection and Condition Rating.** The Consultant shall develop inspection schedules and workflows (routine surveillance, post-event (e.g., extreme rainfall, earthquake), special inspections, calibration checks) based on asset type, risk, and regulatory requirements, establish standardized condition rating methodologies and health indices // maturity matrices tied to failure modes, and define thresholds, alarms, and escalation procedures for abnormal performance.
- c. **Asset Valuation.** The Consultant shall review the current valuation methodologies, including the processes for calculating, updating, and archiving asset values. The Consultant shall advise on implementation of a standardized valuation models, such as historical cost, replacement cost, or depreciated replacement cost; based on the asset category and the strategic needs of JVA.

The Consultant shall ensure that valuation data is integrated into the system and enabling automated updates. This integration is to support financial planning, investment prioritization, and long-term sustainability of asset management practices.

c. Maintenance Management

- a. **Routine Maintenance.** The Consultant shall: (i) define preventive, predictive, corrective and run-to-failure maintenance tasks for all asset classes; (ii) develop maintenance schedules and frequencies aligned with Original Equipment Manufacturer recommendations and operational risks; (iii) establish work order management processes, standard operating procedures (SOPs), checklists, including prioritization and tracking; and (iv) define procedures

for defect identification, assessment, and corrective actions and the integration of emergency and reactive maintenance workflows.

- b. Rehabilitation and Capital Works Planning.** The Consultant shall: (i) define a long-term capital planning module with backlog of rehabilitation needs; (ii) identify assets requiring rehabilitation or replacement based on condition, risk, and lifecycle analysis; (iii) develop medium- and long-term rehabilitation plans; (iv) risk-based prioritization using likelihood-consequence or RBI frameworks; alignment with dam safety standards; (v) support cost estimation, prioritization, and funding planning; (vi) integrate rehabilitation activities into the AMS for tracking and reporting; (vii) scenario planning (e.g., climate stressors, sedimentation impacts) and multi-year investment programming.
- c. Equipment Stores and Spare Parts Management.** The Consultant shall: (i) establish a register of spare parts, tools, and critical equipment, including definition of minimum and maximum stock levels based on criticality and lead times and implementation of inventory tracking, issue, and replenishment processes; and (ii) identify critical spares required for dam safety and operational continuity, including develop storage, preservation, and inspection requirements, and definition of supplier management and procurement strategies.
- d. Risk, Safety, and Compliance.** The Consultant shall: (i) integrate dam safety risk assessments into asset prioritization and maintenance planning; (ii) ensure alignment with regulatory inspection and reporting obligations; (iii) support emergency preparedness and response planning; and, (iv) establish audit trails and compliance reporting mechanisms.
- e. System Integration and Technology.** The Consultant shall: (i) Configure or customize the AMS platform to support defined processes; (ii) enable integration with SCADA and monitoring systems, GIS systems, financial and procurement systems (where applicable), define data security, backup, and access control requirements.
- f. Reporting and Performance Management.** The Consultant shall: (i) develop standard dashboards and reports, including, asset condition, overdue work, maturity matrices and risk profiles, maintenance performance and backlogs, rehabilitation planning and expenditure, inventory, spare parts usage and status, mean time to repair, contractor performance, define KPIs aligned with safety, reliability, and cost efficiency, among others.
- g. Training and Change Management.** The Consultant shall: (i) prepare a training and change management plan for system administrators, engineers, operators, and maintenance staff; (ii) develop user manuals, procedures, and technical documentation; and, (iii) estimate the level of effort and cost associated with implementation of the plan to be considered by the client for implementation under the time-based component of the contract.

Task 5: Asset Management System

- Asset Management Framework and Strategy
- Complete Asset Register
- Configured AMS platform
- Training materials and completion records

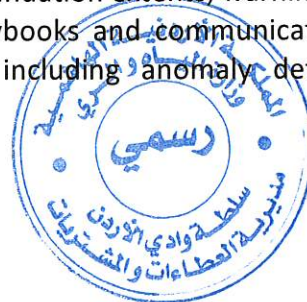


Task 6: Decision Support System

The Consultant shall design a Decision Support System for dam safety that integrates the archive database (including feasibility studies, detailed designs, as-built drawings, etc.), as well as the data and information management system to provide real-time monitoring, risk analysis, and operational guidance and support timely, evidence-based decisions that prevent failures and protect downstream communities and infrastructure. This should include, but not necessarily be limited to, the following functions:

a. Visualization, Analytics, and Decision Support.

- **Dashboards:** Build operational dashboards for dam safety surveillance (thresholds, trends, alarms), reservoir operations (rule curves, inflow/outflow balances), and hydromet/basin conditions.
- **Geospatial and web services:** Publish web map and feature services to integrate with existing webGIS portals and flood risk visualization/processing platforms, enabling shared situational awareness.
- **Data exploration tools,** including portfolio maps with filtering, searching, and thematic layers (risk classes, condition, EPP status), and ability to drill-down from national to regional to asset level.
- **Risk management tools:** Support probabilistic risk analyses, portfolio risk assessment, and performance monitoring consistent with the World Bank's risk management approach to dam safety and good practice notes.
- **Emergency readiness:** Offer decision support for emergency preparedness (EPP) including visualization of inundation maps, warning system configuration, and playbooks for roles and communications.
- **Portfolio risk assessment:** Screening-level risk scoring using standardized indicators (e.g., condition, hazard, consequence, surveillance results), semi-quantitative methods to rank/prioritize dams for further investigation or investment, including modules for consequence assessment (exposure, critical infrastructure dependencies, environmental impacts)
- **Performance and trends:** Instrumentation trend analytics and threshold exceedance summaries at portfolio level; Inspection findings and defect tracking with severity and time-to-resolution indicators;
- **Forecast-informed decision support:** Integrate hydrological/meteorological forecasts to anticipate inflow and stress conditions and configurable triggers for heightened surveillance and pre-emptive actions per EPPs/operating rules, reservoir operations decision support linkages (rule curves, environmental flows)
- **Event and emergency readiness:** Visualization of inundation extents, warning timelines, and exposed populations/infrastructure; checklists/playbooks and communications workflows aligned with EPPs and institutional mandates, including anomaly detection on key sensors/SCADA summaries



- **Reporting and Exports.** Automated preparation of configurable reports (regulatory, performance, investment plans) in standard formats, API-backed data extracts for analysis in external tools, including decision logs capturing context, assumptions, approvals, and outcomes to support accountability and learning
 - **Mobile Applications.** for field inspections with offline synchronization capabilities
- b. **AI Applications.** The Consultant shall identify opportunities for integrating AI models, such as those for anomaly detection, predictive risk forecasting (including potential failure modes), asset health assessment, and early warning/alerting, including the design of human-in-the-loop workflows and explainability features to support transparent, auditable decisions, and Machine Learning Operations for continuous model monitoring and retraining.
- c. **Implementation, Integration, and Migration Plan.** The Consultant shall prepare a plan that allows for phased delivery, such as starting with a pilot cohort of dams and priority dam management units, then scaling nationally, along with a data migration plan, with End-to-End tests for each external system interface, failover, disaster recovery, and cyber incident tabletop exercises. The system should allow for auditing and oversight, including decision logs and audit trails for key actions, and periodic independent reviews of risk methods and data quality.

Task 6: Decision Support System

- Inception package: Stakeholder map, use cases, requirements, and implementation plan
- Information model and governance, including data dictionaries, portfolio asset schema, risk model definitions and data governance framework and data sharing agreements/MOUs
- System architecture design, integration specifications, cyber security plan, DR/BCP

Task 7: Preparation of Bidding Documents and Completion

The Consultant shall

- a) Prepare all needed **Bidding Documents** for the following contract Supply and Installation of the IT system needed to support the three systems.
- b) Finalize the Contract with the submittal of the **Final Completion Report**, summarizing all activities carried out under the assignment, key outputs delivered, lessons learned, outstanding issues, and recommendations for long-term sustainability and future system enhancement.

Task 7: Preparation of Bidding Documents

- Bidding Documents
- Completion Report



D. Reporting Requirements for Deliverables

The Consultant shall submit all reports and deliverables in English, in both hardcopy and editable softcopy formats, to JVA for review and onward transmittal to the World Bank for review and guidance. The reporting requirements shall include, but not necessarily be limited to, the following:

Inception Report. The Consultant shall submit an Inception Report within one month from the contract signing date. The report shall include the Consultant's understanding of the assignment, methodology, detailed work plan and implementation schedule, stakeholder engagement and communication plan, staffing schedule, and proposed approach for delivery of the assignment outputs.

Monthly Progress Reports. The Consultant shall submit monthly progress reports throughout the contract duration. The reports shall summarize progress against the approved work plan, status of deliverables, coordination activities, issues and risks encountered, proposed mitigation measures, planned activities for the following period, and any supporting documentation relevant to the assignment.

Final Completion Report.

Task 1 Deliverables – Inception Phase

Draft Inception Report for approval of Employer, including 1. Introduction & Background (Brief recap of the contract, objectives, and administrative setup), 2. Review of ToR & Context (Initial findings from stakeholder interviews, site visits, and preliminary data review), 3. Technical Methodology (Detailed engineering, management, or analytical approaches to be used), 4. Work Plan & Schedule Update (Gantt charts, activity sequencing, and critical milestones), 5. Team Deployment & Org Chart (Staffing allocations, reporting lines, and counterpart coordination).

Final Inception Report after approval of Employer, including the comments from the Employer and the Donor.

Task 2 Deliverables – Current State Analysis

Draft Current State Analysis Report. The Consultant shall submit a report detailing the assessment of the existing archiving systems, data management systems, workflows, institutional arrangements, and asset management practices, including identification of gaps, redundancies, and operational challenges.

Stakeholder Workshop Report. The Consultant shall conduct stakeholder consultations and workshops and submit a report summarizing stakeholder requirements, comments, and key findings.

Final Current State Analysis report . The Consultant shall submit a final report including comments from Employer and Donor resolved and stakeholder needs, functional and non-functional requirements, and preliminary system requirements.



Task 3 Deliverables – Employer's Requirements Definition

Employer's Requirements and Technical Specifications Report : The Consultant shall prepare and submit a comprehensive business blueprint and system requirements specification covering the Data Management System, Asset Management System, and Decision Support System.

System Architecture and Integration Report: The Consultant shall submit the proposed system architecture, integration framework, interoperability requirements, cybersecurity considerations, and technical specifications.

User Acceptance and Workshop Reports: The Consultant shall conduct stakeholder demonstrations and workshops and submit user feedback summaries and user acceptance checklists.

Task 4 Deliverables – Data and Information Management System

Data and Information management System Report, including:

Data Architecture and Interoperability Report: The Consultant shall submit the system data architecture, metadata standards, interoperability framework, and information security plan.

System Integration and Implementation Report: The Consultant shall submit reports covering implementation of data acquisition services, operational databases, catalogues, APIs, and integration with SCADA, GIS, and related systems.

Testing and Acceptance Reports. The Consultant shall submit system testing reports, including integration, performance, security, failover, and user acceptance testing results.

Task 5 Deliverables – Asset Management System

Asset Management System Report, including:

Asset Management Framework Report: The Consultant shall submit the AMS framework, asset hierarchy, asset classification methodology, and lifecycle management approach.

Asset Register and Maintenance Management Reports: The Consultant shall submit the complete asset register, maintenance workflows, inspection procedures, rehabilitation planning framework, and KPI dashboards.

Training and Capacity Building Reports: The Consultant shall submit training materials, user manuals, workshop summaries, and completion records.

Task 6 Deliverables – Decision Support System

Decision Support System Report, including:

DSS Functional Design Report: The Consultant shall submit the DSS functional design including dashboards, visualization tools, analytics modules, and reporting functionalities.



Risk and Emergency Support Tools Report: The Consultant shall submit the portfolio risk framework, emergency preparedness support tools, inundation visualization concepts, and forecasting integration approach.

AI and Advanced Analytics Report: The Consultant shall submit proposed AI applications, anomaly detection concepts, predictive analytics approaches, and implementation roadmap.

Task 7 Deliverables – Preparation of Bidding Documents and Completion

Bidding Documents. The Consultant shall prepare all needed bidding documents for the following contract Supply and Installation of the IT system.

Final Completion Report: The Consultant shall submit a Final Completion Report summarizing all activities carried out under the assignment, key outputs delivered, lessons learned, outstanding issues, and recommendations for long-term sustainability and future system enhancement.

E. Team Composition and Qualification Requirements for the Key Experts

The Consultant shall have a multidisciplinary team with demonstrated expertise in dam safety engineering, asset management, information systems, data management, and digital decision-support platforms. The team shall collectively possess strong experience in dams management, operation, safety management, and risk assessment, as well as in the development and implementation of integrated digital systems including data platforms, SCADA integration, GIS, and decision support systems. Familiarity with internationally recognized standards and guidelines, including ICOLD and relevant World Bank dam safety requirements, is essential.

The Consultant shall mobilize qualified personnel as required to successfully deliver the assignment. The minimum key expert positions are outlined below; however, the Consultant shall remain fully responsible for proposing any additional staff required to complete the Services. All key experts shall be fluent in written and spoken English and shall be fully computer literate, with relevant experience in digital tools and systems applicable to their respective roles.

The CVs of all proposed key experts shall be submitted for evaluation to verify compliance with the required qualifications and experience. The Consultant's key personnel shall include, but not necessarily be limited to, the following position:

Table 3: The Consultant's key personnel proposed.

Position	Qualifications
Team Leader / Dam safety expert	Demonstrated experience and at least 20 years of experience with concrete gravity, embankment rock fill, or other relevant types of dams, including the design and construction, quality control and/or other type of structures in terms of the structural design of the dam. Languages: English, with Arabic an advantage.

Enterprise Systems and solution Architect Expert shall have a degree in Computer Science, Information Systems, or related field with 10–15 years of experience in enterprise architecture and large-scale digital systems. He/She must demonstrate experience in designing integrated platforms (data, GIS, asset management, and DSS), including APIs, cloud/hybrid architectures, and interoperability frameworks. Experience in infrastructure or government digital transformation projects is an advantage.

Dam Safety monitoring and SCADA Specialist e Specialist shall have at least 10–15 years of demonstrated experience in dam instrumentation and SCADA systems. He/She must have proven experience in monitoring systems integration, including sensors, RTUs/PLCs, telemetry, and real-time data acquisition for dams or hydropower facilities. Knowledge of alarm systems, threshold management, and operational safety monitoring is required.

Data Management Specialist The Specialist shall hold a degree in Data Science, Computer Science, or Information Systems with 8–12 years of experience in data management and system integration. He/She must have strong expertise in database design, data architecture, data governance, QA/QC processes, and large-scale data migration. Experience with geospatial, hydrological, or sensor-based data systems is an advantage.

Cybersecurity and AI Specialist The Specialist shall have a degree in Cybersecurity, Computer Science, or Artificial Intelligence with 8–12 years of experience in cybersecurity and AI systems. He/She must demonstrate expertise in secure system design, critical infrastructure protection (including SCADA/IoT), and AI applications such as anomaly detection and predictive analytics. Knowledge of ISO 27001, NIST, and MLOps is required.

Procurement specialist The Specialist shall have a degree in Procurement, Engineering, or Business Administration with at least 10 years of experience in procurement of infrastructure or ICT systems. He/She must have strong experience in World Bank or MDB procurement procedures, including preparation of RFPs, bidding documents, evaluation reports, and contract management. Experience in procurement of complex digital systems is essential.



Training and institutional support specialist

The Specialist shall have at least 10 years of experience in institutional capacity building, training program design, and change management for public sector or infrastructure projects. He/She must have proven experience in developing and delivering training programs, user manuals, and capacity-building plans for technical and non-technical users. Experience in supporting institutionalization of complex IT or asset management systems is required.

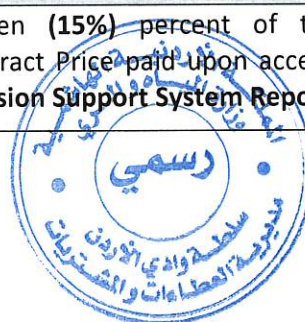
F. Payment Schedule

All payments shall be made on a lumpsum basis, upon submission and approval of the corresponding deliverables.

Payments shall be made according to the following schedule:

Table 4: Payment schedule

Deliverables Submittals	Payment Schedule
Payment No.1: Inception Report	Ten (10%) percent of the Lumpsum Contract Price paid upon acceptance of the Inception Report
Payment No.2: Current State Analysis Report	Fifteen (15%) percent of the Lumpsum Contract Price paid upon acceptance of the Current State Analysis Report
Payment No.3: Employer's Requirements and Technical Specifications Report, System Architecture and Integration Report and User Acceptance and Workshop Reports	Twenty (20%) percent of the Lumpsum Contract Price paid upon acceptance of the Employer's Requirements and Technical Specifications Report, System Architecture and Integration Report and User Acceptance and Workshop Reports
Payment No.4: Data and Information Management System Report	Fifteen (15%) percent of the Lumpsum Contract Price paid upon acceptance of the Data and Information Management System Report.
Payment No.5: Asset Management System Report	Fifteen (15%) percent of the Lumpsum Contract Price paid upon acceptance of the Asset Management System Report
Payment No.6: Decision Support System Report	Fifteen (15%) percent of the Lumpsum Contract Price paid upon acceptance of the Decision Support System Report.



Payment No.7: Bidding Documents	Five (5%) percent of the Lumpsum Contract Price paid upon acceptance of the Bidding Documents
Payment No.8: Final Completion Report	Five (5%) percent of the Lumpsum Contract Price paid upon acceptance of the Final Completion Report .

G. Duration Schedule

Estimated duration of the services is 12 months:

Table 6: Duration of Tasks (figures in months, ND meaning Notification Date)

	SUBMITTAL	DEADLINE FOR SUBMISSION
TASK 1	Draft Inception Report-	ND+1
	Client Review	+0.5
	Inception Report-final report	+0.5
TASK 2	Current State Analysis Report-initial report	ND+3
	Client Review	+0.5
	Current State Analysis Report-final report	+0.5
TASK 3	Employer's Requirements and Technical Specifications Report (and all other reports in this task)	ND+4
	Client Review	+0.5
	System Definition and design Report-final report	+0.5
TASK 4	Data and information management System - initial Report	ND+6
	Client Review	+0.5
	Data and Information Management System - Final Report	+0.5
TASK 5	Asset Management System – Initial Report	ND+8



	Client Review	+0.5
	Asset Management System – Final Report	+0.5
TASK 6	Decision Support System – Initial Report	ND+9
	Client Review	+0.5
	Decision Support System – Final Report	+0.5
TASK 7	Bidding Documents – Initial Report	ND+10
	Client Review	+0.5
	Bidding Documents – Final Report	+0.5
	Final completion report – initial report	ND+11
	Client Review	+0.5
	Final Completion report – Final report	+0.5

