Project Readiness Financing
Project Administration Manual

Project Number: 51359-001
Loan Number: {PRFXXXX}
December 2019

Islamic Republic of Pakistan: Punjab Water Resources Management Projects

CONTENTS

Project Administration Manual for Project Readiness Financing: Purpose and Process

The project administration manual (PAM) for the project readiness financing (PRF) facility is an abridged version of the regular PAM of the Asian Development Bank (ADB) and describes the essential administrative and management requirements to implement the PRF facility following the policies and procedures of the government and ADB. The PAM should include references to all available templates and instructions either by linking to relevant URLs or directly incorporated them in the PAM.

The Punjab Irrigation Department (the executing agency) and Punjab Agriculture Department (the implementing agency) are wholly responsible for the implementation of ADB-financed PRF projects, as agreed jointly between the borrower and ADB, and following the policies and procedures of the Government and ADB. ADB staff is responsible for supporting implementation, including compliance by the executing and implementing agencies of their obligations and responsibilities for PRF project implementation following ADB's policies and procedures.

In the event of any discrepancy or contradiction between the PAM and the loan agreement, the provisions of the PRF loan agreement will prevail.

After ADB's approval of the PRF proposal, changes in implementation arrangements are subject to agreement and approval pursuant to relevant government and ADB administrative procedures (including the Project Administration Instructions) and upon such approval, they will be subsequently incorporated in this PAM.

Abbreviations

ADB	–	Asian Development Bank
FM	–	financial management
O&M	–	operation and maintenance
PAD	–	Punjab Agriculture Department
PID	–	Punjab Irrigation Department
PMO	–	project management office
PRF	–	project readiness financing
SOE	–	statement of expenditure

I. IMPLEMENTATION PLAN

A. Overall Implementation Plan

1. Table 1 should be updated annually and submitted to the Asian Development Bank (ADB) with updated contract and disbursement projections for the following year.

Table 1: Implementation Schedule

Activities	Advance Action			PRF Year 1												PRF Year 2												PRF Year 3												PRF Year 4											
	2019			2020												2021												2022												2023											
	Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
A. Implementation																																																			
Consultants selection under PRF																																																		
Advertisement																																																		
Selection																																																		
Contract award																																																		
Delivery of Detailed Design and Studies - Output 1																																																	
Project 1: DG Khan Canal Irrigated Agriculture Improvement																																																
Project 2: Rehabilitation and Upgrading of Upper Jhelum Canal System																																																
Project 3: Remodeling of Rasul-Qadirabad, Qadirabad-Balloki, Balloki-Suleimanki Canals																																																
Project 4: Greater Thal Canal Project Phase 2																																																
Project 5: Harnessing of Hill Torrents in Dera Ghazi Khan and Rajanpur																																																
Delivery of Capacity Building - Output 2																																																
PRF Management																																																
B. Management Activities																																																
Submission of quarterly progress report																																																
Submission of annual report																																																
Submission of audited project financial statements																																																

DG = Dera Ghazi, PRF = projecet readiness financing.

Source: Asian Development Bank estimates.

II. PROJECT MANAGEMENT ARRANGEMENTS

A. Project Implementation Organizations: Roles and Responsibilities

Table 2: Role and Responsibilities

Organizations	Management Roles and Responsibilities
A. Executing agency	
1. Punjab Irrigation Department (PID)	(i) Oversee entire project readiness financing (PRF) implementation and coordination; (ii) Ensure adequate and timely provision of counterpart support including funds; (iii) Have project accounts audited in a timely manner, and respond to audit observations and recommendations; (iv) Constitute a PRF Working Group in consultation with all relevant organizations; (v) Facilitate approval of Planning Commission Proforma No. 1 (PC-I) for ensuing projects from the Provincial Development Working Party, Central Development Working Party, and the Executive Committee of the National Economic Council; and (vi) Monitor the Project Management Office (PMO) Barrages in the PRF implementation.
B. Implementing Agency	
1. PMO in PID: PMO Barrages	(i) Act as a dedicated unit of executing agency for managing entire PRF; (ii) Prepare PC-I for ensuing projects in close coordination with Punjab Agriculture Department (PAD) and submit them to PID; (iii) Coordinate with the PAD and relevant organizations; (iv) Organize a PRF Working Group briefing and share findings with the Punjab Planning & Development Department, participating organizations and the Asian Development Bank (ADB); (v) Responsible for recruitment and contract management of PRF consultants; (vi) Review PRF consultants' reports; (vii) Maintain advance account; (viii) Comply with the project's public disclosure; (ix) Supervise and ensure quality consultants services and counterpart staff; (x) Maintain financial management system and submit withdrawal applications to ADB; (xi) Responsible for consultant recruitment, works procurement and other project readiness activities of the ensuing projects; (xii) Prepare and submit to ADB periodic progress reports and project completion reports; (xiii) Provide counterpart support
2, On-Farm Water Management Directorate in Punjab Agriculture Department (PAD)	(i) Coordinate with the PMO of the PID and provide technical inputs for reviewing PRF consultants' reports and for preparation of ensuing projects; (ii) Provide counterpart support; (iii) Coordinate with the PID and prepare command area development parts of PC-1; and (iv) Responsible for command area development components of consultant recruitment, works procurement and other project

Organizations	Management Roles and Responsibilities
	readiness activities of the ensuing projects;
C. PRF Steering Committee Chaired by Chairman Punjab Planning & Development Board Departments of Planning & Development, Irrigation, Agriculture, Livestock, and Forest & Wildlife, the Government of Punjab	(i) Ensure timely review of the PRF twice a year.
D. PRF Working Group chaired by Secretary PID Departments of Planning & Development, Irrigation, Agriculture, Livestock, and Forest & Wildlife, the Government of Punjab	(i) Ensure coordination for better design preparedness; (ii) Meet and receive semi-annual briefing on progress from PMO Barrages, walk-through of PRF consultant's deliverables and recommend improvements; and (iii) Each member of the Working Group will act as focal person and is responsible for coordination with PMO Barrages.
E. ADB	(i) Assist the executing agency for smooth implementation of the PRF in accordance with the agreements made; (ii) Process and approve withdrawal applications submitted by PMO; (iii) Review all the documents that require ADB approval; (iv) Conduct periodic PRF review missions, midterm review, and completion mission; (v) Monitor compliance with agreements; and (vi) Regularly post on ADB website the updated project information and documents for public disclosures.

Source: Asian Development Bank.

B. Key Persons Involved in Implementation

2. Changes on the executing agency local persons and ADB division director and mission leaders will be updated as necessary.

Executing Agency	
Punjab Irrigation Department	Secretary Irrigation Government of Punjab, Irrigation Secretariat, Old Anarkali Lahore, Pakistan Phone: +92 42 9212117-8 E-mail: sec_irr@punjab.net.pk
Project Management Office (PMO) Barrages	Mr. Amjad Saeed Head / Project Director, PMO Barrages Projects Office Building, Irrigation Department, Canal Bank, Mustafa Abad, Lahore, Pakistan. Phone: +92-42-99 250 351; Fax: +92-42-99 250 352 E-mail: pmoipd@yahoo.com
Implementing Agency	
Punjab Agriculture Department	Mr. Wasif Khurshid Secretary, Agriculture 2 - Bank Road Lahore, Punjab

	Phone: +92 42 99210499, 99210130
Director General, On-Farm Water Management (OFWM) Directorate	Mr. Malik Muhammad Akram Director General, OFWM Directorate Agriculture House, 21-Agha Khan (Davis) Road, Lahore, Pakistan Phone: +92 42 99200703 E-mail: pipipwm@gmail.com
ADB	
Environment, Natural Resources and Agriculture Division	Ms. Donneth A. Walton Director Phone: +63 2 632 5847 E-mail: dwalton@adb.org
Mission Leader	Ms. Noriko Sato Natural Resources Specialist Phone: +63 2 632 1757 Email: nsato@adb.org
	Asad Ali Zafar Senior Project Officer (Water Resources) Phone: +92 51 2600351 to 69, 2087300 Email: asadzafar@adb.org

III. COSTS AND FINANCING

3. ADB will finance consulting services cost, surveys, recurrent cost (project management), and financial charges during implementation. The government will finance taxes and duties. The government has not requested for refinancing of the project readiness loan under an ensuing or another ongoing loan.

A. Key Assumptions

4. The following key assumptions underpin the cost estimates and financing plan:

(i) Exchange rate: PKR 150 = $1.00

(ii) Price contingencies based on expected cumulative inflation over the implementation period are as follows:

Table 3: Escalation Rates for Price Contingency Calculation

Item	2019[a]	2020	2021	2022	2023	Average
Domestic Cost Escalation Factor	7.5%	7.0%	6.5%	6.0%	5.5%	6.5%
Compounded Cost Escalation	-	11.0%	18.2%	25.3%	32.2%	-

[a] 2019 taken as base year for cost estimation.
Source: Asian Development Bank estimates.

(iii) In-kind contributions were calculated based on estimates provided by the executing agency and includes in-kind project management cost contributed by the executing agency and other government organizations during implementation.

B. Allocation and Withdrawal of Loan Proceeds

Table 4: Allocation and Withdrawal of Loan Proceeds

Number	Item	Total Amount Allocated for ADB Financing ($) Category	Basis for Withdrawal from the Loan Account
1	Project Management	430,000	100% of total expenditure claimed
2	Consulting Services	5,950,000	100% of total expenditure claimed*
3	Interest Charges	470,000	100% of amounts due
4	Unallocated	1,470,000	
	TOTAL	8,320,000	

*: Exclusive of taxes and duties imposed within the territory of the Borrower.
Source: Asian Development Bank estimates.

C. Detailed Cost Estimates by Expenditure Category and Financier

Table 5: Detailed Cost by Expenditure Category and Financier
($ million)

Item		ADB		Government		Total Cost	
		Amount	% of Cost Category	Amount	% of Cost Category	Amount	Taxes and Duties
A.	**Consulting Services**						
	1. Design Consultants	4.80	94.1%	0.30	5.9%	5.10	0.30
	2. Studies, Investigations, Models, Satellite Imageries	1.15	100.0%	0.00	0.0%	1.15	0.00
	Subtotal (A)	**5.95**	95.2%	**0.30**	4.8%	**6.25**	**0.30**
B.	**Project Management**						
	1. Recurring Cost	0.43	100.0%	0.00	0.0%	0.43	0.00
	Subtotal (B)	**0.43**	100.0%	**0.00**	0.0%	**0.43**	**0.00**
	Total Base Cost	**6.39**	95.5%	**0.30**	4.5%	**6.68**	**0.30**
C.	**Contingencies**	**1.47**	100.0%	**0.00**	0.0%	**1.47**	**0.00**
	1. Physical Contingency	0.20	100.0%	0.00	0.0%	0.20	0.00
	2. Price Contingency	1.27	100.0%	0.00	0.0%	1.27	0.00
D.	**Financial Charges During Implementation**	**0.47**	100.0%	**0.00**	0.0%	**0.47**	**0.00**
	Total Project Cost (A+B+C+D)	**8.32**	96.6%	**0.30**	3.5%	**8.62**	**0.30**
	% Total Project Cost					**100%**	

Note: Numbers may not sum precisely because of rounding.
Source: Asian Development Bank estimates.

D. Detailed Cost Estimates by Year

Table 6: Detailed Cost Estimates by Year
($ million)

Item		Total Cost	2019	2020	2021	2022	2023
A.	**Consultant costs**						
	1. Design Consultants	5.10	0.00	1.02	1.40	1.30	1.38
	2. Studies, Investigations, Models, Satellite Imageries	1.15	0.00	0.23	0.32	0.30	0.30
	Subtotal (A)	**6.25**	**0.00**	**1.25**	**1.72**	**1.60**	**1.68**
B.	**Project Management**						
	1. Recurring Cost	0.43	0.00	0.09	0.12	0.11	0.11
	Subtotal (B)	**0.43**	**0.00**	**0.09**	**0.12**	**0.11**	**0.11**
	Total Base Cost	**6.68**	**0.00**	**1.34**	**1.84**	**1.71**	**1.79**
C.	**Contingencies**	**1.47**	**0.00**	**0.18**	**0.35**	**0.42**	**0.52**
	1. Physical Contingency	0.20	0.00	0.04	0.06	0.05	0.05
	2. Price Contingency	1.27	0.00	0.14	0.29	0.36	0.47
D.	**Financial Charges During Implementation**	**0.47**	**0.00**	**0.07**	**0.10**	**0.14**	**0.16**
	Total Project Cost (A+B+C+D)	**8.62**	**0.00**	**1.58**	**2.29**	**2.26**	**2.49**
	% Total Project Cost	**100%**	**0%**	**18%**	**26%**	**26%**	**29%**

Sources: Asian Development Bank estimates.

E. Contract and Disbursement S-Curve (ADB Loan)

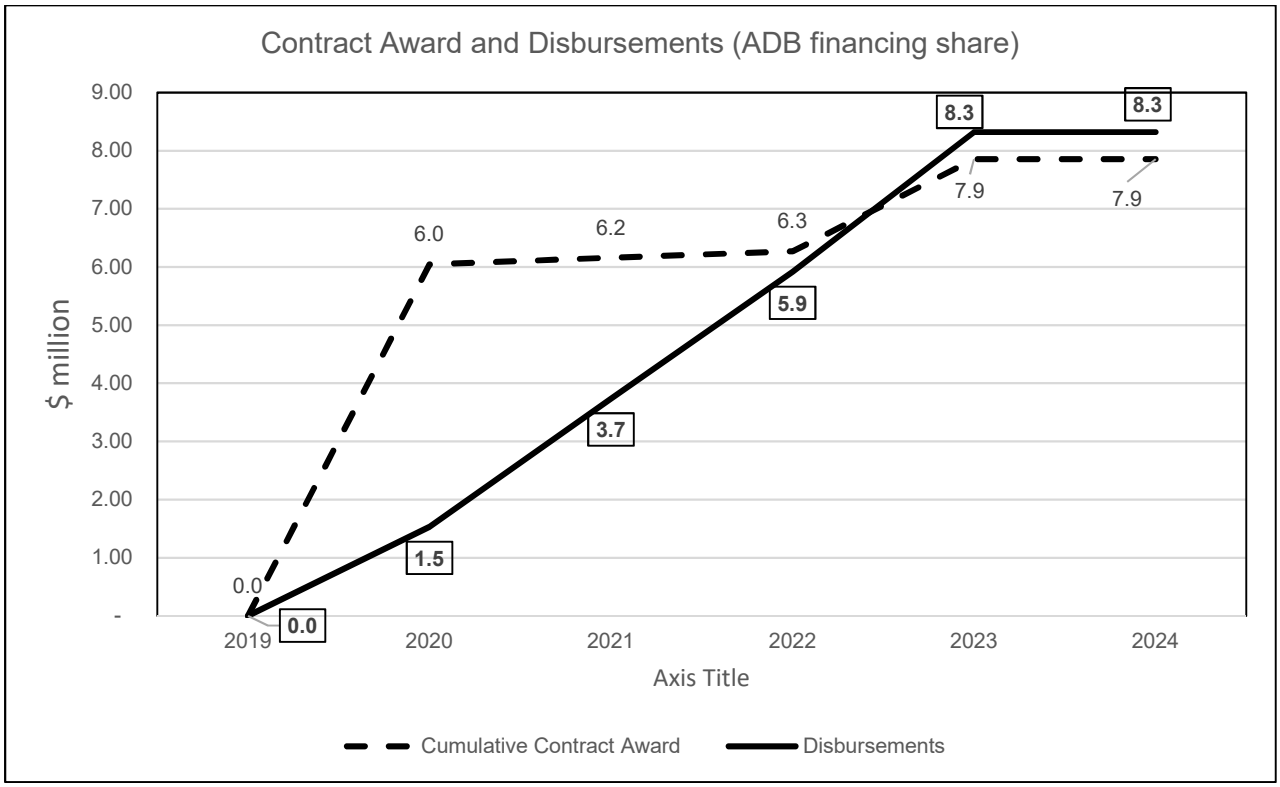
Table 7: Projections for Contract Award
($ million equivalent)

Year	Annual	Cumulative
2019	0.00	0.00
2020	6.04	6.04
2021	0.12	6.16
2022	0.11	6.27
2023	1.58	7.85

Table 8: Projections for Disbursement
($ million equivalent)

Year	Annual	Cumulative
2019	0.00	0.00
2020	1.53	1.53
2021	2.21	3.74
2022	2.18	5.92
2023	2.40	8.32
2024	0.00	8.32

Figure 1. Contract and Disbursement S-Curve



IV. FINANCIAL MANAGEMENT

A. Financial Management Assessment

5. The financial management assessment of the executing agency, Punjab Irrigation Department (PID), and the implementing agency, Punjab Agriculture Department (PAD), was conducted in 2017 and updated more recently in July 2019,[1] following ADB's Guidelines for the Financial Management and Analysis of Projects and the Financial Due Diligence: A Methodology Note.[2] PAD is expected to serve as an implementing agency of an on-farm command area development component under the ensuing loans, while it will not be involved in an financial transaction during the PRF implementation. The financial management assessment considered the financial management capacity, including funds-flow arrangements, staffing, accounting and financial reporting systems, financial information systems, and internal and external auditing arrangements. Based on the assessment, the key financial management risks identified were lack of internal audit arrangement, shortage of accounting staff for PID and PAD and high ratio of Operations and Maintenance (O&M) cost in budget allocation. The government, and PID have agreed to implement an action plan as key measures to address the deficiencies for the PRF implementation. Key measures are: (i) adoption of the Financial Management Manual and tailor it accordingly to the need of the project; (ii) establishment and timely hiring of relevant positions in finance and accounting; (iii) timely opening of an advance account; and (iv) preparation for retroactive financing arrangement based on the *Loan Disbursement Handbook* (2017, as amended from time to time) and the Financial Management Manual. The overall pre-mitigation financial management (FM) risk rating was specifically concluded as substantial. Nevertheless, there is sufficient FM capacity to render the use of advance fund and the statement of expenditure (SOE) procedure suitable for the executing and implementing agency within the limits defined in section B, Disbursement below. The financial management, internal control and risk assessment used to derive the FM risk rating and the associated recommendations are given in the financial management action plan below.

Table 9: Financial Management, Internal Control and Risk Assessment

Risk	Risk rating*	Remarks/Risk Mitigation Measures
Inherent Risk		
Country-specific Risks	H	The MOF and Punjab Government shall ensure the timely release of counterpart funds, as per loan covenants. PID shall ensure its annual budget is allocated and available during the fiscal year.
Entity-specific Risks	N	The PID is already experienced in implementing ADB and World Bank financed irrigation projects.
Project-specific Risks	M	For Financial Management, conduct training annually on ADB procedures even though the PID is experienced in ADB procedures, vigilance in land acquisition and resettlement activities, frequent risk reassessments and timely project progress reporting and diligent complaint management should be exercised.
Overall Inherent Risk	**H**	
Control Risk		

[1] ADB. 2017. Jalalpur Irrigation Project. PAM (accessible from the list of linked documents in Appendix 2) and ADB. Forthcoming. Major Change in Project: Trimmu and Panjnad Barrages Improvement Project. Revised PAM (accessible from the list of linked documents in Appendix 2). Manila.

[2] ADB. 2005. *Financial Management and Analysis of Project*. Manila. ADB 2009. *Financial Due Diligence: A Methodology Note*. Manila.

Risk	Risk rating*	Remarks/Risk Mitigation Measures
Experience of managing externally financed projects	N	PID has experience of executing externally financed projects funded by ADB and World Bank.
Fund Flow Mechanisms	N	A rule-based mechanism for fund flow is available and governed under rules of the Government of Pakistan's Ministry of Finance: Revolving fund account (Advance Account) and direct payment procedure can be suitably used by the executing agency/implementing agency.
Organization and Staffing	N	Staff is sufficient in number and well-trained to manage the project. Vacant positions in accounts department are being filled.
Accounting Policies and Procedures	N	Accounting standards and practices are based on IPSAS Standards which are in compliance with International Accounting Standards.
Payments	M	All payments are governed under the government's Financial Rules and Irrigation Department's manuals.
Policies and Procedures	N	Government Financial Rules, New Accounting Manual and ADB disbursement procedures are the guiding principles.
Cash and Bank	M	PID has separate bank accounts operated jointly with dual signatories and up to date cashbooks.
Safeguard Over Assets	N	Project specific fixed assets registers are available. Physical verification on periodical bases is conducted.
Internal Audit	S	PID does not have a permanent internal audit arrangement for PMO (e.g. PMO Barrages). PID and the provincial auditor will assist in internal auditing matters.
Financial sustainability risk and counterpart-financed O&M budget shortfall	S	Historical data suggests that in some instances budget allocation for O&M was less than yardstick or estimated requirement of PID. However, an asset management plan has resulted in improvements in budgetary allocation, estimation and gradually reduced the maintenance backlog. PID has adopted a third party for the monitoring and evaluation of M&R works. The overall O&M allocation has relatively improved in recent years and has been sufficient in relation to actual expenditure. PID's operations manual provides comprehensive guidance on O&M for barrages and the ADB assisted MFF program has further improved the technical sustainability, enhanced and sustained water diversions and conveyance capacity, and reduced maintenance requirements in the short to medium term.
Information Systems	S	Considering the current scale of the project, computerized Excel-based accounting ledgers are sufficient, however it is suggested that an off-the-shelf accounting software and decision support system to prioritize spending, especially O&M expenses, is implemented to ensure completeness and accuracy of accounting records, and informed decision making. Needs assessment must be carried out.
Overall Control Risk	**M**	
Overall (Combined) Risk	**S**	

ADB = Asian Development Bank, H = high, IPSAS = International Public Sector Accounting Standards, M = moderate, M&R = maintenance and repair, MFF = multitranche financing facility, MOF = Ministry of Finance, N = Negligible or Low, O&M = operation and maintenance, PID = Punjab Irrigation Department, PMO = project management office, S = substantial.

Table 10: Financial Management Action Plan for the PRF

		Action	Responsibility	Resources	Target Date
1	Timely and adequate counterpart funds allocation and its monitoring is not achieved	Covenant as part of regular performance reporting. Budget allocations for the project to be monitored as part of semiannual performance reporting	PID	PMO Financial Management Staff	Covenant included in Loan Agreement and project performance monitored on semiannual basis.
2	Project expenditures are not monitored and updated	Prepare an Operational Business Plan including the budget allocations for the estimated project expenditures in the succeeding year.	PID	PMO Financial Management Staff	Prior to the start of each fiscal year
3	Existing Internal Audit system enhanced	Appoint a full-time, qualified and experienced internal auditor (individual or accounting firm) to conduct quarterly internal audit to strengthen the internal control and reporting.	PID/PAD	PMO Project Director	Covenant included in Loan Agreement to hire internal auditor with qualification acceptable to ADB immediately after loan effectiveness
4	No computerized accounting information system	Develop a roadmap with defined scope, resources, actions and timeline for implementation of a computerized financial accounting and reporting system along with adequate capacity development.	PID/PAD	PMO Project Director	The Roadmap submission to ADB with 12 months of project effectiveness

ADB = Asian Development Bank, PAD = Punjab Agriculture Department, PID = Punjab Irrigation Department, PMO = project management office.

B. Disbursement

6. The Project Management Office (PMO) under the PID will disburse the project readiness loan proceeds following the ADB *Loan Disbursement Handbook* (2017, as amended from time to time),[3] and detailed arrangements agreed between the government and ADB. Online training for project staff on disbursement policies and procedures is available.[4] Project staff are encouraged to avail of his training to help ensure efficient disbursement and fiducially control. The direct payment and reimbursement procedures will normally be used for disbursements under the project readiness financing (PRF). The PMO will be responsible for (i) collecting supporting documents, and (ii) preparing and sending withdrawal applications to ADB.

7. **Advance account**. An advance account will be established at National Bank of Pakistan for receipt of funds from ADB. The currency of the advance account is United States dollar. The

[3] ADB. 2017. *Loan Disbursement Handbook*. Manila.
[4] Disbursement eLearning.

account is to be used exclusively for ADB's share of eligible expenditures. The PMO of the PID who administers the advance account is accountable and responsible for the proper use of advances to the advance account.

8. Considering the financial arrangements of the PID's current ADB project, the advance fund limit is set to the advance equivalent to 6 months forecast or 10% of the loan amount. These financial arrangements are the same as the ones being applied to the currently implemented projects by PID.[5]

9. **Statement of expenditure procedures.** The PMO may use the SOE procedure for reimbursement of eligible expenditures.[6] The ceiling of the SOE procedure is the equivalent of $100,000 per individual payment. Supporting documents and records for the expenditures claimed under the SOE should be maintained and made readily available for review by ADB's disbursement and review missions, upon ADB's request for submission of supporting documents on a sampling basis and for independent audit. Reimbursement and liquidation of individual payments in excess of the SOE ceiling should be supported by full documentation when submitting the withdrawal application to ADB.

10. Before submitting the first withdrawal application, the government should submit to ADB sufficient evidence of the authority of the person(s) who will sign the withdrawal applications on behalf of the government, together with the authenticated specimen signatures of each authorized person. The minimum value per withdrawal application is stipulated in ADB's Loan Disbursement Handbook. Individual payments below such amount should be paid by the PID and subsequently claimed to ADB through reimbursement unless otherwise accepted by ADB. The borrower should ensure sufficient category and contract balances before requesting disbursements. Use of ADB's Client Portal for Disbursements system is encouraged for submission of withdrawal applications to ADB.[7]

11. No further disbursements will be made from the PRF account upon refinancing under an ensuing or ongoing loan. The PRF loan amount and accrued financing charges are paid out under the PRF cost category of the ensuing or ongoing loan that will refinance the PRF loan. Provided the following costs are eligible expenditures, the ensuing or ongoing loan will finance (i) costs incurred under PRF that have not yet been paid from the PRF account by the refinancing date; (ii) costs for activities initiated under PRF and contributing beyond the refinancing date; and (iii) costs incurred during PRF implementation but ineligible under PRF.

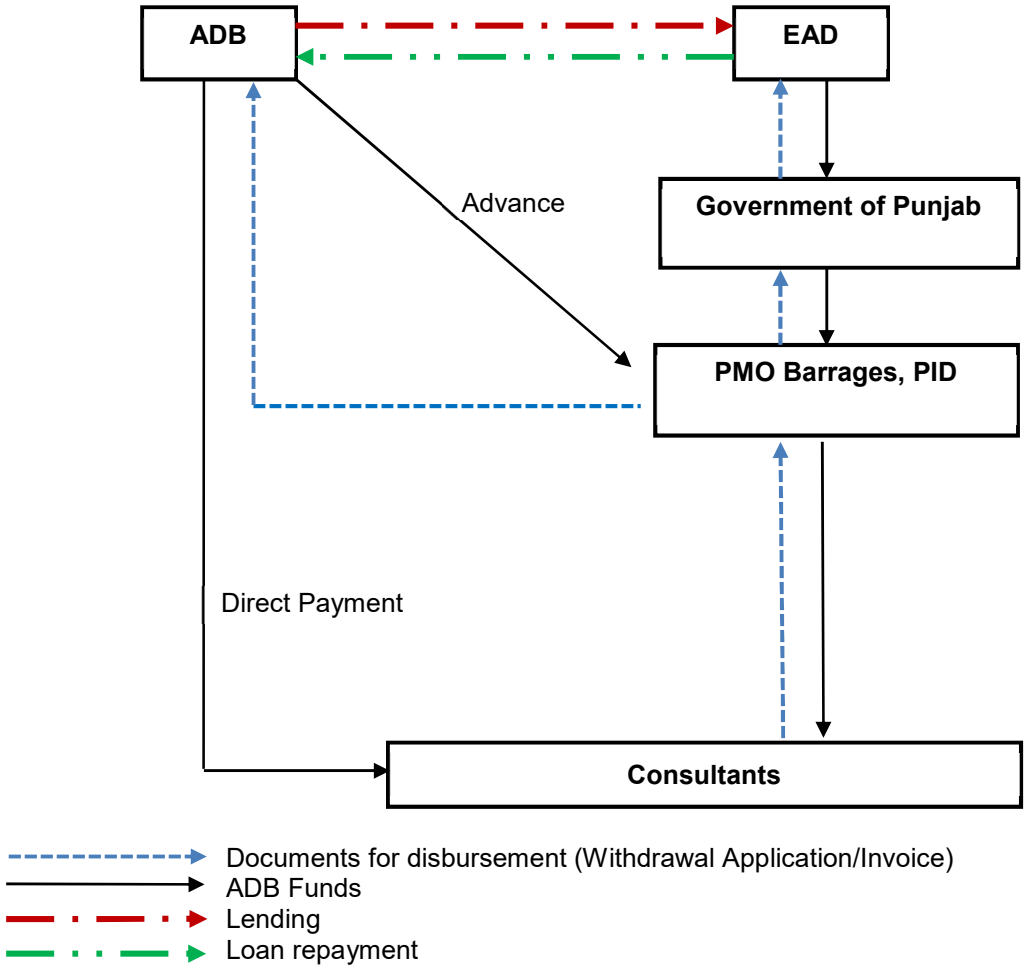
---

[5] The PAD will not be provided advance funds under the PRF.

[6] SOE forms are available in Appendix 7B of ADB's *Loan Disbursement Handbook* (2017, as amended from time to time).

[7] The Client Portal for Disbursements facilitates online submission of WA to ADB, resulting in faster disbursement. The forms to be completed by the Borrower are available online at https://www.adb.org/documents/client-portal-disbursements-guide.

Figure 2. Fund Flow Diagram



ADB = Asian Development Bank; EAD = Economic Affairs Division; PID = Punjab Irrigation Department; PMO = project management office.
Source: ADB.

C. Accounting

12. The PID will maintain separate PRF project accounts and records by funding source for all expenditures incurred on the PRF project. The project accounts will be prepared using the cash basis of accounting as prescribed in the International Public Sector Accounting Standards issued by the International Public Sector Accounting Board, which is a member of the International Federation of Accountants.

D. Auditing and Public Disclosure

13. The PID will cause the project financial statements to be audited following the International Standards on Auditing by an independent auditor acceptable to ADB. The PID will present the audited project financial statements together with the auditor's opinion, in English, to ADB within 6 months from the end of the fiscal year.

14. The audit report for the project financial statements will include a management letter and auditor's opinions, which cover (i) whether the project financial statements present an accurate and fair view or are presented fairly, in all material respects, following the applicable financial reporting standards; (ii) whether the proceeds of the loan were used only for the purpose(s) of the project; and (iii) whether the borrower or executing agency complied with the financial covenants contained in the legal agreements (where applicable).

15. The PID will monitor compliance with financial reporting and auditing requirements during review missions and normal program supervision and will followed up regularly with all concerned, including the external auditor.

16. ADB has made the government and the PID aware of ADB's approach to delayed submission and the requirements for satisfactory and acceptable quality of the audited project financial statements.[8] ADB reserves the right to require a change in the auditor (in a manner consistent with the constitution of the borrower) or for additional support to be provided to the auditor, if the audits required are not conducted in a manner satisfactory to ADB, or if the audits are substantially delayed. ADB reserves the right to verify the project's financial accounts to confirm that its policies and procedures were followed when the share of ADB's financing was used.

17. ADB's Access to Information Policy 2018 will guide the public disclosure of the audited project financial statements, including the auditor's opinion on the project financial statements. After the review, ADB will disclose the audited project financial statements and the opinion of the auditors on the project financial statements no later than 14 days of ADB's confirmation of their acceptability by posting them on its website. The management letter, additional auditor's opinions, and audited entity financial statements will not be disclosed.[9]

[8] ADB's approach and procedures regarding delayed submission of audited project financial statements:
(i) When audited project financial statements are not received by the due date, ADB will write to the executing agency advising that (a) the audit documents are overdue; and (b) if they are not received within the next 6 months, requests for new contract awards and disbursement such as new replenishment of advance accounts, processing of new reimbursement, and issuance of new commitment letters will not be processed.
(ii) When audited project financial statements are not received within 6 months after the due date, ADB will withhold processing of requests for new contract awards and disbursement such as new replenishment of advance accounts, processing of new reimbursement, and issuance of new commitment letters. ADB will (a) inform the executing agency of ADB's actions; and (b) advise that the loan may be suspended if the audit documents are not received within the next 6 months.
(iii) When audited project financial statements are not received within 12 months after the due date, ADB may suspend the loan.

[9] ADB. 2018. *Access to Information Policy*. Manila. pp. 23–24, paras. 97(iv) and/or 97(v). This type of information would generally fall under access to information policy exceptions to disclosure.

V. PROCUREMENT AND CONSULTING SERVICES

A. Advance Contracting

18. All advance contracting will be undertaken in conformity with ADB's *Procurement Policy* (2017, as amended from time to time) and its associated guidance notes, user's guides and staff instructions. The issuance of consulting services recruitment notices, or invitations to bid under advance contracting and retroactive financing will be subject to ADB approval. ADB has advised the borrower, and PID that approval of advance contracting and retroactive financing does not commit ADB to finance the PRF project.

19. **Advance contracting**. Advance contracting will be used for recruitment of consulting services.

B. Procurement of Consulting Services

20. The PID will recruit all consultants following the ADB *Procurement Policy* (2017, as amended from time to time), *Procurement Regulations for ADB Borrowers* (2017, as amended from time to time), and its associated guidance notes, user's guide, project administration instructions and/or staff instructions. The terms of reference for all consulting services are detailed in Section E.

21. An estimated 322 key person-months (30 international and 292 national) of consulting services are required to (i) update existing feasibility studies for the proposed priority projects; (ii) prepare detailed engineering designs, studies and bidding documents; (iii) independently review and advise the executing agency on project preparatory work; and (iv) strengthen the institutional capacity of the executing agency. Consulting firms will be engaged using the quality- and cost-based selection method with a quality-cost ratio of 90:10.

C. Procurement Plan

22. The procurement plan is prepared and given below.

Procurement Plan

<table>
<tr><th colspan="3">Basic Data</th></tr>
<tr><td colspan="3">Project Name: Punjab Water Resources Management Projects</td></tr>
<tr><td>Project Number: 51359-001</td><td colspan="2">Approval Number:</td></tr>
<tr><td>Country: Pakistan</td><td colspan="2">Executing Agency: Punjab Irrigation Department</td></tr>
<tr><td>Project Procurement Classification: B</td><td colspan="2" rowspan="2">Implementing Agency: Project Management Office Barrages under PID and On-Farm Water Management Directorate of PAD</td></tr>
<tr><td>Procurement Risk: Low</td></tr>
<tr><td>Project Financing Amount: $8.62 million
ADB Financing: $8.32 million
Cofinancing (ADB Administered): $ 0
Non-ADB Financing: $ 0.3</td><td colspan="2">Loan Closing Date: 30 June 2024</td></tr>
<tr><td>Date of First Procurement Plan (TBD on project approval)</td><td colspan="2">Date of this Procurement Plan: tbd</td></tr>
<tr><td>Procurement Plan Duration: 10 months</td><td>Advance contracting: Yes</td><td>eGP: No</td></tr>
</table>

D. Methods, Review and Procurement Plan

23. Except as ADB may otherwise agree, the following methods shall apply to procurement of consulting services.

Consulting Services	
Method	**Comments**
Open competitive bidding with international advertisement, using quality- and cost-based selection for consulting services	Two international detailed design consultant teams will be engaged through international advertisements.

E. List of Active Procurement Packages (Contracts)

24. The following table lists consulting services contracts for which the procurement activity is either ongoing or expected to commence within the procurement plan's duration.

Consulting Services							
Package Number	General Description	Estimated Value ($)	Selection Method	Revie	Type of Proposal	Advertisement Date	Comments
PWRM/ DD-01	Detailed design for Irrigation Canal and Link Canal Projects	3,375,000	QCBS	Prior	FTP	Q4 2019	International advertisement Quantity-Cost Ratio: 90:10
PWRM/ DD-02	Detailed design for Harnessing of Hill Torrents in Dera Ghazi Khan and Rajanpur	2,875,000	QCBS	Prior	FTP	Q4 2019	International advertisement Quantity-Cost Ratio: 90:10

FTP = full technical proposal, Q = quarter, QCBS = quality- and cost-based selection.

F. List of Awarded and Completed Contracts

25. The following table lists the awarded contracts and completed contracts for consulting services.

Consulting Services					
Package Number	General Description	Contract Value	Date of ADB Approval of Contract Award	Date of Completion	Comments

G. Procurement Capacity

26. The procurement capacity of the PID as the executing agency and the PMO Barrages as implementing agency (IA) was reviewed during the recently carried due diligence for the Major Change in Project: L3159/3160-PAK: Trimmu and Panjnad Barrages Improvement Project (TPBIP), and it was concluded as acceptable.[10] Since the approval of TPBIP, the PMO Barrages' staff received multiple training, demonstrated successful procurement of two civil works packages through international competitive bidding, and one consulting services package. The PMO Barrages is currently working for the advance action of recruiting one consulting firm for the Islam Barrage - an additional component to TPBIP in consultation with ADB following ADB's Procurement Policy. With completion of the projects of Sulemanki Barrage and Pakpattan Canal,

[10] ADB. Forthcoming. Major Change in Project: L3159/3160-PAK: Trimmu and Panjnad Barrages Improvement Project. Revised PAM (accessible from the list of linked documents in Appendix 2). ADB. The procurement capacity assessment report and recommendations (PCAAR) conducted for the PMO Barrages is in Annex B.

and New Khanki Barrage under the Punjab Irrigated Agriculture Investment Program, PMO Barrages' procurement unit workload has reduced. There are gaps as certain positions in the procurement unit are vacant, and to address this gap, PMO Barrages has confirmed to fill all those vacant positions as soon as their recruitment plan is approved by the PID. Key PMO staff responsible for procurement and contract administration comprises Director Procurement and Contract, Deputy Director Procurement and Deputy Director Contracts. The post of Director that is currently vacant is being recruited. Deputy Director Contracts is taking change of the responsibility under the direct supervision of Project Director. It is assessed that PMO Barrages Procurement Unit will successfully administer the recruitment needed for the PRF.

H. Consultant's Terms of Reference

27. The consultant's team composition and minimum estimation of person-months for its team staffing for feasibility review, detailed design, tender and construction drawings and performance of the assignment are given in Table 9 and details are given in Appendix 1: Consulting firm's terms of reference. The prospective consultants could propose breakdown of staffing and level of effort / staff work based on their own experience and evaluation of the proposed services. The consulting services shall follow the implementation schedule given and the professionals shall be deployed accordingly.

Table 11: Key and Non-Key Experts
(Detailed Design Consultants for Irrigation Canal and Linked Canal Projects)

No.	Position	Person-months
KEY STAFF (INTERNATIONAL)		
1	Water Resources Specialist	10
2	Environmental Specialist	3
3	Climate Change Specialist	2
	SUB-TOTAL (INTERNATIONAL)	**15**
NATIONAL KEY STAFF		
1	Irrigation and Drainage Management Specialist / Team Leader	36
2	Lead Design Engineer / Dep. Team Leader	30
3	Senior Hydraulic Engineer	24
4	Senior Structural Design Engineer	15
5	Senior Groundwater/Drainage Engineer	12
6	Senior Hydrologist	12
7	Water Management Specialist (WMS) / Agricultural Engineer (AE)	9
8	Environmental Specialist	12
9	Resettlement Specialist	6
10	Procurement Specialist	6
11	Economist	6
SUB-TOTAL (NATIONAL KEY STAFF)		**168**
NATIONAL NON-KEY STAFF		
1	Irrigation Design Engineers (2 persons)	54
2	Hydraulic Design Engineer	24
3	Structural Design Engineers (2 persons)	36
4	Geotechnical Engineer	12
5	Mechanical Engineer	9
6	Hydrologist	9
7	Geologist	6
8	Modelling Expert	3
9	Procurement Engineer	12
10	Irrigation Agronomist	9

No.	Position	Person-months
11	Horticulturist/ High Value Agriculture (HVA) Specialist	6
12	Assistant Agriculture Engineer	9
13	High Efficiency Irrigation System Specialist	2
14	Range Management Specialist	2
15	Livestock Development Specialist	3
16	Climate Change Specialist	2
17	GIS Expert	4
18	Junior Sociologist	12
19	Junior Resettlement Expert	9
20	Social Development and Gender Expert[a]	3
21	Survey Engineer	6
22	Junior Engineers (3-4 persons)	75
	SUB-TOTAL (NATIONAL NON-KEY STAFF)	**307**
PMO SUPPORT STAFF		
1	Project Coordinator	36
2	Senior Procurement Engineer	18
3	Safeguard Specialist	18
4	Agronomist	18
	SUB-TOTAL (PMO SUPPORT STAFF)	**90**
	TOTAL[b]	**580**

[a] Taken into consideration the country gender issues and cultural context, as well as the specific tasks under the expert's TORs, a consulting firm will be encouraged to engage a female gender specialist for this assignment.

[b] In addition, 30 person-months are unallocated.

Table 12: Key and Non-Key Experts
(Detailed Design Consultants for Harnessing of Hill Torrents in Dera Ghazi Khan and Rajanpur)

No.	Position	Person-months
KEY STAFF (INTERNATIONAL)		
1	Watershed Management Specialist	4
2	Environmental Specialist	3
3	Spate Irrigation Specialist	4
4	Dam Specialist	4
	SUB-TOTAL (INTERNATIONAL)	**15**
NATIONAL KEY STAFF		
1	Water Resources Management Specialist / Team Leader	30
2	Lead Design Engineer / Dep. Team Leader	24
3	Senior Hydraulic Engineer	8
4	Senior Structural Design Engineer	15
5	Senior Groundwater/Drainage Engineer	6
6	Senior Hydrologist	12
7	Environmental Specialist	8
8	Dam Expert	8
9	Resettlement Specialist	6
10	Procurement Specialist	3
11	Economist	4
	SUB-TOTAL (NATIONAL KEY STAFF)	**124**
NATIONAL NON-KEY STAFF		
1	Irrigation Design Engineer	18
2	Hydraulic Design Engineer (2 persons)	45
3	Structural Design Engineers (2 persons)	27
4	Geotechnical Engineer	12

No.	Position	Person-months
5	Mechanical Engineer	6
6	Hydrologist	15
7	Geologist	3
8	Modelling Expert	3
9	Procurement Engineer	6
10	Spate Irrigation Specialist	12
11	Water Management Specialist (WMS) / Agricultural Engineer (AE)	8
12	Irrigation Agronomist	6
13	Horticulturist/ High Value Agriculture (HVA) Specialist	6
14	Assistant Agriculture Engineer	8
15	High Efficiency Irrigation System Specialist	2
16	Range Management Specialist	2
17	Livestock Development Specialist	3
18	Climate Change Specialist	2
19	GIS Expert	5
20	Junior Sociologist	12
21	Junior Resettlement Expert	9
22	Social Development and Gender Expert[a]	3
23	Survey Engineer	6
24	Junior Engineers (3-4 persons)	50
	SUB-TOTAL (NATIONAL NON-KEY STAFF)	**269**
	TOTAL[b]	**408**

[a] Taken into consideration the country gender issues and cultural context, as well as the specific tasks under the expert's TORs, a consulting firm will be encouraged to engage a female gender specialist for this assignment.

[b] In addition, 30 person-months are unallocated.

VI. SAFEGUARDS

28. Since the PRF activities consist of consulting services only, activities have not been categorized in accordance with ADB's *Safeguard Policy Statement* (2009). The safeguard classification for the ensuing loan of the Greater Thal Canal Irrigation Project is expected as 'A' for environment, and 'C' for involuntary resettlement. The safeguard classifications for the other ensuing loans are not yet known. No adverse impact from the ensuing projects are expected for indigenous peoples (Category C). For the ensuing loans, the PRF will finance the preparation of necessary safeguard documents.

29. **Prohibited investment activities.** Pursuant to ADB's *Safeguard Policy Statement* (2009), ADB funds may not be applied to the activities described on the ADB Prohibited Investment Activities List set forth at Appendix 5 of the Safeguard Policy Statement.

VII. PERFORMANCE MONITORING

A. Monitoring and Evaluation

30. **Project readiness financing project performance monitoring:** The PID will monitor PRF project performance semiannually and provide consolidated reports to ADB. These reports will include (i) key implementation issues and solutions, (ii) each activity's progress measured against the implementation schedule, (iii) an updated procurement plan, and (iv) an updated implementation plan for the next 12 months. To ensure PRF projects continue to be both viable and sustainable, the PID should adequately review PRF project financial statements and the associated auditor's report. In the event that an ensuring loan is not approved, the PID will submit a PRF project completion report to ADB within 6 months of physical completion of the PRF project.[11]

31. **Compliance monitoring**: The PID will submit the status of covenants on policy, legal, financial, environmental, and others in its project performance monitoring report.

32. **Safeguards monitoring**: Since activities consist of consulting services only, the PRF has not been categorized in accordance with ADB's *Safeguard Policy Statement* (2009). No action is required.

B. Reporting

33. The PID will provide ADB with:

(i) semi-annual progress reports on the PRF project in a format consistent with ADB's project performance reporting system;
(ii) consolidated annual reports, including (a) progress achieved by output measured against the performance targets, (b) key implementation issues and solutions; (c) an updated procurement plan, and (d) an updated implementation plan for next 12 months;[12] and
(iii) PRF project accounts, the PID's audited financial statements, and the associated auditor's report.

[11] Project completion report format is available at: http://www.adb.org/sites/default/files/pai-6-07-a.pdf
[12] The regional departments will present the performance of the completed PRF in the project completion report of the ensuing loan.

VIII. ANTICORRUPTION POLICY

34. ADB reserves the right to investigate, directly or through its agents, any violations of the *Anticorruption Policy* (1998, as amended to date) relating to the PRF project following ADB's *Integrity Principles and Guidelines*.[13] All contracts financed by ADB will include provisions specifying ADB's right to audit and examine the records and accounts of the executing agency and all PRF project contractors, suppliers, consultants, and other service providers. This includes the examination of project outputs, assets, and all other information that may be considered relevant for audit or inspection by ADB regardless of project completion, termination, or cancellation. Firms or individuals on ADB's anticorruption debarment list are ineligible to participate in activities that are financed, supported, or administered by ADB; and may not be awarded any contracts under the PRF project.[14]

35. To support these efforts, ADB included relevant provisions in the loan agreement and the bidding documents for the PRF project. Further, the PID and ADB agreed on anticorruption policy issues as part of the country portfolio management. Any complaint referred to ADB will be reviewed by ADB Office of Anticorruption and Integrity.

IX. ACCOUNTABILITY MECHANISM

36. People who are, or may in the future be, adversely affected by the PRF project may submit complaints to ADB's Accountability Mechanism. The Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted PRF projects can voice and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make an effort in good faith effort to solve their problems by working with the concerned ADB operations department. Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.[15]

X. RECORD OF CHANGES TO THE PROJECT ADMINISTRATION MANUAL

37. All revisions and/or updates during implementation should be retained in this Section to provide a chronological history of changes to implemented arrangements recorded in the project administration manual.

Appendices
1: Consulting firm's terms of reference (Package 1: Irrigation Canal and Linked Canal Projects)
2: Consulting firm's terms of reference (Package 2: Harnessing of Hill Torrents in Dera Ghazi Khan and Rajanpur)

[13] ADB. 1998. *Anticorruption Policy*. Manila.
[14] ADB's Office of Anticorruption and Integrity.
[15] ADB. 2012. *Accountability Mechanism*. Manila.

TERMS OF REFERENCE 1:

DETAILED DESIGN CONSULTANTS FOR IRRIGATION CANAL AND LINK CANAL PROJECTS

I. BACKGROUND

1. Pakistan's population of 210 million in 2017 is projected to reach 229 million in 2025. The increase in population combined with improved living standards will require 40% to 50% additional food by 2025. This additional food can be achieved through expanded irrigated area and agricultural productivity, wherever opportunities exist. Increased agriculture activities will also contribute to job creation and poverty reduction in the province's rural communities. Punjab, Pakistan's second largest province, contributes about 80% to the country's food requirements and 57% to the production value of the country's agriculture. Irrigated agriculture accounts for more than 26% of Punjab's gross domestic product and employs over 40% of its labor force. Punjab manages an existing irrigation system serving 8.4 million hectare (ha) irrigated land. The value of Punjab's irrigation infrastructure has been estimated at $20 billion (2005-06 estimates).

2. Agriculture production in Punjab has benefitted from the Indus Basin Irrigation System (IBIS) that provides irrigation water to 15 million ha of land, of which about 60% lies in Punjab. The IBIS is the lifeline of the Punjab agriculture sector. However, deteriorated century-old structures and inefficient water management within irrigation schemes and /or on farm resulted to the unreliable surface irrigation water delivery in the IBIS. Some cultivable lands in Punjab remain outside of the IBIS and relay on unpredictable scarce rainfall or ground water that may lower the water table. Although the Government of Punjab has placed a high priority on improving irrigation infrastructure and its efficiency[1], additional efforts are required for improved agriculture productivity and water use efficiency to achieve economic growth target and food security in the province.

3. Among the priority projects identified by the Punjab provincial government to improve irrigation infrastructure that will enhance water availability and, thus, increase productivity of the agriculture sector; four projects involve construction, rehabilitation, remodeling, and upgradation of irrigation canals. A list of these priority projects is in Table 1.

Table 1: List of PID's Priority Canal Projects[2]

No.	Project[a]	Culturable Command Area, (ha)	Estimated Cost (US$ million)
1	Remodeling and Upgrading of Dera Ghazi Khan Canal System Project	384,082	68
2	Rehabilitation and Upgrading of Upper Jhelum Canal System Project	244,328	174
3	Greater Thal Canal (Phase-III) Project (Dhingana Branch System, Noorpur Branch System and Mehmood Sub Branch System) Project	440,850	600

[1] The Punjab Irrigation Department (PID) has taken actions by working closely with ADB, the World Bank, and Japan International Cooperation Agency for the improvement of irrigated agriculture. ADB's $700 million multitranche financing facility for Punjab Irrigated Agriculture Investment Program has successfully supported the improvement of the irrigation infrastructure, on-farm agriculture of over 2 million ha, and institutional reforms.

[2] The list of the priority project(s) may be revised.

No.	Project[a]	Culturable Command Area, (ha)	Estimated Cost (US$ million)
4	Remodeling of R-Q, Q-B & B-S Link Canals Project	1,083,159	50
	Total	**2,152,419**	**892**

4. The provincial government, through the Government of Pakistan, has requested the Asian Development Bank (ADB) to provide support for improved project preparation of these priority projects. A project readiness financing (the PRF) is proposed as the financing modality.

II. OBJECTIVES OF THE ASSIGNMENT

5. The PRF will support accomplishing high project preparation readiness of these priority projects by (i) reviewing and revising the feasibility studies and making up their deficiencies to ensure the efficacy and compliance with funding agency's requirements; (ii) preparing detailed design and procurement documents; and (iii) providing other project readiness support.

6. Feasibility studies for the Package I priority projects were carried out by various consultants. The detailed design of Greater Thal Canal (Phase-III) was also carried out previously. The proposed consulting services package will: (i) scrutinize the priority of the projects; (ii) review / update existing feasibility studies; (iii) conduct detailed engineering design, including preparation of drawings and priced bill of quantities for all priority projects (for GTC project, the existing WAPDA detailed design will be updated while for the other three projects, detailed design will be prepared) and (iv) provide project readiness support, including the preparation of bidding documents and PC-Is for all priority projects. The priority of projects may be updated during the PRF. Detailed design of individual projects will be conducted / updated sequentially, starting from higher priority or urgent project(s).

7. A brief description of the PID's proposed priority projects is in **Annexure A1**.

III. SCOPE OF SERVICES, TASKS AND EXPECTED DELIVERABLES

8. More specifically, the scope of services for the consultants will include but not limited to:

General Scope:

(i) perform specific tasks for review and updating the feasibility studies for the identified priority projects to ensure the efficacy and compliance with funding agency's and government's acceptable requirements, including undertake of additional social, agricultural, hydrological, topographical and geotechnical investigation and surveys;
(ii) prepare feasibility level outputs documenting the viability of civil works while adequately addressing both environmental and resettlement issues and outlining in detail the implementation arrangements, service delivery mechanisms and monitoring and evaluation procedures;
(iii) carry out required additional field surveys and geotechnical, hydrological and other investigations necessary for final designs of the identified priority projects;
(iv) provide necessary support for their independent technical and economic reviews and oversight to ensure improved quality in the updated feasibility studies, design and other related issues; based on the fresh topographic surveys, investigations and studies carried out, prepare layouts of the irrigation and drainage system for the project area;

(v) prepare recommendations of water allowance, irrigation intensity, and cropping pattern; prepare capacity and command statements for the watercourses, channels, dams, and weirs; determination or location of each hydraulic structure including outlets; identification of crops suitable for command area; recommend efficient irrigation system models; prepare water balance; collection of agricultural data from primary and secondary resources, and estimation of present agriculture situation in the command area and in the adjacent irrigated areas; formulation of agriculture parameters including land-use, cropping pattern, season of crops, quantity of inputs, cultural operations and production of outputs;

(vi) carry out required additional surveys, geotechnical investigations, hydrological analysis and other such activities where necessary to provide a basis for final design of all hydraulic structures.

(vii) prepare Chakbandi plan (document showing characteristics of area served by the outlet) of each outlet showing field levels, location of nakkas for new canal systems.

(viii) design and prepare longitudinal profiles and cross sections for irrigation and drainage channels;

(ix) prepare hydraulic, structural, electro-mechanical and geotechnical design criteria;

(x) identify various hydraulic structures for efficient conveyance of irrigation and drainage flows;

(xi) design necessary flood protection works for main canal, distribution system and other project works as required;

(xii) carry out physical model studies for flood protection works for main canal, distribution system and other project works where needed;

(xiii) prepare / update detailed engineering design for all facets of construction works of the identified priority projects including tender and construction drawings of the irrigation systems covering bridges, canal falls, cross regulators, head regulators, aqueducts, outlets and all associated cross drainage works including electro-mechanical works and will be designed strictly in accordance with the accepted state of the art methods and irrigation science, hydraulics, soil mechanics and structural engineering. Moreover, effective innovations to mitigate flood damages need to be included;

(xiv) analyze all hydraulic design options for ensuring satisfactory sediment transport and minimizing cost requirements without sacrificing system performance or control required for efficient and equitable distribution of irrigation water;

(xv) prepare rules for optimal sediment control into head regulator and amend Operation and Maintenance Rules of falls and other civil structures accordingly;

(xvi) identify minor and distributary canals those involve community participation, conduct walk-thorough pre-design exercise with the community and consider related resettlement and environmental issues in the design;

(xvii) use focus groups and stakeholder consultation to develop a rehabilitation process for distributary and minor canals that fully involves farmers in general in both the detailed design and implementation of system improvements;

(xviii) develop relevant operation and maintenance (O&M) strategies for main canals, distribution systems and barrages under the projects

(xix) ensure that while carrying out design works, optimal solution of technical, environmental and social issues is kept in consideration;

(xx) analyze design options for all aspects of the head-works (if applicable) and main canal rehabilitation and upgrading including cross and head regulators, bridges, measurement structures, escapes, lining and all necessary earthworks as well as evaluating potential construction modalities to be considered with a view to timely and cost effective rehabilitation; divide the project works in to suitable number or contract packages, prepare Bill of Quantities, cost estimate;

(xxi) explore relevant non-crop interventions (like farmers' training, crop production support

interventions, value-addition initiatives, animal husbandry, tree plantation, etc.) that may facilitate additional income to the project beneficiaries;

(xxii) assess procurement, financial management, and O&M capacity of the relevant agencies and propose measures for improvement, if any required;

(xxiii) prepare / review the Climate Change Risk Assessment study and ensure that design adequately considers the climate change impacts and is stable against factors such as impacts on agriculture water uses, frequent and excessive flows and sedimentation;

(xxiv) prepare and/ or update PC-I and all necessary appendixes for government's review and approval, including necessary revisions to incorporate comments from the relevant government authorities;

(xxv) prepare Engineer' Estimate for civil, mechanical and electrical works, packaging of contracts following ADB's Procurement Policy 2017 and Procurement Regulations for Borrowers (2017, as amended from time to time) and their procurement methods;

(xxvi) prepare tender documents for different contract packages, update/prepare bidding documents incorporating EMP and gender action plan (GAP);

(xxvii) prepare/ update land acquisition and resettlement plan (LARPs) and environmental impact assessment (EIA) or IEE, environmental management plan (EMP) as required under national laws as well as ADB's Safeguard Policy Statement (SPS) (2009, as amended from time to time) and relevant government laws and regulations;

(xxviii) prepare TOR for environmental monitoring and management required during construction and implementation of the ensuing projects.

(xxix) train selected PID staff with a view to strengthening their ability to adequately oversee resettlement activities under each of the ensuing priority projects;

(xxx) assess social and gender impact and prepare social development and gender action plans (GAP) and participation and communication strategy;

(xxxi) address specific needs of women farmers for each of the ensuing loans to ensure targeted gender category is expected "effective gender mainstreaming;"

(xxxii) conduct or revise project benefits, and economic and financial analysis; and document economic, social and environmental rationale to justify the proposed investments;

(xxxiii) advise on soil reclaiming and develop effective use strategies for optimal use of the limited canal supplies and local groundwater resources with identification of crops suitable for canal command;

(xxxiv) develop cropping and land use patterns consistent with the proposed integrated development of livestock and crop production together with the Irrigation Specialist, Range Management Specialist, and Livestock Specialist;

(xxxv) prepare viability of the hydropower generation in Upper Jhelum Canal System and provide necessary provisions of interface where necessary while designing such structures;

(xxxvi) prepare detailed implementation plans preferably using software such as Primavera P6 or equivalent for monitoring the project activity and generating progress reports using 'earned value' criteria. This shall provide a baseline for all subsequent plan amendments, if needed;

(xxxvii) carry out necessary rectification, modifications and improvement of documents resultant to review of any or all project documents by the Irrigation Department, allied sister departments of the Government of the Punjab, Government of Pakistan, and financers/ donors;

(xxxviii) prepare responses to audit observations and paras in respect of the payments made to consultants and assist the Employer in getting them resolved;

(xxxix) attend project level meeting with Working Group, ADB Missions as required;

(xl) prepare all the supporting documents and provide legal support to Employer and attend court / hearing if required;

(xli) supervise engineering or other studies associated with the project and its components as per instructions of the client;

(xlii) prepare/ update draft Operational Manuals for all the major structures, main canal and each branch and distributary canal in the command ensuring optimization of water deliveries using the existing or newly constructed;
(xliii) assist the Client in preparation of quarterly, semiannual and annual progress reports for sending to Donors and government offices; and
(xliv) Support the PMO and ADB missions, as required.

9. **Specific Scope.** Following are specific tasks for the consultant for updating feasibility studies of the identified three priority projects, followed by their detailed designing. For the GTC project, the existing detailed design will be updated:

(i) **Specific Tasks for Updating Feasibility Studies:** Following are specific tasks for the consultant for updating feasibility studies of the identified priority projects, followed by their detailed designing:

(a) Remodeling and Upgrading of Dera Ghazi Khan Canal System

- **Remodeling of D.G Khan Canal System:** The consultant will need to work for their independent technical and economic reviews and oversight to ensure improved quality in the updated feasibility studies through a consensus solution based on regime flow analysis that would lead to stable canal geometry.
- **Rehabilitation and Remodeling of Various Structures:** The consultant will review the proposals regarding rehabilitation and remodeling of various water distribution structures, cross drainage works, sediment ejectors, and bridges and finalize recommendations.
- **Multiple Uses of Water:** The consultant will explore the optimal combined use of water for human consumption, as well as high-value crop production using HEISs.
- **Sustainability:** The consultant will need to design the project to ensure sustainability by devising suitable operation and maintenance (O&M) procedures, maximum cost recovery, strong stakeholders' participation at all stages, and project design suitable for local conditions and culture.
- **Climate Change Adaptations:** The consultant will incorporate suitable adaptations in project design that will meet the challenges of climate changes.
- **Due Diligence:** The consultant will ensure that the project complies fully with the ADB due diligence guidelines related to environment, involuntary resettlement, and social aspects including gender.
- **Revision and Updating of Project Design, Costs, and Economic and Financial Analyses:** The consultant will develop alternate development plans, including non-crop initiatives (like farmers' training, crop production support interventions, value-addition initiatives, animal husbandry, tree plantation, etc.) that may facilitate additional income to the project beneficiaries, with their estimated costs and benefits and select the most suitable alternate in consultation with all stakeholders including PID and ADB. The consultant will prepare the feasibility level design for the selected alternate and revise the economic and financial analysis following relevant ADB Guidelines.

(b) Rehabilitation and Upgrading of Upper Jhelum Canal (UJC) System

- **Remodeling of Upper Jhelum Canal:** The consultant will work for their independent technical and economic reviews of the existing feasibility study, and

oversight to ensure improved quality in the updated feasibility studies through a consensus solution based on regime flow analysis that would lead to stable canal geometry.

- **Rehabilitation and Remodeling of Various Structures:** The consultant will review the proposals regarding rehabilitation and remodeling of various water distribution structures, cross drainage works, sediment ejectors, and bridges and finalize recommendations.
- **Sustainability:** The consultant will need to design the project to ensure sustainability by devising suitable operation and maintenance (O&M) procedures, maximum cost recovery, strong stakeholders' participation at all stages, and project design suitable for local conditions and culture.
- **Climate Change Adaptations:** The consultant will incorporate suitable adaptations in project design that will meet the challenges of climate changes.
- **Due Diligence:** The consultant will ensure that the project complies fully with the ADB due diligence guidelines related to environment, involuntary resettlement, and social aspects including gender.
- **Revision and Updating of Project Design, Costs, and Economic and Financial Analyses:** The consultant will develop alternate development plans, including non-crop initiatives (like farmers' training, crop production support interventions, value-addition initiatives, animal husbandry, tree plantation, etc.) that may facilitate additional income to the project beneficiaries, with their estimated costs and benefits and select the most suitable option in consultation with all stakeholders including PID and ADB. The consultant will prepare the feasibility level design for the selected alternate, and revise the economic and financial analysis following relevant ADB Guidelines

(ii) **Specific Tasks for Updating Detailed Design and Project Readiness Support:** The consultant will develop alternate development plans with their estimated costs and benefits and select the most suitable alternate in consultation with all stakeholders including PID and ADB. The consultant will prepare the feasibility level design for the selected alternate and revise the economic and financial analysis following relevant ADB Guidelines.

(c) Greater Thal Canal (Phase-III) Project

Greater Thal Canal (GTC) Project comprising three (3) Phases was taken up by WAPDA. The Project feasibility study for the entire scheme was prepared by the Consultants hired by WAPDA during 1992-94 and detailed design was completed in 2007. Greater Thal Canal Phase-III has been identified as a priority project for updating the detailed design and other project preparation under the ADB's Project Readiness Financing Facility. Following are specific tasks for the consultant for updating detailed design for the above identified priority project:

i. plan and execute additional social, agricultural, hydrological, topographical surveys, geotechnical investigations and other such activities along the canal alignment and around structures necessary for updating the detailed design;
ii. update all relevant technical documents; design parameters & criteria. Check whether the design calculations were correct and appropriate standards were adopted. In case of any disagreement, the Consultants will update the detailed design as per fresh surveys and investigations and revised design calculations.
iii. plan and execute any additional investigations deemed necessary for any

hydraulic or structural aspects to be included in the studies;

iv. review and update all topographic maps, profile and cross-section surveys required to develop required working drawings of canal reaches and hydraulic structures being rehabilitated. Provide necessary input data for updating the detailed design of the main and branch canals and associated works;

v. analyze all hydraulic design options for ensuring satisfactory sediment transport and minimizing cost requirements without sacrificing system performance or control required for efficient and equitable distribution of irrigation water;

vi. develop alternate development plans, including non-crop initiatives (like farmers' training, crop production support interventions, value-addition initiatives, animal husbandry, tree plantation, etc.) that may facilitate additional income to the project beneficiaries, with their estimated costs and benefits and select the most suitable option in consultation with all stakeholders including PID and ADB. The consultant will prepare the feasibility level design for the selected alternate, and revise the economic and financial analysis following relevant ADB Guidelines; and

vii. review all other documents required for project readiness as indicated in section 'C' "Detailed Engineering Designs and Project Readiness Support."

Command Area Development (CAD) Activities: In this context, the consultants will:

i. prepare inventory of quantity and quality of all available resources including soil types, topography, availability of surface/ groundwater resources, groundwater depths, aquifer quality, depletion trends, recharge rates along with their sources, number of tubewells & density, rainfall pattern, rainwater harvesting potential & its contribution in irrigation, farm sizes, land tenure, etc. The resource assessment would also include farming practices, irrigation methods, efficacy of existing agricultural practices, water productivity, cropping patterns & intensities, input use levels, crop yields etc. The consultants will carry out field surveys for ground truthing/ verification of such data gleaned from various documents/ reports, statistical records, etc.;

ii. consultants will develop a detailed engineering and revenue Chakbandi of the proposed new outlets/ watercourses;

iii. suggest suitable farmers' friendly cost sharing arrangements for various packages of interventions for each area to promote adoption of modern technologies e.g. watercourse development, LASER land levelling, drip/ sprinkler irrigation systems, tunnel farming etc. among various categories of farmers after thorough consultation with the farming community and the OFWM wing of Agriculture Department;

iv. recommend mechanisms and plans for capacity building of farmers as well as training of other stakeholders for each area to ensure provision of technical assistance for successful adoption of proposed interventions;

v. carry out economic and financial analyses for each of the proposed package/ CAD model and intervention for each area.;

vi. explore the possibility for development of waste lands through cooperative, corporate or any other such farming mode; and

vii. consult with the OFWM wing of Agriculture Department and propose a comprehensive implementation strategy for the recommended development options including investment priority, timeframe, institutional setup, stakeholders, roles/ responsibilities.

(d) <u>Remodeling of R-Q, Q-B & B-S Link Canals:</u>

Remodeling of Link Canals: The project involves remodeling of Rasool-Qadirabad, Qadirabad-Balloki, and Balloki-Suleimanki link canals. There seems to be differences in the opinion of various experts of PID on the remodeling proposals. Thus, the consultant will need to work for their independent technical and economic reviews and oversight to ensure improved quality in the updated feasibility studies through a consensus solution based on regime flow analysis that would lead to stable canal geometry.

Rehabilitation and Remodeling of Various Structures: The consultant will review the proposals regarding rehabilitation and remodeling of various structures on the link canals and finalize recommendations.

Multiple Uses of Water: The consultant will explore the optimal combined use of water for human consumption, as well as high-value crop production using HEISs.

Value Addition and Value Chain: The consultant will be required to explore the possible value addition activities relevant to the project and promotion of value chain particularly relevant to the products.

Climate Change Adaptations: The consultant will incorporate suitable adaptations in project design that will meet the challenges of climate changes.

Due Diligence: The consultant will ensure that the project complies fully with the ADB due diligence guidelines related to environment, involuntary resettlement, and social aspects including gender.

Revision and Updating of Project Design, Costs, and Economic and Financial Analyses: The consultant will develop alternate development plans with their estimated costs and benefits and select the most suitable alternate in consultation with all stakeholders including PID and ADB. The consultant will prepare the feasibility level design for the selected alternate and revise the economic and financial analysis following relevant ADB Guidelines.

Detailed Engineering Designs and Project Readiness Support:

i. the Consultants shall proceed with the identified priority projects and complete the detailed engineering designs of all structures for the selected alternatives of the project components i.e. main canal, distribution system, crossings of Hill torrents and drainage measures including all electro-mechanical works.

ii. prepare cost estimates and PC-I of the Projects as and when required for approval. For the purpose of cost estimating:
   - all unit prices for major quantities of work shall be established by the latest methods. These methods will simulate each construction activity in such a way as to fit it into the available time span in the proposed construction schedule. Construction equipment, crews, materials and other resources would be adjusted to accomplish the work within the required time span. The computations or unit prices shall be supported by detailed sets or financial price with source.
   - indirect cost of construction for all major items should be established separately. Total cost of each construction item shall then be obtained by multiplying the direct cost of construction by a bid factor representing the influence of indirect cost.

iii. preparation or cost estimates of the project broken into local and foreign components. These shall include:
   - reasonable breakdown by major items or electro-mechanical and civil works or canal / irrigation network. Price for major civil works and permanent equipment shall be estimated on the basis of internationally advertised open competitive bidding (OCB).

- environmental Impact Assessment and Resettlement Action Plan with cost estimation.
- project engineering and management expenses and an adequate allowance of physical contingencies.
- import duties, taxes and interest during construction (to be assessed separately and not be included in the base cost estimate).
- preparation or a construction schedule using CPM analysis and schedules for annual construction expenditures, both for local and foreign currency components, throughout the construction period as well as a schedule of annual expenditures for resettlement Action Plan and other items.
- task shall culminate at the production by the consultants of a design report with the cost estimate to be discussed in PMO, PID, Steering Committee and ADB.

iv. preparation of tender drawings with sufficient details for the purpose of international competitive bidding.

v. preparation of tender documents (Bidding documents including BOQ, special provisions and technical specifications) in line with FIDIC Conditions of Contract for Construction. The bidding documents shall cover the civil / electro-mechanical works of the project and its components.

vi. preparation of construction drawings complete in all respect for all civil, electrical and mechanical works.

Survey and Investigations. Plan and execute additional surveys, geotechnical investigations and other such activities where necessary to provide a basis for both detailed designing and subsequent preparation of construction drawings. The consultants shall hire, with prior approval of the client, any additional services of such other agencies responsible for carrying out the aforesaid surveys, investigations and model studies etc.

IV. TEAM COMPOSITION AND QUALIFICATION REQUIREMENTS FOR KEY EXPERTS

10. The Consultant will maintain one main office at Lahore, amongst other project offices for their team members.

Indicative Staffing Requirements for Design Consultants

11. Following matrix represents the client's reflection on the consultant's team composition and indicative estimation of person-months for its team staffing for feasibility review, detailed design, tender and construction drawings and performance of the assignment. The prospective consultants should, however, propose their own breakdown of staffing and level of effort / staff work based on their own experience and evaluation of the proposed services. The consultants should propose a realistic deployment schedule for all positions depending on the work requirements as all positions listed below would have inputs for different durations.

12. Indicative inputs are 183 person-months of key experts (15 international person-months and 168 person-months national person-months) and 307 person-months of non-key experts as shown in the table below. Person-months of the Key experts and the composition of the Non-key experts and their person-months and assignment schedule will be evaluated as part of work plan and methodology of the services. and consultants' ability to provide all required professionals. The assignment further envisages an additional pool of 30 unallocated person-months of experts under "physical contingencies" to support the implementation of assignment

components as and when required. The estimated duration of the consulting services is thirty-six (36) months. The consultants shall follow and deploy the professionals as per the implementation schedule given.

Indicative Staffing Requirements For Feasibility Review And Detailed Design Consultants

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
KEY EXPERTS					
KEY EXPERTS (International)					
1	Water Resources Specialist	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Civil / Water Resources / Hydraulic Engineering is preferable and would be rated higher.	20	15 years' professional experience in the planning and design of large scale water resources development projects. Five years of that experience shall have been on large irrigation project and 5 years on major projects in South Asia will be preferred.	10
2	Environmental Specialist	Master's degree in Environmental Sciences/ Environmental Engineering, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in conducting environmental assessment[3] of major water sector projects in accordance with environmental guidelines of ADB or similar development partners like the World Bank.	03
3	Climate Change Specialist	Master's degree in climate science/ climatology, or other relevant degree, or other equivalent professional experience.	15	10 years' professional experience in, climate change or related water resource issues. Experience in South Asia is preferred.	02
Sub-Total Key Experts (International)					**15**
KEY EXPERTS (National)					
1	Irrigation and Drainage Management Specialist / Team Leader	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Water	20	15 years' professional experience in planning, implementation and management of large scale irrigation and drainage systems including those where	36

[3] It includes 'environmental screening".

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
		Resources / Hydraulic Engineering / Irrigation Engineering is preferable and would be rated higher.		conjunctive use is an important aspect. Five years of that experience will have been related to large scale irrigation systems in a senior position.	
2	Lead Design Engineer / Deputy Team Leader	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Water Resources / Hydraulic Engineering / Irrigation Engineering is preferable and would be rated higher.	20	15 years' professional experience in design of new and rehabilitation of existing large scale irrigation systems including 5 years' specific experience in design of similar projects in a senior position.	30
3	Senior Hydraulic Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Water Resources / Hydraulic Engineering is preferable and would be rated higher.	15	10 years' professional experience in design of civil works on major hydraulic structures of large water sector projects including 5 years' specific experience in planning and designing of dams.	24
4	Senior Structural Design Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Structural Engineering is preferable and would be rated higher.	15	10 years' professional experience in structural design of major infrastructure including 5 years' specific experience in design of new and rehabilitation of barrages, head-works and canal head regulators on major irrigation projects.	15
5	Senior Groundwater / Drainage Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in civil / hydraulic engineering and/or hydrogeology is preferable and would be rated higher.	15	10 years' professional experience in groundwater utilization and management including 5 years' specific experience in similar position related to alluvial aquifer systems.	12

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
6	Senior Hydrologist	B. Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Water Resources Engineering / Hydrology is preferable and would be rated higher.	15	10 years' professional experience in hydrological analysis/studies on major streams in the Indus Basin including 5 years' specific experience in similar position on dams.	12
7	Water Management Specialist (WMS) / Agricultural Engineer (AE)	B.Sc. Agriculture Engineering, or other relevant degree, or equivalent professional experience. Master's degree in Agriculture Engineering. / Water Resources Management.	15	10 years' professional experience in water management activities in public/ private sector, or equivalent professional experience, including 7 years' specific experience in on-farm water management, command area development and irrigated agriculture development projects with demonstrated ability to work with government officials, technical field staff, donors and farmers. In addition, WMS/ AE should have familiarity with the principles and practices of participatory community development, irrigated agriculture and water management related issues besides fluency in spoken and written English.	9
7	Environmental Specialist	Master's degree in Environmental Sciences / Environmental Engineering, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in conducting environmental assessment[4] of major water resources projects in accordance with GoP and ADB's Environmental Guidelines.	12

[4] It includes 'environmental screening".

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
08	Resettlement Specialist	Master's degree in Sociology / Rural Sociology / Social work / Social Sciences, or other relevant degree, or equivalent professional experience.	15	10 Years' professional experience in activities relating to land acquisition and planning & implementation of resettlement plans on large construction projects including 5 years' specific experience in similar position on large water sector projects in accordance with GoP and ADBs' / World Bank's Social Safeguards Policy Guidelines.	06
9	Procurement Specialist	B. Sc. Civil Engineering, or other relevant degree, or equivalent professional experience.	15	10 years' experience in the procurement of civil works and contract management including 3 years' specific experience in similar position related to procurement under ADB / World Bank Projects using international and national competitive bidding procedures.	06
10	Economist	Master's degree in Project Economics, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in costing and analyzing the economics of major irrigation investment projects.	06
	Sub-Total Key Experts (National)				**168**
Total Key Experts (International & National)					**183**
NON-KEY EXPERTS (National)					
1	Irrigation Design Engineers (02 persons) • 1st. person = 30 month • 2nd person = 24 month	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Water Resources/ Irrigation Engineering is preferable and would be rated higher	12	8 years' professional experience in design of irrigation civil works including 5 years' specific experience in design of new and rehabilitation works on major canal systems.	54
2	Hydraulic Design	B.Sc. Civil Engineering, or other relevant	12	8 years' professional experience in detailed	24

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
	Engineer	degree, or equivalent professional experience. An additional Master's degree in Hydraulic / Engineering is preferable and would be rated higher.		design of the hydraulic aspects of civil works related to irrigation and drainage projects including 5 years' specific experience in design of new and rehabilitation of existing barrages, headworks and canal head regulators.	
3	Structural Design Engineers (02 persons) • 1st. person = 20 month • 2nd person = 16 month	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Structural Engineering is preferable and would be rated higher.	10	7 years' professional experience in structural design of major infrastructure including 4 years' specific experience in structural design of headworks, barrages, and other hydraulic structures on large canals	36
4	Geotechnical Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Geotechnical Engineering is preferable and would be rated higher.	15	10 years' professional experience in design of geotechnical works for major hydraulic structures including 5 years' specific experience in design of similar works on dams.	12
5	Mechanical Engineer	B. Sc Mechanical Engineering, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in design / fabrication and operation of gates, hoists and mechanical equipment for major irrigation and drainage projects.	09
6	Hydrologist	B. Sc Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Water Resources Engineering/ Hydrology is preferable and would be rated higher.	15	10 years' professional experience in hydrological analysis/ studies on major streams in the Indus Basin including 3 years' specific experience in similar position on dams.	09
7	Geologist	B. Sc. Civil Engineering or M.Sc. in Geology, or	15	10 years' professional experience in Planning	06

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
		other relevant degree, or equivalent professional experience. An additional Master's degree in Water Resources Engineering is preferable and would be rated higher.		and supervision of various geological investigation programs in the structural design of head-works, bridges and other hydraulic structures of major streams of the Indus Basin.	
8	Modelling Expert	B. Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Civil / Hydraulics Engineering is preferable and would be rated higher.	15	10 years' professional experience in modelling the hydraulic aspects of civil works related to irrigation and drainage projects including 5 years' specific experience in physical modelling of rivers and major irrigation structures.	03
9	Procurement Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience.	12	8 years' professional experience in procurement of civil works including 5 year's specific experience in procurement under ADB / World Bank Guidelines using ICB procedures under FIDIC Conditions of Contract for Construction.	12
10	Irrigation Agronomist	Master's/ Ph.D degree in Agronomy/ Agriculture, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in the relevant field in public/private sector including 5 years' specific experience in irrigation agronomy and irrigated agriculture development projects. Should have demonstrated ability to work with government officials, technical field staff, donors and farmers. In addition, work experience in related computer tools, good communication skills, fluency in English and satisfactory record of similar consultancies	09

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
				would be preferred.	
11	Horticulturist/ High Value Agriculture (HVA) Specialist	Master's/ Ph.D degree in Horticulture, or other relevant degree, or equivalent professional experience.	10	5 years' professional experience in horticulture related activities with 3 years; specific experience in development of irrigated agriculture and high-value agriculture projects. Work experience in related computer tools, good communication skills, fluency in English and satisfactory record of similar consultancies would be preferred.	06
12	Assistant Agriculture Engineer	Bachelor's degree in Agriculture Engineering, or other relevant degree, or equivalent professional experience.	10	5 years' professional experience engineering in on-farm water management projects. Work experience in related computer tools, good communication skills, fluency in English and satisfactory record of similar consultancies would be preferred.	09
13	High Efficiency Irrigation Systems Specialist	B. Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Water Management Systems is preferable and would be rated higher.	15	10 years' professional experience in planning, design and setting up of high efficiency irrigation systems.	02
14	Range Management Specialist	B.Sc. Agriculture / Forestry, or relevant degree, or equivalent professional experience. An additional Master's degree in Forestry is preferable and would be rated higher.	15	10 years' professional experience in planning, design, and management of range lands.	02
15	Livestock Development Specialist	Basic degree in Veterinary Sciences / Animal Husbandry, Doctor of Veterinary	15	10 years' professional experience in planning, design, and management of	03

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
		Medicine (DVM), or other relevant degree, or equivalent professional experience. An additional Master's degree in Livestock Management is preferable and would be rated higher.		livestock.	
16	Climate Change Specialist	Graduate degree, preferably post graduate degree, in civil engineering, hydrology, climate science, or other relevant degree, or equivalent professional experience	10	5 years' professional experience in carrying out climate risk and vulnerability assessment of irrigated agricultural project together with experience of climate change adaptation measures for such projects.	02
17	GIS Expert	Master's degree in GIS / Space Science, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in GIS database development of Water Resources Systems.	04
18	Junior Sociologist	Master's degree in Sociology / Rural Sociology / Social work/ Social Sciences, or other relevant degree, or equivalent professional experience.	07	5 years' professional experience in developing social studies and plans for large-scale water sector projects in Pakistan	12
19	Junior Resettlement Expert	Master's degree in Sociology / Rural Sociology / Social work / Social Sciences, or other relevant degree, or equivalent professional experience.	07	5 years' professional experience in planning and implementing resettlement programs associated with irrigation infrastructure projects.	09
20	Social Development and Gender Expert (preferably female)[5]	Master's degree in Sociology/ Anthropology/ Gender & Women Studies/ Economics, or other relevant degree, or	07	4 years' professional experience in working with development organizations, communities (rural areas) and government	03

[5] Taken into consideration the country gender and cultural context, as well as the specific tasks under the expert's TORs, a consulting firm is encouraged to engage a female gender specialist for this assignment.

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
		equivalent professional experience.		line departments and implementation of social development programs and gender action plan on various projects including 2 years' specific experience in similar position on various projects with multiple donors.	
21	Survey Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience.	07	5 years' professional experience in surveying of civil works preferably related to irrigation and drainage projects.	06
22	Junior Engineers (3-4 No.)	B.Sc. Civil / Mechanical / Electrical Engineering, or other relevant degree, or equivalent professional experience..	05	3 years' professional experience in engineering design projects.	75
	Sub-Total:				**307**
	PMO Support Staff*				
1	Project Coordinator	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience.	12	8 years' professional experience in the relevant field.	36
2	Procurement Engineer	B.Sc. degree in Civil/ Mech. Engineering, or other relevant degree, or equivalent professional experience.	12	10 years' experience in the procurement of civil works and contract management. Also 5 years' specific experience related to procurement of works & consulting services under ADB/ World Bank/ JBIC funded Projects with 2 years' experience in similar position on projects using ICB procedures under FIDIC Conditions of Contract for Construction.	18
3	Safeguard Specialist	Master's degree in Sociology / Social Work / Social Sciences, or other relevant degree, or equivalent professional experience.	12	10 years' professional experience in social development action plan activities and planning/implementation resettlement plans on large construction	18

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
				projects including 5 years' experience in similar position on large water sector projects in accordance with GoP and ADBs' / World Bank's Social Safeguards Policy Guidelines.	
4	Agronomist	Master's/ Ph.D degree in Agronomy/ Agriculture, or other relevant degree, or equivalent professional experience.	12	10 years' professional experience in the relevant field in public/ private sector including 5 years' specific experience in irrigation agronomy and irrigated agriculture development projects. Should have demonstrated ability to work with government officials, technical field staff, donors and farmers.	18
	Sub-Total (PMO Support Staff)				**90**
	GRAND TOTAL (EXPERTS)*				**580**

* In addition, 30 person-months are unallocated.

Summary of the Consulting Services Required

Expertise	person-months
Key Experts (International)	15
Key Experts (National)	168
Non-key Experts (National)	307
PMO Support Staff*	90
Grant Total Experts**	**580**

* PMO Support Staff will be hired for Client's Office. These Experts will be a part of the Consultants Team but will work in Client's office to support the client.

** In addition, 30 person-months are unallocated.

Notes:

(i) The above-mentioned person-months include Consultant's professional input only.

(ii) The unallocated 30 person-months of experts to be paid under physical contingencies to support the implementation of assignment components as and when required.

***(iii)** The above positions do not include miscellaneous contract / support staff (non-technical, semi-technical and technical input) like office manager, accounts manager, accountant, surveyors, quantity surveyors, inspectors, social enumerators (male and female), auto-CAD operators, draftsmen, guards, drivers and office boys etc. They should be included in consultant's estimated reimbursable expenses items (see the item [iv] below). They should not be included in costs and person-months of experts.*

(iv) All support staff in the Design Office will be provided by the Consultants who are required to include cost of such support staff in the Reimbursable Expenses items.

13. In the evaluation of technical proposals, the Key experts will be evaluated individually.

The Consultants should submit CVs for all positions of Key experts. Any TBN position in the key experts will be marked zero. The CV template of ADB's Standard Request for Proposals should be used to prepare these CVs. The Consultants shall bear full responsibility for correctness of the submitted CVs.

V. JOB DESCRIPTION OF CONSULTANTS' KEY EXPERTS[6]

INTERNATIONAL EXPERTS

14. Indicative tasks of each experts are indicated below. Detailed tasks of each experts will be developed by the consultants to meet with the requirements given under scope of work and will be described in their technical proposals.

15. **Water Resources Specialist (International: 10 person-months indicative):** Responsibilities of the Water Resources Specialist will include but not limited to the following:

(i) manage field surveys, investigations, and physical and mathematical models, if any, requires for feasibility studies and detailed designs;
(ii) timely delivery and quality control of all required outputs including feasibility studies for new designs, rehabilitation and upgrading of the existing priority projects;
(iii) develop alternate plans for all priority projects and selecting optimal plans keeping in view the water availability (quantity and schedule), local climatic and social conditions, and groundwater quality and depth. The plan should consider long-term water storage with integrated livestock farming, domestic water supply, and crop production with high efficiency irrigation systems (HEISs) particularly in in areas to be served with flood water supplies only. Assess the technical and physical support required (like veterinary and range management services) together with financial resources during the O&M period;
(iv) provide coordination and oversight to ensure that monitoring and evaluation (M&E), resettlement, environmental, agricultural, on-farm water management, groundwater resource management and institutional aspects of the studies appropriately address the situations identified on the ground;
(v) work with the project team to develop innovative quality assurance mechanisms to ensure institutional reforms remain the key element driving all project activities; and
(vi) provide his input regarding spate irrigation for updating the feasibility studies and preparation of detailed design for hill torrent projects using his international experience.

16. **Environmental Specialist (International: 03 person-months indicative):** Responsibilities of the Environmental Specialist will include but not limited to the following:

(i) assess and compare PID and the Punjab and Pakistan Governments' environmental legislation and frameworks with those of ADB and best international practice to identify gaps, differences or conflicts and recommend modifications and/or mechanisms to promote compatibility;
(ii) conduct initial environmental assessment and determine categorization for the projects and for individual components and where applicable individual distributary commands as appropriate to comply with ADB's environmental assessment guidelines;
(iii) based on determined categorization, prepare initial environment examinations (IEEs) or

[6] Responsibilities of individual specialists should be read in conjunction with the capsule TOR for the undertaking as a whole. Some specialists will be involved in both the feasibility level studies and detailed design while others will provide inputs solely for planning or for detailed design.

environmental impact assessments (EIAs) studies including environmental management plans (EMPs)[7] compliant with ADB guidelines;

(iv) assess the capacity of PMO/PID staff for environmental assessment and implementation of EMPs, and assess the training requirements for capacity building;

(v) assess the environmental capacity of the Punjab and Pakistan government agencies involved in vetting and approving the environmental assessments and develop environmental assessment and review procedures and prepare detailed arrangements, agreeable to all parties, which may be used throughout the program to facilitate review of documents related to the various projects; and

(vi) identify environmental issues related to the sector or any of the ensuing projects requiring loan covenants to ensure subsequent appropriate resource management.

17. **Climate Change Specialist (International: 02 person-months indicative):** Responsibilities of the Climate Change Specialist will include but not limited to the following:

(i) assess and report on the climate risks to the beneficiaries, structure, and performance of the Projects and, in collaboration with the project readiness financing team, assess, recommend, and report opportunities to reduce these risks through adaptation interventions;

(ii) prepare and appraise feasibility studies for the proposed projects and will provide detailed inputs to these feasibility studies, and more general, area-based assessments to inform future, potential projects or the detailed designs of existing projects;

(iii) carry out the climate risk and vulnerability assessment (CRVA) to assess the expected changes in the pattern and level of precipitation, groundwater, river flows, and flood risks for each project; and

(iv) undertake more detailed assessment and/or modeling at site level for each project that will be studied under the Project Readiness Financing. These site-specific assessments will inform these project designs, including (a) selection of target beneficiaries; (b) offtake points and flood defenses;(c) canal alignment and distribution options; (d) alternative sources; and (e) command area development.

NATIONAL KEY EXPERTS

18. National experts can be grouped in two categories i.e. those who will support the international experts of their fields constitute the first category while those who have no international experts of their respective fields constitute the second category. National experts of the first category will assist and support the relevant principal international experts and while working under the supervision of the Team Leader will receive technical guidance directly from the relevant international expert. In each case, they will assist in carrying out all aspects of the relevant international expert' TOR and in his/her absence accept full responsibility for all aspects of his/her TOR. Therefore, detailed individual terms of reference are not separately prepared for these individuals. However, expected qualifications and detailed TOR of the national experts of the second category i.e. experts with no respective international experts, are given here.

19. **Irrigation and Drainage Management Specialist / Team Leader (National: 36 person-months indicative)** Responsibilities of the Irrigation and Drainage Management Specialist / Team Leader will include but not limited to the following:

(i) provide overall direction to all specialists making up the consulting team and appropriately

[7] EMPs should include concrete mitigation measures specific to the project context, monitoring and training plan.

group individuals into work units responsible for a particular feasibility study and/or detailed design undertaking;
(ii) manage relationships with Project Management Office (PMO), Punjab Irrigation Department (PID), the Punjab Government, Review Panel, and the Asian Development Bank (ADB) as well as with other stakeholders including farmers;
(iii) prepare detailed, time bound work plans for the design, and tendering of all civil works contract packages envisaged for the works assigning various team members to each key task;
(iv) provide technical support and guidance on design and tendering on all aspects of head regulators; canals; distribution system and associated facilities for livestock watering, domestic water supply, and HEIS for high value crops; and other relevant aspects;
(v) provide coordination and oversight to ensure that monitoring and evaluation (M&E), resettlement, environmental, agricultural, on-farm water management, groundwater resource management, and institutional aspects of the studies appropriately address the situations identified on the ground;
(vi) monitor the progress of all planning and design work ensuring that deadlines relating to delivery dates are met;
(vii) review in detail both the design and construction work underway on the main, branch, distributary, and minor canals with a view to adoption of best practice innovations;
(viii) prepare comprehensive plans and feasibility level designs for rehabilitating and upgrading main, branch, distributary and minor canals including all associated control structures and other required supporting infrastructure including cross drainage, emergency escapes, bridges etc., for the commands of the project canals;
(ix) confirm both functional and structural requirements of main canal and distribution system structures in consultation with the hydraulic and structural specialist;
(x) review and recommend any changes in supply arrangements from the main to distributary canals and from the distributary and minor canals to watercourses to improve either efficiency or equity of distribution;
(xi) work with the agriculturist in making adequate provision for the water requirements of higher value crops which may be introduced into the cropping pattern in the future;
(xii) provide his input regarding spate irrigation for updating the feasibility studies and preparation of detailed design for hill torrent projects using his national experience and under the guidance of International Spate Irrigation Specialist; and
(xiii) attend all meetings, provide feedback and backstopping on different aspects of spate irrigation and integrated resources management approach.

20. **Lead Design Engineer / Deputy Team Leader (National: 30 person-months indicative):** Responsibilities of the Lead Design Engineer / Deputy Team Leader will include but not limited to the following:

(i) assist the Team Leader in providing, and in his/ her absence, provide overall direction to all specialists making up the consulting team and appropriately group individuals into work units responsible for a particular feasibility study and/ or detailed design undertaking;
(ii) assume overall responsibility for management and supervision of the design teams for design of new and rehabilitation and upgrading work and timely consultation on all design considerations with PMO, PID, Review Panel and ADB;
(iii) provide technical support and guidance in all aspects of the design efforts including hydrology, flood routing, physical and mathematical hydraulic modeling, canal design, sediment transport, mechanical considerations, etc.;
(iv) organize and supervise all topographic, profile, and cross-section surveys required to provide necessary input data for detailed design of the head regulators; main; branch;

distributary and minor canals and associated facilities for livestock watering, domestic water supply, and HEIS for high value crops; and associated works;

(v) undertake the design of new and rehabilitation and upgrading or replacement works including but not limited to (a) head regulators, cross regulator and distributary head regulator replacement/rehabilitation for surface irrigation systems, (b) main, branch, distributary and minor canal sectioning, grading and rerouting if required, (c) upgrading and/or replacement of existing water control and bifurcation structure and provision of additional structures as required, (d) cross canal structures such as inverted siphons, aqueducts, etc., (e) required bridges and culverts, (f) moghas (watercourse outlets) as appropriate, (g) aqueducts, (h) escape facilities and associated channels, and (i) associated flood and erosion control measures; and

(vi) ensure that during designing of all structures and features of a repetitive nature, standard designs, pre-approved by the Team Leader and PMO should be used as appropriate to minimize duplicity of design inputs

21. **Senior Hydraulics Engineer (National: 24 person-months indicative):** Responsibilities of the Senior Hydraulics Engineer will include but not limited to the following:

(i) organize and coordinate topographic surveys and any other investigations required to provide necessary input data for detailed design;

(ii) work in estimating the design water levels at all points of interest for flood flows of differing return intervals and during normal operation;

(iii) use mathematical modeling results as appropriate to refine both design proposals and operating rules for each point of interest by simulating the effects of varying design parameters;

(iv) analyze hydraulic design options for all points of interest in order to come up with cost effective rehabilitation;

(v) coordinate and supervise detailed design of all hydraulic aspects of the rehabilitation works including preparation of relevant construction drawings and specifications as well as contributing as required to the preparation of the final tender documents;

(vi) undertake the design of new and rehabilitation and upgrading or replacement works of existing facilities;

(vii) design the large and deep long-term water storage areas to store flood flows for integrated development including livestock farming, domestic water supply, and crop production with HEISs;

(viii) ensure that in the design of all structures and features of a repetitive nature, standard designs, pre-approved by the Team Leader and PMO should be used as appropriate to minimize duplicity of design inputs; and

(ix) analyze all hydraulic design options for cross regulators, drop structures, measurement structures, road bridges, distributary and minor head regulators, and lined reaches ensuring satisfactory sediment transport and minimizing cost requirements without sacrificing system performance or control required for efficient and equitable distribution of irrigation water throughout the command areas.

22. **Senior Structural Design Engineer (National: 15 person-months indicative):** Responsibilities of the Senior Structural Design Engineer will include but not limited to the following:

(i) organize and undertake a critical examination targeted to establishing the overall structural and geotechnical (foundation) integrity of various sites where new structures are to be constructed or existing structures need to be rehabilitated and upgraded, identifying all

remedial works required;
(ii) organize and coordinate all investigations deemed necessary for structural aspects of all features to be included in the rehabilitation and upgrading package for each project structure;
(iii) analyze structural design options for all features to be constructed/rehabilitated with a view to cost-effective, but sustainable rehabilitation;
(iv) coordinate, supervise and undertake preparation of detailed structural design, bills of quantities, and technical specifications for all required new and rehabilitation works identified requiring structural input and treatment, and contribute as required to the preparation of the final tender documents;
(v) analyze structural design options for all project works including cross regulators, distributary and minor canal head regulators, escapes, duck-bill weirs and road bridges with a view to be cost-effective, but sustainable rehabilitation; and
(vi) coordinate, supervise and undertake preparation of detailed structural design, bills of quantities and technical specifications for cross regulators, falls, distributary and minor canal head regulators, escapes, siphons, aqueducts, duck-bill weirs, moghas, and road and foot bridges as well as any other features identified requiring structural input and treatment and contribute as required to preparation of the final tender documents.

23. **Senior Groundwater/ Drainage Engineer (National: 12 person-months indicative):** Responsibilities of the Senior Groundwater / Drainage Engineer will include but not limited to the following:

(i) review all relevant studies on groundwater and drainage in the project canal commands and surrounding areas with regard to sources, recharge quantity, quality, and all aquifer characteristics require to satisfactorily project safe aquifer yields;
(ii) review and investigate each of the canal commands in question with regard to salinization and solidification of project area soils and assess the need for conjunctive use of surface water if groundwater of marginal quality is to be used for irrigation purposes;
(iii) review prior groundwater monitoring activities which establish the number and location of existing tube-wells in the command areas;
(iv) develop, for each of the project areas, a program of enhanced and regularized monitoring of groundwater levels and quality to serve as a data base for development of a finite difference groundwater model to serve as a tool for groundwater management in the command area; and
(v) identify and cost up, for each of the commands, for its respective required improvements in additions to the surface water drainage system to complement irrigation rehabilitation and upgrading.

24. **Senior Hydrologist (National: 12 person-months indicative):** Responsibilities of the Senior Hydrologist will include but not limited to the following:

(i) establish updated flood frequency analyses of the relevant river sites reflecting all recent upstream development at both the feasibility and detailed design degrees of refinement;
(ii) evaluate the effect of the increased extent of flood levees and embankments along the rivers and the resulting confinement of flow area on the historic flood of record and the flood distribution regime at appropriate sites in the project area; and
(iii) establish flood frequency analyses for all cross-drainage facilities related to the project facilities as directed by the Irrigation Planning and Design Engineers.

25. **Water Management Specialist (WMS) / Agricultural Engineer (AE) (National: 9**

person-months indicative): Responsibilities of the Water Management Specialist (WMS) / Agricultural Engineer (AE) will include but not limited to the following:

(i) analyse the potential of available water resources for their irrigated agriculture and command area development;
(ii) identify successful models adopted for development of waste lands for irrigated agriculture in neighboring/ other countries under similar conditions;
(iii) tailor the identified package for various categories/ combinations of available resources in terms of farmers, soils, and water categories for development of irrigated agriculture in various parts of these areas;
(iv) scrutinize the most suitable strategies replicable in the project areas for development of irrigated agriculture;
(v) work closely with the Economist, Irrigation Agronomist, Sociologist and other experts for recommending the technically feasible, economically viable, socially acceptable, and environmentally sustainable packages for each zone/area/region;
(vi) suggest suitable farmers' friendly cost sharing arrangements for various packages of interventions for each area in coordination with concerned experts to promote adoption of modern technologies e.g. watercourse development, LASER land leveling, drip/ sprinkler irrigation systems, tunnel farming etc. among various categories of farmers;
(vii) provide support in exploring the possibility for development of waste lands through cooperative, corporate or any other such farming mode;
(viii) recommend mechanisms and plans for capacity building of farmers as well as training of other stakeholders for each area to ensure provision of technical assistance for successful adoption of proposed interventions; and
(ix) propose a comprehensive implementation strategy for the recommended development options separately for each area including investment priority, timeframe, institutional setup, stakeholders, roles/ responsibilities, monitoring etc. The description should include all necessary information subsequently required for projects formulation.

26. **Environmental Specialist (National: 12 person-months indicative):** The Environmental Specialist will assist and support the relevant principal international specialists and while working under the supervision of the Team Leader will receive technical guidance directly from the relevant international specialist. In each case, the specialist will assist in carrying out all aspects of the relevant international specialists' TOR and in his / her absence accept full responsibility for all aspects of his / her TOR. The specialist will assist the international environment specialist in screening and categorizing, identifying gaps; updating environmental assessments; obtaining necessary clearance and permits domestically; carrying local disclosure and public consultation; and following national and local applicable regulations and standards.

27. **Resettlement Specialist (National: 06 person-months indicative):** Responsibilities of the Resettlement Specialist will include but not limited to the following:

(i) assess all potential; resettlement impacts from the range of interventions proposed for the priority projects within the umbrella of ADB's resettlement policy;
(ii) prepare a resettlement framework consistent with ADB guidelines for each priority project;
(iii) prepare resettlement plans as required in collaboration with Resettlement Unit established in the PMO and relevant PID staff;
(iv) develop detailed implementation arrangements to carry out resettlement activities under all projects and assess the capacity within PMO/PID and other relevant agencies with respect to resettlement and prepare detailed capacity development programs for resettlement activities to be carried out under the projects;

(v) assist PID and PMO staff in complying with ADBs Guidelines for Involuntary Resettlement for those cases where resettlement or temporary disruption of production cannot be avoided;
(vi) in such cases a resettlement plan, in accordance with the existing resettlement framework will be prepared for implementation by PID; and
(vii) review PID, Government of Punjab, and Government of Pakistan policies and practice relevant to resettlement make recommendations for strengthening these and if necessary, provide draft guidelines for Government's consideration.

28. **Procurement Specialist (National: 06 person-months indicative):** Responsibilities of the Procurement Specialist will include but not limited to the following:

(i) review detailed procurement plans and packages and determine realistic time bound schedules for procurement, including parallel and sequential steps for procurement of civil works from initial steps to the delivery of the services under the contracts;
(ii) review the prequalification criteria, notices of pre-qualification and prequalification documents and conduct the prequalification of international contractors in accordance with both PID procedures and ADB guidelines;
(iii) review and update international tender documents for the new and rehabilitation and upgrading of project works in FIDIC format agreeable to PMO, PID and ADB;
(iv) documents to be prepared under (iii) above will include (a) invitation to bid, (b) instructions to bidders, (c) form of bid, (d) form of contract, (e) special and general conditions of contract, (f) drawings and specifications, (g) bill of quantities, (h) schedule of completion, and (i) all necessary addenda;
(v) advise the committee established for evaluation regarding bid opening and the technicalities of the evaluation process and ADB's guidelines and requirements pertaining thereto; and
(vi) advise on preparation of the summary of evaluation and recommendation for award.

29. **Economist (National: 06 person-months indicative):** The Economist will assist and support the relevant principal international specialists and while working under the supervision of the Team Leader will receive technical guidance directly from the relevant international specialist. In each case, he will assist in carrying out all aspects of the relevant international specialists' TOR and in his / her absence accept full responsibility for all aspects of his / her TOR. Therefore, detailed individual terms of reference are not separately prepared for this sort of individual.

NATIONAL NON-KEY SPECIALISTS

30. **Irrigation Design Engineer (02 persons) National: 54 person-months (1st person: 30 months; 2nd person: 24 months indicative):** Responsibilities of the Irrigation Design Engineers will include but not limited to the following:

(i) review in detail both the design and construction work underway on the main, branch, distributary, and minor canals with a view to adoption of best practice innovations;
(ii) promote the use of HEIS particularly in the D G Khan hill torrents command area for growing high value crops;
(iii) design and associated facilities for livestock watering, domestic water supply, and HEIS for growing high value crops wherever required and particularly D G Khan hill torrents area,
(iv) prepare comprehensive plans and feasibility level designs for rehabilitating and upgrading main, branch, distributary and minor canals including all associated control structures and

other required supporting infrastructure including cross drainage, emergency escapes, bridges etc. for the commands of the project canals;

(v) confirm both functional and structural requirements of main canal and distribution system structures in consultation with the Hydraulic and Structural Specialists,

(vi) develop effective conjunctive use strategies for optimal use of the limited canal supplies and local groundwater resources in consultation with the Groundwater Specialists and Agriculturist;

(vii) ensure that adequate flow measurement sites are provided throughout the system to facilitate both system management and monitoring of system performance; and

(viii) develop relevant operation and maintenance (O&M) strategies for the farmers relative to the distributary and minor canals and for PID relative to main canals and barrages under the projects.

31. **Hydraulic Design Engineer (National: 24 person-months):** Responsibilities of the Hydraulic Design Engineer will include but not limited to the following:

(i) organize and coordinate topographic surveys and any other investigations required to provide necessary input data for detailed design;

(ii) analyze hydraulic design options for all points of interest in order to come up with cost effective rehabilitation;

(iii) coordinate and supervise detailed design of all hydraulic aspects of the rehabilitation works including preparation of relevant construction drawings and specifications as well as contributing as required to the preparation of the final tender documents;

(iv) draft relevant portions of the Operational Manuals for the projects with emphasis on operating rules based upon water level observations, available flood prediction information and the irrigation demand on the project systems served;

(v) undertake the design of new and rehabilitation and upgrading or replacement works of existing facilities including but not limited to (a) cross regulators and distributary head regulators, (b) main canal sectioning, grading and rerouting if required, distributary and minor canal sectioning, grading and rerouting, (c) upgrading and/or replacement of existing water control and bifurcation structures and provision of additional structures as required, (d) cross canal structures such as inverted siphons, aqueducts, etc., (e) required bridges and culverts, (f) moghas as appropriate, (g) escape facilities and associated channels, and (h) associated flood and erosion control measures;

(vi) ensure designing the conveyance and distribution system including the canals, control structures and all associated works in accordance with accepted fundamentals of irrigation science, hydraulics, soil mechanics and structural engineering;

(vii) in the design of all structures and features of a repetitive nature, standard designs, pre-approved by the Team Leader and PMO should be used as appropriate to minimize duplicity of design inputs;

(viii) analyze all hydraulic design options for cross regulators, drop structures, measurement structures, road bridges, distributary and minor head regulators, and lined reaches ensuring satisfactory sediment transport and minimizing cost requirements without sacrificing system performance or control required for efficient and equitable distribution of irrigation water throughout the command areas;

(ix) draft relevant portions of the Operation Manuals for the project facilities ensuring optimization of water deliveries.

32. **Structural Design Engineer (02 persons) National: 36 person-months (1st person: 20 months; 2nd person: 16 months indicative):** Responsibilities of the Structural Design Engineers will include but not limited to the following:

(i) organize and undertake a critical examination targeted to establishing the overall structural and geotechnical (foundation) integrity of various sites where new structures are to be constructed or existing structures need to be rehabilitated and upgraded, identifying all remedial works required;
(ii) analyze structural design options for all features to be constructed/rehabilitated with a view to cost-effective, but sustainable rehabilitation;
(iii) coordinate, supervise and undertake preparation of detailed structural design, bills of quantities, and technical specifications for all required new and rehabilitation works identified requiring structural input and treatment, and contribute as required to the preparation of the final tender documents;
(iv) assist in drafting relevant portions of the Operational Manual with emphasis on procedures/practices to ensure the long-term structural integrity of the structure/complex;
(v) organize and undertake a critical examination targeted to establish the overall structural integrity of major structures to be constructed and/or rehabilitated identifying all remedial works required;
(vi) analyze structural design options for all project works including cross regulators, distributary and minor canal head regulators, escapes, duck-bill weirs and road bridges with a view to be cost-effective, but sustainable rehabilitation; and
(vii) coordinate, supervise, and undertake preparation of detailed structural design, bills of quantities, and technical specifications for cross regulators, falls, distributary and minor canal head regulators, escapes, siphons, aqueducts, duck-bill weirs, moghas, and road and foot bridges as well as any other features identified requiring structural input and treatment and contribute as required to preparation of the final tender documents.

33. **Geotechnical Engineer (National: 12 person-months indicative):** Responsibilities of the Geotechnical Engineer will include but not limited to the following:

(i) responsible for all geotechnical investigation at site and provide data with recommendations to designs;
(ii) review the capacity of soils for designing of structures foundations and identify any remedial foundation stabilization work to be included in the packages of works for new construction, rehabilitation, and upgrading;
(iii) review of design considerations relating to soils and materials engineering;
(iv) locate appropriate sites for materials to be used;
(v) formulate plans for and carry out detailed foundation investigations for the project facilities;
(vi) supervise the work of the sub-contracted drilling, sampling and testing services to ensure compliance with best geotechnical practice; and
(vii) prepare geotechnical and material reports.

34. **Mechanical Engineer (National: 09 person-months indicative):** Responsibilities of the Mechanical Engineer will include but not limited to the following:

(i) organize, coordinate and carry out a detailed inspection of all gates as well associated head regulator gates of the project facilities to be constructed/rehabilitated;
(ii) prepare detailed designs including drawings, specifications and costs for all remedial measures required for gate rehabilitation works;
(iii) prepare feasibility-level and detailed designs and estimate bills of quantities for the mechanical and electrical works;
(iv) coordinate and supervise detailed design of all mechanical and electrical aspects of the new and rehabilitation works including preparation of relevant construction drawings and

specifications as well as contributing as required to the preparation of the final tender documents; and

(v) draft relevant portions of the Operational Manual for the proposed mechanical and electrical facilities with particular emphasis on O&M of the gates and associated hoisting equipment.

35. **Hydrologist (National: 09 person-months indicative):** Responsibilities of the Hydrologist will include but not limited to the following:

(i) establish updated flood frequency analyses of the relevant river sites reflecting all recent upstream development at both the feasibility and detailed design degrees of refinement;
(ii) evaluate the effect of the increased extent of flood levees and embankments along the rivers and the resulting confinement of flow area on the historic flood of record and the flood distribution regime at appropriate sites in the project area;
(iii) using all available data, simulations and comparisons with like situations in other river basins in South Asia, update and/or prepare a detailed and refined flood frequency analysis at each barrage site relevant to the project including comprehensive hydrographs of flood events for all return frequencies required by the principal hydraulic engineer in planning and designing the rehabilitation and upgrading of the project facilities; and
(iv) establish flood frequency analyses for all cross drainage facilities related to the project facilities as directed by the irrigation planning and design engineers.

36. **Geologist (National: 6 person-months indicative):** Responsibilities of the Geologist will include but not limited to the following:

(i) investigating the structure and evaluation of the earth and its natural resources;
(ii) surveying and mapping geologically promising sites;
(iii) collecting and recording samples and data from test sites;
(iv) analyzing geological data using specialist computer applications; and
(v) ascertaining extraction risks

37. **Modelling Expert (National: 03 person-months indicative):** Responsibilities of the Modelling Expert will include but not limited to the following:

(i) identify together with the Team Leader and Irrigation Engineers, river reaches and barrage intakes/hydraulic structure, for which modelling would be desirable;
(ii) coordinate with the survey team and sediment collection team for collection of topographic, river bed, and other data required for physical model;
(iii) collect the data on river flow and its variation over the year, and the design flow the barrage/intake structure and its variation over the year;
(iv) select a suitable facility where the model would be constructed and negotiate model construction arrangements and schedule and associated cost; and
(v) supervise the running of the model and collection of data for various scenarios that would facilitate design of the new or remodeling of existing facilities.

38. **Procurement Engineer (National: 12 person-months indicative):** Responsibilities of the Procurement Engineer will include but not limited to the following:

(i) prepare detailed procurement plans and packages and prepare realistic time bound schedules for procurement, including parallel and sequential steps for procurement of civil works from initial steps to the delivery of the services under the contracts;

(ii) develop, in consultation with PMO, the prequalification criteria, prepare notices of pre-qualification and prequalification documents and conduct the prequalification of international contractors in accordance with both PID procedures and ADB guidelines;
(iii) under the direction of the Team Leader/Design Engineer and using input from various specialists on the team, prepare the international tender documents for the new and rehabilitation and upgrading of project works in FIDIC format agreeable to PMO, PID and ADB;
(iv) The documents to be prepared under (iii) above will include (a) invitation to bid, (b) instructions to bidders, (c) form of bid, (d) form of contract, (e) special and general conditions of contract, (f) drawings and specifications, (g) bill of quantities, (h) schedule of completion, and (i) all necessary addenda;
(v) invite the pre-qualified bidders to submit bids and advise the committee established for evaluation regarding bid opening and the technicalities of the evaluation process and ADB's guidelines and requirements pertaining thereto; and
(vi) advise on preparation of the summary of evaluation and recommendation for award.

39. **Irrigation Agronomist (National: 9 person-months indicative):** Responsibilities of the Irrigation Agronomist will include but not limited to the following:

(i) assess the available resources of each area in terms of agronomic aspects including irrigation methods, efficacy of existing agricultural practices, irrigation requirements, water productivity, cropping patterns & intensities, input use levels, crop yields etc.;
(ii) address issues and suggest solutions to the problems related to crop production as confronted by the farmers for bringing the wastelands under cultivation;
(iii) Identify and recommend water efficient crop varieties based on soil and climatic conditions for each area/ zone;
(iv) estimate crop water requirements (CWR) by using climatic data (rainfall, sunshine, humidity, wind speed, temperature etc.);
(v) develop guidelines/ manual for irrigation and fertigation schedules to meet input requirements of proposed crops in each area;
(vi) prepare cropping patterns based on the water availability for sustainability of irrigated agriculture in each area;
(vii) develop crop budgets/ farm budgets under existing and proposed conditions for identifying economically viable interventions and cropping patterns for each area;
(viii) recommend plans/packages for successful crop production including land preparation, planting, irrigation scheduling, inter-culture, fertigation, harvesting, processing and marketing, etc. under modern crop production technologies particularly high efficiency irrigation systems; and
(ix) identify requisite agronomic support to be provided to the farmers for successful adoption of proposed interventions to enhance crop & water productivities for each area; and
(x) provide his input regarding spate irrigation for updating the feasibility studies and preparation of hill torrent projects using his national experience and under the guidance of International Spate Irrigation Specialist.

40. **Horticulturist / High Value Agriculture (HV) Specialist (National: 6 person-months indicative):** Responsibilities of the Horticulturist / High Value Agriculture (HVA) Specialist will include but not limited to the following:

(i) review the existing information about horticulture/ HVA and its potential in various areas;
(ii) carry out baseline survey to determine status of horticultural production, potential, local

demand etc. in each area;
(iii) identify technical and business problems related to horticultural/ HVA development in these areas and propose solutions accordingly;
(iv) assess the role of moisture retention materials in promotion of horticultural plants in deserts;
(v) design a comprehensive strategy for crop diversification from traditional crops to high value plantations including orchards, vegetables and flowers;
(vi) develop technology driven programs to improve productivity and quality by introduction of improved varieties, medicinal plants, rejuvenation with improved cultivars, high density plantations, use of high efficiency irrigation systems etc. for each area; and
(vii) develop guidelines for successful adoption of horticulture by the farmers in each area.

41. **Assistant Agriculture Engineer (National: 09 person-months indicative):** Responsibilities of the Assistant Agriculture Engineer will include but not limited to the following:

(i) work under the WMS/ AE and assist him for carrying out the planned activities;
(ii) design CAD plans in consultation with all stakeholders for different areas;
(iii) modify the CAD plans/ designs of proposed project interventions for cost effectiveness and technical suitability;
(iv) coordinate with other team members for preparation of various CAD plans for various activities; and
(v) perform other duties as assigned by the project management.

42. **High Efficiency Irrigation Systems Specialist (National: 02 person-months indicative):** The High Efficiency Irrigation Systems Specialist will report to the Team Leader and work with the Irrigation Agronomist for planning, design, installation and management studies and formulation of the operation procedures for the system. He will support the Team Leader in preparation of related reports and returns.

43. **Range Management Specialist (National: 02 person-months indicative):** Responsibilities of the Range Management Specialist will include but not limited to the following:

(i) under the Team Leader, the Range Management Specialist will work closely with Irrigation Planning Engineer and Livestock Management Specialist to develop an integrated sustainable development plan for D G Khan hill torrents areas of which livestock would be the key component.
(ii) quantify the range area to be allocated for each water storage area and plants and shrubs to be planted under range management for the size and composition of the herd assigned to each water storage area
(iii) advise if one water storage area would require to facilitate better management by reducing crowding on one water storage area; and
(iv) advise on possibility of value chain in provision of feed and other inputs.

44. **Livestock Development Specialist (National: 03 person-months indicative):** Responsibilities of the Livestock Development Specialist will include but not limited to the following:

(i) under the Team Leader, the Livestock Development Specialist will work closely with Irrigation Planning Engineer and Livestock Management Specialist to develop an integrated sustainable development plan for D G Khan hill torrents areas of which livestock would be the key component.

(ii) determine the additional veterinary services required for the proposed intervention including the number of field centers, the facilities (infrastructure, medicines, and equipment) needed, with their investment and annual running costs;
(iii) quantify the range area to be allocated for each water storage area and plants and shrubs to be planted under the range management for the size and composition of the herd assigned to each water area;
(iv) advise on possibility of value chain in provision of feed and other inputs and handling and marketing of products like wool and animals; and
(v) explore the possibility of attracting meat companies to invest in the project area and enter into contract with the locals that would create local employment and benefit both the farmers and the companies.

45. **Climate Change Specialist (National: 02 person-months indicative):** The Climate Change Specialist will assist and support the relevant principal international specialists and while working under the supervision of the Team Leader will receive technical guidance directly from the relevant international specialist. In each case, he will assist in carrying out all aspects of the relevant international specialists' TOR and in his / her absence accept full responsibility for all aspects of his / her TOR. Therefore, detailed individual terms of reference are not separately prepared for this sort of individual.

46. **GIS Expert (National: 04 person-months indicative):** Responsibilities of the GIS Specialist will include but not limited to the following:

(i) digitize all project area using satellite imageries starting from head up to tail level;
(ii) establish GIS database for the irrigation and drainage network providing reach-wise detail of hydraulic and command parameters based on both previous data and new design parameters to expand its utility and create a central data depository of the PID;
(iii) develop / refine GIS database for groundwater monitoring system in the canal commands using coordinates of the observation points collected by Directorate of Land Reclamation (DLR) of PID. Where ever errors will be found in the coordinates, the consultants will get it corrected through DLR field staff and update the same in GIS database. All past available data relevant to the observation points e.g. depth to water table will be made part of the database;
(iv) develop groundwater quality, depth and elevation maps for the project area;
(v) digitize / extract major rail/road network present within the canal project area; and
(vi) develop / process maps in the printable form and print maps at appropriate scale in the format and quantity as per requirement of the client.

47. **Junior Sociologist (National: 12 person-months indicative):** Responsibilities of the Junior Sociologist will include but not limited to the following:

(i) assist PMO in the development and establishment of an appropriate M&E strategy and plans for rehabilitation and upgrading of the facilities in the priority projects;
(ii) M&E systems referred to above will include input, progress, output and impact indicators and be computerized, so they are compatible with and form a part of the MIS for the project to which they apply;
(iii) plan, design and supervise the conducting of baseline, intermediate and end of Project socio-economic surveys in selected parts in the project area;
(iv) develop appropriate analytical methodology for socio-economic impact assessment; and
(v) conduct in depth workshops for PMO/PID staff and for those who will carry out the surveys in the field covering the survey design, sampling criteria, questionnaire requirements,

interview methodology and survey analysis.

48. **Junior Resettlement Expert (National: 9 person-months indicative):** Responsibilities of the Junior Resettlement Expert will include but not limited to the following:

(i) assess all potential; resettlement impacts from the range of interventions proposed for the priority projects within the umbrella of ADB's resettlement policy;
(ii) prepare a resettlement framework consistent with ADB guidelines for each priority project;
(iii) prepare resettlement plans required in collaboration with Resettlement Unit established in the PMO and relevant PID staff; and
(iv) develop detailed implementation arrangements to carry out resettlement activities under all projects and assess the capacity within PMO/PID and other relevant agencies with respect to resettlement and prepare detailed capacity development programs for resettlement activities to be carried out under the projects.

49. **Social Development and Gender Expert (preferably female) (National: 03 person-months indicative):** Responsibilities of the Social Development and Gender Expert will include but not limited to the following:

(i) develop the Gender Action Plan through close working with the project team;
(ii) develop community mobilization and training plan aligned with the GAP targets and lead community consultations for the identification of trainees for livelihood raising programs as detailed in GAP;
(iii) prepare data collection tools for collecting baseline information required for upgradation of schools, health facilities and vocational trainings etc. in selected project areas;
(iv) conduct qualitative studies at suitable sites of how women see the impact on their lives of provision of improved health care, skills training, education, and recreational provision; and
(v) conduct field visits and any other function and responsibility, as assigned by the Employer.

50. **Survey Engineer (National: 06 person-months indicative):** Responsibilities of the Survey Engineer will include but not limited to the following:

(i) maintain close coordination with the GIS Expert for sharing satellite imagery;
(ii) procure from Survey of Pakistan updated survey maps covering the project area; and
(iii) establish and maintain benchmarks at suitable locations around the project facilities.

51. **Junior Engineer (Civil / Mechanical / Electrical) (National: 75 person-months indicative):** Responsibilities of the Junior Engineer will include but not limited to the following:

(i) Assist the Team Leader / Deputy Team Leader and other experts in carrying out their TORs; and
(ii) Assist the Team Leader / Deputy Team Leader and other experts in designing, prepare relevant records, work measurements, collecting and keeping the records for use by the professional staff, preparation of progress reports, financial statements, etc.

PMO Support Staff

52. **Project Coordinator (National: 36 person-months indicative):** Responsibilities of the Project Coordinator will include but not limited to the following:

(i) assist the Project Director, PMO, Punjab Barrages in maintaining an effective coordination with the Consultants' team, Review Panel and other stakeholders for efficient performance of the consulting services;
(ii) assist the PMO, Punjab Barrages in processing of assignment-related cases, arranging meetings and maintaining close follow-up action with the Consultants, Review Panel, government functionaries and other stakeholders.

53. **Senior Engineer Procurement (National: 18 person-months indicative):** Responsibilities of the Senior Engineer Procurement will include but not limited to the following:

(i) provide capacity support to the PMO in all procurement activities regarding goods, works and services;
(ii) assist the PMO in preparing/ up-dating procurement plans;
(iii) oversee the working of Consultants and Contractors engaged by PMO in contract management/ administration;
(iv) carry out procurement risk assessment and general procurement capacity development;
(v) building PID's capacity to become accredited for Alternate Procurement Agency;
(vi) assist the PMO in reviewing and determining contractor's claims; and
(vii) assist and render advice to the PMO in any contractual issue that may arise.

54. **Safeguard Specialist (National: 18 person-months indicative):** Responsibilities of the Safeguard Specialist will include but not limited to the following:

(i) review Resettlement Plan (RP) and resettlement conditions pf loan and ensure these are followed during the award of contract and construction work;
(ii) review RP for consistency with SPS 2009 and outline of a RP. Identify any gaps and assist PMO in addressing those gaps to ADB's satisfaction; and
(iii) assist and render advice to PMO in any other Resettlement issue that may arise during design stage.

55. **Agronomist (National: 18 person-months indicative):** Responsibilities of the Agronomist will include but not limited to the following:

(i) review the available resources of each area in terms of agronomic aspects including irrigation methods, efficacy of existing agricultural practices, irrigation requirements, water productivity, cropping patterns & intensities, input use levels, crop yields etc.;
(ii) address issues and suggest solutions to the problems related to crop production as confronted by the farmers for bringing the wastelands under cultivation;
(iii) Identify and recommend water efficient crop varieties based on soil and climatic conditions for each area/ zone;
(iv) review crop water requirements (CWR) by using climatic data (rainfall, sunshine, humidity, wind speed, temperature etc.);
(v) review guidelines/ manual for irrigation and fertigation schedules to meet input requirements of proposed crops in each area;
(vi) review crop budgets/ farm budgets under existing and proposed conditions for identifying economically viable interventions and cropping patterns for each area; and
(vii) review and identify requisite agronomic support to be provided to the farmers for successful adoption of proposed interventions to enhance crop & water productivities for each area.

VI. REPORTING REQUIREMENTS AND TIME SCHEDULE FOR DELIVERABLES

Reporting Requirements:

56. The consultants will have a dual reporting function to the Executing Agency (EA) and ADB. The consultants will prepare the following reports in English with Arial font (12 for headings and 11 for body text). The tables should use 10 Arial. The consultant will submit Table of Contents (TOC) for each report for prior approval of the client. A brief description of some important reports is given below.

(i) **Quarterly Progress Report:** Ten copies of Quarterly Progress Reports shall be presented quarterly before the 10th day of the subsequent quarter and shall indicate progress of the implementation of the consultancy contract. The issues that may hinder implementation as planned shall be flagged in these reports along with the suggested solutions.

(ii) **Resettlement Plans:** The project falls in "Category A" under ADB's resettlement guidelines meaning that there may likely be significant impacts for at least 200 persons due to the project. Based on this reclassification, the TA Consultants have developed a draft resettlement framework, and resettlement action plan (RAP) for a subproject that was likely to encounter the greatest resettlement impacts. The ADB and Government of Punjab have agreed to the following principles with regard to resettlement under the project:

- the approach to resettlement under the project should not be to remove all persons who have encroached on the right of way(s), but to move only those persons who will be directly affected,
- design will be drafted with the objective of minimizing resettlement activities, and
- contract packages and execution of civil works will be directed in such a way to minimize resettlement activities.

The Consultants would assist PMO in updating the RAP prepared during PPTA on the basis of the detailed design and assist PMO in preparing RAP to meet funding agency's requirements for any other area affecting more than 200 persons.

(iii) **Draft and Final Design Criteria:** The Consultants shall prepare the draft design criteria for review by the Client. The final design criteria shall be prepared after incorporating / remedying the comments made by the Client.

(iv) **Detailed Engineering Design Report:** Both the draft and final version of Detailed Design Report shall be prepared separately. The Report shall comprise of sections / sub-sections covering detailed field surveys, investigations and all types of engineering and economic studies. The Report shall consist of detailed design after incorporating comments of the Client. The reference of the formulae used in calculations will be mentioned in the calculation sheets in the remarks column for ease of review. Soft copy of the design calculations in Excel with formula format or any other software used will be submitted with the design reports.

(v) **Tender drawings and Construction Drawings:** Based on the detailed design carried out, the consultants shall prepare tender drawings as well as construction drawings for all facets of the construction works.

(vi) **Engineer's Estimate:** Prepare the Engineer's Estimate of the expected cost of construction immediately prior to the finalization of bidding documents. This estimate shall be based on the most up-to-date assessment of construction rates prevailing at the time and shall include all items such as contractor's mobilization and insurance costs, allowance for all necessary provisional sums and estimated day works, and contingencies.

Deliverables

57. The consulting services will be for 36 months. The schedule for various reports and documents that are likely to be generated has been prepared. Additional reports shall be developed as required. The consultants will supply the deliverables as per schedule given below along with the respective soft copy thereof:

Report	No. of Copies	Submission deadline
Draft Inception Report	10	One (01) month after the Commencement of Services
Final Inception Report	25	Two (02) months after the Commencement of Services
Quarterly Progress Report	10	10th of the following Quarter
Identified Priority Project – A Remodeling and Upgrading of Dera Ghazi Khan Canal System		
Draft Updated Feasibility Report	25	04 months after the Commencement of Services
Final Updated Feasibility Report	25	05 months after the Commencement of Services
Draft Design Criteria	10	07 months after the Commencement of Services
Final Design Criteria	10	08 months after the Commencement of Services
Draft Design Reports including detailed Calculation folder and software	10	11 months after the Commencement of Services
Final Design Reports	25	12 months after the Commencement of Services
Resettlement Plans	10	07 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	08 months after the Commencement of Services
Draft PC-I	25	12 months after the Commencement of Services
Final PC-I	25	13 months after the Commencement of Services
Engineer's Estimate	10	13 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	14 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mech. and Electrical works	25	15 months after the Commencement of Services
Development / Review of System's Operational Rules	10	16 months after the Commencement of Services
Identified Priority Project – B Rehabilitation and Upgrading of Upper Jhelum Canal System		
Draft Updated Feasibility Report	25	13 months after the Commencement of Services
Final Updated Feasibility Report	25	14 months after the Commencement of Services
Draft Design Criteria	10	16 months after the Commencement of Services
Final Design Criteria	10	17 months after the Commencement of Services
Draft Design Reports including detailed Calculation folder and software	10	21 months after the Commencement of Services
Final Design Reports	25	22 months after the Commencement of Services
Resettlement Plans	10	20 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	21 months after the Commencement of Services
Draft PC-I	25	22 months after the Commencement of Services
Final PC-I	25	23 months after the Commencement of Services
Engineer's Estimate	10	23 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	24 months after the Commencement of Services
Complete set of Construction Drawings	25	25 months after the Commencement of Services

Report	No. of Copies	Submission deadline
for all Civil, Mech. and Electrical works		
Development / Review of System's Operational Rules	10	26 months after the Commencement of Services
Identified Priority Project – C Greater Thal Canal (Phase-III) Project		
(a) Greater Thal Canal (Phase III-A) – Dhingana Branch System and Mehmood Sub Branch Systems		
Draft Updated Design Criteria (for both GTC Phase III-A and III-B)	10	27 months after the Commencement of Services
Final Updated Design Criteria (for both GTC Phase III-A and III-B)	10	28 months after the Commencement of Services
Draft Updated Design Reports including detailed Calculation folder and software	10	30 months after the Commencement of Services
Final Updated Design Reports	25	31 months after the Commencement of Services
Resettlement Plans	10	29 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	30 months after the Commencement of Services
Draft PC-I	25	32 months after the Commencement of Services
Final PC-I	25	33 months after the Commencement of Services
Engineer's Estimate	10	33 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	34 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mechanical and Electrical works	25	35 months after the Commencement of Services
Development / Review of System's Operational Rules	10	36 months after the Commencement of Services
(b) Greater Thal Canal (Phase III-B) – Noorpur Branch System		
Draft Design Reports including detailed Calculation folder and software	10	30 months after the Commencement of Services
Final Design Reports	25	31 months after the Commencement of Services
Resettlement Plans	10	32 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	32 months after the Commencement of Services
Draft PC-I	25	32 months after the Commencement of Services
Final PC-I	25	33 months after the Commencement of Services
Engineer's Estimate	10	34 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	35 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mech. and Electrical works	25	36 months after the Commencement of Services
Development / Review of System's Operational Rules	10	36 months after the Commencement of Services
Identified Priority Project – D Remodeling of R-Q, Q-B & B-S Link Canals		
(a) Remodeling of Rasul-Qadirabad (R-Q) Link Canal		
Draft Updated Feasibility Report	25	15 months after the Commencement of Services
Final Updated Feasibility Report	25	16 months after the Commencement of Services
Draft Design Criteria	10	17 months after the Commencement of Services

Report	No. of Copies	Submission deadline
Final Design Criteria	10	18 months after the Commencement of Services
Draft Design Reports including detailed Calculation folder and software	10	20 months after the Commencement of Services
Final Design Reports	25	22 months after the Commencement of Services
Resettlement Plans	10	18 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	19 months after the Commencement of Services
Draft PC-I	25	23 months after the Commencement of Services
Final PC-I	25	24 months after the Commencement of Services
Engineer's Estimate	10	25 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	26 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mech. and Electrical works	25	27 months after the Commencement of Services
Development / Review of System's Operational Rules	10	27 months after the Commencement of Services
(b) Remodeling of Qadirabad-Balloki (Q-B) Link Canal		
Draft Updated Feasibility Report	25	22 months after the Commencement of Services
Final Updated Feasibility Report	25	23 months after the Commencement of Services
Draft Design Criteria	10	25 months after the Commencement of Services
Final Design Criteria	10	26 months after the Commencement of Services
Draft Design Reports including detailed Calculation folder and software	10	27 months after the Commencement of Services
Final Design Reports	25	28 months after the Commencement of Services
Resettlement Plans	10	26 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	27 months after the Commencement of Services
Draft PC-I	25	29 months after the Commencement of Services
Final PC-I	25	30 months after the Commencement of Services
Engineer's Estimate	10	31 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	32 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mech. and Electrical works	25	33 months after the Commencement of Services
Development / Review of System's Operational Rules	10	33 months after the Commencement of Services
(c) Remodeling of Balloki-Suleimanki (B-S) Link Canal		
Draft Updated Feasibility Report	25	28 months after the Commencement of Services
Final Updated Feasibility Report	25	29 months after the Commencement of Services
Draft Design Criteria	10	30 months after the Commencement of Services
Final Design Criteria	10	31 months after the Commencement of Services
Draft Design Reports including detailed Calculation folder and software	10	32 months after the Commencement of Services
Final Design Reports	25	33 months after the Commencement of Services
Resettlement Plans	10	32 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	32 months after the Commencement of Services
Draft PC-I	25	34 months after the Commencement of Services
Final PC-I	25	35 months after the Commencement of Services

Report	No. of Copies	Submission deadline
Engineer's Estimate	10	35 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	36 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mech. and Electrical works	25	36 months after the Commencement of Services
Development / Review of System's Operational Rules	10	36 months after the Commencement of Services
Project Completion Report	25	36 months after the Commencement of Services

Project Readiness Financing facility for Punjab Water Resources Management

Project Implementation Shedule

Activities		Advance Action	PRF Year 1												PRF Year 2												PRF Year 3												PRF Year 4											
		2019	2020												2021												2022												2023											
		Q4	Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
		-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
A	PC-II Preparation and Approval																																																			
B	Recruitment of Design Consultants																																																		
C	Inception Reports																																																		
D	Review of Projects Priority																																																	
Project A	(i) Remodeling and Upgrading of Dera Ghazi Khan Canal System (Updated Feasibility Study and Detailed Design)																																																		
	(ii) Preparing procurement documents and processing. PC-I approval of Remodeling and Upgrading of Dera Ghazi Khan Canal System Project																																																		
Project B	(i) Rehabilitation and Upgrading of Upper Jhelum Canal System (Updated Feasibility Study and Detailed Design)																																																		
	(ii) Preparing procurement documents and processing PC-I approval of Rehabilitation & Upgrading of Upper Jhelum Canal System Project																																																		
Project C	(i) Greater Thal Canal (Phase III-A) - Dhingana Branch System and Mehmood Sub Branch Systems (Updated Detailed Design)																																																		
	(i)(a) Preparing procurement documents and processing PC-I approval of Greater Thal Canal (Phase III-A) Project																																																		
	(ii) Greater Thal Canal (Phase III-B) - Noorpur Branch (Updated Detailed Design)																																																		
	(iii) Preparing procurement documents and processing PC-I approval of Greater Thal Canal (Phase III-B) Project																																																		
Project D	(i) Remodeling of R-Q, Q-B & B-S Link Canals (Updated Detailed Design)																																																		
	(ii) Preparing procurement documents and processing PC-I approval of Remodeling of R-Q, Q-B & B-S Link Canals																																																		
	Project Completion																																																		

VII. CLIENT'S INPUT AND COUNTERPART PERSONNEL

58. The Client shall make available to the Consultants at no charge the following facilities:

(i) Access to all reports, studies, data, photographs, maps, and institutions relating to the works, access to all sites for surveys and investigations.
(ii) Assistance to procure all necessary administrative documents including but not limited to visas, exchange control documentation, import licences, exemption certificates, work permits, driving licences, resident visas.
(iii) Free use of vehicles[8] procured by the Consultants for official purposes and approved personal use, during the entire period of consultancy services. The vehicles procured by the Consultants will be returned to Client after the completion of the Consultancy services.
(iv) Permission to use facilities such as Guest Houses, payable at the official rates, will be granted where possible, to members of the Consultants' staff in connection with their official duties.

VIII. INFORMATION TO FACILITATE PROPOSAL PREPARATION

59. The information on engineering design of the project is open/ available to all shortlisted firms for fair competition and can be obtained from the Project Management Office at the address indicated in Clause 2.1 of Data Sheet, RFP.

[8] As *per Client indicative estimate, consultant may provide four (04) vehicles (one car 1300 cc, two cars 1000 cc, one double cabin pickups (4x4) and one motorcycle (70 cc) for their use in performance of the assignment. However, actual requirements and pricing of the same shall be done by the consultants themselves in their proposals as per their own experience and assessment of the work quantum.*

Annexure A
SUMMARY OF FOUR PRIORITY PROJECTS

PROJECT A: Remodeling and Upgrading of Dera Ghazi Khan Canal System

Feasibility Study Consultants: Joint Venture of Engineering & Agricultural Service Entity-Pakistan and Quality Engineering and Consultancy Services

Culturable Command Area: 384,082 ha (949,087 acre)

Location: Dera Ghazi Khan and Rajanpur tehsils

Estimated Cost: $68.00 million

Status of Studies and Specific Issues: Dera Ghazi Khan Canal, a non-perennial channel, off taking from Taunsa Barrage on the right bank of river Indus was commissioned in 1959. DG Khan main canal was initially designed to carry 8,757 cusecs and later on remodeled to 11,549 cusecs as its authorized discharge. All structures on the main canal have been designed for the same discharge. It was anticipated at the time of designing of DG Khan Canal that area between DG Khan Canal and River Indus besides some partial area on the right side of DG Khan Canal would be irrigated through DG Khan Canal system, for which DG Khan Canal will be remodeled to carry a discharge of 14,503 cusec. Though the capacity of DG Khan was enhanced from 8,757 cusecs to 11,549 cusecs, it is still unable to carry the anticipated discharge of 11,549 cusecs due to problems in approach angle of river resulting in un-balanced flow, deterioration of banks, excessive berm growths and due to abnormal silt deposit in the bed of channel which ranges from 1 ft to 2.5 ft in depth resulting incapacitation of the channel section.

The Feasibility Study for Remodeling and Upgrading of Dera Ghazi Khan Canal System was awarded to **Joint Venture of Engineering & Agricultural Service Entity-Pakistan and Quality Engineering** and Consultancy Services by Executive Engineer, DG Khan Canal Division. The main objectives of the feasibility study were as follows:

i) Due to construction of Kachi Canal on right side of D.G. Khan canal, flow pattern of hill torrent flood water across hill torrent crossing structure already constructed on D.G. Khan canal system has been changed.
ii) To carry out hydraulic survey of D.G. Khan Canal system, establish bottlenecks / problems in feeding D.G. Khan Canal to its designed discharge and propose solution for improvement of efficiency of D.G. Khan Canal system.
iii) There is chronic tail shortage problem especially in Rajanpur Canal Division which requires detailed investigation and engineering solution to the problem.

The feasibility study for D.G. Khan Canal was completed in January 2018 which indicated that the viability of the Project with high rate of return which is obvious on the count that if the system can deliver 11,549 cusecs against the presently running capacity of 8,757 cusecs only, the difference is almost 1/3rd of the capacity and the rehabilitation would result in increase in intensity and yields both. The feasibility has been prepared for discharge of 11,549 cusecs however the structures have been checked for 14,503 cusecs, the ultimate discharge.

PROJECT B: Rehabilitation and Upgrading of Upper Jhelum Canal (UJC) System

Feasibility Study Consultants: Barqaab Consulting Services (Pvt.) Ltd. (Lead), Rehman Habib Consultants (Pvt.) Ltd. (JVP) and Engineering & Agricultural Service Entity-Pakistan (JVP)

Culturable Command Area: 244,328 ha (603,749 acre)

Location: Between Mangla Dam and Khanki Barrage. The canal **traverses through the districts of Jhelum, Gujrat, Mandi Bahauddin, and Gujranwala**

Estimated Cost: $174.00 million

Status of Studies and Specific Issues: The Upper Jhelum Canal Project area lies to Longitude – 73° 42' 55" to 74° 01' 23" of East and Latitude – 32° 27' 44" to 33° 05' 36" of North and is located between Rim stations of Mangla on Jhelum River and New Khanki Barrage on Chenab River. The Upper Jhelum Canal traverses in districts of Jhelum, Gujrat, Mandi Bahuddin and Gujranwala.
UJC was designed in 1905 and commissioned in 1915. The design discharge of UJC at the time of commissioning was 8,500 cs. However, in 1923 the design discharge of the canal was increased to 9,031 cs. The canal was partly remodeled in 1982 on the request of WAPDA for providing 1,800 cs of additional water to Rasul Hydropower Station but head discharge was restricted to 8,500 cs due to abnormal scour in the head reach. Since then it is running with restricted head discharge.

UJC is designed to serve as a Link channel connecting River Jhelum with River Chenab to mitigate the shortages of canal supply upstream of New Khanki Barrage. The off-taking system of New Khanki Barrage as Lower Chenab Canal (LCC) needs about 6,000 - 8000 cs during certain lean periods (Rabi season) from UJC Link channel.

At present, the UJC is unable to deliver its authorized discharge of 8,500 cs and facing severe silting problems in the middle and tail reaches particularly reach RD 244+000 to 417+805 (Tail) is badly silted up. The recommended freeboard (FB) of 3 ft is not available in major portion of the canal sections and almost upstream of all hydraulic structures (bridges, falls, X-regulators and head regulator of the distributaries). There are chances of breaches due to weak banks and overflowing sections, especially in reach downstream of Khokhra Head Regulator. Most of the worn-out decking of bridges and regulators need replacement. The overall conveyance efficiency has significantly decreased and most of the Gates and Gearing systems have badly deteriorated. The Feasibility Study for Remodeling of Upper Jhelum Canal was awarded to **Joint Venture of Barqaab Consulting Services (Pvt.) Ltd. (Lead), Rehman Habib Consultants (Pvt.) Ltd. (JVP) and Engineering & Agricultural Service Entity-Pakistan (JVP)** in February 2016 by Executive Engineer, Jhelum Division. The main objectives of this study were as follows:

i) To improve conveyance efficiency, reliability and durability of the system as per enhanced proposed discharged by rehabilitating / remodeling Upper Jhelum Canal.
ii) To ensure water supply for Rasul Power House.
iii) To ensure water supply at tail for Shadiwal Power House.
iv) To ensure irrigation supplies for Khanki heads in dry / rabi season.

The feasibility study (FS) report was submitted in May 2017 and it has been discussed at various forums. The canal and structures remodeling will (i) increase the canal capacity at head from 8,500 cubic feet per second (cfs) to 12,655 cfs; and (ii) enable two (02) power houses to achieve full potential of 33 megawatt (MW) up from current generation of 10 MW. The Consultants recommended the project being technically and economically viable on fast track basis to offset

the shortage of River Chenab at New Khanki Barrage during the winter season.

Several alternatives were investigated at the feasibility stage. However, the report has not been rigorously reviewed by experts and hence there is little agreement among various Punjab Irrigation Department (PID) specialists on the final solution.

PROJECT C: Greater Thal Canal (GTC) Project (Phase III) - (Dhingana Branch, Nurpur Brach And Mahmood Sub Branch Systems)

Detailed Design Consultants: JV of National Engineering Services Pakistan, National Development Consultants (Pvt.) Ltd., Associated Consulting Engineers-ACE (Pvt.) Limited and Barqaab Consulting Services (Pvt.) Ltd. in association with Engineering General Consultants EGC (Pvt) Limited.

Culturable Command Area: 440,850 ha (1,088,900 acre)

Estimated Cost: $600 million

Project Background: Greater Thal Canal Project, with a designed capacity of 8,500 cusec (240 m^3/s), aims at new irrigated agriculture development of 1.738 million acres (703,345 ha) CCA of land, in the eastern part of Thal Doab falling within the boundaries of Bhakkar, Layyah, Khushab, Jhang and Muzaffargarh districts. The project envisages increasing crop production from 12,032 ton/ annum to 2,250,950 ton/ annum at full development ensuring food security for the increasing population of Pakistan. The project will not only result in boosting of economy but will also bring improvement in quality of life associated with socio-economic and socio-cultural changes in the life of poor people of the project area.

The overall project comprises main canal (34 km length – lined) with 5 branch canals (Mankera, Chaubara, Dhingana, Nurpur and Mahmood Sub Branch) in a length of 341 km, distributaries/ minors of about 2,000 km length. The Project PC-I amounting to Rs. 30,467 million was approved by ECNEC in 2002. The design capacity Greater Thal canal is 8,500 cusec with water allowance of 3.88 cusec/ 1000 acres. The Project feasibility study was prepared by the Consultants hired by WAPDA during 1992-94 and detailed design for the entire scheme was completed in 2007.

Project Phasing: Greater Thal Canal (Phase-I) works, covering the construction of canals up to minors for a CCA of 0.356 million acres (144,068 ha), were completed under WAPDA during 2008 at a cost of Rs. 10.17 billion. The GTC overall project was then handed over to Punjab Irrigation Department in October 2009 for operation and implementation of remaining two phases. The Phase II project (Choubara) was decided to be constructed by the provincial government, and the WAPDA detailed design was updated by the consultant engaged by the PID in 2017-2018. The PID and ADB agreed in April 2019 that the Choubara branch system construction will be shifted from the provincial government financing to ADB financing. **As regards the last Greater Thal Canal (Phase-III) Project,** the Asian Development Bank (ADB) has agreed to include it in the ensuing ADB's Project Readiness Financing Facility (PRF) for developing an implementation project. The current consulting assignment envisages, amongst others, updating the project detailed design and preparation of land acquisition and resettlement plan, social safeguard documents, project PC-I and procurement documents including technical specifications etc.

Phase-I: Construction Completed by WAPDA in 2008

- Construction of main canal and 8 No. direct distributaries with minors.
- Construction of Mankera branch and distribution system.

Phase-II: Undertaken under ADB Financing

- Updated detailed design and construction of Chaubara branch and distribution system will be done under ADB Financing.

Phase-III: Planned to be taken up by PID under PRF

- Updating detailed design and construction of Dhingana branch and distribution system.
- Updating detailed design and construction of Nurpur branch and distribution system
- Updating detailed design and construction of Mahmood Sub branch and distribution system.

Salient features of Greater Thal Canal (Phase-III)

Sr. No.	Canal	Discharge (Cusecs)	CCA (Acres)	Canal Length
1	Dhingana Branch Canal	3,879	200,931	Branch Canal: 91 km Distributaries: 450 km Minors: 101 km Outlets: 1,014 No.
2	Nurpur Branch Canal	1,500	124,615	Branch Canal: 58 km Distributaries: 224 km Minors: 128 km Outlets: 609 No.
3	Mehmood Sub Branch	1,480	115,304	Sub Branch Canal: 54 km Distributaries: 296 km Minors: 17 km Outlets: 527 No.

PROJECT D: Remodeling of R-Q, Q-B & B-S Link Canals

Feasibility Study Consultants: Joint Venture of National Engineering Services Pakistan (Pvt.) Limited (NESPAK), AAB (Pvt.) Limited (AAB), and Development and Management Consultants (DMC).

Proposed Culturable Command Area: 1,083,159 ha (2,676,544 acres)

Estimated Cost: $50.00 million

Project Background: Rasul-Qadirabad (R-Q), Qadirabad-Balloki (Q-B), and Balloki-Suleimanki (B-S) Link Canal System is the water transfer system where the capacity enhancement is needed to remove capacity constraint for reducing water shortages in the canal commands served from this system and rehabilitating the structures where necessary.

The R-Q Link Canal is the first tier of three link canals forming Rasul-Qadirabad-Balloki-Suleimanki Link System which connects four eastern rivers i.e. Jhelum, Chenab, Ravi and Sutlej. R-Q link offtakes from Rasul Barrage with a full supply discharge of 19,000 cusec. This unlined canal is 29 miles long, and outfalls into River Chenab upstream of Qadirabad Barrage. This Link Canal meets the water transfer requirement of Q-B Link, which in turn fulfills water requirement of canal systems offtaking from Balloki Barrage on River Ravi and Suleimanki and Islam Barrages on River Sutlej.

Q-B Link Canal is the second tier in the inter-river water transfer system. With a design discharge of 25,000 cusec, this Link Canal takes off from Qadirabad Barrage and outfalls into Ravi River upstream of Balloki Barrage. Although the capacity of this canal has been increased from 18,500 cusec to 25,000 cusec, the structures have not been correspondingly modified. Therefore,

backing up of water takes places at various regulation structures even at discharge of 22,000 cusec particularly at the aqueduct of Gajar Gola distributary and LCC Complex. The maximum discharge which is presently carried by the canal is only 22,000 cusec against the official figure of 25,000 cusec.

The Balloki-Suleimanki Link Canal is the third and last segment of this inter-river transfer system. This Link canal offtakes from River Ravi at Balloki Barrage and flows in a southern direction for distance of 53 miles towards River Sutlej where its outfalls at a point approximately 10 miles above Suleimanki Barrage. In June 1960, capacity of the Link was increased from 15,200 cusec to 18,500 cusec. For carrying this enhanced discharge, the first 14 miles unlined reach of the canal was widened to accommodate additional 6,500 cusec, and thereafter a new (unlined) canal, was dug to run parallel to existing lined BS-I to carry additional discharge of 6,500 cusec. This parallel unlined canal is designated as Balloki-Suleimanki-II (BS-II) Link Canal.

To meet the increased irrigation demand of Sutlej Valley Canals, BS Link Canal System was remodeled repeatedly by Irrigation Department, first from 18,600 cusec to 22,000 cusec, and then from 22,000 cusec to 24,500 cusec. In the most recent remodeling of canal in 2003-2005, the capacity of BS-II was raised from 6,500 cusec to 9,000 cusec. The BS-II Link runs parallel to the BS-I along its left, or up-doab side, for a distance of 38 miles and ends at tail regulator constructed adjacent to the outfall structure of the BS-I. The two Links discharge into a common outfall channel that extends about a mile into Sutlej River.

TERMS OF REFERENCE 2:

DETAILED DESIGN CONSULTANTS FOR HARNESSING OF HILL TORRENTS IN D. G. KHAN AND RAJANPUR

I. BACKGROUND

1. Pakistan's population of 210 million in 2017 is projected to reach 229 million in 2025. The increase in population combined with improved living standards will require 40% to 50% additional food by 2025. This additional food can be achieved through expanded irrigated area and agricultural productivity, wherever opportunities exist. Increased agriculture activities will also contribute to job creation and poverty reduction in the province's rural communities. Punjab, Pakistan's second largest province, contributes about 80% to the country's food requirements and 57% to the production value of the country's agriculture. Irrigated agriculture accounts for more than 26% of Punjab's gross domestic product and employs over 40% of its labor force. Punjab manages an existing irrigation system serving 8.4 million hectare (ha) irrigated land. The value of Punjab's irrigation infrastructure has been estimated at $20 billion (2005-06 estimates).

2. Agriculture production in Punjab has benefitted from the Indus Basin Irrigation System (IBIS) that provides irrigation water to 15 million ha of land, of which about 60% lies in Punjab. The IBIS is the lifeline of the Punjab agriculture sector. However, deteriorated century-old structures and inefficient water management within irrigation schemes and /or on farm resulted to the unreliable surface irrigation water delivery in the IBIS. Some cultivable lands in Punjab remain outside of the IBIS and relay on unpredictable scarce rainfall or ground water that may lower the water table. Although the Government of Punjab has placed a high priority on improving irrigation infrastructure and its efficiency[1], additional efforts are required for improved agriculture productivity and water use efficiency to achieve economic growth target and food security in the province.

3. Although hill torrents in D G Khan and Rajanpur, and the area they traverse before entering the Indus River, lie in the Indus basin, they are not part of the IBIS. The area of about 100,000 hectares (ha) the hill torrents traverse, is currently used for crop production using spate irrigation, residual moisture and recharging of local aquifers. However, there is potential of improvement in spate irrigation, watershed management in the catchment, building reservoirs, flood protection and developing an irrigation network to cover a vast command area which will greatly help in meeting the food security targets of the country and improving livelihood of millions of the residents of the area. In this context, the Punjab provincial government has identified Harnessing of Hill Torrents in Dera Ghazi Khan and Rajanpur as one of the priority projects to improve water availability in the area and, thus, increase productivity of the agriculture sector. The project will also provide flood protection to the infrastructure in the area which includes residential and farm areas, roads, D G Khan Canal and Kachhi Canal. The Government has identified 13 potential hill torrents that are expected to serve a culturable command area (CCA) of 80,937 ha with estimated cost of US$316 million. This is subject to feasibility studies and detail design as there are uncertainties related to floods, hydraulic challenge of guiding or storing flood flows, sediment loads, economics, water rights, and management models. In addition, previous studies indicated paucity of data and thus warrants further review of selected hill torrents, harnessing the

[1] The Punjab Irrigation Department (PID) has taken actions by working closely with ADB, the World Bank, and Japan International Cooperation Agency for the improvement of irrigated agriculture. ADB's $700 million multitranche financing facility for Punjab Irrigated Agriculture Investment Program has successfully supported the improvement of the irrigation infrastructure, on-farm agriculture of over 2 million ha, and institutional reforms.

water and feasible interventions before undertaking the detail design.

4. The provincial government, through the Government of Pakistan, has requested the Asian Development Bank (ADB) to provide support for improved project preparation of these priority projects. A project readiness financing (the PRF) is proposed as the financing modality.

II. OBJECTIVES OF THE ASSIGNMENT

5. The PRF will identify and recommend feasible interventions in hill torrents in Dera Ghazi Khan and Rajanpur for improved water and agriculture productivity. The PRF will support project readiness of selected hill torrents for the proposed project "Harnessing of Hill Torrents in Dera Ghazi Khan and Rajanpur".

III. SCOPE OF SERVICES, TASKS AND EXPECTED DELIVERABLES

General Approach:

6. The services will be carried out in three-phased approach. **Phase 1:** (i) review secondary information including available data and studies of 13 hill torrents, (ii) perform desk based assessment of proposed interventions, (iii) provide recommendations for selecting, possibly, 7-8 hill torrents for improving, upgrading or conducting feasibility studies, (iv) present alternate options other than proposed in previous studies, (v) install stream gauging and sediment sampling stations at key locations of the hill torrent, observe the flow and sediment data. **Phase 2:** feasibility studies of 7-8 hill torrents (see footnote [2]). **Phase 3:** detail design, procurement documents and other documents and studies to fulfill the project readiness support for 4-5 hill torrents (see footnote 2).

7. In transition from each stage to the next, the consultants are required to provide a walk-through of their recommendations to wider-stake holders including the panel of experts. There is a possibility that final intervention of any hill torrent may result in a mix of interventions, notably and not limited to new or improved spate irrigation infrastructure, improving catchment degradation, flood management, improving interaction between spate irrigation and groundwater, water storages, improved soil and field water management, agricultural practices and extension services, and improved capacities of institutions and beneficiaries.

8. A brief description of the projects is placed as **Annexure A2** to the TOR

9. More specifically, the scope of services for the consultants will include but not limited to:

General Scope

(i) during initial stages of the study period, install stream gauging, meteorological, and sediment sampling stations at key locations of the hill torrents, collect the field information, analyze it, and use it in the design of the project;
(ii) study all available data and studies of hill torrents (total 13 or more) in the area;
(iii) provide recommendations for selecting, possibly, 7-8 hill torrents for improving, upgrading or conducting feasibility studies while ensuring efficacy and compliance with

[2] The person months are based on reviewing 13 hill torrents, 7-8 feasibility studies and 4-5 detail design. In case of change in this number, the Client and Consultants will adjust the scope of the Services and each party shall give due consideration to any proposals for modification or variation made by the other Party.

funding agency's and government's requirements, including undertaking of additional social, agricultural, hydrological, topographical, and geotechnical investigation and surveys;

(iv) detail design, procurement documents and other documents and studies to fulfill the project readiness support for 4-5 hill torrents;

(v) during the first year, the consultant will identify the most viable and economical hill torrent development model project based on the available data and surveys and discussion with the client and pursue further studies and detailed design of the model hill torrent project;

(vi) prepare feasibility level outputs documenting the viability of civil works while adequately addressing both environmental and resettlement issues and outlining in detail the implementation arrangements, service delivery mechanisms and monitoring and evaluation procedures;

(vii) carry out required additional field surveys and geotechnical, hydrological and other investigations necessary for final designs of the identified priority projects;

(viii) provide necessary support for their independent technical and economic reviews and oversight to ensure improved quality in the updated feasibility studies, design and other related issues; based on the fresh topographic surveys, investigations and studies carried out, prepare layouts of the irrigation and drainage system for the project area;

(ix) prepare recommendations of water allowance, irrigation intensity, and cropping pattern; prepare capacity and command statements for the watercourses, channels, dams, and weirs; determination or location of each hydraulic structure including outlets; identification of crops suitable for command area; recommend efficient irrigation system models; prepare water balance; collection of agricultural data from primary and secondary resources, and estimation of present agriculture situation in the command area and in the adjacent irrigated areas; formulation of agriculture parameters including land-use, cropping pattern, season of crops, quantity of inputs, cultural operations and production of outputs;

(x) after completing feasibility studies of all hill torrents of the project area, the consultant will discuss the results and recommendations with the client and select the four to five most suitable hill torrents and pursue further studies and detailed design of the selected hill torrents;

(xi) carry out required additional surveys, geotechnical investigations, hydrological analysis and other such activities where necessary to provide a basis for final design of all hydraulic structures.

(xii) prepare Chakbandi plan (document showing characteristics of area served by the outlet) of each outlet showing field levels, location of nakkas for new canal systems.

(xiii) design and prepare longitudinal profiles and cross sections for irrigation and drainage channels;

(xiv) prepare hydraulic, structural, electro-mechanical and geotechnical design criteria;

(xv) identify various hydraulic structures for efficient conveyance of irrigation and drainage flows;

(xvi) design necessary flood protection works for main canal, distribution system and other project works as required;

(xvii) carry out physical model studies for flood protection works for main canal, distribution system and other project works where needed;

(xviii) prepare / update detailed engineering design for all facets of construction works of the identified priority projects including tender and construction drawings of the irrigation systems covering bridges, canal falls, cross regulators, small dams, head regulators, aqueducts, outlets and all associated cross drainage works including electro-mechanical works and will be designed strictly in accordance with the accepted state of the art methods and irrigation science, hydraulics, soil mechanics and structural engineering. It

must be kept in mind that lessons learnt from previous hill torrents projects (infrastructure and associated activities) need to be incorporated in new schemes. Moreover, effective innovations to mitigate flood damages need to be included;

(xix) analyze all hydraulic design options for ensuring satisfactory sediment transport and minimizing cost requirements without sacrificing system performance or control required for efficient and equitable distribution of irrigation water;

(xx) prepare rules for optimal sediment control into head regulator and amend Operation and Maintenance Rules of falls / dams / other civil structures accordingly;

(xxi) identify minor and distributary canals those involve community participation, conduct walk-thorough pre-design exercise with the community and consider related resettlement and environmental issues in the design;

(xxii) use focus groups and stakeholder consultation to develop a rehabilitation process for distributary and minor canals that fully involves farmers in general in both the detailed design and implementation of system improvements;

(xxiii) develop relevant operation and maintenance (O&M) strategies for main canals, distribution systems and barrages under the projects

(xxiv) ensure that while carrying out design works, optimal solution of technical, environmental and social issues is kept in consideration;

(xxv) analyze design options for all aspects of the head-works (if applicable) and main canal rehabilitation and upgrading including cross and head regulators, bridges, measurement structures, escapes, lining and all necessary earthworks as well as evaluating potential construction modalities to be considered with a view to timely and cost effective rehabilitation; divide the project works in to suitable number or contract packages, prepare Bill of Quantities, cost estimate;

(xxvi) explore relevant non-crop interventions (like farmers' training, crop production support interventions, value-addition initiatives, animal husbandry, tree plantation, etc.) that may facilitate additional income to the project beneficiaries;

(xxvii) assess procurement, financial management, and O&M capacity of the relevant agencies and propose measures for improvement, if any required;

(xxviii) prepare / review the Climate Change Risk Assessment study and ensure that design adequately considers the climate change impacts and is stable against factors such as impacts on agriculture water uses, frequent and excessive flows and sedimentation;

(xxix) prepare and/ or update PC-I and all necessary appendixes for government's review and approval, including necessary revisions to incorporate comments from the relevant government authorities;

(xxx) prepare Engineer' Estimate for civil, mechanical and electrical works, packaging of contracts following ADB's Procurement Policy 2017 and Procurement Regulations for Borrowers (2017, as amended from time to time) and their procurement methods;

(xxxi) prepare tender documents for different contract packages, update/prepare bidding documents incorporating EMP and gender action plan (GAP);

(xxxii) prepare/ update land acquisition and resettlement plan (LARPs) and environmental impact assessment (EIA) or IEE, environmental management plan (EMP) as required under national laws as well as ADB's Safeguard Policy Statement (SPS) (2009, as amended from time to time) and relevant government laws and regulations;

(xxxiii) prepare TOR for environmental monitoring and management required during construction and implementation of the five ensuing projects.

(xxxiv) train selected PID staff with a view to strengthening their ability to adequately oversee resettlement activities under each of the ensuing priority projects;

(xxxv) train designing and implementation of spate irrigation / hill torrent and local knowledge to PID and Agriculture Department Staff;

(xxxvi) assess social and gender impact and prepare social development and gender action plans

(GAP) and participation and communication strategy;
(xxxvii) address specific needs of women farmers for each of the ensuing loans to ensure targeted gender category is expected “effective gender mainstreaming”;
(xxxviii) conduct or revise project benefits, and economic and financial analysis; and document economic, social and environmental rationale to justify the proposed investments;
(xxxix) advise on soil reclaiming and develop effective use strategies for optimal use of the limited canal supplies and local groundwater resources with identification of crops suitable for canal command;
(xl) develop cropping and land use patterns consistent with the proposed integrated development of livestock and crop production together with the Irrigation Specialist, Range Management Specialist, and Livestock Specialist;
(xli) prepare viability of the hydropower generation in project works and provide necessary provisions of interface where necessary while designing such structures;
(xlii) prepare detailed implementation plans preferably using software such as Primavera P6 or equivalent for monitoring the project activity and generating progress reports using ‘earned value’ criteria. This shall provide a baseline for all subsequent plan amendments, if needed;
(xliii) carry out necessary rectification, modifications and improvement of documents resultant to review of any or all project documents by the Irrigation Department, allied sister departments of the Government of the Punjab, Government of Pakistan, and financers/ donors;
(xliv) prepare responses to audit observations and paras in respect of the payments made to consultants and assist the Employer in getting them resolved;
(xlv) attend project level meeting with Working Group, ADB Missions as required;
(xlvi) prepare all the supporting documents and provide legal support to Employer and attend court / hearing if required;
(xlvii) supervise engineering or other studies associated with the project and its components as per instructions of the client;
(xlviii) prepare/ update draft Operational Manuals for all the major structures, main canal and each branch and distributary canal in the command ensuring optimization of water deliveries using the existing or newly constructed facilities;
(xlix) assist the Client in preparation of quarterly, semiannual and annual progress reports for sending to Donors and government offices; and
(l) Support the PMO and ADB missions, as required.

10. **Specific Scope.** Specific Tasks for Collecting Hydro-meteorological Data, and Preparing and Updating Feasibility Studies of the **Harnessing of Hill Torrents in Dera Ghazi Khan and Rajanpur**, followed by their detailed designing.

- **Installation of Hydro-meteorological Stations, Collection of Data, and its Analysis:** During initial stages of the project, the consultant would install stream gauging, meteorological and sediment data collection / sampling stations, study the field observation records and analyze them. This data will be compared with the data used in the previous feasibility studies and various parameters adjusted as deemed necessary.
- **Ranking List for Major Hill Torrents:** More than 200 hill torrents originate from Suleiman range and after crossing Pachad area, spread over in the canal command area of DG Khan and Rajanpur District. Out of above, thirteen are major of which again, four hill torrents namely Chachar, Vidore, Mithawan and Kaha have created huge floods and devasted vast irrigation area in the year 2010-2015. Dispersion structures made in the past on various hill torrents have not worked efficiently and some effective innovations are required to mitigate the flood damages by constructing delay action/ storage dams to

attenuate the flood peaks of hill torrent floods. At present, feasibility studies for Chachar, Mithawan and Vidore dams have been prepared. As regards Kaha hill torrent, its feasibility study etc has been picked up by WAPDA. The Consultants will review and analyze the available data/ documents and develop ranking list/ priority of dams for all major hill torrent sites. Out of that, PID plans that Consultants will provide recommendations for selecting, possibly, 7-8 hill torrents for improving, upgrading or conducting feasibility studies and then take up 4-5 hill torrents, under the ADB's Project Readiness Financing Facility. The selection of priority 4-5 hill torrents shall be completed during first year of the Consultancy services. The local knowledge about spate irrigation and international practices in this subject need to be applied in formulation of hill torrent projects.

- **Selection of a Model Project:** During the first year, the consultant will identify the most viable and economical hill torrent development model project based on the available data and surveys and discussion with the client and pursue further studies and detailed design of the model hill torrent project.
- **Flood Protection:** During the recent years, hill torrents have created huge floods and devasted vast irrigation area. For the selection of the priority hill torrent projects, the Consultants will specifically consider the factor of flood protection to the infrastructure in the area which includes residential and farm areas, roads, D G Khan Canal and Kachhi Canal.
- **Design of Dams:** The consultant will review all aspects of the design of the proposed dams with particular emphasis on hydrology, sedimentation, hydraulics, geotechnics, structures, and dam safety; and give recommendations for revisions, if any.
- **Multiple Uses of Water:** The economic returns would be limited if the water is used exclusively for conventional irrigated agriculture. The returns could be significantly increased if the water is used for human consumption, as well as high-value crop production using HEISs. The proposed project activities will lead to ground water recharge which could facilitate conjunctive use of surface, stored, and ground water, thus enhancing sustainability and providing flexibility in systems operation. The department of Livestock and Dairy Development; and Forestry, Wildlife and Fisheries need to be associated to provide the services to support livestock development.
- **Command Area Development (CAD) Activities:** In this context, the consultants will:
  - (i) prepare inventory of quantity and quality of all available resources including soil types, topography, availability of surface/ groundwater resources, groundwater depths, aquifer quality, depletion trends, recharge rates along with their sources, number of tubewells & density, rainfall pattern, rainwater harvesting potential & its contribution in irrigation, farm sizes, land tenure etc. The resource assessment would also include farming practices, irrigation methods, efficacy of existing agricultural practices, water productivity, cropping patterns & intensities, input use levels, crop yields etc. The consultants will carry out field surveys for ground truthing/ verification of such data gleaned from various documents/ reports, statistical records etc;
  - (ii) consultants will develop a detailed engineering and revenue Chakbandi of the proposed new outlets/ watercourses;
  - (iii) suggest suitable farmers' friendly cost sharing arrangements for various packages of interventions for each area to promote adoption of modern technologies e.g. watercourse development, LASER land levelling, drip/ sprinkler irrigation systems, tunnel farming etc. among various categories of farmers after thorough consultation with the farming community and the OFWM wing of Agriculture Department;
  - (iv) recommend mechanisms and plans for capacity building of farmers as well as training of other stakeholders for each area to ensure provision of technical assistance for successful adoption of proposed interventions;

(v) carry out economic and financial analyses for each of the proposed package/ CAD model and intervention for each area.;
(vi) explore the possibility for development of waste lands through cooperative, corporate or any other such farming mode, prepare data of potential agricultural lands and range lands development. For this, present status of land (barren, shingle, uneven, boulders/rocky etc.) need to be documented along with ownership and user rights. The data will include quantity, quality and characteristics of land and including land tenure; and
(vii) consult with the OFWM wing of Agriculture Department and propose a comprehensive implementation strategy for the recommended development options including investment priority, timeframe, institutional setup, stakeholders, roles/ responsibilities.

- **Use of More Efficient Agriculture Management Techniques:** Considering limited amount of water, high evapotranspiration, remoteness of the area, and development of new areas; the consultant need to promote more efficient management techniques like HEISs; tunnel farming; use of solar pumps; and growing high-value fruits, vegetables, condiments, and medicinal products. The project would provide a unique opportunity for organic crop production considering livestock development is likely to be an important component of the project which would provide farmyard manure.
- **Spate Irrigation:** The consultant will train/orient PID and Agriculture Department Staff in theory and practice of spate irrigation in Pakistan and will share knowledge of other countries to have better understanding of hill torrent as integrated resource management. The consultant will liaise with different academic / research institutions and projects within country and international level to get support in hill torrent knowledge.
- **Value Addition and Value Chain:** The consultant will be required to explore the possible value addition activities relevant to the project and promotion of value chain particularly relevant to the products (like wool, meat, and grains, fruits, and vegetables produced in the project area).
- **Sustainability:** The consultant will need to design the project to ensure sustainability by devising suitable operation and maintenance (O&M) procedures, maximum cost recovery, strong stakeholders' participation at all stages, and project design suitable for local conditions and culture.
- **Climate Change Adaptations:** The consultant will incorporate suitable adaptations in project design that will meet the challenges of climate changes.
- **Sediment Studies:** The consultant will review the already available sediment studies for hill torrent projects and will conduct the sediment studies including sediment loads and transport modelling preferably for three years from Irrigation Research Institute / any other independent source and will incorporate the results of these studies in their detailed design.
- **Groundwater Investigations:** The consultant will carry out groundwater investigations by aquifer mapping using Geophysical and other techniques / tools by monitoring Groundwater quality and levels from Groundwater Management Cell of Irrigation Research Institute / any other independent source and will incorporate the results of these studies in their detailed design.
- **Due Diligence:** The consultant will ensure that the project complies fully with the ADB due diligence guidelines related to environment, involuntary resettlement, and social aspects including gender.
- **Revision and Updating of Project Design, Costs, and Economic and Financial Analyses:** The consultant will develop alternate development plans, including non-crop initiatives (like farmers' training, crop production support interventions, value-addition

initiatives, animal husbandry, tree plantation, etc.) that may facilitate additional income to the project beneficiaries, with their estimated costs and benefits and select the most suitable alternate in consultation with all stakeholders including PID and ADB. The consultant will prepare the feasibility level design for the selected alternate and revise the economic and financial analysis following relevant ADB Guidelines.

- The consultant will develop alternate development plans, including non-crop initiatives (like farmers' training, crop production support interventions, value-addition initiatives, animal husbandry, tree plantation, etc.) that may facilitate additional income to the project beneficiaries, with their estimated costs and benefits and select the most suitable option in consultation with all stakeholders including PID and ADB. The consultant will prepare the feasibility level design for the selected alternate, and revise the economic and financial analysis following relevant ADB Guidelines; and review all other documents required for project readiness as indicated in section (b) "Detailed Engineering Designs and Project Readiness Support."
- **Detailed Engineering Designs and Project Readiness Support:**
  - (i) the Consultants shall proceed with the identified priority projects and complete the detailed engineering designs of all structures for the selected alternatives of the project components i.e. main canal, distribution system, crossings of Hill torrents and drainage measures including all electro-mechanical works.
  - (ii) prepare cost estimates and PC-I of the Projects as and when required for approval. For the purpose of cost estimating:
    - all unit prices for major quantities of work shall be established by the latest methods. These methods will simulate each construction activity in such a way as to fit it into the available time span in the proposed construction schedule. Construction equipment, crews, materials and other resources would be adjusted to accomplish the work within the required time span. The computations or unit prices shall be supported by detailed sets or financial price with source.
    - indirect cost of construction for all major items should be established separately. Total cost of each construction item shall then be obtained by multiplying the direct cost of construction by a bid factor representing the influence of indirect cost.
  - (iii) preparation or cost estimates of the project broken into local and foreign components. These shall include:
    - reasonable breakdown by major items or electro-mechanical and civil works or canal / irrigation network. Price for major civil works and permanent equipment shall be estimated on the basis of internationally advertised open competitive bidding (OCB).
    - environmental Impact Assessment and Resettlement Action Plan with cost estimation.
    - project engineering and management expenses and an adequate allowance of physical contingencies.
    - import duties, taxes and interest during construction (to be assessed separately and not be included in the base cost estimate).
    - preparation or a construction schedule using CPM analysis and schedules for annual construction expenditures, both for local and foreign currency components, throughout the construction period as well as a schedule of annual expenditures for resettlement Action Plan and other item.
    - task shall culminate at the production by the consultants of a design report with the cost estimate to be discussed in PMO, PID, Steering Committee and ADB.
  - (iv) preparation of tender drawings with sufficient details for the purpose of international competitive bidding.
  - (v) preparation of tender documents (Bidding documents including BOQ, special

provisions and technical specifications) in line with FIDIC Conditions of Contract for Construction. The bidding documents shall cover the civil / electro-mechanical works of the project and its components.

(vi) preparation of construction drawings complete in all respect for all civil, electrical and mechanical works.

Survey and Investigations

(i) The consultant will plan and execute additional surveys, geotechnical investigations and other such activities where necessary to provide a basis for both detailed designing and subsequent preparation of construction drawings. The consultants shall hire, with prior approval of the client, any additional services of such other agencies responsible for carrying out the aforesaid surveys, investigations and model studies. etc.

IV. TEAM COMPOSITION AND QUALIFICATION REQUIREMENTS FOR KEY EXPERTS

11. The Consultant will maintain one (01) office at Lahore, amongst other, their design team that will work for performance of the consulting assignment. However, during the initial stage of the Consultancy assignment, the Consultants may establish a field office in site for installation of hydro-meteorological stations, collection of data etc. for a period of twelve (12) months.

Indicative Staffing Requirements for Design Consultants

12. Following matrix represents the client's reflection on the consultant's team composition and indicative estimation of person-months for its team staffing for feasibility review, detailed design, tender and construction drawings and performance of the assignment. The prospective consultants should, however, propose their own breakdown of staffing and level of effort / staff work based on their own experience and evaluation of the proposed services. The consultants should propose a realistic deployment schedule for all positions depending on the work requirements as all positions listed below would have inputs for different durations.

13. Indicative outputs are 139 person-months of key experts (15 international person-months and 124 person-months national person-months) and 269 person-months of non-key experts as shown in the table below. Person-months of the Key experts and the composition of the Non-key experts and their person-months and assignment schedule will be evaluated as part of work plan and methodology of the services. and consultants' ability to provide all required professionals. The assignment further envisages an additional pool of 30 unallocated person-months of experts under "physical contingencies" to support the implementation of assignment components as and when required. The estimated duration of the consulting services is thirty-six (36) months. The consultants shall follow and deploy the professionals as per the implementation schedule given.

CONSULTING SERVICE REQUIRED FOR FEASIBILITY REVIEW AND DETAILED DESIGN

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
KEY EXPERTS					

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
KEY EXPERTS (International)					
1	Watershed Management Specialist	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Civil / Water Resources / Hydraulic Engineering is preferable and would be rated higher.	20	15 years' professional experience in the planning and design of large-scale water resources development projects. Five years of that experience shall have been on similar hill torrent projects and 05 years will have been on major projects in South Asia.	04
2	Environmental Specialist	Master's degree in Environmental Sciences/ Environmental Engineering, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in conducting environmental assessment[3] of major water sector projects in accordance with the World Bank or ADB's Environmental Guidelines.	03
3	Spate Irrigation Specialist	B.Sc. Civil Engineering / Agriculture Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or Ph D in Water Resources / Irrigation Engineering is preferable and would be rated higher	15	10 years' proven practical and theoretical expertise of spate irrigation in various countries including Five (05) years of integrated spate irrigation experience related to agricultural, watershed, range management, biodiversity, climate change, water ponds, soil conservation and livestock sectors in accordance with the World Bank or ADB's Environmental Guidelines.	04
4	Dam Specialist	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Civil / Hydraulics Engineering is preferable and would be rated higher.	15	10 years' professional experience in design and construction supervision of major water resources projects including 05 years' specific experience in rehabilitation/ design, construction and operation of barrages/ dams, headworks and similar hydraulic structures.	04
Sub-Total Key Experts (International)					**15**
KEY EXPERTS (National)					

[3] It includes 'environmental screening".

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
1	Water Resources Management Specialist / Team Leader	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or Ph D in Water Resources / Hydraulic Engineering / Irrigation Engineering is preferable and would be rated higher.	20	15 years' professional experience in planning, designing and management of large scale irrigation and drainage systems including those where conjunctive use is an important aspect. 05 years of that experience will have been related to large scale irrigation / water management systems in a senior position. Also 05 years of experience as Team Leader of water sector project.	30
2	Lead Design Engineer / Deputy Team Leader	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Water Resources / Hydraulic Engineering / Irrigation Engineering is preferable and would be rated higher.	20	15 years' professional experience in design of new and rehabilitation of existing large scale irrigation / water management systems including 05 years' specific experience in design of similar projects in a senior position.	24
3	Senior Hydraulic Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Water Resources / Hydraulic Engineering is preferable and would be rated higher.	15	10 years' professional experience in design of civil works on major hydraulic structures of large water sector projects including 05 years' specific experience in planning and designing of dams.	8
4	Senior Structural Design Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Structural Engineering is preferable and would be rated higher.	15	10 years' professional experience in structural design of major infrastructure including 05 years' specific experience in design of new and rehabilitation of barrages, dams, head-works and canal head regulators on major irrigation projects.	15
5	Senior Groundwater /	B.Sc. Civil Engineering, or other relevant	15	10 years' professional experience in groundwater	06

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
	Drainage Engineer	degree, or equivalent professional experience. An additional Master's degree or PhD in civil / hydraulic engineering and/or hydrogeology is preferable and would be rated higher.		utilization and management including 05 years' specific experience in similar position related to alluvial aquifer systems.	
6	Senior Hydrologist	B. Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Water Resources Engineering / Hydrology is preferable and would be rated higher.	15	10 years' professional experience in hydrological analysis/ studies on major streams in the Indus Basin including 05 years' specific experience in similar position on dams.	12
7	Environmental Specialist	Master's degree in Environmental Sciences / Environmental Engineering, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in conducting environmental assessment[4] of major water resources projects in accordance with GoP and ADB's Environmental Guidelines	08
8	Dam Expert	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Civil / Hydraulics Engineering is preferable and would be rated higher.	15	10 years' professional experience in design and construction supervision of major water resources projects including 05 years' specific experience in rehabilitation/ design, construction and operation of barrages/ dams, headworks and similar hydraulic structures.	08
09	Resettlement Specialist	Master's degree in Sociology / Rural Sociology / Social work / Social Sciences, or other relevant degree, or equivalent professional experience.	15	10 Years' professional experience in activities relating to land acquisition and planning & implementation of resettlement plans on large construction projects including 05 years' specific experience in similar position on large water	06

[4] It includes 'environmental screening".

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
				sector projects in accordance with GoP and ADBs' / World Bank's Social Safeguards Policy Guidelines.	
10	Procurement Specialist	B. Sc. Civil Engineering, or other relevant degree, or equivalent professional experience.	15	10 years' experience in the procurement of civil works and contract management including 03 years' specific experience in similar position related to procurement under ADB / World Bank Projects using international and national competitive bidding procedures.	03
11	Economist	Master's degree in Project Economics, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in costing and analyzing the economics of major irrigation investment projects under ADB / World Bank Projects.	04
	Sub-Total Key Experts (National)				**124**
Total Key Experts (International & National)					**139**
NON-KEY EXPERTS (National)					
1	Irrigation Design Engineers	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Water Resources/ Irrigation Engineering is preferable and would be rated higher.	12	08 years' professional experience in design of irrigation civil works including 05 years' specific experience in design of new and rehabilitation works on major canal systems.	18
2	Hydraulic Design Engineer (02 persons) • 1st. person = 30 month • 2nd. person = 15 month	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Hydraulic / Engineering is preferable and would be rated higher.	12	08 years' professional experience in detailed design of the hydraulic aspects of civil works related to irrigation and drainage projects including 05 years' specific experience in design of new and rehabilitation of existing barrages, headworks and canal head regulators.	45

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
3	Structural Design Engineers (02 persons) • 1st. person = 15 month • 2nd person = 12 month	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Structural Engineering is preferable and would be rated higher.	10	07 years' professional experience in structural design of major infrastructure including 04 years' specific experience in structural design of headworks, barrages, and other hydraulic structures on large canals	27
4	Geotechnical Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or PhD in Geotechnical Engineering is preferable and would be rated higher.	15	10 years' professional experience in design of geotechnical works for major hydraulic structures including 05 years' specific experience in design of similar works on dams.	12
5	Mechanical Engineer	B.Sc Mechanical Engineering, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in design / fabrication and operation of gates, hoists and mechanical equipment for major irrigation and drainage projects.	06
6	Hydrologist	B.Sc Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Water Resources Engineering/ Hydrology is preferable and would be rated higher.	15	10 years' professional experience in hydrological analysis/ studies on major streams in the Indus Basin including 03 years' specific experience in similar position on dams.	15
7	Geologist	B.Sc. Civil Engineering or M.Sc. in Geology, or other relevant degree, or equivalent professional experience. An additional Master's degree in Water Resources Engineering is preferable and would be rated higher.	15	10 years' professional experience in Planning and supervision of various geological investigation programs in the structural design of head-works, bridges and other hydraulic structures of major streams of the Indus Basin.	03

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
8	Modelling Expert	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree in Civil / Hydraulics Engineering is preferable and would be rated higher.	15	10 years' professional experience in modelling the hydraulic aspects of civil works related to irrigation and drainage projects including 05 years' specific experience in physical modelling of rivers and major irrigation structures.	03
9	Procurement Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience.	12	08 years' professional experience in procurement of civil works including 05 year's specific experience in procurement under ADB / World Bank Guidelines using ICB procedures under FIDIC Conditions of Contract for Construction.	06
10	Spate Irrigation Specialist	B.Sc. Civil Engineering / Agriculture Engineering, or other relevant degree, or equivalent professional experience. An additional Master's degree or Ph D in Water Resources / Irrigation Engineering is preferable and would be rated higher	10	05 years' professional experience in design of irrigation civil works including 03 years' specific experience in design of new and rehabilitation works on major canal systems.	12
11	Water Management Specialist (WMS) / Agricultural Engineer (AE)	B.Sc. Agriculture Engineering, or other relevant degree, or equivalent professional experience. Master's degree in Agriculture Engineering. / Water Resources Management.	15	10 years' professional experience in water management activities in public/ private sector including 07 years' specific experience in on-farm water management, command area development and irrigated agriculture development projects with demonstrated ability to work with government officials, technical field staff, donors and farmers. In addition, WMS/ AE should have familiarity with the principles and practices of participatory community development, irrigated agriculture and water	08

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
				management related issues besides fluency in spoken and written English.	
12	Irrigation Agronomist	Master's/ Ph.D degree in Agronomy/ Agriculture, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in the relevant field in public/ private sector including 05 years' specific experience in irrigation agronomy and irrigated agriculture development projects. Should have demonstrated ability to work with government officials, technical field staff, donors and farmers. In addition, work experience in related computer tools, good communication skills, fluency in English and satisfactory record of similar consultancies would be preferred.	06
13	Horticulturist/ High Value Agriculture (HVA) Specialist	Master's/ Ph.D degree in Horticulture, or other relevant degree, or equivalent professional experience.	10	05 years' professional experience in horticulture related activities with 03 years; specific experience in development of irrigated agriculture and high-value agriculture projects. Work experience in related computer tools, good communication skills, fluency in English and satisfactory record of similar consultancies would be preferred.	06
14	Assistant Agriculture Engineer	Bachelor's degree in Agriculture Engineering, or other relevant degree, or equivalent professional experience.	10	05 years' professional experience engineering in on-farm water management projects. Work experience in related computer tools, good communication skills, fluency in English and satisfactory record of similar consultancies would be preferred.	08

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
15	High Efficiency Irrigation Systems Specialist	B. Sc. Civil Engineering, or other relevant degree, or equivalent professional development. An additional Master's degree in Water Management Systems is preferable and would be rated higher.	15	10 years' professional experience in planning, design and setting up of high efficiency irrigation systems.	02
16	Range Management Specialist	B.Sc. Agriculture / Forestry or equivalent, or other relevant degree, or equivalent professional experience. An additional Master's degree in Forestry is preferable and would be rated higher.	15	10 years' professional experience in planning, design, and management of range lands.	02
17	Livestock Development Specialist	Basic degree in Veterinary Sciences / Animal Husbandry, Doctor of Veterinary Medicine (DVM), or other relevant degree, or equivalent professional experience. An additional Master's degree in Livestock Management is preferable and would be rated higher.	15	10 years' professional experience in planning, design, and management of livestock.	03
18	Climate Change Specialist	Graduate degree preferably post graduate degree, in civil engineering, hydrology, climate science, or other relevant degree, or equivalent professional experience.	10	05 years' professional experience in carrying out climate risk and vulnerability assessment of irrigated agricultural project together with experience of climate change adaptation measures for such projects.	02
19	GIS Expert	Master's degree in GIS / Space Science, or other relevant degree, or equivalent professional experience.	15	10 years' professional experience in GIS database development of Water Resources Systems.	05

Sr. #	Position	Qualification	General/ Overall experience (Years)	Job Specific experience (Years)	Indicative Input of Experts (Months)
20	Junior Sociologist	Master's degree in Sociology / Rural Sociology / Social work/ Social Sciences, or other relevant degree, or equivalent professional experience.	07	05 years' professional experience in developing social studies and plans for large-scale water sector projects in Pakistan	12
21	Junior Resettlement Expert	Master's degree in Sociology / Rural Sociology / Social work / Social Sciences, or other relevant degree, or equivalent professional experience.	07	05 years' professional experience in planning and implementing resettlement programs associated with irrigation infrastructure projects.	09
22	Social Development and Gender Expert (preferably female)[5]	Master's degree in Sociology/ Anthropology/ Gender & Women Studies/ Economics, or other relevant degree, or equivalent professional experience.	07	04 years' professional experience in working with development organizations, communities (rural areas) and government line departments and implementation of social development programs and gender action plan (GAP) on various projects including 02 years' specific experience in similar position on various projects with multiple donors.	03
23	Survey Engineer	B.Sc. Civil Engineering, or other relevant degree, or equivalent professional experience.	07	05 years' professional experience in surveying of civil works preferably related to irrigation and drainage projects.	06
24	Junior Engineers (3-4 No.)	B.Sc. Civil / Mechanical / Electrical Engineering, or other relevant degree, or equivalent professional experience.	05	03 years' professional experience in engineering design projects.	50
	Sub-Total:				**269**
	GRAND TOTAL (EXPERTS)*				**408**

* In addition, 30 person-months are unallocated.

[5] Taken into consideration the country gender and cultural context, as well as the specific tasks under the expert's TORs, a consulting firm is encouraged to engage a female gender specialist for this assignment.

Summary of the Consulting Services Required

Expertise	person-months
Key Experts (International)	15
Key Experts (National)	124
Non-key Experts (National)	269
Grant Total Experts*	**408**

* In addition, 30 person-months are unallocated.

Notes:

(i) The above-mentioned person-months include Consultant's professional input only.

(ii) The unallocated 30 person-months of experts to be paid under physical contingencies to support the implementation of assignment components as and when required.

(iii) The above positions do not include miscellaneous contract / support staff (non-technical, semi-technical and technical input) like office manager, accounts manager, accountant, surveyors, quantity surveyors, inspectors, social enumerators (male and female), auto-CAD operators, draftsmen, guards, drivers and office boys etc. They should be included in consultant's estimated reimbursable expenses items (see the item [iv] below). They should not be included in costs and person-months of experts.

(iv) All support staff in the Design Office will be provided by the Consultants who are required to include cost of such support staff in the Reimbursable Expenses items.

14. In the evaluation of technical proposals, the Key experts will be evaluated individually. The Consultants should submit CVs for all positions of Key experts. Any TBN position in the key experts will be marked zero. The CV template of ADB's Standard Request for Proposals should be used to prepare these CVs. The Consultants shall bear full responsibility for correctness of the submitted CVs.

V. JOB DESCRIPTION OF CONSULTANTS' KEY EXPERTS[6]

INTERNATIONAL EXPERTS

15. Indicative tasks of each experts are indicated below. Detailed tasks of each experts will be developed by the consultants to meet with the requirements given under scope of work and will be described in their technical proposals.

16. **Watershed Management Specialist (International: 04 person-months indicative):** Responsibilities of the Watershed Management Specialist will include but not limited to the following:

(i) Visit all catchment areas of the hill torrents included in the project and prepare an inventory of the terrains, rivers and channels, lakes, soil types, flora and fauna, settlements, and land use;

(ii) together with hydrologist, collect relevant hydro-meteorological data of the catchments and the surrounding areas, analyze it relating it with terrain and soil characteristics, and land use; and calculate the water and sediment flow characteristic of various areas within the project watershed areas;

(iii) identify key factors affecting flow patterns and sediment flows, and propose measures for regulating the flow patterns, stabilizing soils and reducing sediment flows;

(iv) identify locations and types of economical, environmental-friendly, and sustainable structural and non-structural measures for reducing flow peaks, regulating flows, and reducing sediment generation and flows; and

[6] Responsibilities of individual specialists should be read in conjunction with the capsule TOR for the undertaking as a whole. Some specialists will be involved in both the feasibility level studies and detailed design while others will provide inputs solely for planning or for detailed design.

(v) propose social means, actions, required government support, and legislation necessary for sustainable management of the project watersheds; and
(vi) provide his input regarding spate irrigation for updating the feasibility studies and preparation of detailed design for hill torrent projects using his international experience.

17. **Environmental Specialist (International: 03 person-months indicative):** Responsibilities of the Environmental Specialist will include but not limited to the following:

(i) assess and compare PID and the Punjab and Pakistan Governments' environmental legislation and frameworks with those of ADB and best international practice to identify gaps, differences or conflicts and recommend modifications and/or mechanisms to promote compatibility;
(ii) conduct initial environmental assessment and determine categorization for each of the five priority projects and for individual components and where applicable individual distributary commands as appropriate to comply with ADB's environmental assessment guidelines;
(iii) based on determined categorization, prepare initial environment examinations (IEEs) or environmental impact assessments (EIAs) studies including environmental management plans (EMPs)[7] compliant with ADB guidelines;
(iv) assess the capacity of PMO/PID staff for environmental assessment and implementation of EMPs, and assess the training requirements for capacity building;
(v) assess the environmental capacity of the Punjab and Pakistan government agencies involved in vetting and approving the environmental assessments and develop environmental assessment and review procedures and prepare detailed arrangements, agreeable to all parties, which may be used throughout the program to facilitate review of documents related to the various projects; and
(vi) identify environmental issues related to the sector or any of the ensuing projects requiring loan covenants to ensure subsequent appropriate resource management.

18. **Spate Irrigation Specialist (International: 04 person-months indicative):** Responsibilities of the Spate Irrigation Specialist will include but not limited to the following:

(i) discuss, guide, and provide national and international experience on spate irrigation by sharing lessons learnt elsewhere and within country;
(ii) provide his input regarding spate irrigation for updating the feasibilities and preparation of detailed design for hill torrent projects;
(iii) attend all meetings, provide feedback and backstopping on different aspects of spate irrigation and integrated resources management approach; and
(iv) coordinate with irrigation engineers, design engineers, agricultural engineers, sociologist/community development expert, gender and social expert, agronomist, livestock specialist and other experts on regular basis and wherever applicable.

19. **Dam Specialist (International: 04 person-months indicative):** Responsibilities of the Dam Specialist will include but not limited to the following:

(i) establish together with Water Resources Engineer, and Irrigation Engineer, the design, maximum, and variation of flows through the dam structure throughout the year;
(ii) coordinate with the Geotechnical Engineer and Survey team to get surveys and field investigations carried out for the design of the structure;
(iii) arrange physical model studies for the geometry of intake, design of dividing wall(s),

[7] EMPs should include concrete mitigation measures specific to the project context, monitoring and training plan.

training of the intake channel, and dam / barrage structure;
(iv) design the dam / barrage structure keeping in view the flow conditions and level in the main river, discharge capacity of the intake structure, and foundation conditions;
(v) design suitable tail conditions to facilitate energy dissipation and protect against banks and bed erosion; and
(vi) devise appropriate construction plan and schedule keeping in view the river flow conditions and that would result in minimum disruption to existing diversion facilities.

NATIONAL KEY EXPERTS

20. National experts can be grouped in two categories i.e. those who will support the international experts of their fields constitute the first category while those who have no international experts of their respective fields constitute the second category. National experts of the first category will assist and support the relevant principal international experts and while working under the supervision of the Team Leader will receive technical guidance directly from the relevant international expert. In each case, they will assist in carrying out all aspects of the relevant international expert' TOR and in his/her absence accept full responsibility for all aspects of his/her TOR. Therefore, detailed individual terms of reference are not separately prepared for these individuals. However, expected qualifications and detailed TOR of the national experts of the second category i.e. experts with no respective international experts, are given here.

21. **Water Resources Management Specialist / Team Leader (National: 30 person-months indicative)** Responsibilities of the Water Resources Management Specialist / Team Leader will include but not limited to the following:

(i) provide overall direction to all specialists making up the consulting team and appropriately group individuals into work units responsible for a particular feasibility study and/or detailed design undertaking;
(ii) manage relationships with Project Management Office (PMO), Punjab Irrigation Department (PID), the Punjab Government, Review Panel, and the Asian Development Bank (ADB) as well as with other stakeholders including farmers;
(iii) prepare detailed, time bound work plans for the design, and tendering of all civil works contract packages envisaged for the works assigning various team members to each key task;
(iv) provide technical support and guidance on design and tendering on all aspects of head regulators; canals; distribution system and associated facilities for livestock watering, domestic water supply, and HEIS for high value crops; and other relevant aspects;
(v) visit all catchment areas of the hill torrents included in the project and prepare an inventory of the terrains, rivers and channels, lakes, soil types, flora and fauna, settlements, and land use;
(vi) together with hydrologist, collect relevant hydro-meteorological data of the catchments and the surrounding areas, analyze it relating it with terrain and soil characteristics, and land use; and calculate the water and sediment flow characteristic of various areas within the project watershed areas;
(vii) provide coordination and oversight to ensure that monitoring and evaluation (M&E), resettlement, environmental, agricultural, on-farm water management, groundwater resource management, and institutional aspects of the studies appropriately address the situations identified on the ground;
(viii) monitor the progress of all planning and design work ensuring that deadlines relating to delivery dates are met;
(ix) review in detail both the design and construction work underway on the main, branch,

distributary, and minor canals with a view to adoption of best practice innovations;
(x) prepare comprehensive plans and feasibility level designs for rehabilitating and upgrading main, branch, distributary and minor canals including all associated control structures and other required supporting infrastructure including cross drainage, emergency escapes, bridges etc. for the commands of the project canals;
(xi) confirm both functional and structural requirements of main canal and distribution system structures in consultation with the hydraulic and structural specialist;
(xii) review and recommend any changes in supply arrangements from the main to distributary canals and from the distributary and minor canals to watercourses to improve either efficiency or equity of distribution;
(xiii) work with the agriculturist in making adequate provision for the water requirements of higher value crops which may be introduced into the cropping pattern in the future;
(xiv) provide his input regarding spate irrigation for updating the feasibility studies and preparation of detailed design for hill torrent projects using his national experience and under the guidance of International Spate Irrigation Specialist; and
(xv) attend all meetings, provide feedback and backstopping on different aspects of spate irrigation and integrated resources management approach.

22. **Lead Design Engineer / Deputy Team Leader (National: 24 person-months indicative):** Responsibilities of the Lead Design Engineer / Deputy Team Leader will include but not limited to the following:

(i) assist the Team Leader in providing, and in his/ her absence, provide overall direction to all specialists making up the consulting team and appropriately group individuals into work units responsible for a particular feasibility study and/ or detailed design undertaking;
(ii) assume overall responsibility for management and supervision of the design teams for design of new and rehabilitation and upgrading work and timely consultation on all design considerations with PMO, PID, Review Panel and ADB;
(iii) provide technical support and guidance in all aspects of the design efforts including hydrology, flood routing, physical and mathematical hydraulic modeling, canal design, sediment transport, mechanical considerations, etc.;
(iv) organize and supervise all topographic, profile, and cross-section surveys required to provide necessary input data for detailed design of the head regulators; main; branch; distributary and minor canals and associated facilities for livestock watering, domestic water supply, and HEIS for high value crops; and associated works;
(v) undertake the design of new and rehabilitation and upgrading or replacement works including but not limited to (a) head regulators, cross regulator and distributary head regulator replacement/rehabilitation for surface irrigation systems, (b) main, branch, distributary and minor canal sectioning, grading and rerouting if required, (c) upgrading and/or replacement of existing water control and bifurcation structure and provision of additional structures as required, (d) cross canal structures such as inverted siphons, aqueducts, etc., (e) required bridges and culverts, (f) mogas (watercourse outlets) as appropriate, (g) aqueducts, (h) escape facilities and associated channels, and (i) associated flood and erosion control measures; and
(vi) ensure that during designing of all structures and features of a repetitive nature, standard designs, pre-approved by the Team Leader and PMO should be used as appropriate to minimize duplicity of design inputs

23. **Senior Hydraulics Engineer (National: 08 person-months indicative):** Responsibilities of the Senior Hydraulics Engineer will include but not limited to the following:

(i) organize and coordinate topographic surveys and any other investigations required to provide necessary input data for detailed design;
(ii) work in estimating the design water levels at all points of interest for flood flows of differing return intervals and during normal operation;
(iii) use mathematical modeling results as appropriate to refine both design proposals and operating rules for each point of interest by simulating the effects of varying design parameters;
(iv) analyze hydraulic design options for all points of interest in order to come up with cost effective rehabilitation;
(v) coordinate and supervise detailed design of all hydraulic aspects of the rehabilitation works including preparation of relevant construction drawings and specifications as well as contributing as required to the preparation of the final tender documents;
(vi) undertake the design of new and rehabilitation and upgrading or replacement works of existing facilities;
(vii) design the large and deep long-term water storage areas to store flood flows for integrated development including livestock farming, domestic water supply, and crop production with HEISs;
(viii) ensure that in the design of all structures and features of a repetitive nature, standard designs, pre-approved by the Team Leader and PMO should be used as appropriate to minimize duplicity of design inputs; and
(ix) analyze all hydraulic design options for cross regulators, drop structures, measurement structures, road bridges, distributary and minor head regulators, and lined reaches ensuring satisfactory sediment transport and minimizing cost requirements without sacrificing system performance or control required for efficient and equitable distribution of irrigation water throughout the command areas.

24. **Senior Structural Design Engineer (National: 15 person-months indicative):** Responsibilities of the Senior Structural Design Engineer will include but not limited to the following:

(i) organize and undertake a critical examination targeted to establishing the overall structural and geotechnical (foundation) integrity of various sites where new structures are to be constructed or existing structures need to be rehabilitated and upgraded, identifying all remedial works required;
(ii) organize and coordinate all investigations deemed necessary for structural aspects of all features to be included in the rehabilitation and upgrading package for each project structure;
(iii) analyze structural design options for all features to be constructed/rehabilitated with a view to cost-effective, but sustainable rehabilitation;
(iv) coordinate, supervise and undertake preparation of detailed structural design, bills of quantities, and technical specifications for all required new and rehabilitation works identified requiring structural input and treatment, and contribute as required to the preparation of the final tender documents;
(v) analyze structural design options for all project works including cross regulators, distributary and minor canal head regulators, escapes, duck-bill weirs and road bridges with a view to be cost-effective, but sustainable rehabilitation; and
(vi) coordinate, supervise and undertake preparation of detailed structural design, bills of quantities and technical specifications for cross regulators, falls, distributary and minor canal head regulators, escapes, siphons, aqueducts, duck-bill weirs, moghas, and road and foot bridges as well as any other features identified requiring structural input and treatment and contribute as required to preparation of the final tender documents.

25. **Senior Groundwater/ Drainage Engineer (National: 06 person-months indicative):** Responsibilities of the Senior Groundwater / Drainage Engineer will include but not limited to the following:

(i) review all relevant studies on groundwater and drainage in the project canal commands and surrounding areas with regard to sources, recharge quantity, quality, and all aquifer characteristics require to satisfactorily project safe aquifer yields;
(ii) review and investigate each of the canal commands in question with regard to salinization and solidification of project area soils and assess the need for conjunctive use of surface water if groundwater of marginal quality is to be used for irrigation purposes;
(iii) review prior groundwater monitoring activities which establish the number and location of existing tube-wells in the command areas;
(iv) develop, for each of the project areas, a program of enhanced and regularized monitoring of groundwater levels and quality to serve as a data base for development of a finite difference groundwater model to serve as a tool for groundwater management in the command area; and
(v) identify and cost up, for each of the commands, for its respective required improvements in additions to the surface water drainage system to complement irrigation rehabilitation and upgrading.

26. **Senior Hydrologist (National: 12 person-months indicative):** Responsibilities of the Senior Hydrologist will include but not limited to the following:

(i) establish updated flood frequency analyses of the relevant river sites reflecting all recent upstream development at both the feasibility and detailed design degrees of refinement;
(ii) during the initial stages of the project, he will monitor for the installation of hydro-met equipment in the project site and will work closely for collection and analysis of the data;
(iii) evaluate the effect of the increased extent of flood levees and embankments along the rivers and the resulting confinement of flow area on the historic flood of record and the flood distribution regime at appropriate sites in the project area; and
(iv) establish flood frequency analyses for all cross-drainage facilities related to the project facilities as directed by the Irrigation Planning and Design Engineers.

27. **Environmental Specialist (National: 08 person-months indicative):** The Environmental Specialist will assist and support the relevant principal international specialists and while working under the supervision of the Team Leader will receive technical guidance directly from the relevant international specialist. In each case, the specialist will assist in carrying out all aspects of the relevant international specialists' TOR and in his / her absence accept full responsibility for all aspects of his / her TOR. The specialist will assist the international environment specialist in screening and categorizing, identifying gaps; updating environmental assessments; obtaining necessary clearance and permits domestically; carrying local disclosure and public consultation; and following national and local applicable regulations and standards.

28. **Dam Expert (National: 08 person-months indicative):** Responsibilities of the Dam Expert will include but not limited to the following:

(i) establish together with Water Resources Engineer, and Irrigation Engineer, the design, maximum, and variation of flows through the dam structure throughout the year;
(ii) coordinate with the Geotechnical Engineer and Survey team to get surveys and field investigations carried out for the design of the structure;

(iii) arrange physical model studies for the geometry of intake, design of dividing wall(s), training of the intake channel, and dam / barrage structure;
(iv) design the dam / barrage structure keeping in view the flow conditions and level in the main river, discharge capacity of the intake structure, and foundation conditions;
(v) design suitable tail conditions to facilitate energy dissipation and protect against banks and bed erosion; and
(vi) devise appropriate construction plan and schedule keeping in view the river flow conditions and that would result in minimum disruption to existing diversion facilities.

29. **Resettlement Specialist (National: 06 person-months indicative):** Responsibilities of the Resettlement Specialist will include but not limited to the following:

(i) assess all potential; resettlement impacts from the range of interventions proposed for the priority projects within the umbrella of ADB's resettlement policy;
(ii) prepare a resettlement framework consistent with ADB guidelines for each priority project;
(iii) prepare resettlement plans as required in collaboration with Resettlement Unit established in the PMO and relevant PID staff;
(iv) develop detailed implementation arrangements to carry out resettlement activities under all projects and assess the capacity within PMO/PID and other relevant agencies with respect to resettlement and prepare detailed capacity development programs for resettlement activities to be carried out under the projects;
(v) assist PID and PMO staff in complying with ADBs Guidelines for Involuntary Resettlement for those cases where resettlement or temporary disruption of production cannot be avoided;
(vi) in such cases a resettlement plan, in accordance with the existing resettlement framework will be prepared for implementation by PID; and
(vii) review PID, Government of Punjab, and Government of Pakistan policies and practice relevant to resettlement make recommendations for strengthening these and if necessary, provide draft guidelines for Government's consideration.

30. **Procurement Specialist (National: 03 person-months indicative):** Responsibilities of the Procurement Specialist will include but not limited to the following:

(i) review detailed procurement plans and packages and determine realistic time bound schedules for procurement, including parallel and sequential steps for procurement of civil works from initial steps to the delivery of the services under the contracts;
(ii) review the prequalification criteria, notices of pre-qualification and prequalification documents and conduct the prequalification of international contractors in accordance with both PID procedures and ADB guidelines;
(iii) review and update international tender documents for the new and rehabilitation and upgrading of project works in FIDIC format agreeable to PMO, PID and ADB;
(iv) documents to be prepared under (iii) above will include (a) invitation to bid, (b) instructions to bidders, (c) form of bid, (d) form of contract, (e) special and general conditions of contract, (f) drawings and specifications, (g) bill of quantities, (h) schedule of completion, and (i) all necessary addenda;
(v) advise the committee established for evaluation regarding bid opening and the technicalities of the evaluation process and ADB's guidelines and requirements pertaining thereto; and
(vi) advise on preparation of the summary of evaluation and recommendation for award.

31. **Economist (National: 04 person-months indicative):** The Economist will assist and

support the relevant principal international specialists and while working under the supervision of the Team Leader will receive technical guidance directly from the relevant international specialist. In each case, he will assist in carrying out all aspects of the relevant international specialists' TOR and in his / her absence accept full responsibility for all aspects of his / her TOR. Therefore, detailed individual terms of reference are not separately prepared for this sort of individual.

NATIONAL NON-KEY SPECIALISTS

32. **Irrigation Design Engineer (National: 18 person-months):** Responsibilities of the Irrigation Design Engineer will include but not limited to the following:

(i) review in detail both the design and construction work underway on the main, branch, distributary, and minor canals with a view to adoption of best practice innovations;
(ii) promote the use of HEIS particularly in the D G Khan hill torrents command area for growing high value crops;
(iii) design and associated facilities for livestock watering, domestic water supply, and HEIS for growing high value crops wherever required and particularly D G Khan hill torrents area,
(iv) prepare comprehensive plans and feasibility level designs for rehabilitating and upgrading main, branch, distributary and minor canals including all associated control structures and other required supporting infrastructure including cross drainage, emergency escapes, bridges etc. for the commands of the project canals;
(v) confirm both functional and structural requirements of main canal and distribution system structures in consultation with the Hydraulic and Structural Specialists,
(vi) develop effective conjunctive use strategies for optimal use of the limited canal supplies and local groundwater resources in consultation with the Groundwater Specialists and Agriculturist;
(vii) ensure that adequate flow measurement sites are provided throughout the system to facilitate both system management and monitoring of system performance; and
(viii) develop relevant operation and maintenance (O&M) strategies for the farmers relative to the distributary and minor canals and for PID relative to main canals and barrages under the projects.

33. **Hydraulic Design Engineer (02 persons) National: 45 person-months (1st person: 30 months; 2nd person: 15 months indicative):** Responsibilities of the Hydraulic Design Engineers will include but not limited to the following:

(i) organize and coordinate topographic surveys and any other investigations required to provide necessary input data for detailed design;
(ii) analyze hydraulic design options for all points of interest in order to come up with cost effective rehabilitation;
(iii) coordinate and supervise detailed design of all hydraulic aspects of the rehabilitation works including preparation of relevant construction drawings and specifications as well as contributing as required to the preparation of the final tender documents;
(iv) draft relevant portions of the Operational Manuals for the projects with emphasis on operating rules based upon water level observations, available flood prediction information and the irrigation demand on the project systems served;
(v) undertake the design of new and rehabilitation and upgrading or replacement works of existing facilities including but not limited to (a) cross regulators and distributary head regulators, (b) main canal sectioning, grading and rerouting if required, distributary and minor canal sectioning, grading and rerouting, (c) upgrading and/or replacement of

existing water control and bifurcation structures and provision of additional structures as required, (d) cross canal structures such as inverted siphons, aqueducts, etc., (e) required bridges and culverts, (f) moghas (watercourse outlets) as appropriate, (g) escape facilities and associated channels, and (h) associated flood and erosion control measures;

(vi) ensure designing the conveyance and distribution system including the canals, control structures and all associated works in accordance with accepted fundamentals of irrigation science, hydraulics, soil mechanics and structural engineering;

(vii) in the design of all structures and features of a repetitive nature, standard designs, pre-approved by the Team Leader and PMO should be used as appropriate to minimize duplicity of design inputs;

(viii) analyze all hydraulic design options for cross regulators, drop structures, measurement structures, road bridges, distributary and minor head regulators, and lined reaches ensuring satisfactory sediment transport and minimizing cost requirements without sacrificing system performance or control required for efficient and equitable distribution of irrigation water throughout the command areas;

(ix) draft relevant portions of the Operation Manuals for the project facilities ensuring optimization of water deliveries.

34. **Structural Design Engineer (02 persons) National: 27 person-months (1st person: 15 months; 2nd person: 12 months indicative):** Responsibilities of the Structural Design Engineers will include but not limited to the following:

(i) organize and undertake a critical examination targeted to establishing the overall structural and geotechnical (foundation) integrity of various sites where new structures are to be constructed or existing structures need to be rehabilitated and upgraded, identifying all remedial works required;

(ii) analyze structural design options for all features to be constructed/rehabilitated with a view to cost-effective, but sustainable rehabilitation;

(iii) coordinate, supervise and undertake preparation of detailed structural design, bills of quantities, and technical specifications for all required new and rehabilitation works identified requiring structural input and treatment, and contribute as required to the preparation of the final tender documents;

(iv) assist in drafting relevant portions of the Operational Manual with emphasis on procedures/practices to ensure the long-term structural integrity of the structure/complex;

(v) organize and undertake a critical examination targeted to establish the overall structural integrity of major structures to be constructed and/or rehabilitated identifying all remedial works required;

(vi) analyze structural design options for all project works including cross regulators, distributary and minor canal head regulators, escapes, duck-bill weirs and road bridges with a view to be cost-effective, but sustainable rehabilitation; and

(vii) coordinate, supervise, and undertake preparation of detailed structural design, bills of quantities, and technical specifications for cross regulators, falls, distributary and minor canal head regulators, escapes, siphons, aqueducts, duck-bill weirs, moghas, and road and foot bridges as well as any other features identified requiring structural input and treatment and contribute as required to preparation of the final tender documents.

35. **Geotechnical Engineer (National: 12 person-months indicative):** Responsibilities of the Geotechnical Engineer will include but not limited to the following:

(i) responsible for all geotechnical investigation at site and provide data with recommendations to designs;

(ii) review the capacity of soils for designing of structures foundations and identify any remedial foundation stabilization work to be included in the packages of works for new construction, rehabilitation, and upgrading;
(iii) review of design considerations relating to soils and materials engineering;
(iv) locate appropriate sites for materials to be used;
(v) formulate plans for and carry out detailed foundation investigations for the project facilities;
(vi) supervise the work of the sub-contracted drilling, sampling and testing services to ensure compliance with best geotechnical practice; and
(vii) prepare geotechnical and material reports.

36. **Mechanical Engineer (National: 06 person-months indicative):** Responsibilities of the Mechanical Engineer will include but not limited to the following:

(i) organize, coordinate and carry out a detailed inspection of all gates as well associated head regulator gates of the project facilities to be constructed/rehabilitated;
(ii) prepare detailed designs including drawings, specifications and costs for all remedial measures required for gate rehabilitation works;
(iii) prepare feasibility-level and detailed designs and estimate bills of quantities for the mechanical and electrical works;
(iv) coordinate and supervise detailed design of all mechanical and electrical aspects of the new and rehabilitation works including preparation of relevant construction drawings and specifications as well as contributing as required to the preparation of the final tender documents; and
(v) draft relevant portions of the Operational Manual for the proposed mechanical and electrical facilities with particular emphasis on O&M of the gates and associated hoisting equipment.

37. **Hydrologist (National: 15 person-months indicative):** Responsibilities of the Hydrologist will include but not limited to the following:

(i) establish updated flood frequency analyses of the relevant river sites reflecting all recent upstream development at both the feasibility and detailed design degrees of refinement;
(ii) evaluate the effect of the increased extent of flood levees and embankments along the rivers and the resulting confinement of flow area on the historic flood of record and the flood distribution regime at appropriate sites in the project area;
(iii) using all available data, simulations and comparisons with like situations in other river basins in South Asia, update and/or prepare a detailed and refined flood frequency analysis at each barrage site relevant to the project including comprehensive hydrographs of flood events for all return frequencies required by the principal hydraulic engineer in planning and designing the rehabilitation and upgrading of the project facilities; and
(iv) establish flood frequency analyses for all cross drainage facilities related to the project facilities as directed by the irrigation planning and design engineers.

38. **Geologist (National: 03 person-months indicative):** Responsibilities of the Geologist will include but not limited to the following:

(i) investigating the structure and evaluation of the earth and its natural resources;
(ii) surveying and mapping geologically promising sites;
(iii) collecting and recording samples and data from test sites;
(iv) analyzing geological data especially the sedimentation data received from the installed gauges using specialist computer applications and calculate the design loads for hydraulic

and structural engineers; and
(v) ascertaining extraction risks.

39. **Modelling Expert (National: 03 person-months indicative):** Responsibilities of the Modelling Expert will include but not limited to the following:

(i) identify together with the Team Leader and Irrigation Engineers, river reaches and barrage intakes/hydraulic structure, for which modelling would be desirable;
(ii) coordinate with the survey team and sediment collection team for collection of topographic, river bed, and other data required for physical model;
(iii) collect the data on river flow and its variation over the year, and the design flow the barrage/intake structure and its variation over the year;
(iv) select a suitable facility where the model would be constructed and negotiate model construction arrangements and schedule and associated cost; and
(v) supervise the running of the model and collection of data for various scenarios that would facilitate design of the new or remodeling of existing facilities.

40. **Procurement Engineer (National: 06 person-months indicative):** Responsibilities of the Procurement Engineer will include but not limited to the following:

(i) prepare detailed procurement plans and packages and prepare realistic time bound schedules for procurement, including parallel and sequential steps for procurement of civil works from initial steps to the delivery of the services under the contracts;
(ii) develop, in consultation with PMO, the prequalification criteria, prepare notices of pre-qualification and prequalification documents and conduct the prequalification of international contractors in accordance with both PID procedures and ADB guidelines;
(iii) under the direction of the Team Leader/Design Engineer and using input from various specialists on the team, prepare the international tender documents for the new and rehabilitation and upgrading of project works in FIDIC format agreeable to PMO, PID and ADB;
(iv) The documents to be prepared under (iii) above will include (a) invitation to bid, (b) instructions to bidders, (c) form of bid, (d) form of contract, (e) special and general conditions of contract, (f) drawings and specifications, (g) bill of quantities, (h) schedule of completion, and (i) all necessary addenda;
(v) invite the pre-qualified bidders to submit bids and advise the committee established for evaluation regarding bid opening and the technicalities of the evaluation process and ADB's guidelines and requirements pertaining thereto; and
(vi) advise on preparation of the summary of evaluation and recommendation for award.

41. **Spate Irrigation Specialist (National: 12 person-months indicative):** Responsibilities of the Spate Irrigation Specialist will include but not limited to the following:

(i) discuss, guide, and provide national experience on spate irrigation by sharing lessons learnt elsewhere and within country;
(ii) under the supervision of International Spate Irrigation Specialist, will provide his input regarding spate irrigation for updating the feasibilities and preparation of detailed design for hill torrent projects;
(iii) attend all meetings, provide feedback and backstopping on different aspects of spate irrigation and integrated resources management approach; and
(iv) coordinate with irrigation engineers, design engineers, agricultural engineers, sociologist/community development expert, gender and social expert, agronomist,

livestock specialist and other experts on regular basis and wherever applicable.

42. **Water Management Specialist (WMS) / Agricultural Engineer (AE) (National: 08 person-months indicative):** Responsibilities of the Water Management Specialist (WMS) / Agricultural Engineer (AE) will include but not limited to the following:

(i) analyse the potential of available water resources for their irrigated agriculture and command area development;
(ii) identify successful models adopted for development of waste lands for irrigated agriculture in neighboring/ other countries under similar conditions;
(iii) tailor the identified package for various categories/ combinations of available resources in terms of farmers, soils, and water categories for development of irrigated agriculture in various parts of these areas;
(iv) scrutinize the most suitable strategies replicable in the project areas for development of irrigated agriculture;
(v) work closely with the Economist, Irrigation Agronomist, Sociologist and other experts for recommending the technically feasible, economically viable, socially acceptable, and environmentally sustainable packages for each zone/area/region;
(vi) suggest suitable farmers' friendly cost sharing arrangements for various packages of interventions for each area in coordination with concerned experts to promote adoption of modern technologies e.g. watercourse development, LASER land leveling, drip/ sprinkler irrigation systems, tunnel farming etc. among various categories of farmers;
(vii) provide support in exploring the possibility for development of waste lands through cooperative, corporate or any other such farming mode;
(viii) recommend mechanisms and plans for capacity building of farmers as well as training of other stakeholders for each area to ensure provision of technical assistance for successful adoption of proposed interventions; and
(ix) propose a comprehensive implementation strategy for the recommended development options separately for each area including investment priority, timeframe, institutional setup, stakeholders, roles/ responsibilities, monitoring etc. The description should include all necessary information subsequently required for projects formulation.

43. **Irrigation Agronomist (National: 06 person-months indicative):** Responsibilities of the Irrigation Agronomist will include but not limited to the following:

(i) assess the available resources of each area in terms of agronomic aspects including irrigation methods, efficacy of existing agricultural practices, irrigation requirements, water productivity, cropping patterns & intensities, input use levels, crop yields etc.;
(ii) address issues and suggest solutions to the problems related to crop production as confronted by the farmers for bringing the wastelands under cultivation;
(iii) Identify and recommend water efficient crop varieties based on soil and climatic conditions for each area/ zone;
(iv) estimate crop water requirements (CWR) by using climatic data (rainfall, sunshine, humidity, wind speed, temperature etc.);
(v) develop guidelines/ manual for irrigation and fertigation schedules to meet input requirements of proposed crops in each area;
(vi) prepare cropping patterns based on the water availability for sustainability of irrigated agriculture in each area;
(vii) develop crop budgets/ farm budgets under existing and proposed conditions for identifying economically viable interventions and cropping patterns for each area;
(viii) recommend plans/packages for successful crop production including land preparation,

planting, irrigation scheduling, inter-culture, fertigation, harvesting, processing and marketing, etc. under modern crop production technologies particularly high efficiency irrigation systems; and

(ix) identify requisite agronomic support to be provided to the farmers for successful adoption of proposed interventions to enhance crop & water productivities for each area; and

(x) provide his input regarding spate irrigation for updating the feasibility studies and preparation of hill torrent projects using his national experience and under the guidance of International Spate Irrigation Specialist.

44. **Horticulturist / High Value Agriculture (HV) Specialist (National: 06 person-months indicative):** Responsibilities of the Horticulturist / High Value Agriculture (HVA) Specialist will include but not limited to the following:

(i) review the existing information about horticulture/ HVA and its potential in various areas;
(ii) carry out baseline survey to determine status of horticultural production, potential, local demand etc. in each area;
(iii) identify technical and business problems related to horticultural/ HVA development in these areas and propose solutions accordingly;
(iv) assess the role of moisture retention materials in promotion of horticultural plants in deserts;
(v) design a comprehensive strategy for crop diversification from traditional crops to high value plantations including orchards, vegetables and flowers;
(vi) develop technology driven programs to improve productivity and quality by introduction of improved varieties, medicinal plants, rejuvenation with improved cultivars, high density plantations, use of high efficiency irrigation systems etc. for each area; and
(vii) develop guidelines for successful adoption of horticulture by the farmers in each area.

45. **Assistant Agriculture Engineer (National: 08 person-months indicative):** Responsibilities of the Assistant Agriculture Engineer will include but not limited to the following:

(i) work under the WMS/ AE and assist him for carrying out the planned activities;
(ii) design CAD plans in consultation with all stakeholders for different areas;
(iii) modify the CAD plans/ designs of proposed project interventions for cost effectiveness and technical suitability;
(iv) coordinate with other team members for preparation of various CAD plans for various activities; and
(v) perform other duties as assigned by the project management.

46. **High Efficiency Irrigation Systems Specialist (National: 02 person-months indicative):** The High Efficiency Irrigation Systems Specialist will report to the Team Leader and work with the Irrigation Agronomist for planning, design, installation and management studies and formulation of the operation procedures for the system. He will support the Team Leader in preparation of related reports and returns.

47. **Range Management Specialist (National: 02 person-months indicative):** Responsibilities of the Range Management Specialist will include but not limited to the following:

(i) under the Team Leader, the Range Management Specialist will work closely with Irrigation Planning Engineer and Livestock Management Specialist to develop an integrated sustainable development plan for D G Khan hill torrents areas of which livestock would be the key component.

(ii) quantify the range area to be allocated for each water storage area and plants and shrubs to be planted under range management for the size and composition of the herd assigned to each water storage area
(iii) advise if one water storage area would require to facilitate better management by reducing crowding on one water storage area; and
(iv) advise on possibility of value chain in provision of feed and other inputs.

48. **Livestock Development Specialist (National: 03 person-months indicative):** Responsibilities of the Livestock Development Specialist will include but not limited to the following:

(i) under the Team Leader, the Livestock Development Specialist will work closely with Irrigation Planning Engineer and Livestock Management Specialist to develop an integrated sustainable development plan for D G Khan hill torrents areas of which livestock would be the key component.
(ii) determine the additional veterinary services required for the proposed intervention including the number of field centers, the facilities (infrastructure, medicines, and equipment) needed, with their investment and annual running costs;
(iii) quantify the range area to be allocated for each water storage area and plants and shrubs to be planted under the range management for the size and composition of the herd assigned to each water area;
(iv) advise on possibility of value chain in provision of feed and other inputs and handling and marketing of products like wool and animals; and
(v) explore the possibility of attracting meat companies to invest in the project area and enter into contract with the locals that would create local employment and benefit both the farmers and the companies.

49. **Climate Change Specialist (National: 02 person-months indicative):** The Climate Change Specialist will assist and support the relevant principal international specialists and while working under the supervision of the Team Leader will receive technical guidance directly from the relevant international specialist. In each case, he will assist in carrying out all aspects of the relevant international specialists' TOR and in his / her absence accept full responsibility for all aspects of his / her TOR. Therefore, detailed individual terms of reference are not separately prepared for this sort of individual.

50. **GIS Expert (National: 05 person-months indicative):** Responsibilities of the GIS Specialist will include but not limited to the following:

(i) digitize all project area using satellite imageries starting from head up to tail level;
(ii) establish GIS database for the irrigation and drainage network providing reach-wise detail of hydraulic and command parameters based on both previous data and new design parameters to expand its utility and create a central data depository of the PID;
(iii) develop / refine GIS database for groundwater monitoring system in the canal commands using coordinates of the observation points collected by Directorate of Land Reclamation (DLR) of PID. Wherever errors will be found in the coordinates, the consultants will get it corrected through DLR field staff and update the same in GIS database. All past available data relevant to the observation points e.g. depth to water table will be made part of the database;
(iv) develop groundwater quality, depth and elevation maps for the project area;
(v) digitize / extract major rail/road network present within the canal project area; and
(vi) develop / process maps in the printable form and print maps at appropriate scale in the

format and quantity as per requirement of the client.

51. **Junior Sociologist (National: 12 person-months indicative):** Responsibilities of the Junior Sociologist will include but not limited to the following:

(i) assist PMO in the development and establishment of an appropriate M&E strategy and plans for rehabilitation and upgrading of the facilities in the priority projects;
(ii) M&E systems referred to above will include input, progress, output and impact indicators and be computerized, so they are compatible with and form a part of the MIS for the project to which they apply;
(iii) plan, design and supervise the conducting of baseline, intermediate and end of Project socio-economic surveys in selected parts in the project area;
(iv) develop appropriate analytical methodology for socio-economic impact assessment; and
(v) conduct in depth workshops for PMO/PID staff and for those who will carry out the surveys in the field covering the survey design, sampling criteria, questionnaire requirements, interview methodology and survey analysis.

52. **Junior Resettlement Expert (National: 09 person-months indicative):** Responsibilities of the Junior Resettlement Expert will include but not limited to the following:

(i) assess all potential; resettlement impacts from the range of interventions proposed for the priority projects within the umbrella of ADB's resettlement policy;
(ii) prepare a resettlement framework consistent with ADB guidelines for each priority project;
(iii) prepare resettlement plans required in collaboration with Resettlement Unit established in the PMO and relevant PID staff; and
(iv) develop detailed implementation arrangements to carry out resettlement activities under all projects and assess the capacity within PMO/PID and other relevant agencies with respect to resettlement and prepare detailed capacity development programs for resettlement activities to be carried out under the projects.

53. **Social Development and Gender Expert (preferably female) (National: 03 person-months indicative):** Responsibilities of the Social Development and Gender Expert will include but not limited to the following:

(i) develop the Gender Action Plan through close working with the project team;
(ii) develop community mobilization and training plan aligned with the GAP targets and lead community consultations for the identification of trainees for livelihood raising programs as detailed in GAP;
(iii) prepare data collection tools for collecting baseline information required for upgradation of schools, health facilities and vocational trainings etc. in selected project areas;
(iv) conduct qualitative studies at suitable sites of how women see the impact on their lives of provision of improved health care, skills training, education, and recreational provision; and
(v) conduct field visits and any other function and responsibility, as assigned by the Employer.

54. **Survey Engineer (National: 06 person-months indicative):** Responsibilities of the Survey Engineer will include but not limited to the following:

(i) maintain close coordination with the GIS Expert for sharing satellite imagery;
(ii) procure from Survey of Pakistan updated survey maps covering the project area; and
(iii) establish and maintain benchmarks at suitable locations around the project facilities.

55. **Junior Engineer (Civil / Mechanical / Electrical) (National: 50 person-months indicative):** Responsibilities of the Junior Engineer will include but not limited to the following:

(i) Assist the Team Leader / Deputy Team Leader and other experts in carrying out their TORs; and
(ii) Assist the Team Leader / Deputy Team Leader and other experts in designing, prepare relevant records, work measurements, collecting and keeping the records for use by the professional staff, preparation of progress reports, financial statements, etc.

VI. REPORTING REQUIREMENTS AND TIME SCHEDULE FOR DELIVERABLES

Reporting Requirements:

56. The consultants will have a dual reporting function to the Executing Agency (EA) and ADB. The consultants will prepare the following reports in English with Arial font (12 for headings and 11 for body text). The tables should use 10 Arial. The consultant will submit Table of Contents (TOC) for each report for prior approval of the client. A brief description of some important reports is given below.

- **Quarterly Progress Report:** Ten copies of Quarterly Progress Reports shall be presented quarterly before the 10th day of the subsequent quarter and shall indicate progress of the implementation of the consultancy contract. The issues that may hinder implementation as planned shall be flagged in these reports along with the suggested solutions.
- **Resettlement Plans:** The project falls in "Category A" under ADB's resettlement guidelines meaning that there may likely be significant impacts for at least 200 persons due to the project. Based on this reclassification, the TA Consultants have developed a draft resettlement framework, and resettlement action plan (RAP) for a subproject that was likely to encounter the greatest resettlement impacts.
- The ADB and Government of Punjab have agreed to the following principles with regard to resettlement under the project:
  - the approach to resettlement under the project should not be to remove all persons who have encroached on the right of way(s), but to move only those persons who will be directly affected,
  - design will be drafted with the objective of minimizing resettlement activities, and
  - contract packages and execution of civil works will be directed in such a way to minimize resettlement activities.

  The Consultants would assist PMO in updating the RAP prepared during PPTA on the basis of the detailed design and assist PMO in preparing RAP to meet funding agency's requirements for any other area affecting more than 200 persons.
- **Draft and Final Design Criteria:** The Consultants shall prepare the draft design criteria for review by the Client. The final design criteria shall be prepared after incorporating / remedying the comments made by the Client.
- **Detailed Engineering Design Report:** Both the draft and final version of Detailed Design Report shall be prepared separately. The Report shall comprise of sections / sub-sections covering detailed field surveys, investigations and all types of engineering and economic studies. The Report shall consist of detailed design after incorporating comments of the Client. The reference of the formulae used in calculations will be mentioned in the calculation sheets in the remarks column for ease of review. Soft copy of the design

calculations in Excel with formula format or any other software used will be submitted with the design reports.

- **Tender drawings and Construction Drawings:** Based on the detailed design carried out, the consultants shall prepare tender drawings as well as construction drawings for all facets of the construction works.
- **Engineer's Estimate:** Prepare the Engineer's Estimate of the expected cost of construction immediately prior to the finalization of bidding documents. This estimate shall be based on the most up-to-date assessment of construction rates prevailing at the time and shall include all items such as contractor's mobilization and insurance costs, allowance for all necessary provisional sums and estimated day works, and contingencies.

Deliverables

57. The consulting services will be for 36 months. The schedule for various reports and documents that are likely to be generated has been prepared. Additional reports shall be developed as required. The consultants will supply the deliverables as per schedule given below along with the respective soft copy thereof:

Report	No. of Copies	Submission deadline
Draft Inception Report	10	1 month after the Commencement of Services
Final Inception Report	25	2 months after the Commencement of Services
Quarterly Progress Report	10	10th of the following Quarter
Installation of Hydro-met and Sediment sampling equipment		6 months after the Commencement of Services
Recommendations to carryout feasibility studies of 7-8 hill torrent studies using available data and studies		9 months after the Commencement of Services
Preparation of Feasible Studies for 7-8 Hill Torrents		15 months after the Commencement of Services
Hill Torrents Appraisal and Ranking List	10	15 months after the Commencement of Services
(a) Model Hill Torrent Project		
Preparation of / Updating Draft Feasibility Report	25	4 months after the Commencement of Services
Preparation of / Updating Final Feasibility Report	25	5 months after the Commencement of Services
Draft Design Criteria	10	7 months after the Commencement of Services
Final Design Criteria	10	8 months after the Commencement of Services
Draft Design Reports including detailed Calculation folder and software	10	10 months after the Commencement of Services
Final Design Reports	25	11 months after the Commencement of Services
Resettlement Plans	10	9 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	9 months after the Commencement of Services
Draft PC-I	25	12 months after the Commencement of Services
Final PC-I	25	13 months after the Commencement of Services
Engineer's Estimate	10	13 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	14 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mech. and Electrical works	25	14 months after the Commencement of Services

Report	No. of Copies	Submission deadline
Development / Review of System's Operational Rules	10	15 months after the Commencement of Services
(b) First Priority Hill Torrent		
Draft Design Criteria	10	18 months after the Commencement of Services
Final Design Criteria	10	19 months after the Commencement of Services
Draft Design Reports including detailed Calculation folder and software	10	21 months after the Commencement of Services
Final Design Reports	25	22 months after the Commencement of Services
Resettlement Plans	10	22 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	22 months after the Commencement of Services
Draft PC-I	25	22 months after the Commencement of Services
Final PC-I	25	23 months after the Commencement of Services
Engineer's Estimate	10	23 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	24 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mech. and Electrical works	25	25 months after the Commencement of Services
Development / Review of System's Operational Rules	10	25 months after the Commencement of Services
(c) Second Priority Hill Torrent		
Draft Design Criteria	10	25 months after the Commencement of Services
Final Design Criteria	10	26 months after the Commencement of Services
Draft Design Reports including detailed Calculation folder and software	10	27 months after the Commencement of Services
Final Design Reports	25	28 months after the Commencement of Services
Resettlement Plans	10	28 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	28 months after the Commencement of Services
Draft PC-I	25	29 months after the Commencement of Services
Final PC-I	25	30 months after the Commencement of Services
Engineer's Estimate	10	30 months after the Commencement of Services
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	30 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mech. and Electrical works	25	30 months after the Commencement of Services
Development / Review of System's Operational Rules	10	30 months after the Commencement of Services
(d) Third and Fourth Priority Hill Torrent		
Draft Design Criteria	10	31 months after the Commencement of Services
Final Design Criteria	10	32 months after the Commencement of Services
Draft Design Reports including detailed Calculation folder and software	10	33 months after the Commencement of Services
Final Design Reports	25	34 months after the Commencement of Services
Resettlement Plans	10	34 months after the Commencement of Services
ESIA, EMP, EMMP, GAP, Social framework agreement	10	34 months after the Commencement of Services
Draft PC-I	25	34 months after the Commencement of Services
Final PC-I	25	35 months after the Commencement of Services
Engineer's Estimate	10	35 months after the Commencement of Services

Report	No. of Copies	Submission deadline
Complete set of Bidding Documents including Technical Specifications and Tender Drawings	25	35 months after the Commencement of Services
Complete set of Construction Drawings for all Civil, Mech. and Electrical works	25	36 months after the Commencement of Services
Development / Review of System's Operational Rules	10	36 months after the Commencement of Services
Project Completion Report	25	36 months after the Commencement of Services

Harnessing Hill Torrents in Dera Ghazi and Khan Rajanpur

Project Implementation Shedule

	Activities	Advance Action			PRF Year 1												PRF Year 2												PRF Year 3												PRF Year 4											
		2019			2020												2021												2022												2023											
		Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
		-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
A	PC-II Preparation and Approval																																																			
B	Recruitment of Design Consultants																																																		
C	Inception Reports																																																		
D	Installation of Hydro-met and Sediment sampling equipment																																																	
E	Collection of hydromet data and its analysis																																																	
F	Topographic and social survey, ad geotechnical investigation																																																	
G	Collection of additional field data on soils, crops, and socio-economic aspects																																																	
H	Review and updating of available feasibility studies																																																	
I	Study and selection of the model project																																																	
J	Discussion with the client and selection of the projects for detailed design																																																	
K	Preparation of the detailed designs, bull of quantities, cost estimates and procurement documents																																																	
L	Processing and approval of PC-I																																																	
	Project Completion																																																	

VII. CLI ENT'S INPUT AND COUNTERPART PERSONNEL

58. The Client shall make available to the Consultants at no charge the following facilities:

(i) Access to all reports, studies, data, photographs, maps, and institutions relating to the works, access to all sites for surveys and investigations.
(ii) Assistance to procure all necessary administrative documents including but not limited to visas, exchange control documentation, import licences, exemption certificates, work permits, driving licences, resident visas.
(iii) Free use of vehicles[8] procured by the Consultants for official purposes and approved personal use, during the entire period of consultancy services. The vehicles procured by the Consultants will be returned to Client after the completion of the Consultancy services.
(iv) Permission to use facilities such as Guest Houses, payable at the official rates, will be granted where possible, to members of the Consultants' staff in connection with their official duties.

VIII. INFORMATION TO FACILITATE PROPOSAL PREPARATION

59. The information on engineering design of the project is open/ available to all shortlisted firms for fair competition and can be obtained from the Project Management Office at the address indicated in Clause 2.1 of Data Sheet, RFP.

[8] As *per Client indicative estimate, consultant may provide four (04) vehicles (one car 1300 cc, two cars 1000 cc, one double cabin pickups (4x4) and one motorcycle (70 cc) for their use in performance of the assignment. However, actual requirements and pricing of the same shall be done by the consultants themselves in their proposals as per their own experience and assessment of the work quantum.*

Annexure
SUMMARY

PROJECT E: Harnessing of Hill Torrents in Dera Ghazi Khan and Rajanpur

Feasibility Study Consultants: Joint Venture of National Engineering Services Pakistan (Pvt.) Limited (Lead) and Associated Consulting Engineers-ACE (Pvt.) Limited (JVP) and with Technical Resources Services (Pvt.) Limited (SC)

Culturable Command Area: 80,937 ha (200,000 acre)

Location: Dera Ghazi Khan and Rajanpur districts

Estimated Cost: $316.00 million

Status of Studies and Specific Issues: Suleman Mountainous Range runs in the vicinity of 20-30 Kilometers along D. G. Khan and Rajanpur districts. More than 200 hill torrents originate from Suleiman range and spread over in the canal command area of DG Khan and Rajanpur District after crossing Pachad area. These streams outfall in the Indus River stretched in a reach of 57 miles upstream of Taunsa Barrage to 5.5 miles upstream of Guddu Barrage. Out of the 200 hill torrents, thirteen are major, Kaura, Vehowa, Sanghar, Sori Lund, Vidore, Sakhi Sarwar and Mithawan are in DG Khan District, whereas, Kaha, Chachar, Pitok, Sori Shumali, Zangi and Sori Janubi are in Rajanpur District. The catchment area of each hill torrent has two distinct parts; mountainous area and plain area. The plain area is called as Pached area and comprises good quality land for cultivation with hill torrents flows being the only source of irrigation. The mountainous and sub mountainous catchment area is about 7,184 square miles.

Out of above thirteen major hill torrents, four hill torrents namely Chachar, Vidore, Mithawan and Kaha created huge floods in the year 2010, 2012, 2013 and 2015. These Hill Torrent mostly irrigate the Pachad area from foothills to Kachhi canal. The PID has constructed number of dispersion structures on these hill torrents to disperse flood water in the Pachad area which is constructed along the right side of the D.G Khan and Dajal Branch Canal to irrigate the area of Balochistan Province. Now Kachhi Canal is in the direct hit of these hill torrents. The dispersion structures are suitable for low flood flows whereas these structures are not working efficiently in case of high flood or as second freshet of flood. The Chachar hill torrent has no permanent structure for dispersion. Only small dikes are constructed by local irrigators for low flood, but during high flood, whole flood water reaches at Kachhi canal and Dajal Branch, the two cross drainage structures on these canals do not ample capacity to pass such high flood flows. Therefore, main objective of the feasibility study is to mitigate the flood damages by constructing delay action/ storage dams to attenuate the flood peaks of hill torrent floods.

Various studies were conducted at different forums for hill torrents management. A Hill Torrent Management Study in Dera Ghazi Khan Division was conducted under Kachii Canal Project by WAPDA in 2016 for all the thirteen hill torrents. A Feasibility Study of dams on Kaha, Chachar, Vidore and Mithawan Hill Torrents in Districts D. G. Khan & Rajanpur was awarded to **Joint Venture of National Engineering Services Pakistan (Pvt.) Limited (Lead) and Associated Consulting Engineers-ACE (Pvt.) Limited (JVP) and with Technical Resources Services (Pvt.) Limited (SC)** by Chief Engineer, DG Khan Irrigation Zone in February 2017. The objectives of the study were to:

i) explore the possible dam sites on Chachar, Kaha, Vidore & Mithawan hill torrents for the construction of storage dam across the local stream for flood mitigation;
ii) assure that the storage water shall be supplied for agriculture to improve the cropping intensities of the Pachad area and
iii) boost up the living standard of the local communities accordingly.

At present, feasibility studies for Kaha, Vidore, Mithawan and Chachar dams have been prepared. As regards Kaha hill torrent, its feasibility study etc has been picked up by WAPDA. The Consultants recommended “Short Term Measures” and “Long Term Measures” in their feasibility studies. Short Term Measures” include the improvement of existing Rodkohi system to reduce the flood hazard up to 25 years return period flood along with improvement of dispersion arrangement currently in practice. “Long Term Measures” based on 100 years return period flood are the ultimate solution for the flood management through storage / delay action dams. The priority of dams/ ranking list for the major 13 hill torrent sites will be reviewed and firmed up by the Consultants. Out of that, PID plans to take up four to five hill torrents, under the ADB’s Project Readiness Financing Facility. The documents required to be generated under the study would include projects’ updated feasibility studies, detailed design, tender drawings, construction drawings, cost estimates, social safeguard documents, PC-Is and bidding documents including technical specifications.

Salient Features of 13 Major Hill Torrents of the Project Area:

Sr. No.	Name of Hill Torrent	Catchment Area		Gross Command Area	
		Sq. miles	Sq. km	Acres	Hectares
1	Kaura	197	510	26,305	10,645
2	Vehowa	1,013	2624	51,476	20,832
3	Sanghar	1,844	4776	24,306	9,836
4	Sori Lund	187	484	34,300	13,881
5	Vidore	292	756	28,933	11,709
6	Sakhi Sarwar	56	145	27,403	11,090
7	Mithawan	248	642	38,604	15,623
8	Kaha	2,029	5255	93,690	37,915
9	Chanchar	296	767	38,310	15,504
10	*Pitok	89	231	-	
11	*Sori Shumali	128	332	-	
12	Zangi	146	378	30,978	12,536
13	Sori Janubi	659	1707	39,698	16,065
		7,184	**18,606**	**434,003**	**175,635**

* Brackish water not fit for irrigation