

TERMS OF REFERENCE FOR

PACKAGE NO. CS02 AF: CONSULTANCY SERVICES FOR THE ESTABLISHMENT OF A NATIONAL WATER RESOURCES DATA MANAGEMENT CENTER (NWRDMC) AND A NATIONAL WATER RESOURCES INFORMATION SYSTEM (NWRIS)

A. Background

Cambodia is generally rich in water resources, although water availability varies greatly in space and time. It is of great relevance to various government agencies and other stakeholders to have access to timely and reliable water data relevant to their purposes.

Mandated by the Government of Cambodia, the Ministry of Water Resources and Meteorology (MOWRAM) is required to implement the Law on Water Resources Management (2007), and formulate and execute water policy and perform water resources management. This includes the establishment of a modern, centralized water resources inventory. At present, MOWRAM has a number of databases already in place, including the Cambodian Irrigation Schemes Information System (CISIS) for irrigation; HYMOS platform and other in-house databases used by the Department of Hydrology and River Works (DHRW) to store, process, and present hydrological data; and databases at the Department of Meteorology (DOM) for doppler radar, weather, and climate data.

In addition to MOWRAM's databases, there are other activities and projects where water resources related data is collected. At this stage, however, there is no mechanism for centralizing the storage of the data and to support sharing of the data. Quality control of the data to ensure what is collected can be used to support decision-making processes is also not yet established. This scattered landscape has resulted in challenges on data and information exchange, data sharing, and data management issues.

In 2017, the Asian Development Bank (ADB) approved the Transaction Technical Assistance (TRTA) for the Irrigated Agricultural Improvement Project (the project) (TA 9349-CAM). One of the components under this TRTA is to support MOWRAM to strengthen water resources management practices in Cambodia by developing a modern, national Water Resources Information System (WRIS) to hold water resources related data including ground observations (e.g., stream water levels), analytical information (e.g., outputs from water resource modelling analysis), and remote sensing (e.g., maps). The TRTA is also supporting the construction of a National Water Resources Data Management Center (NWRDMC) where the WRIS is to be located and the construction of new doppler radar to complement and improve forecasting capacity of MOWRAM.

The WRIS will provide a central location for water resources information to support sustainable water resources management and development decision making processes in Cambodia. It is critical that the WRIS is a modern, adaptive system that can support continuous improvements of the quality and type of information stored. The NWRDMC is to provide a modern, state-of-the-art facility, to host the WRIS and technical departments of MOWRAM's and integrate data from doppler radar that have water resources management related responsibilities.

B. The Consultancy Services Objectives

The key objectives of this consulting assignment are to:

- (i) Assess the status of existing water information systems in MOWRAM and the water resources information needs of key government agencies to inform the design of a modern NWRDMC and WRIS.
- (ii) Design the NWRDMC, Doppler Radar Building, and WRIS based on the findings from government consultations and international best practices.
- (iii) Support MOWRAM on tendering processes for the construction of the NWRDMC, Doppler Radar Building including preparation of detailed engineering and architecture designs, technical specifications, bill of quantities and relevant bidding documents.
- (iv) Supervision in the construction of the NWRDMC and Doppler Radar Building.
- (v) Develop a modern and adaptive national WRIS adhering to international best practices.
- (vi) Support MOWRAM to establish sustainable O&M systems for the NWRDMC and WRIS

C. Scope of Services

The consultancy firm scope of work includes support to MOWRAM but not limited to the following:

- (i) Strengthen national management of water resources information through the establishment of the NWRDMC, Doppler Radar building, and the WRIS, and systematic processes for the collection, processing, storage, and dissemination of water resources information.
- (ii) Design a modern NWRDMC, Doppler Radar Building, and WRIS based on the needs of the stakeholders involved in the management and development of Cambodia's water resources, and that meet international best practices.
- (iii) Ensure the WRIS is a common platform for integrating water-related and non-water-related information, and is a user-friendly, web-based system that includes visualization of data and maps.
- (iv) Ensure the NWRDMC and Doppler Radar building are constructed as a modern national center for water resources information.
- (v) Ensure the WRIS integrates all existing water resources related databases and has to compatibility function to integrate new water resources information and database as they become available over time. This include ground measurements (e.g., rainfall, water level) and satellite-derived remote sensing data (e.g., vegetation cover, crop over).¹
- (vi) Ensure the WRIS is housed at the NWRDMC and that it is a central (national) hub for water resources information and in the future water resources analytics (e.g., modelling systems).
- (vii) Integrate data, information and knowledge, maps, and reports into one database system including relevant and accessible data from other ministries (e.g., Ministry of Agriculture, Forestry and Fisheries [MAFF] and Ministry of Environment [MOE]).
- (viii) Build the capacity development of MOWRAM staff to operate and maintain the NWRDMC, Doppler Radar, and the WRIS including the provision of water resources information to meet stakeholders needs.

The specific task of the firm are as follows:

1. Component 1: Design and supervise the establishment of NWRDMC, Doppler Radar Building, and National Water Resources Information System

- Prepare a needs assessment report that summarizes the key stakeholder requirements and international best practices for establishing a NWRDMC, Doppler Radar Building and WRIS. Linkages between existing databases and the WRIS are to be clearly described in the report.
- Prepare a number of concept design options for the WRIS for MOWRAM's consideration that support integration of ground observation information, remote sensing information and water resources related modelling results. This includes information that has been generated from past and present development partner supported projects.
- Develop concept engineering and architecture designs for the NWRDMC, Doppler Radar building, including internal layouts, based on the findings of the needs assessment report. Present the options to MOWRAM for consideration.
- In designing the NWRDMC and Doppler Radar Building, the following is to be considered but not limited to:
 - (i) Appropriate rooms for specific functions such as holding a database and server for the WRIS technical working groups discussions on water resources modelling and analytics; real-time forecasting monitoring room;3 processing of water resources data and information (e.g., remote sensing); conference room with appropriately sized display screens; the National Flood Forecasting Centre,4 etc.).
 - (ii) Information and Communication Technology (ICT) aspects, both traditional (e.g., monitoring room with TV monitors to report water situation) and new media (e.g., website, mobile application) to fit the needs of different end-users, including women, to support water resources management and planning.
 - (iii) O&M of WRIS.
 - (iv) Technical and non-technical training and workshop purposes.
 - (v) Controlling temperature, dust prevention, moisture proof, and noise protection for server and data storage rooms.
 - (vi) Electrical lightning proof and grounding, lightings, air conditioning, air handling unit and ventilation.
 - (vii) Fire alarm and firefighting system and evacuation route.
 - (viii) Convenient and elegant cable management system with channels for electrical and data and/or communication system.
 - (ix) Electric, internet connection, and security specifications to support adequate ICT functions.
 - (x) Other design criteria as deemed necessary for the functions identified.
- Prepare the technical specifications, bill of quantities, drawings, and supplementary information regarding works to be procured for the bidding documents for the construction of the Doppler Radar building and the technical specifications of the goods and equipment for NWRDMC and WRIS. Assist in the preparation of the bidding document in collaboration with the Procurement/Contract Management Specialist of the project management and implementation consultant (PMIC) who will take the lead in preparing all bidding documents (e.g., NWRDMC building, Doppler Radar building, equipment for the WRIS).
- In consultation, MOWRAM make amendments and modifications to the designs, drawings, and documents as needed to obtain the government's approvals and permits, and provide

assistance in obtaining the required government and/or municipal approvals and/or permits and the tendering process

- Supervise all aspects of the construction and installation of the various components of the civil works of NWRDMC (separate contract) and Doppler Radar building to ensure that the constructed structures and equipment meet the design requirements and standards. This includes carrying out the services attributed to “the Project Manager” or to “the Engineer” under NWRDMC and Doppler radar construction contract during the construction period; and interpreting the drawings and specifications to the Construction Contractor as required to ensure compliance with the contract documents and the construction and/or installation program.
- Produce monthly progress reports to provide regular and detailed information on progress and quality of construction works including any outstanding issues and recommendations for improvement. This includes reviewing the construction completion report and the as-built drawings developed by the NWRDMC and Doppler Radar building construction contract.
- Coordinate with the environmental and social safeguard specialists under the PMU to prepare all applicable environmental and social safeguards documents in compliance with the legislation of the government, and the ADB Safeguard Policy Statement 2009, and assist MOWRAM in obtaining approval of all safeguards documents before the contract is awarded. The firm will also coordinate with the Environmental and Social Safeguard Specialists during the construction to ensure compliance, and identify and implement remedial actions where needed.

2. Component 2: Development of the national WRIS

Develop the WRIS components such as database, back-end⁵ (server) and front-end⁶ (user-friendly online platform and mobile application) by considering the findings from the needs assessment report.

During the development of the WRIS secure a cloud-based system to host the WRIS while the NWRDMC and doppler radar building are under construction. Opportunities are to be explored for using a mixture of cloud-based computing and hardware data storages systems, post-

construction of the NWRDMC and doppler radar building, and presented to MOWRAM for consideration. Selection of cloud-based system or in-house server or combination of cloud-based and in-house systems for WRIS will be finalized in collaboration with MOWRAM to meet their requirements.

Configure and validate the WRIS.

Prepare manuals and instructions and how to use the WRIS.

3. Data gathering and data processing

Review, assess, and incorporate water resources data into the WRIS. This includes primary data such as ground observations, surveys, and secondary data including satellite-based information and results from modelling systems. Surface water and groundwater quantity and quality data is to be incorporated in the WRIS. Outputs from doppler radar and data from weather and climate monitoring and forecasting system from the Department of Meteorology. Other projects include:

- (i) Rapid Assessments on the Status of Water Resources and Eco-hydrological Environments for the Tonle Sap and Mekong Delta River Basin Groups and River Basin Surface Water Resource Assessments (ADB)
- (ii) Greater Mekong Subregion Flood and Drought Risk Management and Mitigation Project (ADB)
- (iii) Mekong Integrated Water Resources Management Cambodia Project (World Bank)
- (iv) Strengthening Climate Information and Early Warning Systems in Cambodia to Support Climate Resilience Development and Adaptation to Climate Change (UNDP)
- (v) Uplands Irrigation and Water Resources Management Sector Project (ADB)
- (vi) River Basin Water Resources Utilization Project (JICA)
- (vii) Water Resources Management and Agro-Ecological Transition for Cambodia (AFD)
- (viii) Mekong HYCOS (MRC)

Process all data for quality assurance, including screening, checking and standardizing the format of data. Poor quality data to be cleaned up (e.g. filling in data gaps) and where appropriate, processing the data into simplified format such as graphs, plots and maps etc. for dissemination purposes that is accessible to non-technical audiences. Satellite-based information to be stored and shared in the format (e.g. netCDF, binary and etc.) that can be processed at a later stage for visualization purpose.

4. Set up hardware and software for WRIS

The firm shall set up hardware, including computer units, data storage, networking, and other relevant hardware and software for managing the hardware of WRIS. The procurement of equipment for WRIS will be carried out in a separate contract. The firm is responsible for preparing the bidding documents and providing support on procurement of the hardware and software, and management of software including development of programming codes to migrate the processed data, operate and maintain the database of WRIS. Open-source and free-license software for the WRIS is preferred while the appropriate choices of software should consider the functions of WRIS based on needs assessment.

The firm shall design the user interfaces (online website and mobile application) based on the needs assessment. Open-source programming languages are to be used such as JQuery, Sass, Bootstrap, Angular JS, and etc. to develop the online user interfaces with API-based web application. Choices of programming languages used for user interface development will be based on required features and functions from need assessment. The online platform and mobile application are to link with the database and be capable of disseminating the data (e.g., ground observations, satellite-based information such as from WA+ tool, results from modelling analysis). The online platform shall include information on water availability, water supply, water use, water demand for different sectors, especially on agricultures, weather and climate, hydrological condition, flood forecasting, physical (land-use, topography, elevation, river network, irrigated areas, irrigation canal, road network, and etc.) and socioeconomic conditions of the basin and etc. Information and knowledge to be disseminated on the online platform and mobile application will be based on needs assessment in collaboration with different ministries.

5. Component 4 Capacity Development

Capacity development will be a combination of classroom and on-the-job training, learning-by-doing trainings. Training program will be designed based on a capacity needs assessment. The firm will coordinate with MOWRAM, MAFF, and MOE on the selection of participants; conduct pre- and post-training assessments; design the training program (both classroom and on-the-job trainings) for MONRE and MAFF; conduct the training; and prepare a training evaluation report.

Training topics will be selected based on a capacity needs assessment and priority for WRIS. Training topics could include statistical analysis of hydrological-meteorological data, data gap filling, basic remote sensing and geographic information system (GIS), analysis of remote sensing data and other topics based on the capacity needs assessment.

Training to be undertaken on the O&M of WRIS including database maintenance and upgrade, back-up systems, security, and NWRDMC standard operating protocols.

The training program will be designed by considering two types of targeted groups (technical staff and general audiences who use information from WRIS for water resources management purposes).

During project implementation, on-the-job trainings will also be carried out in close collaboration with the assigned working groups in MOWRAM and MAFF. On-the-job trainings should consider the case study or demonstration project approach.

D. Deliverables

The assignment is expected to produce the following deliverables:

- (i) Design doppler radar building, continue the supervision of NWRDMC and WRIS.
- (ii) Engineering and architecture (exterior and interior) designs for Doppler Radar building.
- (iii) Detailed design of the WRIS including specification of hardware and software.
- (iv) Terms of reference, technical specifications, bill of quantities, and other bidding documents to support tendering processes of doppler radar building, and equipment for NWRDMC and WRIS.
- (v) A fully constructed and functional modern NWRDMC and doppler radar building.
- (vi) A fully functioning modern, national WRIS adhering to international standards

(including World Meteorological Organization) with at least the following features:

- Unified database integrating institutional data, satellite-derived datasets, results from modelling systems.
- Cloud-based computing/data storage systems in parallel with local server.
- Back-up system.
- Scripts/codes for database management and user interface management.
- Database security and data protection.
- Online user-friendly interface (website) with functions for user accounts registration and management, search and filter, layer control features, navigation toolbar, download of dataset, report generation in form of maps, tables, charts, helps and feedback.

- Mobile application for WRIS.
- (vii) Capacity needs assessment to strengthen MOWRAM staff knowledge and skillsets.
- (viii) Implementation of an on-the-job training program based on the capacity needs assessment

E. Duration and Location of Services

The duration of the consultancy services assignment is 36 months, from the date of signature of the contract, which is anticipated to be signed Q2-2025. The Firm's office will be in the MOWRAM PMU in Phnom Penh, Cambodia.

F. Qualifications of the consultancy firm and the Key Experts

F1. Qualifications of the consultancy firm and experts. The firm should have at least 10 years of experience in building design, with proven technical expertise in the preparation of DED: (i) site development and perspective plans, architectural, structural, electrical, solar power system, mechanical, sanitary & plumbing; (ii) construction scheduling and management; (iii) technical specifications; (iv) project scheduling & construction duration/ PERT/CPM or its equivalent (v) bidding documents based on FIDIC for building; (vi) environmental and social safeguards for civil works development; and (vii) health and safety in the workplace, of the Doppler Rada, consistent with the approved project documents including but not limited to Doppler Rada minimum standards and ADB guides and IEE reports with Cambodia construction law, building code, climate change resilient design standard, greenhouse building design, fire code, electrical and mechanical codes of Cambodia and international environmental and social safeguards standards. The Firm will be engaged through international consulting firms using the quality and cost-based selection (QCBS) method (90:10) in accordance with ADB's Procurement Policy (2017) and Procurement Regulations for ADB Borrowers (2017), as amended from time to time.

F2. Team Composition and Qualification Requirements for the Key Experts

The firm will provide the team with relevant expertise and experience in design of a modern NWRDMC, doppler radar building, and national WRIS, and will comprise of international and national key experts with a total input of 114 person-months (p-m) and 294 p-m, respectively, as detailed in the table below. The terms of reference of the specialists are given below.

No.	Position	Person-months		Key Experts
		International	National	
1	Team Leader	12		√
2	Deputy Team Leader		30	√
3	Design Architect	5	6	√
4	Civil Structure Design Engineer	5	6	√
5	Design Mechanical Electrical Plumbing Engineer	4	6	√
6	Supervision Architect	8	15	√
7	Civil Structure Supervision Engineer	12	24	√
8	Mechanical Electrical Plumbing Supervision Engineer	8	15	√
9	Quantity Surveyor/Quality Control		15	√

10	Occupational Health and Safety Specialist		15	√
11	Information System Analyst	12		√
12	Database developer	4		√
13	User interface developer	4		√
14	WRIS Information Technology (IT) Programmer		60	√
15	Hydrologist	8	12	√
16	Meteorologist	8	10	√
17	GIS Specialist	6	8	√
18	Water accounting specialist	6	6	√
19	Water productivity specialist	6	6	√
20	Training specialists - O&M Database	3	5	
21	Training specialists - O&M User Interface	3	5	
22	Autocad-Draftman		20	
23	Data collectors/assitant		18	
24	IT Support Officer		12	
	Total	114	294	

1. Team Leader (International 12 p-m)

The Team Leader must have a Master's degree in civil engineering with water resources engineering background. Team Leader have preferably 15 years of experience in the design and implementation of related engineering and management projects. This position should have experience in leading the team on establishment of NWRDMC with water resources information system including analytical tools and database, and management of doppler radar design and data management. The expert should have experiences in implementing preferably two projects funded by ADB, World Bank, or other development partners. They must have demonstrated ability to lead teams of international and national consultants and create a strong working relationship with the executing and implementing agencies. Excellent communication (written and oral) skills and strong interpersonal skills will be considered an asset.

The Team Leader will:

- (i) Have overall responsibility for leading the team by providing technical advices and supports during implementation, including preparation and implementation of work plans.
- (ii) Coordinate with ADB financed projects and other projects or initiatives (such as World Bank, AFD, JICA, and etc.) relevant to NWRDMC, Doppler radar, and information system development to ensure synergies and coordination on development of NWRDMC, doppler radar building, and information system including infrastructure, hardware and software requirements and enhancement of institution and personal capacities.

- (iii) Support MOWRAM on tendering processes for Doppler Radar building construction and establishment of WRIS by developing the terms of references and relevant bidding documents including support on bidding evaluation.
- (iv) Conduct needs assessment with stakeholders by considering ongoing and planned projects relevant to the NWRDMC, doppler radar building, and information system to understand the gaps and needs on NWRDMC, doppler radar building and WRIS.
- (v) Lead the team to design/supervise construction of NWRDMC, Doppler Radar Building, and WRIS.
- (vi) Collaborate with the team and design a training program.
- (vii) Monitor and evaluate progress against project implementation schedule, and coordinate the preparation and submission of periodic progress and technical reports.
- (viii) Monitor procurement and financial management, and oversee contract management.
- (ix) Work closely with the PMU and other agencies and advise the PMU Project Director on matters related to the NWRDMC, Doppler Radar, and WRIS.
- (x) Maintain good coordination among ADB, PMU, and other stakeholders and assure linkage with key institutions under MOWRAM, MAFF, MOE, and local authorities during project implementation;
- (xi) Provide guidance to the team to ensure that the work meets the required standards.

2. Deputy Team Leader (national, 30 p-m)

The Deputy Team Leader preferably has a Master's degree in civil engineering with water resources background. Deputy Team Leader have preferably 10 years of experience in managing related engineering and management projects in region. This position should have good understanding with experiences on processes of establishment of NWRDMC, doppler radar and WRIS. Working experiences with government agencies under ministries in Cambodia are crucial for this position. Previous working experience in projects funded by ADB, World Bank, or other development agencies will be an advantage. Excellent communication (written and oral) skills and strong inter-personal skills will be considered an asset.

The Deputy Team Leader will:

- (i) Assist the Team Leader in leading the design, providing advices and implementing the assignments.
- (ii) Provide advices and supports the team on governance and appropriate coordination mechanisms to ensure smooth collaboration with relevant agencies in Cambodia.

- (iii) Support the team on networking with other projects or initiatives related to water resources management, NWRDMC, doppler radar building, and information system development in Cambodia.
- (iv) Provide day-to-day advices and supports the team on assignment implementation as required by the clients.
- (v) Closely collaborate with MOWRAM through participatory engagement on implementation of the assignment to ensure achievement of the assignment objectives.
- (vi) Provide advices and supports the team and MOWRAM as required.

3. Design Architect (international 5 p-m, national 6 p-m)

The consultant preferably has a Bachelor's degree in architecture and preferably with 8 years of experience in the architectural design, detailed design of fit-for-purpose buildings, especially with information technology functions. Experiences in design works in Cambodia are beneficial. Previous experience working in projects funded by ADB, World Bank, or other similar development agencies, especially in the region will be beneficial. Excellent English communication (written and oral) skills will be considered an asset.

The Design Architect will:

- (i) Consult with clients and evaluate their needs and then develop ideas for the structure.
- (ii) Carry out architectural designs, both interior and exterior designs of the building and rooms to address the end-users' needs for the Doppler Radar building.
- (iii) Use a range of computer software to develop sketch, blueprint, and render of the doppler radar building and create physical model of the doppler radar building.
- (iv) Present ideas, plans and models to the clients for recommendations and approval.
- (v) Produce drawings, sketches, layout or any document relevant to the design of doppler radar building.

4. Civil/Structure Design Engineer (international 5 p-m, national 6 p-m)

The specialists preferably have a Bachelor's degree in civil or structural engineering preferably with 10 years of experience (8 years of experience for national position) in the design of fit-for-purpose buildings and overseeing the building construction, especially with IT functions. Civil/Structural Design Engineers should hold professional engineer license for building design. Previous experience working in projects funded by ADB, World Bank, or other similar development agencies, especially in the region will be beneficial. Excellent English

communication (written and oral) skills will be considered an asset. The position will:

- (i) Lead and supervise the team (Design Architect, Civil Engineers, and Electrical Engineers) on building construction.
- (ii) Conduct site survey and site investigation using appropriate survey equipment for preparation of building construction.
- (iii) Consult with clients and evaluate their needs and then design the doppler radar building based on the findings from the needs assessment.
- (iv) Carry out the structural designs considering building functions on heating, vent, air conditioning, and water supply and sanitation, internal and external lighting system, communication systems, computer networking, fire alarm and firefighting system, CCTV system, sewerage and drainage systems, and any other functions (refer to design criteria in Component 1) as identified by the needs assessment.
- (v) Produce floor plans, drawings, layouts of each room in the building to serve the functions of the Doppler Radar Building, and WRIS.
- (vi) Collaborate with the Team Leader to supervise construction of the NWRDMC, Doppler Radar building, and establishment of WRIS.
- (vii) Produce drawings, sketches, layout or any document relevant to the design of NWRDMC, doppler radar building.
- (viii) The international and national positions should closely collaborate to ensure continuous support, especially during construction supervision and WRIS establishment, to MOWRAM as required.

5. Mechanical-Electrical-Plumbing Design Engineers (international, 4 p-m, national 6 p-m)

The specialists preferably have a Bachelor's degree in electrical engineering or plumbing engineering or relevant field with preferably 8 years of professional experience (5 years of experience for national position) in designing and overseeing electrical systems and devices of buildings with complex IT and communication systems. Previous experience working in projects funded by ADB, World Bank, or other similar development agencies, especially in the region will be beneficial. Excellent English communication (written and oral) skills will be considered an asset.

The consultant will:

- (i) Consult with clients and evaluate their needs and then design the buildings based on their needs and functions of the doppler radar building
- (ii) Carry out the electrical engineering designs considering building functions on heating, vent, air conditioning, water supply and sanitation, internal and external lighting system, communication systems, computer networking, fire alarm and firefighting system, CCTV system, sewerage and drainage systems, and any other

functions (refer to the design criteria in Component 1) as identified by the needs assessment.

- (iii) Produce floor plans, drawings, layouts of each room in the building to serve the functions of the doppler radar building, and WRIS.
- (iv) Collaborate with the Team Leader to supervise construction of the doppler radar building, and establishment of WRIS.
- (v) Produce drawings, sketches, layout or any document relevant to the design of the doppler radar building.
- (vi) The international and national positions should closely collaborate to ensure continuous support, especially during construction supervision and WRIS establishment, to MOWRAM as required.

6. Supervision Architect (international 8 p-m, national 15 p-m)

The consultant preferably has a Bachelor's degree in architecture and preferably with 8 years of experience in the building architectural construction supervision, especially with information technology functions. Experiences in supervision works in Cambodia are beneficial. Previous experience working in projects funded by ADB, World Bank, or other similar development agencies, especially in the region will be beneficial. Excellent English communication (written and oral) skills will be considered an asset.

The Design Architect will:

- (i) Daily monitor of construction on architecture aspect in accordance to the specifications and designs
- (ii) Review method statements of construction activities
- (iii) Review the request for information, request for approval, and shopdrawing from the contractor
- (iv) Verify the amount and claim in bill related to architect
- (v) Work closely with other engineer in planning, scheduling of task, and execution of the works
- (vi) Prepare report on the work of the contractors
- (vii) Revise architectural drawing during the construction as necessary
- (viii) Coordinate handover process to clients

7. Civil Structure Supervision Engineer (international 12 p-m, national 24 p-m)

The Civil Structure Supervision Engineer shall have a BSc (Undergraduate Degree) in engineering or related field with at least five years' experience as senior site engineer and preferably also have a certificate in Construction or Project Management.

The Construction Supervision Specialist will be mainly in charge of ensuring that all works performed and materials used as indicated in the contractor's daily and

weekly reports are conform with approved construction drawings, standards and norms.

They will report to the Engineer and MOWROW and undertake the following tasks:

- (i) Daily monitoring of construction activities in accordance to the specifications and designs, cost, and schedule to ensure progress follows the work plan
- (ii) Review method statements of construction activities to the contractor
- (iii) Carry out site inspections and assessments as required; prepare reports for submission to CoP and Project teams
- (iv) Act proactively to identify key areas of concerns that relates to quality, health, safety and environmental issues at site and where necessary take the necessary resolution in consultation with Supervisor(s) and project teams.
- (V) Weekly updating of the approved construction schedule and reporting to the Task Leader and client
- (vi) Work closely with other engineers and architects, in the planning, scheduling of tasks and execution of the works
- (vii) Monitor and prepare reports on the work of the contractors.
- (viii) Report all errors, omissions, discrepancies and deficiencies to supervisor.
- (ix) Provide support and guidance to the contractors and assists in resolving site problems, as necessary.
- (x) Carry out technical reviews as appropriate
 - (xi) Consult with project end users to make sure they understand the scope of work and expected time line with advice from client and project team.
 - (xii) Coordinate handover process to clients

8. Mechanical-Electrical-Plumbing supervision engineer (international 8 p-m, national 15 p-m)

The specialists preferably have a Bachelor's degree in electrical engineering or relevant field with preferably 8 years of professional experience (5 years of experience for national position) in supervising and overseeing electrical systems and devices of buildings with complex IT and communication systems. Previous experience working in projects funded by ADB, World Bank, or other similar development agencies, especially in the region will be beneficial. Excellent English communication (written and oral) skills will be considered an asset.

The consultant will:

- (i) Daily monitor of construction on MEP aspect in accordance to the specifications and designs
- (ii) Review method statements of construction activities
- (iii) Review the request for information, request for approval, and shopdrawing from the contractor

- (iv) Verify the amount and claim in bill related to MEP
- (v) Work closely with other engineer in planning, scheduling of task, and execution of the works
- (vi) Prepare report on the work of the contractors
- (vii) Revise architectural drawing during the construction as necessary
- (viii) Coordinate handover process to clients

9. Quantity Surveyor/Quality Control (national 15 p-m)

The consultant should have bachelor degree in civil engineering or construction management with preferably 8 year of field experience. Previous experience working in projects funded by ADB, World Bank, or other similar development agencies, especially in the region will be beneficial. Excellent English communication (written and oral) skills will be considered an asset.

The consultant will:

- (i) Provide monitoring and control costs throughout the project, identifying cost saving opportunity
- (ii) Coordination with design team for analyzing architectural and construction drawing
- (iii) Manage the valuation of work done and handle claims and variations
- (iv) Preparing interim and final valuations, variations and claims of the construction site
- (v) Support the team to monitor and provide professional justification on material, construction technique, and quality of construction work
- (vi) Provide report to the team leader

10. Occupational Health and Safety Specialist (national 15 p-m)

The Occupational Health and Safety specialist (OHS) should be a qualified engineer or have a certificate in Occupation Health and Safety specialist and participated in the OHS training programs with minimum 5 years' experience in protecting local communities from hazard caused and/or exacerbated by project activities, disease, and the accidental collapse or failure of project structural elements with 3 years in the same nature of projects.

The specialist will:

- (i) To anticipate and avoid adverse impacts on the health and safety of affected communities during project from both routine and non-routine circumstances
- (ii) To ensure quality and safety in the construction of project related infrastructure, preventing and minimizing potential safety risks and accidents
- (iii) To avoid or minimize community exposure to disaster risks, diseases and hazardous materials associated with project activities

- (iv) To ensure that the safeguarding of personnel and property minimizes risk to communities and is carried out in accordance with international human rights standards and principles
- (v) To have in place effective measures to address emergency events, whether humanmade or natural hazards
- (vi) Any other related tasks as may be needed

11. Information System Analyst (international 12 p-m)

The specialist requires master's degree in computer science and information technology or equivalent with preferably 10 years of experiences in database and software application development such as Web-Based Application and Mobile App Development or System Management, especially has experiences in asset management.

The specialist will:

- (i) Develop WRIS System Technical Design Document (WRIS Web-Based Application, WRIS Web-Map-GIS, WRIS Mobile App, Integrate with IAMS) such as WRIS System Architecture Design document and WRIS System Terminology document.
- (ii) Integrate all water resources information system component into an operational WRIS
- (iii) Have basic understanding water resources data and climate forecasting procedure and software
- (iv) Work with hydrologist to integrate hydrological model, hydrodynamic model into WRIS system
- (v) Support and monitor closely with team in software development phase until release final version of WRIS.
- (vi) Maintaining and supporting the operating system and associated hardware, software, and databases, ensuring optimum system integrity, security, backup and performance;
- (vii) Troubleshooting and providing service support to users in diagnosing, resolving, and repairing hardware and software malfunctions, encompassing workstations and communication infrastructure, support WRIS server setup and configuration;
- (viii) Prepare documentation on policies and operating instructions, and recording and detailing operational procedures and system logs;
- (ix) Planning, developing, hosting contracts, communication, installing, troubleshooting, maintaining and supporting an operating system and associated hardware, software and databases, ensuring optimum system integrity, security, backup and performance.
- (x) Troubleshooting and providing service support to users in diagnosing, resolving, and repairing hardware and software malfunctions, encompassing workstations and communication infrastructure

12. Database Developer (international, 4 p-m)

The specialist preferably has a degree in Computer Science or relevant fields with preferably 10 years of knowledge on database hardware and industry and have experiences working with database software (Oracle, Microsoft SQL or any others). The expert should have knowledge and skills in back-end development (both hardware and software). The expert should have experience working with frameworks for module testing and with technology for database administration and development (creation of stored procedures, functions, simulations) and managing the interchange data between servers and the online interface. The expert will focus on development of all server-side logic, definition and maintenance of the database, and ensuring high performance and responsiveness to requests from the front-end. The expert must also have a good understanding of the principles of data management for database integration including data normalization and data categorization. Previous experience working in projects funded by ADB, World Bank, or other development agencies will be an advantage, and excellent English communication (written and oral) skills will be considered an asset. The Database Developer will:

- (i) Explore opportunities to use cloud-based data storage as server in parallel with in-house server for WRIS during NWRDMC construction to ensure access to WRIS at all stage of NWRDMC and WRIS development.
- (ii) Design, set up, and install database and server (including cloud-based systems) with application software for WRIS.
- (iii) Develop appropriate programming codes for operation and managing database and implementation of security and data protection as database administrator.
- (iv) Design and implement data storage solutions and optimize application for maximum speed and scalability and flexibility for data integration.
- (v) Edit and modify the database depending on the needs of the clients and users.
- (vi) Design the database architecture for linking several existing databases (ground observation, GIS and remote sensing information and results from modelling systems) into an integrated national database.
- (vii) Develop management processes of access levels to data objects and users' accounts.
- (viii) Ensure that the requirements for data protection in the systems and database management are met.
- (ix) Fix any faults or bugs found in the programming and manage any security issues.
- (x) Manage back-up and data recovery.
- (xi) Provide assistance in the capacity development trainings and workshops related to database O&M and relevant topics.

13. User Interface Developer (international 4 p-m)

The specialists preferably has a degree in Computer Science or relevant fields with preferably 10 years of experience (5 years for national specialist) in development of websites. The specialist should have experiences on front-end development (GIS-based websites and mobile applications) for information and knowledge dissemination based on the needs of end- users. The specialist is expected to work closely with database developers (back-end development) to integrate the works of user interface development. The specialists must have a strong understanding of user interface, cross-browser compatibility, as well as general website and mobile application functions and standards. Previous experience working in projects relevant and funded by ADB, World Bank, or other development agencies will be an advantage, and excellent English communication (written and oral) skills will be considered an asset.

The User Interface Developers will:

- (i) Design and develop GIS-based online website and mobile application (both for android and ios) to gather data and information from different agencies and to disseminate data, information and knowledge from WRIS according to the needs of end-users for WRIS.
- (ii) Edit and modify user interfaces based on the needs of clients and end-users. Fix any faults or bugs found in the programming and manage any security issues.
- (iii) Provide assistance in the capacity development trainings and workshops related to user interface development, O&M and relevant topics.
- (iv) Provide technical support when needed.
- (v) Prepare technical documents, manuals or instructions as required by the project.

14. WRIS Information Technology Programmer (national 4 persons, 60 p-m)

The specialist preferably has a Bachelor's degree in Information technology, programming or equivalent with and preferably 5 years of experience in software application development, especially in Mobile App development and Mobile App with map view processing.

The specialist will:

- (i) develop and implement WRIS Mobile App.
- (ii) support in testing and fixing issues and installing the application to the user. (iii) maintaining and supporting the operating system and associated hardware, software, and databases, ensuring optimum system integrity, security, backup, and performance;
- (iv) troubleshooting and providing service support to users in diagnosing, resolving, and repairing hardware and software malfunctions, encompassing workstations and communication infrastructure;

- (v) support training to users.

15. Hydrologist (international 8 p-m, national 12 p-m)

The specialists preferably have a degree in hydrology/water resources or relevant fields with preferably 10 years of experience (5 years for national specialist) carrying out hydrological studies and hydrological model development and application. The consultant works closely with other team members to integrate model into WRIS. National expert should have experiences on collecting information in Cambodia for hydrological studies and experiences on hydrological model development. Experiences in working with agencies in Cambodia is beneficial. Previous experience in projects financed by ADB, World Bank, or similar organizations is an asset.

The hydrologist will:

- (i) Review and document available hydrological data and relevant reports on water resources in Cambodia;
- (ii) In collaboration with the Meteorologist, collect hydrological-meteorological information (both near-real time and historical information, including results from flood modelling systems) in Cambodia.
- (iii) Carry out data quality assurance and quality control for hydrological data (including data screening, data gap filling, data visualization, etc.) for WRIS. Run river basin hydrologic models and integrate into WRIS system.
- (iv) In collaboration with the Meteorologist, perform hydrometeorological analysis and result visualization for water resources management and WRIS as required.
- (v) Recommend additional information or secondary information, such as satellite-based information, modelling results, etc. to fill the gaps on data insufficiency for hydrometeorological analysis.
- (vi) Provide recommendations on the hydrology part of the design of the water resources database and of the maps and data in the WRIS.
- (vii) Recommend data and information from ground observation and secondary data (remotesensing, water modelling system) for the hydrology part to be integrated in WRIS
- (viii) Provide assistance in the capacity development trainings and workshops related to hydrology for water resources management.
- (ix) Contribute to the preparation of technical and progress reports.

16. Meteorologist (international 8 p-m, national 10 p-m)

The specialists preferably have a degree in Meteorology or Atmospheric Sciences or related fields and with preferably 10 years' experience (5 years for the national specialist)

in climatology studies and climate analysis. National expert should have experiences on collecting information in Cambodia for meteorological studies. Experiences in working with agencies in Cambodia is beneficial. Prior experience in projects financed by ADB, World Bank, or similar organizations is an advantage.

The meteorologist will:

- (i) Review and document available meteorological data and relevant reports on water resources in Cambodia.
- (ii) In collaboration with the Hydrologists, collect hydrological-meteorological information (both near-real time and historical information, including satellite-based information, radar and climate or numerical models) in Cambodia.
- (iii) Carry out data quality assurance and quality control for meteorological data (including data screening, data gap filling, data visualization, etc.) for WRIS. Perform climate model and integrate into WRIS system
- (iv) In collaboration with the Hydrologist, perform hydrological-meteorological analysis and result visualization for water resources management and WRIS as required.
- (v) Recommend additional information or secondary data to address the insufficient data for hydrological-meteorological analysis.
- (vi) Provide recommendations on the meteorology part of design of the water resources database and of the maps and data in the WRIS.
- (vii) Recommend data and information from ground observation and secondary data (satellite-based information, Global Circulation Model, Regional Climate Model) for the meteorology part (weather and climate) to be integrated in WRIS.
- (viii) Provide assistance in the capacity development trainings and workshops related to meteorology for water resources management.
- (ix) Contribute to the preparation of technical and progress reports.

17. GIS Specialist (international 6 p-m, national 8 p-m)

The specialists preferably have a degree in GIS or related fields with preferably 10 years of experience (5 years for national specialist) on applying GIS software (both commercial and free licenses) to process or analyze GIS data. The international expert should have experiences on GIS data and satellite-based information analysis through use of software (both commercial and free wares) and development of scripting for GIS data analysis. The national expert should have experiences on GIS data analysis and map development. Experiences in working with agencies in Cambodia is beneficial. Previous experience working in projects relevant and funded by ADB, World Bank, or other development agencies is an advantage, and excellent English communication (written and oral) skills will be considered an asset.

The specialist will:

- (i) Recommend appropriate remote sensing and satellite data (e.g., optical and radar) and public-domain satellite-based information (e.g., rainfall, land use, digital elevation models [DEM], etc.) to fit the needs of the clients on water resources management. National expert will focus more on using GIS software for data analysis and map preparation for WRIS and water accounting.
- (ii) Develop computer languages and script for GIS data and satellite-based information analysis (including image processing) as required (international specialist).
- (iii) Perform GIS and satellite-based information analysis to support water resources management and application of water accounting plus (WA+) as required by the clients.
- (iv) Develop metadata to provide summary of content, quality, type, creation, spatial information, and source of information about data set by adhering to common metadata standards to ensure data sharing environment of WRIS.
- (v) Prepare maps and figures based on GIS data, satellite-based, and remote sensed information as required (national specialist).
- (vi) Provide assistance in the capacity development, trainings and workshops related to user interface development, O&M and relevant topics.
- (vii) Provide technical support when needed.
- (viii) Prepare technical documents, manuals or instructions as required by the project.

18. Water Accounting Specialist (international 6 p-m, national 6 p-m)

The specialists preferably have a degree in water resources engineering and/or related field and extensive experience on application of water resource models and/or remote sensing and satellite-based tools to investigate water accounting to support water resources management. They should have comprehensive knowledge on the parameters of water accounting including the different types of water users and water demands (e.g., environmental water regime). They should have good awareness of the range of water accounting tools (e.g., WA+ framework) and the types of data inputs required to run them. Experience in working with agencies in Cambodia is beneficial. Prior experience in projects financed by ADB, World Bank, or similar organizations is an advantage. The Water Accounting Specialists will:

- (i) Set up conceptual framework of water accounting to be integrated into WRIS.
- (ii) Water accounting framework is to include parameters of the water cycle and all water user type including the environment.
- (iii) Review and identify international best practice for water accounting (e.g., WA+ framework, Australian national water accounting reports).

- (iv) Set up a process for annual water accounting reporting including usage (extraction and consumption) by major water users in a format that can be accessible by a non-technical person.
- (v) Provide recommendations on improving water accounting and reporting such as strengthening water metering and/or satellite-based information of water used by an irrigation scheme in those river basins that annually experience extreme water scarcity.
- (vi) Have basic IT knowledge and collaborate with IT specialist to integrate water accounting information into WRIS.
- (vii) Provide assistance in the planning and delivery of capacity development workshops with focus on water accounting.
- (viii) Contribute to preparation of reports, manuals, instructions as required.

19. Water Productivity Specialist (international 6 p-m, national 6 p-m)

The specialists preferably have Master's degree in agriculture or relevant field with extensive knowledge on water productivity concepts and application of remote sensing information for monitoring and evaluation of crop water productivity. Experience in agricultural management and crop water productivity in the Mekong region is beneficial. Prior experience in projects financed by ADB, World Bank, or similar organizations is an advantage.

The specialist will:

- (i) Provide assessments of crop water productivity for selected river basins and pilot areas in Cambodia, potentially in the subproject areas.
- (ii) Set up a framework for water productivity mapping and quantification in Cambodia through ground observation and public domain satellite information.
- (iii) Advise MOWRAM and ensure MAFF's engagement in the implementation of the water productivity framework and integrate the framework into the WRIS.
- (iv) Have basic IT knowledge and collaborate with IT specialist to integrate water productivity information into WRIS.
- (v) Provide assistance in planning and delivery of capacity development workshops with focus on water productivity.
- (vi) Contribute to preparation of reports, manuals, instructions as required.

20. Training Specialists – O&M Database Development (international, 3 p-m, national 5 p-m)

The specialists preferably have a degree in Computer Science or relevant fields with experiences in O&M of user database and interfaces (website and mobile application). The specialists should have experiences on design and deliver trainings course to fit the backgrounds of participants. Previous experience working in projects relevant and funded by ADB, World Bank, or other development agencies will be an advantage, and excellent English communication (written and oral) skills are necessary.

The specialists will:

- (i) Review existing training courses related to O&M user database and interface (if available) and conduct preliminary needs assessment on O&M user database and interface.
- (ii) Design the training courses with training module details (objectives, targeted participants, training types, expected outputs) to fit backgrounds and needs of end- users. Various types of trainings (e.g., classroom type, on-the-job training type, etc.) should be considered.
- (iii) In collaboration with the IT specialist and IT programmer, develop training courses

21. Training Specialist – O&M user interface (international 3 p-m, national, 5 p-m)

The specialists preferably have a degree in Computer Science or relevant fields with experiences in O&M of user interfaces (website and mobile application). The specialists should have experiences on design and deliver trainings course to fit the backgrounds of participants. Previous experience working in projects relevant and funded by ADB, World Bank, or other development agencies will be an advantage, and excellent English communication (written and oral) skills are necessary.

The Training Specialists – O&M User Interface will:

- (i) Review existing training courses related to O&M user interface (if available) and conduct preliminary needs assessment on O&M user interface.
- (ii) Design the training courses with training module details (objectives, targeted participants, training types, expected outputs) to fit backgrounds and needs of end- users. Various types of trainings (e.g., classroom type, on-the-job training type, etc.) should be considered.
- (iii) In collaboration with the Database Developer Specialists, develop training courses (both in English and Khmer) and deliver the training courses.
- (iv) Prepare training related documents, manuals, or instructions as required by the project.

22. Autocad-Draftman (national 4 persons, 20 p-m)

The draftman should have associate degree in engineering field or professional training in Autocad drawing. The draftman is preferably having more than 2 years and active previous job experience. Basic understanding of English is required.

The draftman will:

- (i) Under supervision of Design Architect, Civil Structure Design Engineer, MEP Engineer, draw all layout drawing of doppler radar building
- (ii) Provide shopdrawing if necessary
- (iii) Other tasks assigned by Team Leader

23. Data collectors/Assistant (national, 18 p-m)

The Data Collectors/Assistants preferably have a degree in Engineering or Information Technology or other related courses and should have a background in collecting data and information related to water resources management (both water and non-water information) in digital and hardcopy formats. The experts should have experiences in coordinating with government agencies to request for meetings and data through formal approach (sending official letters). The experts should have experiences in contacting and coordinating with government agencies in Cambodia. The experts should have excellent English communication and interpersonal skills.

The Data Collectors/Assistants will:

- (i) Collect institutional data from agencies for WRIS as required by the project.
- (ii) Coordinate and follow up with agencies that hold data and information related to water resources management for data gathering.
- (iii) Carry out basic data screening for checking data missing and data error.
- (iv) Document data availability (locations, periods, type of data, etc.), source of data, year of data record, etc.
- (v) Coordinate and communicate with government agencies in Cambodia to support organization of meetings, trainings, and workshops.
- (vi) Support the team for meeting organization including logistics and arrangement.
- (vii) Support the team in preparing the technical reports, manuals, and instructions as required by the project.

24. IT Support Officer (national, 12 p-m)

The IT Support Officer preferably has a Bachelor's degree in Computer Science, Information Technology or relevant fields. The expert should have experiences on computer set up, installation of software (Microsoft Offices, GIS software, Windows OS, mac OS, Linux, virus security, etc.). Knowledge on software related to GIS and remote sensing is beneficial. The expert should have knowledge and experiences on the installation and maintenance of various hardware and software for information system. The IT Support Officer will:

- (i) Support the team and Information System Analyst, Database Developers and User Interface Developers on IT and computer related tasks, including but not limited to:
 - install and configure computer hardware operating systems and applications;
 - monitor and maintain computer and information systems; and
 - troubleshoot system and network problems, and diagnose and solve hardware and software faults
- (ii) Provide day-to-day support and recommendations to solve problems, bugs, issues related to IT, computer and information systems (hardware and software), database, printer, internet connection, websites, mobile applications, and other issues for WRIS development