# Terms of Reference

**Name of the Assignment: Water Resources Technical Support Unit (TSU) Consultancy for Government of Kerala**

### 1. Background

Kerala is blessed with rich endowment of water resources. It has a high average annual precipitation of approximately 3,000 mm and has 44 small and medium rivers, several lakes and ponds, a vast stream network, as well as many springs and extensive wetlands. However, this natural system of water resources is highly variable both spatially and temporally, resulting in frequent floods and droughts. The bulk of rainfall is received during the southwest monsoon, which typically sets in by June and extends up to September. The state also receives heavy rains during the northeast monsoon, from October to December. Approximately 90% of rainfall occurs during these six monsoon months. The high intensity storms during the monsoon months result in heavy discharges in all the rivers.

The recent flooding in August of 2018 caused widespread devastation with heavy damage to infrastructure, and loss of human lives, crops and livelihoods. Irrigation canals and drains became heavily silted, canal banks collapsed, and many structures such as cross drains, sluice gates, weirs, check dams, diversion channels, etc. were damaged. The drainage systems in urban areas were blocked due to flood waters carrying heavy sediment load, compounded by local high intensity rainfall. Gushing waters spread deep into the habitations, aggravating the damages to public and private assets. Both inland and coastal protection structures were impacted, which caused salt water intrusion in the Vembanad Lake area.

### 2. Objective

The main objective of the project is to strengthen the capacity of the Government of Kerala (GoK) to deliver effective water resources information services to sector agencies and communities and support the department in development of investments based on scientific data .

This objective will be achieved by strengthening the capacity of government agencies for improved water resources planning and management, hydrological monitoring, forecasting, and early warning systems. In addition to strengthening internal government capacity, the project will also incorporate stakeholder engagement within community sectors to best tailor services to the public need.

The technical support Unit (TSU)  is expected to provide support to WRD and its partner institutions/stakeholders in investment planning, studies, development of draft policies, training and capacity building, technical reviews, implementation supervision of the institutional reform and investment programs approved by the GoK, in addition to progress monitoring, evaluation and reporting.

This Consultancy will provide comprehensive technical support to the Kerala Department of Water Resources (WRD) and its agencies, in implementing activities to modernize its monitoring network, operations, and data management systems; improve its basin planning and management; and enhance hydrological and flood forecasting early warning systems

. The Consultant will help play a crucial role in assessing user needs, identifying and developing services, and facilitating this important process. The Consultant will work closely with the WRD throughout the duration of the assignment.

The support is expected to result in enhanced quality of services and investments throughout Kerala with resilience to extreme events, and improved reliability from water-dependent sectors.

### 3. Scope of Work and Tasks

The outputs of this assignment will be broadly derived from the performance of the consultants' in executing the scope of work given below but not limited to the following:
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1. Gaps analysis and needs assessment of enhanced tools and services;
2. Design of an enhanced hydrometeorological network and data management systems based on the results emerging from the gap analysis;
3. Development and operationalizing Basin planning decision support systems and analytical tools;
4. Development and strengthening of Hydrologic forecasting and early warning systems;
5. Support the head of the department in implementing the institutional reforms, training and capacity building;
6. Based on various hydrological and morphological studies of river basins, develop investment proposals for appropriate interventions in collaboration with other line departments.
7. Build on the institutional reforms report and support GoK in detailing the design, establishment and operationalization of River Basin Management Authority (RBMA);
8. Support WRD in designing and establishment of the Command Control Centre (CCC) for installation and operationalizing Kerala Water Resources Information Management System (KWRIMS), integrating Basin planning and Real Time Decision Support Systems (RTDSS), analytical tools, and other such ICT based systems for monitoring, evaluation, operation, maintenance and progress reporting – on real time basis;
9. Develop Terms of Reference (ToRs) for establishment of Maps, Inventory and Asset management system for WRD and supervise implementation;
10. Develop master plans for each river basin, and ensure relevant data collected is embedded in the systems established under Command Control Center (CCC) for application in planning and forecasting;
11. Support WRD in preparation of detail project reports (DPRs), Environment Impact Assessments (EIAs), Social Impact Assessments (SIAs), Environment and Social Management Framework (ESMF), Resettlement Action plans (wherever required) and Environment Management plans for each investment.

12. Assess the prevailing environment and forest regulations and advise on its implications on various WRM activities;
13. Coordinate with other line departments such as Forest, Environment, Soil studies and conservation, KSEB, and LSGD on soil moisture conservation and slope protection initiatives;
14. Supervise investment implementation and submit progress reports to authorized officers;
15. Design and support establishment of MIS to monitor and manage department operations;
16. Ensure the integration of various solutions being sought by the WRD leading to a unified service delivery with linkages to related sectors like power, agriculture, drinking water supply, fisheries, and services to local bodies, etc.
17. Ensure functional compatibility of the modernized tools, systems, and services with the global and state systems in place;
18. Develop training and capacity building master plan and support the department in implementing the same;
19. Support WRD in procurement and contract management – for externa, such as the preparation/review of EOIs as needed, involvement in pre-bid meetings and review, bid evaluation review, and contract/consultancy execution for numerous contracts;
20. Preparation of ToRs for additional Consultancies or services required by the project;
21. Serve as advisor to the WRD during the entire duration of the contract;
22. Any other work as directed by the head of WRD and or employer, from time to time.

This Consultant shall implement the detailed activities outlined below in collaboration with WRD staff and other line departments under the guidance and directions of Additional Chief Secretary (ACS) WRD and or others as assigned by WRD from time to time.

Specific task descriptions are provided in greater detail in the following sections.

**Task 1:  Gap Analysis and Needs Assessment**

**Task 1.1***Assess the current services and products provided by the WRD and required services and products based on user needs:*  Provide a detailed list of existing water resources information products and services provided to current users.  Provide details on how often the services and products are relayed to the users.  Seek and meet with the major users of water resources services and products for each key sector, report on user needs, services and products that would be useful to the user community and how it will help the specific user. The information should be clearly summarized in a table.

**Output from Task 1.1** will be a clear and detailed project report identifying user needs for water resources services applied for water resources management in general, propose a design for delivery of the WRD services, identify services that can provide a source of revenue generation, and offer proposals for long term sustainability of services.

**Task 1.2***Assessment of hydrometeorological network:* The consultant will examine and review the existing hydro-meteorological network of WRD and prepare recommendations of how it could be modernized. This should be based on assessment of existing system and observation systems packages in use by WRD. The assessment will also be based on feedback from user

needs assessment carried out in Task 1.1 with a focus on where data and information shortcoming could be improved with an enhanced network. The assessment will serve as the foundation for the development of a detailed hydrometeorological network design as described in Task 2.1. Coordinate with other line departments such as Forest, Environment, Soil studies and conservation, KSEB, and LSGD on soil moisture conservation and slope protection initiatives

**Outputs** will include the preparation of an assessment report offering recommendations of how an enhanced network may serve multiple service needs identified in Task 1.1.

**Task 1.3** *Assessment of ICT systems*:  The Consultant will assess the WRD computer facilities, resources, computer servers, databases, data storage, and communication at the State level, national, divisional level and local offices, and advise necessary modernization to support use of MIS and other applications to be developed under CCC for data collections, information dissemination, analysis, monitoring, planning and implementation.  The Consultant will also assess bandwidth requirements for connecting to other regional and global entities for the transmission and reception of water resources information.

**Outputs:** Based on findings, the Consultant will prepare an assessment report with recommendations for enhanced equipment and communication options to serve as the foundation of an ICT and systems design described in Task 3, and support WRD in establishing of the same.

**Task 1.4** *Assessment of existing data management and modeling tools:*  The Consultant will perform a thorough assessment of existing data management systems and processes, and how these data are utilized within various models for decision support. The Consultant will offer recommendations and options for data management and modeling tools that could provide or enhance the service offering needs identified in Task 1.1.  The integration of open-source and preferably license-free software products should be included in the recommended options for review.

**Outputs:** Based on findings, the Consultant will prepare an assessment report with recommendations and support WRD in establishing enhanced data management and modeling tools in CCC to serve as the foundation for improved basin planning and decision support as described in Task 4.

**Task 1.5** *Assessment of existing hydrologic forecasting and early warning systems:*  The Consultant will perform a thorough assessment of existing hydrologic forecasting and early warning systems within the WRD and allied agencies. The Consultant will offer recommendations and options for improved system or tools that could provide or enhance the service offering needs identified in Task 1.1.  In addition, these recommendations will consider the assessments from Tasks 1.2-1.5 for developing and integrated approach of forecasting services when considering staff capacity, the monitoring network, ICT, and data management systems and modeling tools. The integration of open-source and preferably license-free software products should be included in the recommended options for review.

**Outputs:** Based on findings, the Consultant will prepare an assessment report with recommendations and support WRD in establishing a state-of-the-art hydrologic forecasting and early warning systems in the CCC to serve as the foundation of Task 5.1.

**Task 1.6** *Analysis of O&M costs and System Sustainability:* The Consultant will conduct an assessment on the O&M needs for sustainable operation of a modernized river planning, operations, and early warning system outlined from recommendations offered in Tasks 1.1-1.6. This will include determining baseline costs of status quo WRD operations from which to compare. Further, the Consultant will identify different sources of revenue for the WRD by differentiating between data, products, and services that should be provided free of cost and others that could generate revenue for the WRD. The consultant will also undertake a review of other international models whereby national water resources services access budget and generate revenue through service provision and self-sustainability.

**Output:** Based on the review of national and international experiences, the Consultant will develop a detailed report that provides recommendations and assist rollout of the same upon approval for long term financial sustainability of the CCC.

**Task 1.7**: *Assess the WRD Training Requirements and Develop a Comprehensive Training and Capacity building Master Plan:* Building on assessments carried out in Task 1.2-1.7, the Consultant will review, assess, and determine WRD training requirements for staff and develop a training and capacity building master plan, based on the assessments. This training plan will consider all staff employed by the WRD and its field-offices, of staff of related departments.

**Output:** Submission of detailed skills assessment report and a time bound training plan clarifying details of the trainings to be provided to specific staff over a period of four years. Training could include those that could be done in-country, online training, institutions that can provide the training, training that can be received regionally, degree courses for specific staff and so forth.

## Task 2: Hydrometeorological Network Design and Implementation

**Task 2.1**: *Determine data, information and analytical system needs:*
- Leverage findings of Task 1.1 and 1.3
- Types of data and information
- Locations and siting of new equipment
- Types of sampling, frequency
- Range of technical options and ball-park costing
- Associate data to planning and system operational levels of minimum performance
- Data acquisition and management system (in coordination with Tasks 3 - 5)

**Task 2.2:** *Develop design of hydro-meteorological network:*
- Preliminary conceptual design
- Iterative design updates through WRD and PIU review
- Final Design
    - Station Types

- ▪ Surface water (rivers, lakes, coastal)
- ▪ Meteorological
  - o Monitoring data based on needs (stage, discharge, meteorological, water quality, groundwater)
  - o Location optimization
  - o Equipment specification
  - o Civil works

**Task 2.3:** *Develop implementation plan of hydro-meteorological network upgrades:*
- Bill of Quantity (BoQ) and cost estimates for:
  - o Equipment
  - o Civil Works (local labor and materials)
  - o WRD staff capacity development
  - o Consultancy services
- Schedule of implementation
  - o Seasonal considerations
  - o Location dependencies
- Assistance to WRD in procurement of services
  - o Preparation of tender documents for equipment
  - o Preparation of tender documents for civil works

**Task 2.4:** *Implementation of hydro-meteorological network upgrades:*
- Capacity development (staff technicians, managers)
- QC of site civil works
- Install, test, and commission stations (jointly with WRD staff to develop capacity)
- Prepare final station sourcebook and documentation for each site

## Task 3:  ICT related support

**Task 3.1:** *Communications technology and capacity:* The Consultant will support WRD in ensuring the required internet connectivity speeds are procured and installed by the department and its offices to ensure absolute connectivity to interact, pull and push data with the systems in the CCC and WRD's MIS, at pre-fixed intervals.

**Task 3.2:** *ICT improvements:*    The Consultant will support WRD in purchase of ICT related equipment and software for installation and commissioning in RBMA, and shall include, but not limited to, 1) computer servers; 2) data storage; 3) software necessary to manage data; and 4) software necessary to share data over the internet; and 5) computers, printers, and video conference equipment, and others as required.  This includes developing the requirements and specifications for equipment needed for various subsystems such as the data acquisition and management systems as defined in Tasks 2, 4 and 5.

## Task 4:  Basin Planning Decision Support and Analytical Tools

**Task 4.1**: *Design Data Management and Decision Support System Framework:*
- Leverage findings of Tasks 1.1 and 1.5.

- Basin management strategies
- Current status and trends
- Scenario development (Infrastructure, Social, Environmental, Economic, Impacts of Climate change on Water Resources)
- Analysis of decisions to be supported and the process of decision-making
- Data acquisition and management system (in coordination with Tasks 2 and 5)

**Task 4.2**: *Development of Analytical Tools:*
- System Network Simulation Model(s)
- Land Use change Model(s)
- Water Quality Model(s)
- Environmental Flow Model(s)
- Flood Risk Model(s)
- Groundwater Model(s)
- Conjunctive Surface-Groundwater Model(s)
- Basin optimization model(s)
- Basin MCDA tool(s)
- Preference of Open-Source and License Free Software for sustainable growth

**Task 4.3:***Development of Catchment Management Plans:*
- Basin Investment prioritization
- Water allocation planning, drought contingency plans, arbitration process
- Real-Time Basin System Management and authority process
- Institutional Strengthening
- Stakeholder and Community Engagement for Basin Management
- Prepare watershed management plans for each basin
- Assessment of soil moisture conservation and slope protection initiatives, and record data in CCC systems for application in planning and designing investments

**Task 5: Hydrologic Forecasting and Early Warning Systems**

**Task 5.1**: *Design of Hydrologic Forecasting and Early Warning System*
- Leverage findings of Tasks 1.1 and 1.6
- Hydrologic models
- Hydraulic models for flood inundation based on weather forecasts shared by KSDMA
- Data acquisition and management system (in coordination with Tasks 2 and 3)
- Train staff and experts of department and CCC in operation, data analytics, processing and maintenance of the systems.

**Task 5.2:***Hydrologic Model Calibration*
- Historical Data Analysis and QC
- Prepare model inputs (precipitation, discharge, evaporation)
- Calibrate model parameters
- Train department staff to carryout modelling of each river/sub-basin

**Task 5.3:***Hydraulic model calibration and flood inundation*
- Historical Data Analysis and QC
- Prepare model inputs (geometry, discharge)
- Calibrate hydraulic model
- Develop flood inundation extents (either 2-D model or pre-generated mapping infrastructure for real-time use) and process data for supporting forecasting

**Task 5.4:***Real-time forecasting system development with data and model integration*
- Real-time data feeds from data acquisition and management system along with supplemental global data sets
- Forecasting model integration
- Warnings and flood indices connected with early warnings in real-time

**Task 5.5**: *Flood Early Warning Systems*
- Develop procedures and thresholds for warnings and alerts, including designated officials with responsibilities
- Alerts and Warnings from Real-time system provided to WRD website and KSDMA systems to include flood impact indices (inundation, duration, intensity, frequency) for specific impacted areas.
- Run sample test by interfacing with KSDMA and other systems before formal roll out of the same

**Task 6: Consultancy Support to WRD Operations;**

**Task 6.1**: *Preparation*
- Consultant will support the WRD in defining, scoping TORs for various studies as required
- Support the department in planning, designing and implementation of investments through preparation of DPRs, EIAs, SIAs, RAPs, ESMF, EMPs, bidding documents, evaluation reports, etc.
- Support review and ranking of proposal and activities for products or services delivered by WRD and its allied agencies, evaluate the quality, efficiency and efficacy of the investments, benchmark it and recommend improvements

**Task 6.2:** *WRD Training Support*
- Pursuant to Task 1, prepare training and capacity building Master plan for WRD, its agencies and allied line departments & stakeholders to ensure integration of interventions and utilization of $360^o$ services, and long-term sustenance of knowledge and capacities in the state;
- Conduct identified trainings, monitor and evaluate application of the learnings for improvement;
- Complete a program of 'training the trainers' for long-term capacity sustainability and on-boarding of new staff.

**Task 6.3**: *Administrative Support*

- Support investment prioritization with appropriate technical and financial justifications for review by HoD;
- Review budgets for project implementation and support prioritization
- Develop risk trees or analyses in support of capital investments projects.
- The consultant shall conduct field trips and supervise implementation of the investments;
- Prepare ToRs for development, installation and operationalization of WRD MIS with monitoring, evaluation and progress reporting modules for live hierarchical access to viewing daily progress and information dissemination

## 4. Reports and Documents

The consultants will furnish the following reports and documents in English in accordance with the agreed program. These will include:

a) *Inception, progress, mid-term review, and completion reports*

- i). Inception Report (draft submitted within 2 months of mobilization and finalized within 3 months of mobilization)
- ii). Semi-annual Progress Reports (by the end of April and October each year);
- iii). Mid-term Report (middle of year 3)
- iv). Benefit Monitoring and Evaluation Report (conducted thrice during the life of the project i.e at commencement, mid-term and closure of the project);
- v). Project management system generated reports (semi-annually);
- i). Project Completion Reports (draft submitted 3 months prior to project completion

## 5. Deliverables

b) *Technical reports and other deliverables*

- i). Hydrological Study for all tributaries;
- ii). Geo-morphological Studies for all tributaries;
- iii). Sediment load assessment for each tributary;
- iv). Riverbank erosion prediction modelling report;
- v). Flood Risk analysis report;
- vi). GIS mapping of each sub-basin having details of land use, asset inventory, forestry, wetlands, beels, productive green belts, River protection works, flooding plains, flood modelling, erosion, etc;
- vii). Database containing hydro-metric data, flow data, sediment data, water levels, and other data from the studies above;
- viii). Report on the systems established in RBMA;

 **ix).**  Database and Knowledge base systems report;

 **x).**  Operational MIS system (house in CCC) interfaced with the Systems in the data center being developed under NHP and also made available in the public domain;

 **xi).**  Master plans for each sub-basin;

 **xii).**  CBDRM implementation framework and report in collaboration with KSDMA;

 **xiii).**  Investment plans for each sub-basin;

 **xiv).**  Detailed project reports (DPRs) complete with detailed designs and bidding documents for activities in each investment plan in each sub-basin/tributaries;

 **xv).**  Resettlement Action Plans – as required;

 **xvi).**  ESMP/EMPs for each investment plan;

 **xvii).**  Livelihood and agriculture sector development report – (once in 2 years);

 **xviii).**  Status report of wetlands and beels – (1st year, 3rd year, thereafter annually)

 **xix).**  Environment and Social safeguards due diligence and compliance report – (annually);

 **xx).**  Consolidation of Grievances received and action taken report – (annually);

 **xxi).**  Procurement Plans – biannually;

 **xxii).**  Procurement audit report – every 18 months;

 **xxiii).**  Financial management report – Annually,

 **xxiv).**  Training, Capacity building and IEC impact report.

 **xxv).**  Training modules and materials for Capacity building activities

 **xxvi).**  Guidelines for community participation in water resources, environment infrastructure management and maintenance

 **xxvii).**  Performance monitoring and evaluation reports for infrastructure established under the project

## 6. Team Composition

An indicative requirement of key personnel for this assignment will include the following positions. It is expected that the team will have a minimum of 4 key experts with international experience, with one of them being the Team Leader of the assignment, while an additional national key expert will be assigned as a deputy team leader and stationed permanently in Kerala for the entire duration of the contract. The services of the international experts are intermittent both from home and duty stations based on the requirements from time to time. The key experts will be accompanied by a well-qualified team of national and/or international non-key experts. All key experts will be required to have experience in managing teams as it is expected that they will manage national team members, provide guidance, and provide detailed review and support for each activity detailed above.

The Consultant can increase the number of experts in order to adequately address the requirements under this ToR to further strengthen their proposal. The Consultant is encouraged to nominate experts that are multi-disciplinary and therefore cross-over the staffing requirements below to adequately meet the scope of work of the assignment.

| Project Management Consultants | Position | No. of Units | Person Months | Total Months |
|---|---|---|---|---|
| **International** | | | | |
| River Basin Management Specialist | Team Leader | 1 | 48 | 48 |
| Geo-Morphologist | | 1 | 24 | 24 |
| Hydrological Forecast Modelling & Systems Specialist | | 1 | 36 | 36 |
| Sediment management specialist | | 1 | 30 | 30 |
| River & Flood Plain Modelling /Training Specialist | | 1 | 30 | 30 |
| Wetlands Management Specialist | | 1 | 30 | 30 |
| Hydrologist + Hydro modelling expert | | 1 | 30 | 30 |
| Flood plain habitat Specialist | | 1 | 12 | 12 |
| GIS Flood Modelling, Survey and Data Specialist | | 1 | 18 | 18 |
| | | | | **258** |
| **National** | | | | |
| River Engineer + Project Management | N.Team Leader | 1 | 60 | 60 |
| Project coordinators | | 3 | 60 | 180 |
| Flood Management Specialist | | 1 | 48 | 48 |
| Infrastructure & Construction Engineer | | 3 | 48 | 144 |
| GIS Mapping Specialist | | 1 | 36 | 36 |
| Geo-technical Engineer | | 2 | 24 | 48 |
| Community DRM Specialist | | 4 | 36 | 144 |
| River Modelling Specialist | | 1 | 36 | 36 |
| GIS Flood Modelling Specialist | | 2 | 36 | 72 |
| Watershed Management Specialist | | 1 | 36 | 36 |
| Economist | | 1 | 24 | 24 |
| Agriculture Specialist | | 1 | 36 | 36 |
| Environment & Forest Management Specialist | | 2 | 48 | 96 |
| Social Development/livelihood Specialist | | 1 | 36 | 36 |
| Social Safeguards Specialist | | 2 | 48 | 96 |
| Procurement and contract management Specialist | | 1 | 36 | 36 |
| Financial Management Specialist | | 1 | 24 | 24 |
| MIS Specialist | | 1 | 48 | 48 |
| Communication Specialist | | 1 | 30 | 30 |
| Training & Capacity Building Specialist | | 1 | 24 | 24 |
| **Sub Total of Core team - A** | | | | **1,254** |
| **Non- Key staff** | | | | |
| Mid-level River Engineer* | | 1 | 18 | 18 |
| Mid-level River Modelling specialist* | | 1 | 36 | 36 |

| Project Management Consultants | Position | No. of Units | Person Months | Total Months |
|---|---|---|---|---|
| Instrumentation and survey specialist* | | 1 | 15 | 15 |
| Topographic Surveyor* | | 1 | 15 | 15 |
| River Surveyor* | | 1 | 24 | 24 |
| River modelling Assistants* | | 2 | 36 | 72 |
| GIS Operators * | | 2 | 48 | 96 |
| Auto-cad drafts person (Civil 3D) | | 2 | 48 | 96 |
| Accountant | | 1 | 60 | 60 |
| Secretaries | | 4 | 60 | 240 |
| Office Assistants | | 2 | 60 | 120 |
| Sub total of Non-Key Experts & Support staff | | | | 792 |
| Grand Total (A+B) | | | | 2,322 |
| * will be provided by WRD | | | | |

**Detailed Scope of work of Key experts**

| Consultant | Qualification and experience | Key Tasks |
|---|---|---|
| **International** | | |
| River Management Specialist | **Team Leader**<br>The River Engineer will have an advanced degree in civil engineering or water resources engineering, and a minimum of 15 years of experience with river basin management & engineering/training works. Experience in working in any one or more of the following major rivers Krishna, Godavari, Brahmaputra, Ganges, Padma, Meghna, Teesta, Kosi, **- is a must**. Additional experience in large alluvial rivers in Asia is of comparative advantage. The consultant will have experience with flood and erosion protection works, and direct project experience for their design and implementation. Projects incorporating low-cost measures are of comparative advantage. The consultant should also have at least 7-10 years' experience leading a team of experts for water resources management in large river Basin – is preferred | ➤ Prepare an inception report including methodology and detailed work plan for project implementation<br>➤ Work closely with other consultants with other consultants hired by Gok;.<br>➤ Assist the WRD in establishing a system of planning, implementation, management, and monitoring of all project activities with effective MIS, in close liaison with WRD, and other relevant line departments and district administration offices, and central government bodies.<br>➤ Develop planning-design guide/manual for adoption by WRD and other agencies engaged in water resources management;<br>➤ Experience in design, installation and operating hydromet monitoring and observation systems, hydrological forecast systems, early warning systems, institutions and policy making, etc. and provide expert guidance to WRD and other related department and agencies related to water;<br>➤ Review and provide inputs for all studies and reports provided by contractors, consultants, etc. and provide inputs to improve the same;<br>➤ Develop master plans for each river and its sub-basin in collaboration with all team members, consultants, implementing & executing agencies, technical institutions, and other stakeholders;<br>➤ Pursue that sufficient capacities are established and |

| Consultant | Qualification and experience | Key Tasks |
|---|---|---|
| | | institutionalized in WRD through training and capacity building;<br>➢ Oversee procurement, finance management and support the IA in day to day project management;<br>➢ Advise the EA on matters related to instrumentation for monitoring and data collection, environment management and erosion protection works, flood management works;<br>➢ Detailed, planning, design packaging, and procurement, and financial management<br>➢ Construction supervision and quality control<br>➢ Monitoring and evaluation of river response and performance of work<br>➢ Maintenance and adaptation of riverbank protection work<br>➢ Guide surveys and assessment carried out by consultants;<br>➢ Ensure compliance in implementation of all the social and environmental safeguards requirements for the subprojects.<br>➢ Review and updating of feasibility studies offor investment plans prepared;<br>➢ Updating and further preparation of social and environmental safeguards plans based on the requirements of various investments<br>➢ Assist WRD and national team leader to prepare and submit quarterly, annual and mid term progress reports on time, and draft the designated completion reports;<br>➢ Any other work as required /recommended from time to time. |

| Consultant | Qualification and experience | Key Tasks |
|---|---|---|
| Geo-Morphologist | The specialist shall be a post graduate or higher in civil or water resources engineering with specialization in river morphology and will have at least 15 years of experience in river engineering with specific experience in i) alluvial channel mechanics preferably for braided rivers; (ii) sediment transport including wash load in large alluvial rivers; (iii) scour processes under natural conditions; (iv) prediction of bank erosion processes; (v) . the study of morphology and sediment transport experience in both mathematical and physical modeling; and (vi) be familiar and preferably have working experience with the use of remote sensing techniques in river morphology along large alluvial rivers. Experience with monitoring of large alluvial rivers in Asia - a comparative advantage | ➢ Guide the development of data base for morphology, identify the need for additional studies and in particular initiate studies into char land processes and use and into floodplain sedimentation, with special emphasis on the effect of existing hard points on these processes. <br> ➢ Guide the technical investigation program and skill training, including identification of adequate outside research and training institutions with specific focus on river processes and morphology. <br> ➢ Guide morphological studies to improve the guidelines for the design of river bank protection along the rivers, based on historical data and additional studies. <br> ➢ Support the implementing agencies and local research institutes in developing and managing the river morphology prediction model following the practices specially the impacts of the tributaries and its catchment area; <br> ➢ Advise on establishment of data bases for carryout river morphology with related parameters; <br> ➢ Any other work as required /recommended from time to time. <br> ➢ Conduct/supervise morphological work if any carried out in the rivers and tributaries in Kerala; <br> ➢ Identify and collect morphological data from field offices and consultants and consolidate the same for analysis and sharing with Data center established under NHP; them in data base. <br> ➢ Initiate and partly carry out studies of river morphological phenomena on the basis of the established data bases to (i) improve the understanding of river processes and in particular the river |

| Consultant | Qualification and experience | Key Tasks |
|---|---|---|
| | | morphology of the Rivers specifically to the loads received from the tributaries as it traverses through in Kerala and (ii) to assess the quality of the data collected;<br><br>➢ Advice and assist in the analysis of the river response to flood and erosion protection works, including channel changes and sedimentation of floodplains and tributaries;<br><br>➢ Contribute to the technical studies at pre-feasibility level to explore possibilities (i) to improve conditions in the tributaries catchment areas of rivers in Kerala by making designs for the different river training works as proposed in the investment plans emerging from basin sub-basin assessments;<br><br>➢ Study the possibilities to apply alternative flood - erosion and environment protection methods, the technical feasibility and sustainability of these interventions for considering for investments;<br><br>➢ Support the team in developing master plans for each sub-basin;<br><br>➢ Any other work as required /recommended from time to time. |
| Hydrological Forecast Modelling and systems Specialist | The Specialist shall possess a M.Sc degree with Civil Engineering, Water Resources Management, Meteorology and/or Atmospheric Sciences.  Preferable PhD degree in one of the disciplines. Should have Minimum of 10 years' developing hydrologic forecast systems. This includes the use of hydrological/hydraulic numerical | ➢ Develop hydrologic forecast modelling systems<br>➢ Develop institutional capacity to support hydrological - hydro-metrological forecasting systems;<br>➢ Develop capacities for simulation of inundation using weather, dam release forecasts and other data to facilitate early warning to people;<br>➢ Develop systems for water resources information products for sale to earn revenue |

| Consultant | Qualification and experience | Key Tasks |
|---|---|---|
| | models, output statistics, output interpretation, and preparation of forecasts using all various observation systems along with regionally/internationally available water resources information products, developing institution and capacity to support the Hydrological or hydro-meteorological Forecast operations | |
| Flood management Specialist | The Specialist will have an advanced degree with specialization in hydrology, hydraulics, water resources management or equivalent, with 15 years of prior experience in water resources development studies with 7 years in flood management studies, specifically flood modeling, flood forecasting and warning (FFW), and community-based flood risk management (CBDRM). The advisor will have prior experience in integrating government and community based level activities. Experience in South Asia, specifically with monsoon fed flood plains, or in Kerala would be an asset. | ➢ Guide WRD, WRD and KSDMA in programming and implementing flood and erosion based disaster risk mitigation programs;<br>➢ Assist the preparation of state-wide flood and erosion management planning framework and investment plans for tributaries under guidance of international flood management specialist and Basin assessments carried out in the project.<br>➢ Guide preparation of flood and erosion management and sub-basin management knowledge development covering:<br>→ Hydro-meteorological data collection, processing, and storing,<br>→ Arranging runoff and flood modeling including assessment of data requirements, suitable, models and modeling techniques, and evaluation of output data.<br>➢ Guide planning and implementation activities of the CBDRM teams, specifically advising on:<br>→ Non-structural tools and program development and work planning<br>→ Analysis of flood risks in subproject areas and |

| Consultant | Qualification and experience | Key Tasks |
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| | | CBDRM focal villages, <br> → Flood proofing and raised platforms for communities, <br> → Community-based flood warning, including reliable communication procedures between government and local village committees, and <br> → Other technical aspects on flood risk management required for CBDRM <br> ➢ Support training and capacity building activities to different government bodies and local stakeholders, including reviewing training needs assessment, capacity development modules, and training impact assessment; <br> ➢ Support the team in developing master plans for each sub-basin; <br> ➢ Any other work as required /recommended from time to time |
| Sediment management specialist | The expert shall have at least a Master's degree in Civil Engineering with emphasis on Hydropower or Water Resources Engineering/ Development with minimum 20 years of experience in the respective field with adequate training in the area of sediment management and substantial experience in sediment modelling and analysis of rivers carrying heavy sediment loads. Experience in working in South Asian rivers such as Ganga, Teesta, Brahmaputra/Padma/ Meghna would be an advantage | ➢ Guide, and provide hands-on training to staff and other such institutions in sediment modelling and management activities; <br> ➢ Carryout sediment modeling for all the sub-basins/ tributaries in Kerala; <br> ➢ Provide inputs for updating sub-basin master plans of these tributaries; <br> ➢ Advise and guide on sediment management; <br> ➢ Develop models and train staff on forecasting sediment load based on other hydrological, geo-morphological and metrological data; <br> ➢ Measure basic variables characterizing the quantity and quality of water and sediment in the hydrological cycle; |

| Consultant | Qualification and experience | Key Tasks |
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| | | ➤ Acquisition of other related characteristics describing the properties of basins, rivers, and the inland water bodies; <br><br> ➤ Collection, transmission, processing, storage, quality control - archiving, retrieval and dissemination of data and information; <br><br> ➤ Hydrological forecasts and warnings, both under natural and accidental conditions; <br><br> ➤ Development and improvement of methods and technology required for the items above; <br><br> ➤ Application of water-related data and information to the assessment, effective management, and sustainable development of water resources and to the protection of society from hydrological hazards; <br><br> ➤ Work closely with other team members and assist the team leader to carry out field studies, analysis and designs for specific types of sediment problems encountered in run-of-rivers; <br><br> ➤ Recommend suitable designs for various situations based on the study of success/failure cases including previous modeling investigations; <br><br> ➤ Training by assisting in the organization of seminars and workshops and in the preparation of related material and the development of other suitable mechanisms for the transfer of knowledge and methodology, including the results of research, between Members of various institutions engaged in management of the rivers in Kerala; |

| Consultant | Qualification and experience | Key Tasks |
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| | | ➤ Assist the team leader and other team members in synthesizing the inputs provided by different experts in the team and in ensuring timely delivery of all outputs and preparation of reports.<br>➤ Develop manual for sediment modelling of rivers and its tributaries;<br>➤ Provide inputs for updating master plan of the basin;<br>➤ Provide recommendations as deemed necessary from time to time;<br>➤ Any other work as required /recommended from time to time |
| River & Flood Plain Modelling Specialist | The Specialist will have an advanced degree with specialization in hydrology, hydraulics, water resources management or equivalent, with 15 years of prior experience in water resources management with 7 years' experience in flood management studies and activities, specifically river & flood modeling, development of flood forecasting and warning (FFW),. Experience in South Asia, specifically with monsoon fed rivers & flood plains would be an asset. | ➤ Guide WRD, and other such institutions in programming and implementing river and flood plain modelling activities to institutionalize these practices in addition to;<br>→ provide inputs in the preparation of state-wide flood and erosion management planning framework based on modelling studies;<br>→ Review and provide inputs on investment plans prepared for tributaries:<br>→ Guide and provide inputs in the preparation of flood and erosion management and sub-basin management knowledge development covering:<br>→ Hydro-meteorological data collection, processing, and storing,<br>→ Arranging river and flood modeling including assessment of data requirements, suitable, models and modeling techniques, and evaluation of output data.<br>→ recommend Flood proofing activities to be taken up |

| Consultant | Qualification and experience | Key Tasks |
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| | | for habitations, agriculture, storage, and environment protection measures;<br>→ assist in development of FFW<br>➢ Support training and capacity building activities to different government bodies and local stakeholders, including reviewing training needs assessment, capacity development modules, and training impact assessment;<br>➢ Support the team in developing master plans for each sub-basin;<br>➢ Any other work as required /recommended from time to time |
| Wetlands Management Specialist | The expert shall have a doctorate degree or equivalent in environment management and natural sciences with proven experience in Protected Areas management for at least 10 years.  Experience in South Asia and experience in implementing World Bank/ADB or other multilateral funded projects – an advantage. | ➢ Collection, synthesis and analysis of information on the biodiversity of wetland, dry and sub-humid ecosystems/conditions in Kerala<br>➢ Description and analysis of wetlands, dry and sub-humid ecosystems and of their geographic location, areal extent and condition of these ecosystems  and map the same with spatial references in close cooperation with the other team experts and sector organizations in Kerala;<br>➢ Analysis will include the current trends affecting the condition of these ecosystems and the extent of the impacts;<br>➢ Identification and analysis of the direct and indirect causes of biodiversity loss by these wetlands and related ecosystem – including the threatened, endangered and rare species by ecosystem should be highlighted;<br>➢ Identification and analysis of the risks posed by |

| Consultant | Qualification and experience | Key Tasks |
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| | | intrusions/ invasions into these wetlands;<br>➤ Assessment of the use of traditional cultural knowledge related to landscape conservation in selected ecosystems;<br>➤ Identification existing biodiversity monitoring systems and analyze their strengths and weaknesses;<br>➤ Analysis the risks posed by climate change;<br>➤ Identification of the constraints that impede education/ communication and public awareness related to conservation of wetlands;<br>➤ Identify and propose detailed objectives vis-a-vis each task/ thematic area to becovered and propose strategic options for achieving the objective of rejenuvation/restoration and management of wetlands by identifying priorities, constrains and needed resources (financial, legal, institutional, and human), and develop alternative scenarios for implementation of the requirements to meet the objective;<br>➤ Conduct stakeholder consultations, disseminate findings and proposals to restoration, obtain feedback and incorporate the same in the report, and oversee implementation fo the recommendations.<br>➤ Any other work as required /recommended from time to time |
| Hydrologist and Hydrological Modelling expert | Post-graduate qualification in hydrology or similar 15 years professional experience in international water resources management / hydrology projects including instrumentation, data management, flood forecasting, reservoir management | ➤ Monitoring network design<br>➤ Advise on development of hydrological data for tributaries and main stem of the River<br>➤ Carryout hydrological modelling of tributaries and provide necessary inputs in developing Flood forecasting and warning |

| Consultant | Qualification and experience | Key Tasks |
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| | | ➢ Provide appropriate advise and inputs for integrating IWRM approaches in planning;<br>➢ Development of the detailed technical specifications of the monitoring system; i.e. stations, equipment, instruments, technologies, installation guidelines, operation, and maintenance of river flow measurement Acoustic Doppler Current Profiler (ADCPs), Water level monitoring equipment, hygrometry and telemetry systems, and other instrumentation required for collection of flow and sediment load data of the tributaries;<br>➢ Institutionalization of the updated WRD hydro-meteorological monitoring system Review and evaluate technical specifications of proposals received for supply and installation of the above equipment;<br>➢ Peer review of consultancies / modeling undertaken in the project;<br>➢ Guide WRD and other executing agencies on modelling and use of data;<br>➢ Review of reservoir management / sedimentation issues;<br>➢ Advice on use of reservoirs for flood management;<br>➢ Support the team in developing master plans for each sub-basin;<br>➢ Provide inputs in development of Planning and design manual; |
| GIS Flood Modelling, Survey and Data Specialist | The Specialist will have a Postgraduate degree in science related to engineering or geo-sciences or information management, and will have at least 10 years of experience | ➢ Review, train, build capacity and support survey and data management by WRD/ and other line departments/agencies – as mandated/applicable;<br>➢ Outline river and land survey requirements, techniques, |

| Consultant | Qualification and experience | Key Tasks |
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| | with at least 4 years in river surveys, data processing, and mapping. The expert will have demonstrated knowledge in computer and software applications. Design and implementation knowledge as well as command of GIS/management information system (MIS) is of comparative advantage | and methodologies relevant for planning, implementation, adaptation, and monitoring of structural and non-structural  activities undertaken 8n the tributaries; <br> ➢ Prepare data handling, storage, processing, and presentation methodologies for use, guide WRD during their implementation, and monitor operation with regular reporting about performance, gaps, and remedial measures or adaptations <br> ➢ Outline, pilot test, and support institutionalization of the use of modern data collection and processing tools for planning, design, and adaptation, including the specification of standard data processing software (such as GIS, Autocad, Surfer etc.) <br> ➢ Outline standardization of data presentation (like maps) for all planning and presentation tasks of WRD/KSDMA. <br> ➢ Support the team in developing master plans for each sub-basin; <br> ➢ Support logistical arrangements and other data transport to the knowledge center being developed under NHP; <br> ➢ Provide inputs in development of Planning and design manual; <br> ➢ Any other work as required /recommended from time to time |
| **National** | | |
| River Engineer + Project Management | **National Team Leader** <br> The national TL will have a Post Graduate degree or PhD in Water Resources | ➢ Lead the multidisciplinary team on a day to day basis and organize its effective work as team and with government institutions, with effective implementation |

| Consultant | Qualification and experience | Key Tasks |
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| | management, civil engineering, meteorology and or atmospheric sciences, with at least 10 years of experience as flood & erosion management specialist with minimum 5 years as consultant leading or working with multi-disciplinary teams. The national TL must have experience with rivers of similar complexity, such as Krishna, Godavari, Kaveri, Ganges, Brahmaputra, Teesta, Kosi etc. and computer skills. Good experience in working with the Indian administrative system and computer knowledge is required. Experience in MIS is of significant advantage,. The national TL will assume responsibility of day-to-day consultancy activities and work closely with the international TL and project director to support implementation.  Sound knowledge of Kerala's hydrology and experience in implementing World Bank/ADB or other multilateral funded projects – an advantage. | planning.<br>➢ Work closely with other consultant teams, and reflect their advice in implementing envisaged project activities;<br>➢ Assist the WRD in operating a system of planning, implementation, management, and monitoring of all subproject activities with effective project implementation MIS, in close liaison with the diverse project agencies, departments and stakeholder groups.<br>➢ Facilitate the organization of community level consultations and training programs for CBDRM activities and contribute to the discussions.<br>➢ Pursue that sufficient capacities are established with training in the WRD, and contractors in implementing the subprojects.<br>➢ Developing master plans for each sub-basin;<br>➢ Arrange training of the community groups for construction monitoring, infrastructure maintenance, wetland protection measures and efficient utilization of water resources;<br>➢ Assist the IA and other EAs on matters related to implementation of project activities;<br>➢ Detailed design and procurement (including packaging, cost estimates, and tender document preparation) of riverbank protection, embankment and relevant structures<br>➢ Progress and quality monitoring and contract management of structural works, with review and compilation of records of construction supervision and quality control<br>➢ Regular survey, monitoring and evaluation of the |

| Consultant | Qualification and experience | Key Tasks |
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| | | <ul><li>performance of work and the related river response</li><li>Planning and implementation of maintenance and adaptation of riverbank protection work on the basis of the performance monitoring</li><li>Monitor and assist the implementation of all the social and environmental safeguards requirements for the subprojects.</li><li>Review and updating of feasibility studies of subprojects</li><li>Implementation performance review of project activities</li><li>Support for the preparation of social and environmental safeguards reports.</li><li>Preparation of detailed project reports (DPRs) for central clearance</li><li>Assist WRD to prepare and submit annual and quarterly progress reports on time.</li><li>Any other work as required /recommended from time to time</li></ul> |
| Project Coordinators | The Project Coordinator will have a Post Graduate degree in Water Resources management, civil engineering, electronics Engineering with at least 5-8 years of experience as water resources management, flood & erosion management specialist with minimum 2 years leading or working with multi-disciplinary teams. Working experience with rivers basins, and wor watersheds in large international rivers/ Indian rivers Krishna, Godavari, Kaveri, | <ul><li>Support the team leaders and coordinate with line departments on a day to day basis for effective implementation of the activities undertaken in this assignment.</li><li>Work closely with other consultant teams, and reflect their advice in implementing envisaged project activities;</li><li>Coordinate and assist the WRD in operating a system of planning, implementation, management, and monitoring of all subproject activities with effective project implementation MIS, in close liaison with the</li></ul> |

| Consultant | Qualification and experience | Key Tasks |
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| | Ganges, Brahmaputra, Teesta, Kosi etc. with good computer and software operational skills. Good experience in working with the Indian administrative system. Knowledge of Kerala's hydrology and experience in implementing World Bank/ADB or other multilateral funded projects – an advantage. | diverse project agencies, departments and stakeholder groups.<br>➢ Coordinate the organization of community level consultations and training programs for CBDRM activities and contribute to the discussions.<br>➢ Support in development of master plans for each sub-basin;<br>➢ Arrange training of contractors and community groups for construction monitoring, infrastructure maintenance, wetland protection measures and efficient utilization of water resources;<br>➢ Assist the WRD and coordinate with other departments on matters related to implementation of project activities;<br>➢ Provide inputs to detailed design and procurement (including packaging, cost estimates, and tender document preparation) of riverbank protection, embankment and relevant structures<br>➢ Review and prepare reports on program/project progress, quality monitoring and contract management of structural works, with review and compilation of records of construction supervision and quality control<br>➢ Support all members of the team in planning, processing and implementing the projects/program developed in this assignment;<br>➢ Coordinate and monitor providing assistance in implementation of all the social and environmental safeguards requirements for the subprojects.<br>➢ Implementation performance review of subproject activities<br>➢ Support for the preparation of social and environmental |

| Consultant | Qualification and experience | Key Tasks |
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| | | safeguards reports. |
| | | ➤ Preparation of detailed project reports (DPRs) for central clearance |
| | | ➤ Assist WRD to prepare and submit annual and quarterly progress reports on time. |
| | | ➤ Any other work as required /recommended from time to time |
| Flood Management Specialist | The specialist will have a Post-graduate degree in civil engineering, river engineering or water resources management, or equivalent. The specialist will have experience with flood management work, specifically in flood and erosion management, Flood forecasting works, CBDRM, integrating community-based activities with state and central level activities, and with monsoon fed flood plain dynamics. Experience in other basins in the region is of comparative advantage. | ➤ Assist WRD, WRD and KSDMA in programming and implementing flood and erosion based disaster risk mitigation programs; <br> ➤ Assist the preparation of state-wide flood and erosion management planning framework and investment plans for tributaries under guidance of international flood management specialist and Basin assessments carried out in the project. <br> ➤ Support flood and erosion management and sub-basin management knowledge development covering: <br> → Hydro-meteorological data collection, processing, and storing, <br> → Arranging runoff and flood modeling including assessment of data requirements, suitable, models and modeling techniques, and evaluation of output data. <br> ➤ Assist planning and implementation activities of the CBDRM teams, specifically advising on: <br> → Non-structural tools and program development and work planning <br> → Analysis of flood risks in subproject areas and CBDRM focal villages, <br> → Flood proofing and raised platforms for |

| Consultant | Qualification and experience | Key Tasks |
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| | | communities, <br> → Community-based flood warning, including reliable communication procedures between government and local village committees, and <br> → Other technical aspects on flood risk management required for CBDRM <br> ➢ Support the team in developing master plans for each sub-basin; <br> ➢ Assist training and capacity building activities to different government bodies and local stakeholders, including reviewing training needs assessment, capacity development modules, and training impact assessment. <br> ➢ Assist reporting on flood risk management issues , prepare standard and specialist reports to feed into and develop practice for web-based reporting;. <br> ➢ Assist the establishment of effective infrastructure maintenance systems with asset inventory and performance monitoring MIS in collaboration with MIS and GIS specialists in the team; <br> ➢ Support the WRD in activities related to regional networking, including coordination with external agencies for knowledge contribution and exchange. <br> ➢ Any other work as required /recommended from time to time |
| Infrastructure & Construction Engineer | The specialist should be post-graduate in civil engineering degree with a minimum of 10 years of experience in design and execution of infrastructure works of which at least 3-5 years experience should be in river | ➢ Guide WRD, PIUs, and other execution agency staff on adoption of planning and design principles for development of designs for various civil works under the project;. <br> ➢ Review/correct/suggest/comment/guide in planning |

| Consultant | Qualification and experience | Key Tasks |
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| | engineering, flood and erosion protection works.. The engineer's experience with a nyof the rivers of similar complexity, such as Ganges, Brahmaputra, Teesta, Kosi, Krishna, Godavari, Kaveri, etc., and computer skills – is a must. | and development of designs for works proposed in the investment plans;<br>➢ Review/correct/suggest/comment/guide in planning and development of designs for works in the investment plans being prepared v=for various tributaries based on sub-basin assessments and recommendations;<br>➢ Assist the TL, WRD, on design and procurement issues regarding the detailed design drawings, technical specifications, bill of quantities, tender schedules, contractors' qualification, and technical and financial evaluations.<br>➢ Advise the concerned staff of WRD, PIU, executing agencies, etc., on construction management of the various infrastructure works following the established standards and good practices;<br>➢ Assist the WRD, PIUs and executing agencies in development of structural design and cost estimates for DPRs being prepared for various investment plans in the tributaries;.<br>➢ Provide on-the-job training for WRD and engineers from executing agencies including local communities on construction supervision, and issues related to the design and construction methodology of structural measures<br>➢ Any other work as required /recommended from time to time |
| GIS Mapping Specialist | The specialist will have a degree in engineering, computer science or equivalent and holds a GIS professional certification. | ➢ Outline GIS requirements for flood-erosion-environment monitoring and management in close cooperation with relevant experts, specifically river, |

| Consultant | Qualification and experience | Key Tasks |
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| | The expert must have at least 10 years of experience in development of GIS systems including 3 years in programming and 5 or more years in GIS data management mapping and processing systems, including data sources management and interface for real time monitoring, data structure concepts, database design and management, projections, data manipulation for multidisciplinary activities and mining data from different sources. Working experience in the region/ India would be of comparative advantage. | flood, hydrologists, morphologists environment flood and erosion management, specialists in the team and other consultants engaged in implementing various project activities;<br>➢ Develop GIS systems for the above;<br>➢ Develop project GIS system including structural and non-structural work for generation of regular progress reports.<br>➢ Work closely with outsourced agents and WRD and KSDMA computer center staff, and support their development of capacities for GIS data base and its management;]<br>➢ Support the team in developing master plans for each sub-basin;<br>➢ Prepare project GIS database, including updating and generating outputs.<br>➢ Contribute to the establishment of state data and knowledge management center for operationalizing systems development under the project to support IWRM approach in Kerala<br>➢ Any other work as required /recommended from time to time |
| Geo Technical Engineer | The specialist shall be a post graduate or higher in geology with specialization in water resources management and will have at least 8 years of experience in geology of river basins in South Asia | ➢ Guide the development of data base for geology, identify the need for additional studies and in particular identify primary and secondary data for the river basins in Kerala;<br>➢ Identify fold and fault lines in the river basins;<br>➢ Potential impacts of earthquake in the exiting river infrastructure;<br>➢ Guide the technical investigation program and skill |

| Consultant | Qualification and experience | Key Tasks |
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| | | training, including identification of adequate outside research and training institutions with specific focus on geological processes in rivers. |
| | | ➤ Support the implementing agencies and local research institutes in developing and managing the river geological prediction model following the practices specially the impacts on the tributaries and its catchment area; |
| | | ➤ Advise on establishment of data bases for carryout river geology with related parameters; |
| | | ➤ Any other work as required /recommended from time to time. |
| | | ➤ Conduct/supervise geological investigation work if any carried out in the rivers and tributaries in Kerala; |
| | | ➤ Identify and collect morphological data from field offices and consultants and consolidate the same for analysis and sharing with Data center established under NHP; them in data base. |
| | | ➤ Advice and assist in the analysis of the river response to flood and erosion protection works, including channel changes and sedimentation of floodplains and tributaries; |
| | | ➤ Contribute to the technical studies with geological data at pre-feasibility level to explore possibilities (i) to improve conditions in the tributaries catchment areas of rivers in Kerala by making designs for the different river training works as proposed in the investment plans emerging from basin sub-basin assessments; |
| | | ➤ Support the team in developing master plans for each sub-basin; |
| | | ➤ Any other work as required /recommended from time |

| Consultant | Qualification and experience | Key Tasks |
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| | | to time. |
| Community DRM Specialist | The specialist will have a post-graduate degree in social development or equivalent with at least 5 or more years of experience in community mobilization and activities preferably those related to disaster risk management. Experience in North-east – advantage, but proficiency in local language is a must | ➤ The experts will work closely with WRD, PIUs and executing agencies to monitor and support the field level activities of the NGOs and other stakeholders engaged in CBDRM activities, in terms of their capacities and delivery of programs in liaison DDMAs, WRD, and the consultant teams; <br> ➤ Assist the NGOs in terms of work planning, day-to-day implementation, and recording and reporting of CBDRM activities in close communication with the PIUs/DDMAs. <br> ➤ Monitor the NGO activities in light of their work plan as defined with the concerned PIUs/DDMA, WRD, and the consultants. <br> ➤ Seek the guidance of KSDMA/DDMA and consultants (Social development and safeguards specialists) on the implementation and capacity gaps of the NGOs, and deliver the requisite guidance and training programs <br> ➤ Report the field level CBDRM activities to WRD/KSDMA/DDMA on a biweekly basis. <br> ➤ Any other work as required /recommended from time to time |
| River Modelling Specialist | The Specialist will have an advanced degree with specialization in hydrology, hydraulics, water resources management or equivalent, with 8 years of prior experience in water resources management with specific experience in river modeling, development of flood forecasting and warning (FFW),. Experience in South Asia, specifically with | ➤ Guide river Modelling & flood Plain Specialist in the team and WRD, and other such institutions in programming and implementing river and flood plain modelling activities to institutionalize these practices in addition to; <br> → provide modelling inputs for preparation of state-wide flood and erosion management planning framework based on modelling studies; |

| Consultant | Qualification and experience | Key Tasks |
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| | monsoon fed rivers & flood plains would be an asset. | → Review and provide inputs on investment plans prepared for tributaries:<br>→ Guide and provide inputs in the preparation of flood and erosion management and sub-basin management knowledge development covering:<br>→ Hydro-meteorological data collection, processing, and storing,<br>→ Arranging river and flood modeling including assessment of data requirements, suitable, models and modeling techniques, and evaluation of output data.<br>→ assist in development of FFW<br>➢ Support training and capacity building activities to different government bodies and local stakeholders, including reviewing training needs assessment, capacity development modules, and training impact assessment;<br>➢ Support the team in developing master plans for each sub-basin;<br>➢ Any other work as required /recommended from time to time |
| GIS Flood Modelling, Survey and Data Specialist | The Specialist will have a Postgraduate degree in science related to engineering or geo-sciences or information management, and will have at least 5 years of experience with at least 2 years in river surveys, data processing, and mapping. The Specialist will have demonstrated knowledge in computer and software applications. Design and implementation knowledge as well as | ➢ Work in close cooperation with the international exert and other team members in executing the following activities;<br>➢ Review, train, build capacity and support survey and data management by WRD/CCC and other line departments/agencies – as mandated/applicable;<br>➢ Outline river and land survey requirements, techniques, and methodologies relevant for planning, implementation, adaptation, and monitoring of |

| Consultant | Qualification and experience | Key Tasks |
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| | command of GIS/management information system (MIS) is of comparative advantage | <ul><li>structural and non-structural activities undertaken 8n the tributaries;</li><li>Prepare data handling, storage, processing, and presentation methodologies for use, guide WRD?CCC during their implementation, and monitor operation with regular reporting about performance, gaps, and remedial measures or adaptations;</li><li>Outline, pilot test, and support institutionalization of the use of modern data collection and processing tools for planning, design, and adaptation, including the specification of standard data processing software (such as GIS, Autocad, Surfer etc.)</li><li>Outline standardization of data presentation (like maps) for all planning and presentation tasks of WRD/CCC/KSDMA.</li><li>Support the team in developing master plans for each sub-basin;</li><li>Support logistical arrangements and other data transport to the knowledge center being developed under NHP;</li><li>Provide inputs in development of Planning and design manual;</li><li>Any other work as required /recommended from time to time</li></ul> |
| Watershed Management Specialist | The expert shall have a post graduate degree or more in Agricultural Engineering or Natural resources management/ engineering, watershed hydrology, or equivalent, with at least 10 years previous relevant job experience of which five years of | <ul><li>Under the overall guidance of the team leader, the expert shall work in close cooperation and support other team mates in:</li><li>→ the integrated watershed Management (IWM) activities to be undertaken including but not limited to operational planning and defining of sub-basin</li></ul> |

| Consultant | Qualification and experience | Key Tasks |
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| | experience in planning, implementation, evaluation and documentation • Previous work experience/knowledge in field of agricultural studies and practices, good knowledge/experience of river basins in India – advantage. Demonstrated skills use GIS applications – a must | IWM agenda in light of the challenges on climate change adaptation;<br>→ Develop proposals for facilitate/support implementation of subprojects in the sub-basins area of the tributaries;<br>→ Undertake project identification, development, monitoring and technical consultations as required by partner institutions and stakeholders in Kerala;<br>→ Design and carry out participatory action research and knowledge development, gathering and compilation of data from the field for IWM inform decision makers and land use managers on the details to bridge the gaps between the policies, programs and implementation of various schemes of the government by its agencies and other stakeholders;<br>→ Support training and capacity building and networking actions and activities for promoting IWM with and through identified-partners and stakeholders in the tributary catchment area;<br>→ Support and provide inputs for mapping activities and report preparation and work closely with other colleagues in the team for data collection and consolidation;<br>→ Any other work as required /recommended from time to time |
| Economist | The expert shall have a post graduate degree in economics.  8-10 years in conducting economic and financial analysis of complex investment projects in the water sector. | ➢ The analysis must be made comparing the ''without'' sub-project situation with the ''with'' sub-project situation and include the following:<br>➢ Financial analysis of all cash flows associated with the |

| Consultant | Qualification and experience | Key Tasks |
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| | Experience with World Bank projects would be an advantage | sub-project (including capital costs, operating costs and revenues) and financial sustainability (including evaluating the sub-project's fiscal impact). <br> ➢ Economic analysis made from a national welfare perspective (excluding subsidies, taxes and transfers and including externalities, non-market impacts). <br> ➢ Sensitivity and risk analysis on parameters that are uncertain and to identify those to which results are sensitive in order to evaluate sub-project risks. <br> ➢ Distributional analysis in order to determine how various stakeholders are affected by and/or benefit from the sub-project. <br> ➢ Any other work as required from time to time |
| Agriculture Specialist | Master's degree or higher in Agriculture with at least 8-10 years of experience in working in agriculture sector in India and or overseas; should have sound technical knowledge agriculture interlinkages with irrigation systems, working experience on agri-sector reforms– a must | ➢ Assist in providing inputs for enhancement of agriculture activities in the sub-basin catchment area, including land use management; and identify relevant agricultural innovations and practices that can be promoted at the field level for water use efficiency; <br> ➢ Provide regional best practices and experiences to guide, direct, manage and report on Team inputs and outputs; <br> ➢ Provide technical, administrative, and reporting support to the Program Director; assist with developing and operationalizing monitoring systems, preparing and delivering training; <br> ➢ Assist WRD and its consultants in reviewing sub-basin plans and provide inputs/suggestions/ comments for incorporating and integrating activities and linkages with other ongoing agriculture development programs in the state; |

| Consultant | Qualification and experience | Key Tasks |
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| | | ➢ Assist PIUs in establishment of operational practices for participatory approach in improving agriculture production;<br>➢ Plan and coordinate planning, design and other requirements in the sector for implementation in the sub-basin; |
| Environment & Forest Management Specialist | The specialist will have at least 7 years' experience in environmental studies and implementation of environmental management plans, with 5 years of experience in implementing externally assisted projects. Experience in activities related to riverbank, flood & erosion protection, environment management of basin catchment – is a must. Experience in working on environment issues in the North-Eastern Region is of comparative advantage. | ➢ Conduct environmental data collection arrangements for the Project for investment plans prepared under the project;<br>➢ Analyze/review SBA reports and other studies and provide comments as appropriate;<br>➢ Develop and operationalize with WRD and PIUs the designated EMPs (both existing and those developed) for work contracts and other activities undertaken in the project<br>➢ Assist PIUs and NGOs in undertaking initial environmental examination/due diligence of the designated activities included in CBDRM subcomponent.<br>➢ Monitoring contractors' activities that may have environmental impacts through periodic and recurrent spot checks, and submit reports to the team leader for incorporation in the progress reports. Highlight non-compliance to the project director to ensure remedial actions;<br>➢ Carryout environmental impacts monitoring of completed works including morphological impacts on char lands;<br>➢ Conduct specialist training for field staff and contractors on environmental monitoring and |

| Consultant | Qualification and experience | Key Tasks |
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| | | management arrangements to be followed under the Project.<br>➢ Carryout due diligence for all investment plans prepared under the project;<br>➢ Any other work as required /recommended from time to time |
| Social Development/livelihood Specialist | The specialist will have a degree in social development and 10 years of relevant experience in participatory rural development and empowerment projects for women and vulnerable groups. Working experience in the region would be of comparative advantage | ➢ Assist WRD/PIUs and other implementing agencies in establishing bench mark values for project progress monitoring, including preparation and evaluation of outsourced social surveys (included in monitoring and evaluation consultancy package).<br>➢ Assist WRD/PIU/executing agencies in further identifying the special needs of specific/vulnerable groups such as landless and marginal farmers, women, embankment squatter population, and other minority groups such as scheduled tribes and castes.<br>➢ Assist WRD/PIU/executing agencies in operationalizing the methods, procedures, and systems for strengthening the existing village level disaster management committees (DMCs) established at local levels.<br>➢ Identify measures and performance targets to ensure effective participation of vulnerable groups in CBDRM activities. Review progress and ensure that their interests are reflected in the organizational management of DMCs and CBDRM activities. Identify possible actions to improve their participation and performance in flood management;<br>➢ Identify livelihood opportunities along with other Consultants/executing agencies on efficient utilization |

| Consultant | Qualification and experience | Key Tasks |
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| | | ➤ of water resources – specifically livelihood opportunities through enhancement/improving activities in the in-land fisheries sector; <br> ➤ Establish an impartial compliant/grievance handling mechanism (GRM), develop processes and mechanisms for resolving social conflicts in project-areas and related activities undertaken; <br> ➤ Work with the training specialist in the team to update training materials for WRD & agencies under it, WRD, PIUs, DMCs, NGOs, and other stakeholders and provide training on participatory planning, gender mainstreaming, and other social development related areas. <br> ➤ Ensure that MIS developed under the project for WRD has incorporated social and gender aspects in an appropriate manner; <br> ➤ Analyze/review SBA reports and other studies and provide comments as appropriate; |
| Social Safeguards Specialist | The specialist will have at least 5-7 years' experience in resettlement planning and implementation in India. Other qualifications include social impacts, research/evaluations and implementation experience, particularly with regard to resettlement of project-affected persons (PAPs). | ➤ Work closely with WRD, and guide the implementation of the resettlement action plans (RAPs) and preparing due diligence and compliance reports on implementation of agreed Resettlement Policy Framework(RPF) for the project, in close coordination with WRD, PIUs, Executing agencies, NGOs, and other partners in the project;: <br> ➤ Assist WRD, PIUs, executing agencies, and NGOs, in establishing effective planning, implementation, and monitoring and evaluation (M&E: including third party M&E) mechanisms to ensure that compensation, relocation and income restoration measures, among |

| Consultant | Qualification and experience | Key Tasks |
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| | | other activities, are duly carried through during the resettlement process. |
| | | ➤ Design questionnaire that will be used for census/surveys for resettlement planning as required based on the investment plans. The survey must cover all affected households, businesses, and others along the project alignments/right of way and include data, among others, family profiles, income levels, assets (land, structures, crops, etc), tenure status, land use patterns, preferences for relocation and resettlement. |
| | | ➤ Train enumerators to conduct the census/surveys and validate the findings through appropriate cross-checking. |
| | | ➤ Analyze the survey data and present the findings in the RP in a clear, cogent and consistent manner. |
| | | ➤ Conduct stakeholders' meetings and disclose the RAP to the affected persons. |
| | | ➤ Guide the NGOs to effectively assist the activities of the PIUs and district administration for land acquisition procedures, and to implement resettlement activities as per the RAPs, including the facilitation of their inception, progress, and completion reporting. |
| | | ➤ In consultation with local panchayat and the affected/host families, identify availability of land that may be required by PAPs for relocation wherever needed;. |
| | | ➤ Assist NGOs to identify alternative livelihood sources in consultation with the affected families and provide supporting measures (i.e., credit, training etc.) necessary to ensure restoration of income and livelihoods in post-relocation period. |

| Consultant | Qualification and experience | Key Tasks |
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| | | ➢ Generally, assist with the implementation of the project and provide all necessary support to the WRD/Team Leader as necessary; |
| Procurement and Contract Management Specialist | The procurement specialist will have a degree in law or business administration or an equivalent. The expert will have minimum 7 years of experience in public procurement including working experience for World Bank financed projects - preferred. | ➢ The procurement specialist will work closely with WRD and national team leader and other concerned project personnel<br>➢ Assist design staff in preparing bidding documents and DPRs<br>➢ Assist WRD/PIUs/executing agencies in preparing bidding documents for works, goods and services;<br>➢ Assist WRD/PIUs/executing agencies in bidding. evaluation process and reports for works, goods and services<br>➢ Review all contract documents before award, monitor and report on performance of contractors, and advise appropriate actions to be undertaken by the employer, as appropriate from time to time;<br>➢ Ensure compliance to the procurement procedures agreed to by GoA under the project;<br>➢ Assist in day to day management of construction contracts with support from construction quality monitoring involving investigation of claims, assessment of price escalations, checking revisions to contracts, etc.;<br>➢ Help national DTL develop tender documents regarding maintenance contracts or providing for maintenance support in construction contracts.<br>➢ Provide procurement training to the WRD, PIU and executing agencies stafffrom time to time;<br>➢ Prepare procurement manual for the project and for |

| Consultant | Qualification and experience | Key Tasks |
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| | | WRD, and ensure incorporation and linkage to the MIS for institutionalization of robust, transparent procurement practices. |
| Financial Management Specialist | The specialist will have a degree in financial management or relevant field and have a minimum of 7 years working experience in financial management. Working experience for financial management of World Bank and other multilateral funded projects would be of comparative advantage. Proficiency in application computer financial packages – is a must | ➢ Assist in installing appropriate financial and management accounting systems and procedures to aid EAs in managing projects funds, maintaining accounts, and submitting timely and reliable financial reports.<br>➢ Assist in designing, developing, and installing a computerized accounting system or assisting in selection of the off-the-shelf accounting software/ or others to interface with accounting systems for WRD and other executing agencies;<br>➢ Assist in refining the financial management and accounting manual for WRD and provide necessary training to staff for useage of these applications;<br>➢ Assist in reviewing project financial statements/audit reports and resolve qualifications to ensure continuity of disbursement activities and draw lessons for future projects.<br>➢ Assist in adequately forecasting the maintenance funding requirements, preparing the norms for funding as well as prioritizing maintenance expenditure and work on an arrangement for their efficient utilization with an appropriate reporting mechanism.<br>➢ Work out a suitable mechanism with other executing agencies on the funding/reimbursement and leveraging resources to meet expenditures for carrying out activities in the project essential maintenance works |
| MIS Specialist | The specialist will have a degree in engineering, computer science or equivalent | ➢ The consultant will assist the operationalization of infrastructure asset management MIS for WRD; |

| Consultant | Qualification and experience | Key Tasks |
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| | with working experience of at least 10 years in development and application of MIS systems including 5 years in programming and 5 years in MIS development for large projects. Experience in working in North East India and development of systems in river management organizations - advantage | ➢ Design and development of MIS, data entry and reporting systems for efficient monitoring and administration of project activities and other activities by WRD; <br> ➢ Provide close support for all project monitoring and evaluation data collection and processing requirements; <br> ➢ Training and technical support for application and use of MIS systems by WRD, Implementing and executing agencies to facilitate timely progress reporting; <br> ➢ Develop dedicated MIS system for WRD incorporating interface provisions with the existing systems operated by the department under the KSWAN. The MIS developed shall include but not limited to planning, programming, budget management, procurement, financial management and flood-erosion data processing; <br> ➢ Implement and field test the system, test the performance, make necessary corrections, and prepare (i) system application proposal for the schemes covered by WRD and other related agencies, and (ii) training programs and manuals for the MIS applications |
| Communication Specialist | The specialist will be a Postgraduate in mass communication or equivalent, with at least 10 years' experience in design and implementation of mass communication programs, awareness generation, outreach programs and multimedia information management. | ➢ Develop a communication program which will consist of, but not be limited to, laying down a vision, identifying opportunities and challenges, and preparing a plan of action. It will specify the core messages, internal and external audiences, communication channels, types of media, frequency of dissemination, and feedback etc.; <br> ➢ Support IAs and WRD in designing and implementation of project awareness and outreach |

| Consultant | Qualification and experience | Key Tasks |
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| | | ➢ programs for CBDRM and other community development activities;<br>➢ Develop multi- media information dissemination platforms including newsletter, brochures, videos etc. on the achievement/ progress of the project implementation.;<br>➢ Organize workshops, and other information dissemination events, public consultations etc., for public disclosure of information;<br>➢ Facilitate and document case studies of best practices and lessons learned and disseminate these to internal and external audiences;<br>➢ Any other work as required /recommended from time to time |
| Training & Capacity Building Specialist | The Specialist will have a degree in communication, education, or related disciplines and will have at least 10 years of experience in training management and development training communication material in rural development programs. The consultant will have demonstrable experience of using appropriate computer software/programs for capacity building activities.  Experience working in the North East states – is an advantage, while knowledge of local language is a must. | ➢ The training coordinator will assist the consultant teams and the WRD by assuming responsibility for development and organization of project specific training activities;<br>➢ Work with other consultants and assist the WRD to prepare project-specific training programs (for all project components), to address participatory and integrated planning and design, environment and social safeguards application, CBDRM, flood and erosion management, hydrological, geo-morphological modelling, construction management, maintenance, monitoring and evaluation, quality control, and auditing, etc.;.<br>➢ Assist WRD in developing training schedules that include designated trainers and assist with the logistical arrangements to implement the training. |

| Consultant | Qualification and experience | Key Tasks |
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| | | ➤ Work with the WRD and institutional specialists to identify appropriate training institutions, and impart trainer of training programs to develop strong set of trainers who can work for the project training.<br>➤ Advise WRD and consultant teams with respect to their training materials, audio-visual materials, brochures, newsletters, and other public awareness literature for the project;<br>➤ Any other work as required /recommended from time to time |