



Technical Assistance Report

Project Number: 52051–004
Transaction Technical Assistance (TRTA)
December 2019

Islamic Republic of Pakistan: Preparing the Kurram Tangi Integrated Water Resources Development Project

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Asian Development Bank

CURRENCY EQUIVALENTS

(as of 27 November 2019)

| | | |
|---------------|---|-------------------------|
| Currency unit | – | Pakistan rupee (PR/PRs) |
| PR/1.00 | = | \$0.0064 |
| \$1.00 | = | PRs155.35 |

ABBREVIATIONS

| | | |
|----------------|---|--|
| ADB | – | Asian Development Bank |
| FATA | – | Federally Administered Tribal Area |
| GWH | – | gigawatt-hour |
| ha | – | hectare |
| IBIS | – | Indus Basin Irrigation System |
| IRS | – | Indus River Basin |
| KP | – | Khyber Pakhtunkhwa province |
| KPAD | – | Khyber Pakhtunkhwa Agriculture Department |
| KPID | – | Khyber Pakhtunkhwa Irrigation Department |
| m ³ | – | cubic meters |
| PRF | – | project readiness financing |
| TRTA | – | transaction technical assistance |
| USAID | – | United States Agency for International Development |
| WAPDA | – | Water and Power Development Authority |

NOTE

- (i) In this report, "\$" refers to United States dollars

| | |
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TRANSACTION TECHNICAL ASSISTANCE AT A GLANCE

| | | | |
|---|---|--|---------------------------------------|
| 1. Basic Data | | Project Number: 52051-004 | |
| Project Name | Preparing Kurram Tangi Integrated Water Resources Development Project | Department/Division | CWRD/CWER |
| Nature of Activity | Project Preparation | Executing Agency | Water and Power Development Authority |
| Modality | Regular | | |
| Country | Pakistan | | |
| 2. Sector | Subsector(s) | ADB Financing (\$ million) | |
| ✓ Agriculture, natural resources and rural development | Agricultural policy, institutional and capacity development | | 0.20 |
| | Agricultural production | | 0.20 |
| | Irrigation | | 0.60 |
| Energy | Energy efficiency and conservation | | 0.60 |
| | Large hydropower generation | | 0.20 |
| | Total | | 1.80 |
| 3. Operational Priorities | | Climate Change Information | |
| ✓ Addressing remaining poverty and reducing inequalities | | Climate Change impact on the Project | Medium |
| ✓ Accelerating progress in gender equality | | | |
| ✓ Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability | | ADB Financing | |
| ✓ Promoting rural development and food security | | Adaptation (\$ million) | 0.20 |
| ✓ Strengthening governance and institutional capacity | | Mitigation (\$ million) | 0.25 |
| Sustainable Development Goals | | Gender Equity and Mainstreaming | |
| SDG 1.4 | | Effective gender mainstreaming (EGM) | ✓ |
| SDG 2.4 | | | |
| SDG 5.5 | | | |
| SDG 6.4 | | Poverty Targeting | |
| SDG 7.1 | | Geographic Targeting | ✓ |
| SDG 9.4 | | | |
| SDG 10.2 | | | |
| SDG 12.2 | | | |
| SDG 13.a | | | |
| 4. Risk Categorization | Complex | | |
| 5. Safeguard Categorization | Safeguard Policy Statement does not apply | | |
| 6. Financing | | | |
| Modality and Sources | | Amount (\$ million) | |
| ADB | | 1.80 | |
| Transaction technical assistance: Technical Assistance Special Fund | | 1.80 | |
| Cofinancing | | 0.00 | |
| None | | 0.00 | |
| Counterpart | | 0.00 | |
| None | | 0.00 | |
| Total | | 1.80 | |
| Currency of ADB Financing: US Dollar | | | |

I. THE ENSUING PROJECT

1. The proposed project will improve the productivity and sustainability of water resources management in the Kurram river basin, and will improve agricultural productivity, through: (i) construction of a multipurpose dam with a 98-meter height, (ii) construction and upgrading of irrigation canals, (iii) construction of a hydropower generation station, (iv) construction of on-farm water courses and providing agricultural support, and (v) institutional capacity strengthening for efficient water management and sustainability of infrastructures. The dam will also help flood management. The project will improve about 140,000 ha land through improved or new irrigation systems. The project will also construct or upgrade farm roads to improve access to markets and improve the community facilities, such as school, basic health unit and water supply, to improve livelihoods of local population who will be affected by involuntary resettlement due to the construction of infrastructures. The dam will be located on the Kurram River, previously Northern Waziristan Agency of the Federally Administered Tribal Area (FATA) and currently in Khyber Pakhtunkhwa Province (KP). The proposed project will be aligned with the following impact: improved water, food and energy security. Stage 1 construction work¹ is in progress, which will divert a part of flow from the neighboring Kaitu River into the proposed Kurram dam reservoir.

2. The project is estimated to cost \$800 million. For the ensuing investment, Asian Development Bank (ADB) will finance \$300 million from its ordinary capital resources and the government will contribute \$75 million. The balance amount of \$425 million is expected to be financed by cofinanciers. The ensuing loan was included in ADB's country operations business plan, 2020–2022.²

II. THE TECHNICAL ASSISTANCE

A. Justification

3. The transaction technical assistance (TRTA) will help the government prepare the project fully that meets the donors' requirement for funding. It will also help prepare institutional development plans for operational management of reservoir and power houses, on-farm water and agriculture management and irrigation supplies monitoring and control mechanisms vis-à-vis capacity development program for the new institution. The past preparatory works included the government-funded feasibility study in 2004 and a detailed engineering design in 2011. The outputs of these studies were subjected to a comprehensive due diligence review funded by the United States Agency for International Development (USAID) in 2013. The USAID review revealed several serious design flaws, including possible underrating of key design parameters, such as probable maximum flood discharge and design seismic force, as well as inadequacy of geological information. The past studies also lacked design and planning for irrigation and agricultural development in sufficient detail.

4. The small-scale knowledge and support technical assistance³ approved in 2018 identified further gaps in the past studies: (i) impact of climate change was not assessed and was not incorporated in the other relevant assessments (hydrology, sediment, flood, agriculture etc.); (ii) agriculture and command area development was not fully covered; (iii) topographic surveys and

¹ This is financed by the Government of Pakistan and United States for International Development with the overall cost of PKR21 billion.

² ADB. 2019. *Country Operations Business Plan: Pakistan, 2020-22*. Manila.

³ ADB. 2018. *Small-Scale Knowledge and Support Technical Assistance to the Islamic Republic of Pakistan for Preparing the Kurram Tangi Integrated Water Resources Project*. Manila.

geotechnical investigations were not carried out in sufficient detail; (iv) impact of Baran dam raising that is planned downstream of the Kurram River was not discussed; and (v) safeguard documents were not properly prepared. The TRTA team confirmed the shortcomings and emphasized the need for development of a fully integrated project, where water integrates and links the people, land and environment for the sustainable services. The proposed TRTA will enable a comprehensive feasibility study to validate technical feasibility and economic viability of the project, applying best international practice in planning and design of dams, along with planning and layout design of irrigation and agricultural development component, as well as updating and strengthening of environmental and social due diligence works. It will be ensured that lessons learned under ADB-assisted projects are comprehensively addressed as part of the TRTA outputs.⁴ With the result of the due diligence, TRTA will develop an integrated water resources management focused project design. Subsequently the TRTA will also develop a holistic plan for the entire scheme and explore cofinancing opportunities with other development partners and the private sector.

5. To advance the project readiness, the government intends to seek ADB's Project Readiness Financing (PRF), amounting to some \$5 million. The Water and Power Development Authority (WAPDA) will undertake the detailed design of the dam and appurtenant structures and procurement preparation under the PRF. Bidding document preparation, procurement support and other project readiness activities will also be covered by the PRF. The PRF will also support a panel of experts to advise on and review the criteria, assumptions, and standard practices in the design of dams, spillways, tunnels and associated energy dissipating arrangements to ensure safety, integrity and operational reliability of the structures.

B. Outputs and Activities

6. The TRTA has three outputs: (i) Output 1—integrated multi-sector water resources management plan prepared; (ii) Output 2—feasibility-level design of project structures and facilities prepared, and (iii) Output 3—comprehensive agricultural development and irrigation management improvement plan developed.

7. **Output 1—Integrated Multi-Sector Water Resources Management Plan Prepared.** The integrated plan will include energy, irrigation and environment water uses. The activities include: (i) hydrological study on precipitation and river flows, sedimentation, water balance in the downstream impact area, and determination of base flow requirement for downstream riparian users and ecosystem; (ii) climate risk and vulnerability assessment to assess likely climate change impacts on the project's long-term performance and identification of possible adaptation measures; (iii) reservoir simulation study to validate reservoir capacity and its economic life based on the simulated river flows and sediment inflows; (iv) determination of the dam's dependable releases for power generation, irrigation and downstream riparian users and environment; and (v) development of the proposed reservoir operation rules that will ensure optimum allocation between power and irrigation demands and also consider the Barun dam raising plan, along with the formulation of institutional framework necessary to ensure efficient and equitable allocation and releases of water, and the associated institutional development and capacity building proposal.

⁴ Sector Assessment (Summary): Agriculture, Natural Resources, And Rural Development (<https://www.adb.org/sites/default/files/linked-documents/47235-001-ssa.pdf> and <https://www.adb.org/sites/default/files/linked-documents/46528-002-ssa.pdf>)

8. Output 2—Feasibility-level Design of Project Structures and Facilities Prepared.

The activities will include: (i) carrying out of topographic and geotechnical survey including use of GIS and remote sensing data, and investigation over the reservoir area, sites of major project structures and facilities, and the irrigation command area;⁵ (ii) revision/validation of the key engineering design parameters, such as probable maximum flood and credible maximum earthquake; (iii) engineering design of 98-m high dam and its appurtenant structures, such as saddle dam, spillway, diversion works, three power houses and associated diversion tunnels, river diversion weirs, and, canal irrigation systems, including command area development (farm-level irrigation distribution and land levelling), all complete with drawings, bill of quantity, and cost estimates; (iv) preliminary dam break assessment; (v) financial and economic analysis of the project to validate economic viability and financial sustainability; (vi) land acquisition and resettlement requirements will be updated in accordance with ADB's social and environmental safeguard policies. Land acquisition and resettlement plan will be based on resettlement policies specific to the project, formulated through consultation and the lessons learnt from the land acquisition and resettlement performance of WAPDA projects, (vii) environmental assessment and environmental management plan will be developed, as they relate to the direct impacts of project activities in and around the project area, as well as the downstream impact area on the river sub-basin scale; and lastly (viii) a social and gender development plan will be formulated to ensure adequate provision of support to the communities, particularly the vulnerable groups and women, affected by the project's land acquisition and resettlement.

9. Output 3—Comprehensive Agricultural Development and Irrigation Management Improvement Plan Developed.

The activities will include: (i) comprehensive analysis of the agricultural, socioeconomic, demographic, agro-climatic, and infrastructural development conditions of the project's command area and the farming communities within; (ii) development of credible and robust agricultural development scenario that capitalizes on the increased and more reliable supply of irrigation service; (iii) formulation of an agricultural development plan, identifying prevailing and likely future challenges and constraints to the realization of agricultural development scenarios, and the measures that would address such constraints, including improvement in agricultural extension services, promotion of local knowledges, and empowerment of small farmers; (iv) study of the prevailing irrigation and water management practices and underlying sociopolitical conditions in the existing irrigation command areas, and identification of necessary improvements in the management practices and water management institutions for more efficient and equitable distribution and use of irrigation water, with specific attention to the results under the 1997 irrigation sector reform;⁶ and (v) formulation of an institutional development and capacity building plan for more efficient, sustainable and equitable irrigation services for the irrigation department and farmers/water user groups.

C. Cost and Financing

10. The TRTA is estimated to cost \$2.1 million, of which \$1.8 million will be financed on a grant basis by ADB's Technical Assistance Special Fund (TASF-6). The Government will contribute \$300,000 in kind as counterpart support in the form of office space for TRTA consultants, counterpart staff, data and information access, security arrangements, and facilitation of liaisons with stakeholders during the feasibility study. The key expenditure items are listed in Appendix 1. The government was informed that approval of the TRTA does not commit ADB to finance any ensuing project.

⁵ The PRF scope will include confirmatory, supplementary and additional surveys for the purpose of detail design.

⁶ For example, empowered Farmer Organizations resulted in increased rent seeking within water users, reduced collection of irrigation service fee, and increased inequity in distribution of irrigation water. See, for example, Jacoby et al. *Decentralization and Redistribution*, 2018, World Bank.

D. Implementation Arrangements

11. ADB will administer the TRTA. The WAPDA will be the executing agency of the TA.⁷ WAPDA will be responsible for the preparatory work on component 1 (dam and related works). The KP Irrigation Department (KPID) will be responsible for all the preparatory work related to component 2 (irrigation canal system). The KP Agriculture Department (KPAD) will be responsible for preparatory work for component 3 (command area and agriculture). WAPDA will also be responsible for overall coordination of the TA activities with KPID and PKAD. ADB's Central and West Asia Department, Environment, Natural Resources, and Agriculture Division will act as the focal point and coordinator of consulting inputs and activities. The proposed TA will be implemented from December 2019 to June 2021. The implementation schedule is in Table 1.

Table 1: Implementation Arrangements

| Aspects | Arrangements | | |
|---|---|--|-------------|
| Indicative implementation period | December 2019–June 2021 | | |
| Executing agency | WAPDA | | |
| Implementing agencies | Environment, Natural Resources, and Agriculture Division, of Central and West Asia Department | | |
| Consultants | To be selected and engaged by ADB: | | |
| | Firm: QCBS (90:10) | TA consultant team (182 person-months) | \$1,600,000 |
| Procurement | To be procured by the consultant | | |
| | Shopping | 1 contract | \$10,000 |
| Advance contracting and retroactive financing | None | | |
| Disbursement | The TA resources will be disbursed following ADB's <i>Technical Assistance Disbursement Handbook</i> (2010, as amended from time to time). | | |
| Asset turnover or disposal arrangement upon TA completion | Upon TA completion, all equipment procured under the TA will be turned over or disposed of in accordance with ADB's Project Administration Instructions 5.09. | | |

ADB = Asian Development Bank, KPAD = Khyber Pakhtunkhwa Agriculture Department, KPID = Khyber Pakhtunkhwa Irrigation Department, QCBS = quality- and cost-based selection, WAPDA = Water and Power Development Authority
Source: Asian Development Bank.

12. **Consulting Services.** The TA will require a consortium of international and national consulting firms, to be selected under the quality- and cost-based selection (QCBS) method, with 90:10 quality-cost ratio. Consultants will be engaged in accordance with ADB's *Procurement Policy* (2017 as amended from time to time) and associated staff instructions and/or project administration instructions. The indicative expertise and corresponding person-months are in Table 2. Draft terms of references are accessible from the list of linked documents in Appendix 2.

⁷ The Federal Ministry of Water Resources in supervisory role coordinates all WAPDA related works at the federal level including approval of counterpart funds.

Table 2: Summary of Indicative Consulting Services Requirement

| Expertise | International | National | Total |
|---|----------------------|-----------------|--------------|
| KEY EXPERTS | | | |
| Water Res. Planning Expert | 8 | | 8 |
| Water Res. Hydarulic Specialist / Deputy Team Leader | | 12 | 12 |
| Hydrologist | | 6 | 6 |
| Electrical Engineer / Hydropower Specialist | | 6 | 6 |
| Institutional / Governance Specialist | 1 | 4 | 5 |
| Dam Specialist | 2 | 6 | 8 |
| Environmental Specialist | | 5 | 5 |
| Irrigation Specialist | | 6 | 6 |
| Agricultural Specialist | | 6 | 6 |
| Economist | 3 | | 3 |
| Resettlement Specialist | 3 | 6 | 9 |
| Financial Management (FM) Specialist / Consultant | | 3 | 3 |
| SUBTOTAL | 17 | 60 | 77 |
| NON-KEY EXPERTS | | | |
| Climate Change Specialist | | 4 | 4 |
| Geotechnical Specialist / Geologist | | 6 | 6 |
| Structural Engineer | | 5 | 5 |
| Survey Engineer | | 1 | 1 |
| Mechanical Engineer | | 4 | 4 |
| Groundwater Specialist | | 2 | 2 |
| Procurement Specialist | | 4 | 4 |
| Social Development Specialist | | 3 | 3 |
| Gender Development Specialist | | 3 | 3 |
| Sediment Specialist | 2 | | 2 |
| Assistant Civil Engineers (5) | | 30 | 30 |
| Assistant Irrigation Engineers / Hydraulic Engineer (3) | | 21 | 21 |
| Unallocated | | 20 | 20 |
| SUBTOTAL | 2 | 103 | 105 |
| TOTAL | 19 | 163 | 182 |

Source: Asian Development Bank.

COST ESTIMATES AND FINANCING PLAN

(\$'000)

| Item | Total Cost |
|--|-------------------|
| Asian Development Bank^a | |
| 1. Consultants | |
| a. Remuneration and per diem | |
| i. International consultants | 546 |
| ii. National consultants | 807 |
| b. International and local travel | 26 |
| c. Reports and communications | 20 |
| 2. Surveys and supporting studies | 90 |
| 3. Equipment ^b | 10 |
| 4. Workshop, training, seminars ^c | 10 |
| 5. Miscellaneous administrative and support costs ^d | 80 |
| 6. Contingencies | 211 |
| Total | 1,800 |

Note: The TA is estimated to cost is \$1.8 million, which will be contributions from the ADB as presented in the table above. The government will provide counterpart support in the form of office space for TA consultants, security facilitation, counterpart staff, data and information access, and facilitation of liaisons with stakeholders during the feasibility study which is estimated to cost \$300,000.

^a Financed by the ADB Technical Assistance Special Fund (TASF-6).

^b Technical software, printers and photocopiers. The equipment purchased under the TA will be handed over to WAPDA upon TA completion.

^c This includes approximately five (5) training / workshop sessions to be held within country.

^d This includes vehicle rental and miscellaneous expenditures, office operations cost and administrative and security costs.

Source: Asian Development Bank estimates.

LIST OF LINKED DOCUMENTS

1. Terms of Reference for Consultants

Terms of Reference for Consultants

I. Background

1. Kurram Tangi Integrated Water Resources Development Project (the Project) was conceived as the second phase of Kurram Tangi Dam Project.⁸ The project concept and design were developed through a feasibility study in 2004 and an engineering design in 2011, both sponsored by the Water and Power Development Authority (WAPDA). Main project components included a 98-meter-high concrete faced rockfill dam located across the Kurram River in North Waziristan in Khyber Pakhtunkhwa Province, three hydroelectric powerhouses with combined installed capacity of 65MW, two diversion weirs, construction of Thal irrigation canal and remodeling of the existing Civil/Kankot and Marwat/Right Bank irrigation canals. Combined, these canals were envisaged to cover a total cultivable command area of 140,000 ha.

2. In 2013, a due diligence review of the project design was carried out by the United States Agency for International Development (USAID). The review identified a number of concerns over the possible under-rating of key design parameters, such as probable maximum flood, design seismic force, and sediment yield. In addition, it also pointed out the lack of site-specific topographic and geotechnical data and information on several key components, such as saddle dam. Support is also required to develop an integrated water resources management plan and holistic investment plan for preparing a proposed ADB-financed project, co-financed by other development partners and private sector.

II. Objective of the Assignment

3. The objective of the assignment is to validate the feasibility and viability of the project, through necessary updating and modification of the project design, based on the updated topographic and geotechnical information, as well as the updated design criteria and parameters, in compliance with best international practice recommended by the internationally recognized credible authorities and organizations.⁹ The tasks also includes safeguard due diligence, economic and financial, institutional assessment, risk assessment, and other due diligences to meet requirements of ADB and the government to be processed as an ADB financing project. With the results of due diligences, the TA consultant team will develop a proposal of integrated project design to aims at integrated water resources management, and assist the ADB team to plan and explore co-financing opportunities with other development partners and a private sector by providing necessary information and documents.

4. The government plans to request ADB's Project Readiness Financing (PRF) amounting to \$5 million to prepare detailed engineering design of the dam and its appurtenance structures, power houses, procurement preparation and other project readiness activities. A separate consultant team what will be engaged by WAPDA will provide services for the PRF. Detailed engineering design of the irrigation structures will also be separately conducted by the KP government.

III. Scope of Work

⁸ The first stage included construction of a weir across the Kaitu river, construction of Sheratalla and Spaira Ragha irrigation canals, a feeder tunnel to augment Kurram Tangi reservoir, and two power houses with combined installed capacity of 18.9MW. The first stage project is under implementation.

⁹ Such as the International Commission on Large Dams, the United States Army Corps of Engineers, and the United States Bureau of Reclamation for dam, and any other credible authorities and organizations.

A. Survey and Investigation

(1) Topographic Survey and GIS Information

- a. Review the available topographic survey data and maps produced during the earlier studies, and perform the following:
 - preliminary topographic map covering the reservoir surface area, dam, saddle, spillway, weirs, headrace power and diversion tunnels, forebays, power houses, and tailrace;
 - Thal Canal, distributaries and minor mapping through acquisition of satellite images, marking of Thal irrigation system as proposed in previous studies, and alternate alignment options, if required and proposed by GoKP. Strip surveys of selected alignment;
 - Thal Command Area mapping through acquisition of satellite images. Rectification of the satellite image through CPs, and generating topography maps;
 - access road mapping through acquisition of fresh high-resolution satellite images for marking of road alignment;
 - GIS mapping of existing Civil/Kankot and Marwat/Right Bank irrigation canals command area;
 - Civil/Kankot and Marwat/Right Bank irrigation canals, distributaries and minors plan/profile, inventory and condition surveys;
- b. Engage qualified national survey and investigation service provider subcontracted under the consultancy contract as approved by WAPDA and ADB and carry out the necessary survey as identified in (a) above.

(2) Geotechnical Investigation and Analyses

- a. Review the available geotechnical data and information collected during the earlier studies, identify and carry out additional investigation and testing needs, including:
 - areal geological map over the reservoir area, identifying faults, joints, stratigraphy, and other significant geological features that indicate high reservoir leakage potential, potential land slide areas around the reservoir rim, and potential borrow and quarry areas and source of construction materials; and
 - Site-specific geotechnical mapping over the proposed sites for saddle dam and potential borrow and quarry areas; and
- b. Carry out exploratory drilling, along with laboratory testing of samples and in-situ testing as necessary, including the proposed sites for saddle dam, spillway, diversion and power tunnels, weir II, penstock for power house III, and along the proposed and existing irrigation canals with appropriate distances sufficient to allow geotechnical assessment for feasibility level design.
- c. Determine geotechnical engineering characteristics of the subsurface, materials for fill and other components of the project's key facilities; and
- d. Prepare a geotechnical investigation report summarizing the major findings of investigation, and recommendation for further investigation prior to detailed engineering design.

B. Updating Feasibility Study

(1) Hydrological Study

- a. Hydrological data analysis

- Collect and review hydrological data and analysis of the past studies, and identify and carry out additional data assessment and analysis required for comprehensive feasibility level design of the project facilities;
- Review and analyze the water resources development planning documents in the Afghan side of the upstream catchment, which are to be provided by the client, assess the likely impacts on the river flows and sediment yield, and incorporate the anticipated impacts in the project planning and design;
- Re-estimate the probable maximum precipitation that is most credible in accordance with best international practice, calculate probable maximum flood discharges at the dam site using an appropriate runoff simulation model, and develop an inflow design flood hydrograph for design of spillway;
- Review and revise as necessary the construction diversion flood to ensure that the hydrological analysis and the selection of design return period both reflect the best international practice;
- Review and analyze the past sediment studies and re-establish most credible design parameters, such as particle size distribution and annual sediment yield; and
- Review and validate observed and synthesized discharge data used by the past studies and produce 10-daily discharge data at the reservoir site over a period between 1971 and 2018.

b. Sedimentation study

- Carry out sediment study using appropriate approach and available data. It is expected that enough data may not be available for tradition probabilistic or statistical approach to determine the sediment yields at reservoir inlet. Therefore, using appropriate sediment flow and deposition model may be used to assess the total sediment inflow, deposition pattern, and change in reservoir capacity with time including impact of flushing as well as changes in catchment. This may require identifying, screening, ranking and selection of the model.

c. Water balance study

- Collect and analyze present and likely future water use along the Kurram river downstream of the project, including agricultural, industrial, urban, environmental and social requirements, identify likely sources of supply from river systems, return flows and groundwater; and determine the base flow requirement at the dam site for the downstream riparian users and ecosystem, and
- Develop a water balance model sufficient to determine the area of influence where significant impacts may be caused by the reservoir operation and estimate the reservoir's base flow requirements necessary to alleviate any adverse environmental, economic and social impacts from the project.

(2) Water Resource Management Planning

a. Climate change impact study

- Investigate the possible impacts of climate change over the expected economic life of the project on the precipitation, temperature, and associated water resources supply and demands, including within the project and the downstream area of influence;
- Identify, plan and design appropriate adaptation measures; and
- Incorporate the findings in the estimated impacts on the inflows and water demands in the hydrological and water resources management planning analyses.
- Assess watershed management interventions as relevant in the project area

- b. Reservoir simulation study
 - Develop a mathematical reservoir simulation model to simulate reservoir operation, using the synthesized inflow data, estimated base flow requirements, and the anticipated water demands for the project's hydropower generation and irrigation, over the reservoir's changing live storage due to sedimentation; and
 - Examine if the currently set dam height of 98 meters is sufficient to meet the project's water demand and the base flow requirements with sufficient dependability.
- c. Determination of dependable releases
 - In case the reservoir simulation study proves the insufficiency of the reservoir's active storage, estimate the required dam height (i.e., active storage requirement) to ensure the reservoir meets both the base flow and project water demand; and carry out preliminary assessment of the technical feasibility of raising dam height (including examination of topographic constraints, availability of fill materials, and social and economic impacts);
 - Also estimate, in case raising of dam height is found not feasible, the reduced dependable releases for power generation and irrigation with the currently set dam height unchanged; and
 - In case of insufficiency of the reservoir volume, seek a decision from WAPDA on the selection of options for project formulation, which are: (A) raise dam height and keep the planned releases (in case raising of dam height is found technically, politically, and socially feasible); or (B) keep dam height as currently envisaged, but reduce the supply of water for the project's irrigation and power generation (in case of raising of dam height is found difficult).
- d. Reservoir operation rule
 - Develop a preliminary reservoir operation rule for the most economic and equitable use of water resources also considering water augmentation by Baran dam and dependency on diversions from Kaitu river and groundwater, along with the necessary institutional and organizational framework suitable to the prevailing institutional, political, social, and human resource conditions; and
 - Identify likely constraints and risks associated with the reservoir operation and develop an appropriate institutional and capacity development plan.
- e. Dam break study
 - propose parameters for dam break study and inundation mapping to be carried out for the detail design, along with suggestions on modelling and software, associated risk assessments and emergency planning and development of emergency management plans.

(3) Feasibility Design of Dam and Appurtenant Structure

- a. Seismic hazard analysis
 - Review, evaluate and update past studies on the project's seismic hazard analyses, and determine, according to best international practice, the most credible safety evaluation earthquake for the project's critical structures, such as main and saddle dams, spillway, diversion tunnel and weir III, and operating basis earthquake for other non-critical structures, both in terms of peak ground acceleration.
- b. Design of dam and appurtenant structures
 - Based on the validated, and/or revised design parameters determined in the above hydrological, geotechnical, and water resources management analyses, carry out

the feasibility-level design of the following project structures, including mechanical and electrical components and instrumentation for monitoring and evaluation, while ensuring the best technical, economic, financial, social and environmental due diligence:

- Main and saddle dams, including seepage control works;
- Spillway, including backwater analysis to determine maximum reservoir surface area
- Diversion works and power tunnels;
- Construction diversion weir;
- Powerhouses I, II, and III, including intakes, headraces, penstocks, and tailraces, and connecting facilities to the national grid;
- Weir II and III, including diversion works and seepage control;
- Thal, Civil/Kankot and Marwat/Right Bank irrigation canal systems, including main and distributary/minor canals and associated major structures, drainage systems, and typical command area development; and
- Other minor facilities deemed necessary for mitigation of reservoir area hazards (e.g., landslides and leakages) and adverse environmental and social impacts in, around and downstream of the project area.
- Prepare plan and cross/longitudinal sections of the project structures with scale appropriate for the feasibility-level determination of bill of quantity;
- Develop a feasibility-level construction management plan, including design of river diversion arrangement, construction plants, construction road, arrangement for disposal of excavation spoils, and other relevant and required facilities/design parameters;
- Develop a security risk management plan, including organizational arrangements and cost estimates, for the detailed design and construction phase; and
- Propose additional survey and investigation required for detailed engineering design.

(4) Irrigation Management and Agricultural Development Plan

- a. Collect and analyze data and information regarding the agricultural, socioeconomic, demographic, agro-climatic, and infrastructural development conditions of the project's command area and the farming communities within;
- b. Identify credible and robust agricultural development scenario that the project would catalyze through increased and more reliable supply of irrigation service for each of the three canal commands;
- c. Study the current and likely future status of groundwater use, and examine possible measures to promote conjunctive management of surface water and groundwater resources for sustained and efficient use of water resources;
- d. Identify the present prevailing cropping patterns, yields, and farm-gate prices of the produce; and determine credible and robust future-with-project cropping patterns and yields according to the agricultural development scenarios;
- e. Identify main challenges and constraints to the realization of agricultural development scenarios, and propose most cost-effective measures to address such constraints, including improvement in agricultural extension services, promotion of local knowledges, empowerment of small farmers, and others;
- f. Identify the prevailing irrigation and water management practices and underlying sociopolitical frameworks in the existing Civil/Kankot and Marwat/Right Bank canal commands, identify necessary improvements in the management practices and water management institutions for more efficient and equitable distribution and use of irrigation water; gauge the level of local (political) resistance to such improvement measures, and propose an appropriate plan to promote changes in management

practices with specific attention not to repeat the failure in the 1997 irrigation sector reform attempts¹⁰; and

- g. Collect and analyze information on the general performance of Irrigation Department controlled irrigation systems, particularly on the assessment and collection of irrigation service fee, asset management, and efficient and equitable distribution of irrigation water), propose appropriate and plausible improvement measures in the irrigation service management system for the Thal canal command; and propose a credible plan to enable the meaningful realization of such improvement measures, including participatory staff and water user training and monitoring programs.

(5) Social and Environmental Safeguard

a. Land acquisition and resettlement plan

- Review and familiarize with applicable national/provincial and FATA laws/rules/regulations and the ADB's Safeguard Policy Statement and requirements to ensure that the process in which the project's land acquisition and resettlement plan is formulated is in full compliance with national and ADB requirements;
- Determine the scope of land acquisition and resettlement; classify resettlement and land acquisition losses by type;
- Prepare census of displaced persons (DPs) and inventory of losses based on/specifying the stage of project design;
- Propose resettlement policy specific to the project, including the DPs by types of project impacts, entitlements and eligibility;
- Collect and review the information on WAPDA's past performance in implementing large scale land acquisition and resettlement plans including any legacy issues requiring resolution, and identify lessons and good practices to be adopted for the project;
- Carry out consultation with the affected communities to identify their concerns, expectations, and the willingness for and the preferred forms of participation in the formulation of land acquisition and resettlement plan;
- Collect and analyze socio-economic information of the affected people, and determine the need for resettlement plan specific for the vulnerable group;
- Summarize FATA/KPK merger policy relevant to land acquisition, compensation, resettlement, conflict/grievance redress mechanism and propose a participatory mechanism and institutional framework for the development of land acquisition and resettlement plan, including the roles and responsibilities of the institutions and institutional personnel relevant to LARP, the entitlement matrix, relocation planning, income restoration, grievance redressing and monitoring and evaluation;
- In consultations with DPs and key project stakeholders, propose a resettlement strategy including the resettlement options that address the needs of those requiring to be resettled with their proper livelihood restoration;
- Assess the current institutional capacity of WAPDA's land acquisition and resettlement unit, and identify the needs for capacity strengthening including training in safeguards management; implementation and monitoring;
- Identify the possible need and role of non-governmental and community-based organizations, including the need for capacity development; and

¹⁰ For example, empowered Farmer Organizations resulted in increased rent seeking within water users, reduced collection of irrigation service fee, and increased inequity in distribution of irrigation water. See, for example, Jacoby et al. Decentralization and Redistribution, 2018, World Bank.

- Provide preliminary itemized estimates of land acquisition and resettlement budget and propose likely financing arrangement, and LARP implementation schedule bifurcated in (a) LARP preparation, (b) implementation and (c) monitoring milestones with timelines indicated.
- b. Environmental assessment and environmental management plan
- Review and familiarize with ADB's environmental safeguard policies and requirements to ensure that the process in which the project's environmental impact assessment and environmental management plan are formulated is in full compliance with ADB's Safeguard Policy Statement;
 - Identify potential environmental impacts during and after project implementation in, around, and downstream of the project area according to the checklists of ADB and other internationally recognized organizations, and determine the environmental classification of the project according to ADB's Safeguard Policy Statement;
 - Carry out public consultation with groups affected by the project and non-government organizations to obtain views that need to be incorporated in the project design and environmental mitigation measures;
 - Prepare a draft environmental impact assessment report, describing the environment of the project area and downstream, the anticipated environmental impacts, mitigation measures to address likely adverse impacts, results of public consultation, and prepare an environmental management plan including institutional requirements and monitoring; and
 - Propose appropriate measures for public disclosure of the environmental assessment report to the interested parties and general public.
- c. Social and gender development plan
- Collect and analyze social and gender characteristics of the communities affected by the project, including demographic structure, ethnolinguistic characteristics, social structure, land tenure, inheritance systems, religious and cultural beliefs and practices, individual group attitude towards development, and cohesion and division in rural communities;
 - Measure the level of social and gender development, in terms of social characteristics, quality of life, available social services, and social justice, develop summary of poverty reduction and social strategy (SPRSS), and identify the need and opportunities for social and gender development that is necessary for incorporation in the project design to ensure equitable delivery of the project benefits;
 - Carry out consultation with vulnerable groups and women to obtain views on the need and opportunities for social and gender development; and
 - Prepare a social development plan focused on vulnerable groups affected by the project, and a gender development plan for women in the affected communities, both with specific attention on enduring impacts beyond the project implementation period. The plans may include provision of physical facilities, capacity development, and others, with description of the role of non-government and community-based organization, monitoring and evaluation framework, and estimated budgetary requirements.
- (6) Economic and Financial Analysis
- d. Financial analysis

- Preparing component/output-wise, investment cost, segregated by foreign exchange and local costs, with tax and duties, physical contingencies and price escalation estimating for each component/output, and the total interest and financial charges during construction, using Excel, according to ADB's Financial Due Diligence Note (2009) and Note on Preparation and Presentation of Cost Estimates (2008, revised 2010); Base costs are expressed in domestic currency and on real price basis. Project costs would also include estimates of resettlement costs, if applicable;
 - Undertaking financial sustainability analysis of the project (or sample subprojects);
 - Developing the projected cash flow statements for a 10-year period including projected revenue and costs; and
 - Preparing projections of future incremental costs for operation and maintenance of the project facilities, assess if the project agencies will have funding to cover such long-term operational expenditures as needed to ensure adequate and sustainable asset management, and identify actions to ensure project's financial sustainability.
 - Preparing and managing collection of necessary survey data from the field, government or other institutions, for example farm budgets, "cost of cultivation" survey or other data collection required for the analyses;
 - Identify current and future seasonal cropping patterns in the project system command areas from household survey and and/or secondary sources at the system and sub-system levels;
 - Preparing a disbursement schedule including S-curve for projections of contract awards and disbursements, and standard cost estimates tables (by expenditure category, by financier, by Output, and by Year);
 - Preparing a project financing plan taking to account of any prospective co-financing and assess veracity of proposed counterpart funding;
 - Preparing log frames/ formats for baseline and periodic surveys for establishing pre-project dataset as well as for capturing temporal changes.
 - Preparing draft project performance management system guidelines
- e. Economic analysis
- Undertaking a detailed economic analysis in accordance with ADB's Guidelines for the Economic Analysis of Projects (2017);
 - Study the economic risks associated with the project and undertaking a sensitivity and risk analysis;
 - Undertaking an economic analysis that effectively isolates the effect of irrigation development of command area, including factors of program placement and farmer participation, to rigorously predict the effects of irrigation on cropping intensity, yields and variable production costs.
 - Undertaking the economic analysis for the individual components/sub-components estimating benefits/costs for; (i) hydropower and (ii) irrigation systems on agricultural production (farmer income) with linkages to flood damage prevention.
 - Undertaking sensitivity and switching value analysis on the parameters estimated and key assumptions/risks underpinning the rate of return calculations;
 - Distribution analysis between different groups, calculating poverty impact ratio and analyzing project impact on farmers' incomes (farm budget analysis);
- f. Financial Management Assessment

- Assess financial management capacity of executing / implementing agency (EA/IA) in terms of planning and budgeting, management and financial accounting, reporting, auditing, internal controls, and information systems;
- Design and propose disbursement and fund flow arrangements in light of EA/IA capacity and needs of the ensuing project, along with disclosure arrangements for financial reporting and auditing requirements;
- Carry out financial management, internal control and risk assessment (FMICRA), identifying potential project and inherent risks, and proposing mitigation measures along with timelines agreed by the EA/IA or where the risk is deemed high in nature, propose financial covenants to be incorporated in the ensuing loan / project agreement;
- Validating the cost estimates and financing plan, along with financial projections for the project;
- Prepare financial analyses as needed by the project team leader which may include cost-benefit analysis, sensitivity analysis, discounted cash-flow projections, etc.

C. Development of Comprehensive Project Design and Preparation of Project Processing Documents

- a. Institutional assessment, including financial and institutional O&M capacity analyses;
- b. Risk assessment and risk management plan development;
- c. Development of a comprehensive investment plan, including co-financing planning of other development partners and private sector;
- d. Assessment of institutional capacity enhancement necessity;
- e. Assistance to the ADB project team for project processing documents.

D. Deliverables

- a. Inception report (1): within one month from the commencement of topographic and geotechnical investigation, the consultant shall submit an inception report detailing the work plan, and delivery schedule of outputs of survey and investigation;
- b. Inception report (2): within one month from completion of survey and investigation, the consultant shall submit the second inception report detailing the work plan and delivery schedule of the feasibility study;
- c. Water resources management plan: within two months from the completion of survey and investigation, the consultants shall submit a water resources management plan describing the sufficiency of the active reservoir capacity, and the available options in case reservoir's active storage is found insufficient to meet the targeted releases for power generation and irrigation;
- d. Hold stakeholders' consultation workshops and synthesize the outcome.
- e. Draft final report: within 15 months from the commencement of services, the consultant shall submit a draft final report describing the feasibility-level design of the project facilities, social and gender development, land acquisition and resettlement plan, environmental impact assessment and management plan, and economic and financial analysis;
- f. Final report: within one month from the receipt of the comments on the draft final report from the project executing and implementing agencies and ADB, the consultant shall submit final report incorporating the comments received;
- g. Other technical notes that will support the preparation and processing of the proposed ADB-financed project.

IV. Key Personnel, Qualification Requirements and Terms of Reference

1. Water Resources Planning Expert/Team Leader (International 8 person-months)

| | | |
|----------------------------|---|---|
| Qualification Requirements | Academic: | Bachelor's degree or above in civil engineering or water resource engineering or a related field |
| | Professional: | Demonstrated competencies in leading project formulation of at least one complex and large-scale water resources management schemes involving multi-sector water demands and diversified stakeholders |
| | Country Exposure | Not required, but experience in Pakistan and west Asian countries would be advantage |
| Terms of Reference | <ol style="list-style-type: none"> 1. Coordinate and manage team activities to ensure full compliance with the TOR and delivery of quality outputs in a timely manner; 2. Liaise with ADB, TA executing and implementing agencies, and other authorities as required; 3. Lead water balance study in collaboration with Hydrology Expert, Climate Change Specialist, Environmental Specialist and other team members as required; 4. Assist in the climate change impact study and reservoir simulation study; 5. Lead the determination of the project's dependable releases in collaboration with Hydrologist, Environmental Specialist, Dam Specialist, Hydropower Specialist, Irrigation Specialist, Agricultural Specialist, and other team members as required; 6. Lead the preparation of reservoir operation rule in collaboration with Hydrologist, Environmental Specialist, Dam Specialist, Hydropower Specialist, Irrigation Specialist, Agricultural Specialist, and other team members as required; 7. Assist in the preparation of irrigation and agricultural development plan, particularly in identifying plausible options for conjunctive management of surface water and groundwater and formulating plausible measures to ensure sustained and equitable irrigation services; 8. Assist and oversee the development of social and environmental safeguard plans, and social and gender development plans, to ensure that the outputs comply with TOR, particularly in ensuring efficient and effective participatory frameworks for plan formulation with specific focus to vulnerable groups, including small and landless farm households and women; 9. Assist and oversee economic and financial analyses, particularly in identifying major risks on financial and economic viability and the associated risk management measures; and 10. Lead the preparation of the TA outputs to ensure that the reports meet the TOR requirements both in terms of time and quality. | |

2. Water Resources/Hydraulic Specialist/Deputy Team Leader (National 12 person-months)

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| Qualification Requirements | Academic | Bachelor's degree in civil engineering or a related field |
| | Professional | Demonstrated competencies in leading feasibility study of at least three complex and |

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| | large-scale water resources development schemes |
| Other | Experience in Khyber-Pakhtunkhwa Province and its tribal areas would be advantage |
| Terms of Reference | <ol style="list-style-type: none"> 1. Assist the Water Resources Planning Expert/Team Leader in coordinating and managing team activities, and in liaising with ADB, TA executing and implementing agencies, and other authorities as required; and take over the responsibilities of Team Leader in her/his absence; 2. Lead the survey and investigation works in close collaboration with Dam Specialist and Geotechnical Specialist to ensure that the survey and investigation outputs fully meet the requirement of the subsequent team activities; 3. Assist the Water Resources Planning Expert in: <ol style="list-style-type: none"> (i) Coordinate and manage team activities to ensure full compliance with the TOR and delivery of quality outputs in a timely manner; (ii) Liaise with ADB, TA executing and implementing agencies, and other authorities as required; (iii) Lead water balance study in collaboration with Hydrology Expert, Climate Change Specialist, Environmental Specialist and other team members as required; (iv) Assist in the climate change impact study and reservoir simulation study; (v) Lead the determination of the project's dependable releases in collaboration with Hydrologist, Environmental Specialist, Dam Specialist, Hydropower Specialist, Irrigation Specialist, Agricultural Specialist, and other team members as required; (vi) Lead the preparation of reservoir operation rule in collaboration with Hydrologist, Environmental Specialist, Dam Specialist, Hydropower Specialist, Irrigation Specialist, Agricultural Specialist, and other team members as required; (vii) Assist in the preparation of irrigation and agricultural development plan, particularly in identifying plausible options for conjunctive management of surface water and groundwater and formulating plausible measures to ensure sustained and equitable irrigation services; (viii) Assist and oversee the development of institutional, social and environmental safeguard plans, and social and gender development plans, to ensure that the outputs comply with TOR, particularly in ensuring efficient and effective participatory frameworks for plan formulation with specific focus to vulnerable groups, including small and landless farm households and women; (ix) Assist and oversee economic and financial analyses, particularly in identifying major risks on financial and economic viability and the associated risk management measures; and (x) Prepare the TA outputs to ensure that the reports meet the TOR requirements both in terms of time and quality, and |

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- (xi) Coordinate overall engineering design works and lead preparation of security risk management plan.
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3. Hydrologist and Sedimentation Specialist (National 6 person-months)

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|----------------------------|---|--|
| Qualification Requirements | Academic: | Bachelor's degree or above in civil engineering, science or a related field |
| | Professional: | Demonstrated competencies in leading comprehensive hydrological studies for feasibility study of at least three large dams and/or related water resources development projects |
| | Country Exposure | Not required, but experience in Pakistan or west Asian countries would be advantage |
| Terms of Reference | <ol style="list-style-type: none"> 1. Lead the hydrological study, in close collaboration with Water Resources Planning Expert, Water Resources Planning Specialist, Climate Change Specialist, and other team members as required; and 2. Assist in the preparation of water balance study including all type of water uses at downstream and water resources management plan; 3. Assist in the engineering design works, particularly in setting the relevant climatic and hydrological design and planning parameters; and 4. Assist in the preparation of water resources management plan report. | |

4. Electrical/ Hydropower Specialist (National 6 person-months)

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|----------------------------|--|---|
| Qualification Requirements | Academic | Bachelor's degree or above in electrical engineering or a related field |
| | Professional | Demonstrated competencies in leading feasibility-level or detailed engineering design of at least three hydropower generation components of large dam, or similar complex water resources development, projects |
| | Other | None |
| Terms of Reference | <ol style="list-style-type: none"> 1. Review existing documents, design, standard of practices for hydropower and confirm or modify them 2. Lead engineering planning and design works for hydropower generation plants and associated facilities and assist other engineering planning and design works as required; 3. In coordination with other team members, develop alternate proposals/ options for consideration; 4. Assist in the preparation of the project cost estimates, including the preparation of bill of quantities and relevant specifications of the materials and construction methods; and 5. Prepare relevant part of report and participate in meetings and decisions forums. | |

5. Institutional and Governance Specialist (International 1 person-month; National 4 person-months)

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| Qualification Requirements | Academic: | Bachelor's degree or above in social, physical or management sciences or associated disciplines |
| | Professional: | Demonstrated competencies in institutional reforms/ strengthening or water governance. Ten years of experience with five years of experience working on similar assignment. Similarity will be determined by the sector, complexity and scale. |
| | Country Exposure | Not required |
| Terms of Reference | <ul style="list-style-type: none"> ○ Assess institutional capacity of WAPDA, KP irrigation and KP Agriculture departments to implement and manage similar projects, identify gaps and propose measures for improvement ○ Review the effect of merger of FATA and KP and relevant policy, legislation and institutions that may affect the project implementation and operation management after completion ○ Assess coordination efforts that are required and appropriate arrangement that might help a good working relationship among WAPDA and KP and federal governments for implementing the project ○ Review provincial institutional set up to implement the safeguards in accordance with ADB safeguard policy guidelines (2009) ○ Assess farmers-based organizations in the project area and opportunity to improve those organizations more effective. ○ Assess the existing agriculture support services (both government and private) and suggest improving their role. ○ Explore possibility of water measurement at outlet by farmers or water users association and develop plan to build their capacity. ○ Help team leader and contribute to the relevant reports, meetings and stakeholders consultation, and ○ Any other task as advised by the team leader or client. | |

6. Dam Specialist (International 2 person-months; National 6 person-months)

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|----------------------------|--|--|
| Qualification Requirements | Academic | Bachelor's degree or above in civil engineering or a related fields |
| | Professional | Demonstrated competencies in leading feasibility or detailed engineering design of at least three large dams |
| | Other | None |
| Terms of Reference | <ol style="list-style-type: none"> 1. Review the available dam relevant documents and assess the assumptions and criteria used in the earlier studies/ design and confirm or otherwise revise them, 2. Review the dam location, design for material, type suitability, foundation and rock suitability, 3. Confirm or otherwise improve the dam location, design and type, 4. Assist fixing the dam height with the other experts in the team and client, 5. Assess need for topographic survey and geotechnical investigations and integrate them with the requirements prepared | |

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- by others and develop a complete investigation requirement report,
 - 6. Analyze for alternate options for dam if required.
 - 7. Lead engineering design works and assist other engineering planning design works as required;
 - 8. Prepare quantity and cost estimate for relevant part and assist in the preparation of the project cost estimates, including the preparation of bill of quantities and relevant specifications of the materials and construction methods; and
 - 9. Assist in the preparation of draft final report.
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7. Environmental Specialist (National 5 person-months)

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| Qualification Requirements | Academic | Bachelor's degree or above in environmental science or a related science |
| | Professional | Demonstrated competencies in carrying out environmental impact assessment and mitigation planning for feasibility study of at least three large dam, or similar complex and large-scale water resources development projects |
| | Other | None |
| Terms of Reference | <ol style="list-style-type: none"> 1. Assist in water balance study; 2. Lead the preparation of environmental assessment and environmental plan; and 3. Assist in the preparation of water resources management plan report and draft final report. | |

8. Irrigation Specialist (National 6 person-months)

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|----------------------------|--|--|
| Qualification Requirements | Academic | Bachelor's degree or above in civil engineering, agricultural engineering, or a related field |
| | Professional | Demonstrated competencies in leading feasibility study of at least three large scale irrigation development projects |
| | Other | Experience in Khyber-Pakhtunkhwa Province and its tribal areas would be advantage |
| Terms of Reference | <ol style="list-style-type: none"> 1. Assist in the water balance study; 2. Lead engineering design works for irrigation component; 3. Lead, in close collaboration with Agricultural Specialist, Water Resources Planning Expert, Water Resources Planning Specialist, Social Development Specialist, and others as required), the development of irrigation management plan, and assist in the development of agricultural development plan to ensure that agricultural development scenario is fully consistent with the irrigation system and management designs; 4. Assist in the preparation of the project cost estimates, including the preparation of bill of quantities and relevant specifications of the materials and construction methods, as well as costs of plausible institutional development for sustainable and equitable irrigation management; and 5. Assist in the preparation of draft final report. | |

9. Agricultural Specialist (National 6 person-months)

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| Qualification Requirements | Academic | Bachelor's degree or above in agronomy, science, or a related field |
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| | Professional | Demonstrated competencies in leading agricultural development planning for at least three feasibility studies of large-scale irrigation development projects |
| | Other | Experience in Khyber-Pakhtunkhwa Province and its tribal areas would be advantage |
| Terms of Reference | <ol style="list-style-type: none"> 1. Assist in the water balance study; 2. Lead, in close collaboration with Irrigation Specialist, Water Resources Planning Expert, Water Resources Planning Specialist, Social Development Specialist, and others as required), the development of agricultural development scenario and plan, and assist in the development of irrigation management plan to ensure that it fully reflects the prevailing and potential agricultural development constraints and opportunities; 3. Review existing cropping pattern and constraints and opportunities to improve the cropping pattern that is socially and economically acceptable; 4. Assist in the preparation of the project cost estimates, as they relate to the required agricultural development support; and 5. Assist in the preparation of draft final report. | |

10. Economist (International 3 person-months)

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| For Economist (International & person monthly) | | |
| Qualification Requirements | Academic: | The specialist will have preferably a post-graduate degree in Economics, or equivalent with 15 years of professional experience in undertaking economic assessments, preferably within the irrigation, agriculture and water resources management sectors. Demonstrated competencies in leading economic analyses for feasibility study of at least three large scale and complex water resources development projects Required |
| | Professional: | |
| | Country Exposure | |
| Terms of Reference | Lead the Economic and Financial analysis and would be responsible for Preparing, in Pakistani Rupees, component/output-wise, investment cost, segregated by foreign exchange and local costs, with tax and duties, physical contingencies and price escalation estimating for each component/output, and the total interest and financial charges during construction, using Excel, according to ADB's Financial Due Diligence Note (2009) and Note on Preparation and Presentation of Cost Estimates (2008, revised 2010); Base costs are expressed in domestic currency and on real price basis. Project costs would also include estimates of resettlement costs, if applicable. | |

The following key points will be specifically addressed in the analysis:

Financial Analysis

- a. Undertake financial sustainability analysis of the project (or sample subprojects);
- b. Develop the projected cash flow statements for a 10-year period including projected revenue and costs; and

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- c. Prepare projections of future incremental costs for operation and maintenance of the project facilities, assess if the project agencies will have funding to cover such long-term operational expenditures as needed to ensure adequate and sustainable asset management, and identify actions to ensure project's financial sustainability.
 - d. Prepare and manage (or necessary sub-contracts) for collection of necessary survey data from the field, government or other institutions, for example farm budgets, "cost of cultivation" survey or other data collection required for the analyses;
 - e. Identify current and future seasonal cropping patterns in the project system command areas from household survey and and/or secondary sources at the system and sub-system levels;
 - f. Prepare a disbursement schedule including S-curve for projections of contract awards and disbursements, and standard cost estimates tables (by expenditure category, by financier, by Output, and by Year);
 - g. Preparing a project financing plan taking to account of any prospective co-financing and assess veracity of proposed counterpart funding;

Economic analysis

- h. Undertake a detailed economic analysis in accordance with ADB's Guidelines for the Economic Analysis of Projects (2017);
- i. Identify the economic risks associated with the project and undertaking a sensitivity and risk analysis;
- j. Undertake an economic analysis that effectively isolates the effect of irrigation development of command area, including factors of program placement and farmer participation, to rigorously predict the effects of irrigation on cropping intensity, yields and variable production costs.
- k. Undertake the economic analysis for the individual components/sub-components estimating benefits/costs; (i) hydropower and (ii) irrigation systems on agricultural production (farmer income) with linkages to flood damage prevention.
- l. Calculate the conversion factors for translating financial prices into economic prices;
- m. Undertake sensitivity and switching value analysis on the parameters estimated and key assumptions/risks underpinning the rate of return calculations;
- n. Undertake a distribution analysis between different groups, calculating poverty impact ratio and analyzing project impact on farmers' incomes (farm budget analysis);

Output/Report

Prepare draft and final reports detailing the above tasks and outputs; elaborating the note covering (i) Assessment of macroeconomic context, (ii) Assessment of sector context, (iii) Identification of rationale for public intervention, (iv) Demand analysis, (v) identification project alternatives or conduct least cost analysis, (vi) conduct of benefit- cost analysis, (vii)

Assessment sustainability of proposed investment, (viii) undertake sensitivity and risk analysis and (ix) Undertaking of distribution analysis.

11. Resettlement Specialist (International 3 person-months; National 6 person-months)

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| Qualification Requirements | Academic | Bachelor's degree or above in engineering, human science or a related field |
| | Professional | Demonstrated competencies in developing and/or managing land acquisition and resettlement plan for at least three large dam, and/or large-scale water resources development projects |
| | Other | Experience and knowledge of Khyber-Pakhtunkhwa Province and its tribal area would be advantage |
| Terms of Reference | <ol style="list-style-type: none"> 1. Lead, in collaboration with Social Development Specialist and Gender Development Specialist and other members as required, the development of land acquisition and resettlement plan; 2. Assist in the preparation of social development plan, particularly with regard to identifying and classifying the affected communities and households; 3. Assist in the preparation of the project cost estimates, as they relate to the land acquisition and resettlement; and 4. Assist in the preparation of draft final report . | |

12. Financial Management (FM) Specialist (National 3 person-months)

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| Qualification Requirements | Academic | Bachelor's degree or above in finance, economics or a related discipline. Having a recognized professional accountancy or financial qualification would be of added advantage. |
| | Professional | The expert should have at least 10 years of relevant experience in financial and economic analysis, due diligence and risk assessment, along with demonstrated competencies in undertaking comprehensive financial analysis of at least three (3) large dam and/or complex water resources development projects. |
| | Country Exposure | Not required |
| Terms of Reference | Lead the preparation of financial analysis, financial due diligence and assist in the preparation of economic analysis. The expert shall also independently | |

carry out financial management assessment of the executing / implementing agency in accordance with ADB guidelines and best practices, and report on its financial management capacity to execute / implement the project and identifying remedial actions in light of underlying risk assessment. In addition, the expert may be required to carry out any other relevant task, as required by the team leader.

V. Implementation Arrangements

Besides ADB, the government agency that is primarily responsible for the overall oversight and management of consultancy contract will be the WAPDA. The consultant will also be required to liaise and collaborate with the Irrigation Department and the Agriculture Department of the Khyber-Pakhtunkhwa Province.

Figure 1. Indicative Technical Assistance Implementation Plan



