



# Completion Report

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Project Number: 24268  
Loan Number: 1146-PAK  
December 2010

## Pakistan: Chashma Right Bank Irrigation Project (Stage III)



## CURRENCY EQUIVALENTS

Currency Unit: Pakistan Rupee (PRs)

	<b>At Appraisal</b>	<b>At Project Completion Review</b>
	As of 31 October 1991	As of July 2010
PRs1.00 =	\$0.0405	\$0.0119
\$1.00 =	PRs24.7012	PRs83.71

## ABBREVIATIONS

ADB	–	Asian Development Bank
BIC	–	Board Inspection Committee
CCA	–	cultivable command area
CRBIP	–	Chashma Right Bank Irrigation Project
CRP	–	Compliance Review Panel
EIA	–	environmental impact assessment
EIRR	–	economic internal rate of return
EMP	–	environmental management plan
FCC	–	flood carrier channel
FEMU	–	Federal Environmental Management Unit
GRSC	–	Grievance Redress and Settlement Committee
IPD	–	Irrigation and Power Department
NDP	–	National Drainage Programme
NGO	–	nongovernment organization
NWFP	–	North-West Frontier Province
OCC	–	opportunity cost of capital
O&M	–	operation and maintenance
OFWM	–	on-farm water management
PBME	–	project benefit monitoring and evaluation
PCR	–	project completion review
PMO	–	project management office
PSCC	–	project steering and coordination committee
TA	–	technical assistance
WAPDA	–	Water and Power Development Authority (of Pakistan)
WEC	–	WAPDA's Environmental Cell
WUA	–	Water Users Association

## WEIGHTS AND MEASURES

1 hectare (ha)	–	2.471 acres (ac)
1 cubic meter (m) per second (cumec)	–	35.3 cubic feet per second (cusec)
1 acre foot (ac ft)	–	1,233 cubic meter (cu m)
1 RD	–	1,000 feet (304.8 m)

(reduced distance for indicating canal station number)

## GLOSSARY

Mogha	–	The outlet from any canal operated by the Irrigation Department to the watercourse operated and maintained by the farmers
Nucca	–	Outlet from a watercourse to a farm ditch
Kharif	–	The hot (summer) cropping season (April – September)
Rabi	–	The cold (winter) cropping season (October – March)

## NOTES

- (i) The fiscal year (FY) of the Government and its agencies ends on 30 June. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2010 ends on 30 June 2010.
- (ii) In this report, "\$" refers to US dollars.

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## BASIC DATA

### A. Loan Identification

1.	Country	Pakistan
2.	Loan Number	1146-PAK(SF)
3.	Project Title	Chashma Right Bank Irrigation Project (Stage III)
4.	Borrower	Islamic Republic of Pakistan
5.	Executing Agency	WAPDA
6.	Amount of Loan	SDR 155,608,000.00
7.	Project Completion Report Number	PCR: PAK-1204

### B. Loan Data

1.	Appraisal	
	– Date Started	23 April 1991
	– Date Completed	16 May 1991
2.	Loan Negotiations	
	– Date Started	6 November 1991
	– Date Completed	8 November 1991
3.	Date of Board Approval	17 December 1991
4.	Date of Loan Agreement	19 February 1992
5.	Date of Loan Effectiveness	
	– In Loan Agreement	19 May 1992
	– Actual	19 November 1992
	– Number of Extensions	3
6.	Closing Date	
	– In Loan Agreement	30 September 2000
	– Actual	Not yet closed as of 10 December 2010
	– Number of Extensions	5
7.	Terms of Loan	
	– Service Charge	1%
	– Maturity (number of years)	35 years
	– Grace Period (number of years)	10 years
8.	Disbursements	
	a. Dates	

Initial Disbursement	Final Disbursement <sup>1</sup>	Time Interval
01 April 1993	14 June 2010	17 yrs. 2 mos. 14 days
Effective Date	Original Closing Date	Time Interval
20 November 1992	30 September 2000	8 yrs. 10 mos. 11 days

<sup>1</sup> The liquidation/refund of unliquidated imprest advance is still to be finalized which might affect the final date of disbursement.

## b. Amount (SDR)

Category No. (1)	Category Name (2)	Original Allocation (3)	Last Revised Allocation (4)	Amount Disbursed <sup>2</sup> (5)	Undisbursed Balance <sup>2</sup> (6 = 4 - 5)
<b>I</b>	<b>Civil Works</b>				
A.	Part A	23,299,000	88,715,600	84,671,977	4,043,623
B.	Part B	4,094,000	12,592,060	14,310,575	-1,718,515
C.	Part C	736,000	3,797,700	2,205,434	1,592,266
D.	Part D	244,000	774,400	62,809	711,591
E.	KfW Component		4,876,940	26,581	4,850,359
<b>II</b>	<b>Equipment, Materials and Vehicles</b>				
A.	Part A	764,000	1,200,000	1,148,805	51,195
B.	Part B	261,000	0	0	0
C.	Part C	476,000	450,000	46,424	403,576
D.	Part D	241,000	1,100,000	198,812	901,188
<b>III</b>	<b>Other Items of Expenditure</b>				
A.	Consulting Services	4,795,000	12,165,400	10,568,039	1,597,361
B.	Project Mapping	1,358,000	1,461,700	508,353	953,347
C.	Project Monitoring	13,000	222,400	10,963	211,437
D.	Project Support	41,000	15,941,000	18,307,184	-2,366,184
<b>IV</b>	<b>Local Expenditures</b>				
	<b><u>Civil Works</u></b>				
A.	Part A	25,562,000			
B.	Part B	10,635,000			
C.	Part C	2,445,000			
D.	Part D	627,000			
	<b><u>Equipment and Materials</u></b>				
E.	Part A	700,000			
F.	Part B	116,000			
G.	Part C	48,000			
H.	Part D	179,000			
	<b><u>Other Items of Expenditure</u></b>				
I.	Consulting Services	5,520,000			
J.	Project Mapping	505,000			
K.	Project Monitoring	214,000	5,745,800	192,915	5,552,885
L.	Project Support	9,207,000			
	<b><u>Unallocated</u></b>				
M.	Subcategories IV-A to IV-L	24,173,000			
<b>V</b>	<b>Service Charge</b>	4,511,000	4,565,000	4,565,000	
<b>VI</b>	<b>Unallocated</b>	14,616,000	2,000,000		2,000,000
<b>Total</b>		<b>135,380,000</b>	<b>155,608,000</b>	<b>136,823,871</b>	<b>18,784,129</b>

<sup>2</sup> These figures are tentative pending refund to the Asian Development Bank of the unliquidated imprest advance and

final closure of the loan account.

9. Local Costs (Financed)

– Amount (US Dollars)	-	102,705,520.00
– Percent of Local Costs	-	78.08%
– Percent of Total Cost	-	47.60%

**C. Project Data**

1. Project Cost (\$ million)

<b>Cost</b>	<b>Appraisal Estimate</b>	<b>Actual</b>
Foreign Exchange Cost	94.40	103.97
Local Currency Cost	193.10	175.13
<b>Total</b>	<b>287.50</b>	<b>279.10</b>

2. Financing Plan (\$ million)

<b>Cost</b>	<b>Appraisal Estimate</b>	<b>Actual</b>
<b>Implementation Costs</b>		
Borrower Financed	61.10	53.01
ADB Financed	178.80	181.21
Other External Financing	40.00	38.82
<b>Sub-total</b>	<b>279.90</b>	<b>273.04</b>
<b>IDC Costs</b>		
Borrower Financed	1.40	
ADB Financed	6.20	6.06
Other External Financing		
<b>Sub-total</b>	<b>7.60</b>	
<b>Total</b>	<b>287.50</b>	<b>279.10</b>

ADB = Asian Development Bank, IDC = interest during construction.



## 3. Cost Breakdown by Project Components (\$ million)

Component	Appraisal Estimate	Actual
<b>A. Investment Costs</b>		
1. Civil Works		
a. Main Canal (Part A)	103.59	174.42
b. Distributaries and Minors (Part B)	31.32	28.78
c. On-farm Works (Part C)	5.11	3.43
d. Agricultural Package (Part D)	1.19	0.08
e. Project Mapping (Part A)	3.39	1.00
<b>Subtotal</b>	<b>144.61</b>	<b>207.71</b>
2. Land Acquisition	12.51	17.57
3. Vehicles and Equipment	5.25	2.52
4. Consulting Services	18.80	19.49
5. Project Monitoring	0.42	0.38
<b>Subtotal Investment Costs</b>	<b>181.59</b>	<b>247.67</b>
<b>B. Project Support</b>	<b>15.50</b>	<b>25.37</b>
<b>Total Project Costs</b>	<b>197.09</b>	<b>273.04</b>
<b>Contingencies</b>	<b>82.83</b>	
<b>Service Charge</b>	<b>7.58</b>	<b>6.06</b>
<b>Total Costs Financed</b>	<b>287.50</b>	<b>279.10</b>

## 4. Project Schedule

Item	Appraisal Estimate	Actual
Date of Contract with Consultants	January 1993	28 July 1993
Completion of Engineering Designs	June 1998	
Civil Works Contracts:		
(i) Contract 64		
Date of Award	15 November 1994	14 February 1995
Completion of Work	30 September 1995	15 December 1995
(ii) Contract 65		
Date of Award	30 July 1995	30 August 1997
Completion of Work	30 July 2000	16 November 2001
(iii) Contract 66		
Date of Award	30 June 1995	20 February 1999
Completion of Work	30 September 1997	19 November 2001
(iv) Contract 67		
Date of Award	30 June 1996	19 August 1999
Completion of Work	30 March 1999	17 November 2001
(v) Contract 68		
Date of Award	30 March 1998	27 March 2000

Completion of Work Equipment and Supplies Dates	30 September 2000	15 December 2002
First Procurement	February 1993	30 March 1994
Last Procurement	March 2000	29 August 2002

## 5. Project Performance Report Ratings

Implementation Period	Ratings	
	Development Objectives	Implementation Progress
(i) From 1 January 1998 – 30 June 1998	Satisfactory	Unsatisfactory
(ii) From 1 July 1998 – 31 December 1998	Satisfactory	Unsatisfactory
(iii) From 1 January 1999 – 30 June 1999	Satisfactory	Partly Satisfactory
(iv) From 1 July 1999 – 31 December 1999	Satisfactory	Partly Satisfactory
(v) From 1 January 2000 – 30 June 2000	Satisfactory	Partly Satisfactory
(vi) From 1 July 2000 – 31 December 2000	Satisfactory	Partly Satisfactory
(vii) From 1 January 2001 – 30 June 2001	Satisfactory	Satisfactory
(viii) From 1 July 2001 – 31 December 2001	Satisfactory	Satisfactory
(ix) From 1 January 2002 – 30 June 2002	Satisfactory	Satisfactory
(x) From 1 July 2002 – 31 December 2002	Satisfactory	Satisfactory
(xi) From 1 January 2003 – 30 June 2003	Satisfactory	Satisfactory
(xii) From 1 July 2003 – 31 December 2003	Satisfactory	Satisfactory
(xiii) From 1 January 2004 – 30 June 2004	Satisfactory	Satisfactory
(xiv) From 1 July 2004 – 31 December 2004	Satisfactory	Satisfactory
(xv) From 1 January 2005 – 30 June 2005	Satisfactory	Satisfactory
(xvi) From 1 July 2005 – 31 December 2005	Satisfactory	Satisfactory
(xvii) From 1 January 2006 – 30 June 2006	Satisfactory	Satisfactory
(xviii) From 1 July 2006 – 31 December 2006	Satisfactory	Satisfactory
(xix) From 1 January 2007 – 30 June 2007	Satisfactory	Satisfactory
(xx) From 1 July 2007 – 31 December 2007	Satisfactory	Satisfactory
(xxi) From 1 January 2008 – 30 June 2008	Satisfactory	Satisfactory
(xxii) From 1 July 2008 – 31 December 2008	Satisfactory	Satisfactory
(xxiii) From 1 January 2009 – 30 June 2009	Satisfactory	Satisfactory
(xxiv) From 1 July 2009 – 31 December 2009	Satisfactory	Satisfactory

## D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person Days	Specialization of Members
Fact-finding	16 Nov – 6 Dec 1990	4	84	a, b, hh, ii
Appraisal	23 Apr – 16 May 1991	6	144	a, c, b, d, e, jj
Inception	18 Oct – 8 Nov 1993	3	24	f, kk, aa
Review Mission 1	20 Mar – 01 Apr 1994	3	39	f, kk, aa
Special Loan Administration	17 – 27 Oct 1994	2	22	f, aa,
Review Mission 2	16 – 22 Dec 1994	6	34	f,a,g,h,kk,,oo
Review Mission 3	23 Jul – 1 Aug 1995	2	20	b, aa
Special Loan Administration	27 Sep – 8 Oct 1995	2	24	b, jj
Special Loan Administration	29 Jan – 4 Feb 1996	1	7	b
Review 4	16 – 23 May 1996	3	24	b, bb, jj

Special Loan Administration	30 Oct – 5 Nov 1996	1	7	b
Midterm Review	8 – 18 Dec 1997	3	33	i, bb, ll
	8 – 13 Dec 1997	1	6	j
	14 – 18 Dec 1997	1	5	cc
Review 5	7 – 23 Jun 1998	3	51	i, bb, ll
Review 6	19 – 29 Oct 1998	2	22	l, cc
Special Loan Administration	18 – 19 Nov 1998	1	2	cc
Review 7	2 – 9 Jun 1999	1	9	cc
Special Loan Administration	16 – 22 Jul 1999	1	7	i
Special Loan Administration	9 – 16 Nov 1999	2	16	i, k
Special Loan Administration	2 – 8 Mar 2000	1	7	i
Special Loan Administration	23 – 31 Jul 2000	1	9	i
Review 8	13 – 24 Nov 2000	3	36	i, jj, mm
Review 9	24 – 30 Mar 2001	1	7	i
Special Loan Administration	4 – 9 March 2002	4	24	l, m, n, dd
Review 10	5 – 12 May 2002	4	32	l, o, p, cc
Special Loan Administration	19 – 21 Aug 2002	1	3	l
Special Loan Administration	2 – 6 Nov 2002	2	10	o, l
Special Loan Administration	24 – 30 Jan 2003	2	14	l, q
Special Loan Administration	28 Apr – 4 May 2003	2	14	l, dd
Special Loan Administration	23 Jun – 30 June 2003	1	8	l
Special Loan Administration	1 – 9 Aug 2003	1	9	l
Review 11	7 – 19 Oct 2003	1	13	r
Review 12	30 Nov – 8 Dec 2003	3	27	r, o, s
Review 13	20 – 2 Nov 2004	5	23	r, o, t, s, dd
Special Loan Administration	21 – 26 Feb 2005	1	6	r
Special Loan Administration	18 – 25 Mar 2005	4	15	o, r, cc, dd
Special Loan Administration	23 Apr – 6 May 2005	1	14	r
Special Loan Administration	22 – 24 Jun; 1 – 8 July 2005	1	11	r
Compliance Review Panel	12 – 20 Nov 2005	4	36	u, v, w, ee
Review				
Special Loan Administration	15 – 18 Nov 2005	1	3	r
Special Project Administration	19 Jun – 2 Jul 2006	2	26	x, y
Special Project Administration	7 – 15 Aug 2007	3	21	z, ff, g
Special Project Administration	29 Apr – 9 May 2009	2	22	z, ff
Special Project Administration	5 – 7 May 2009	1	3	gg
Special Project Administration	8 – 9 May 2009	1	2	gg
Project Completion Review	5 – 29 July 2010	4	64	z, ff, jj, nn

a = Project Economist; b = Project Engineer; c = Sr. Counsel; d = Sr. Environmental Specialist; e = Economist/Program Officer; f = Rural Development Specialist; g = Environment Specialist; h = Environmental Economist; i = Irrigation Engineer; j = Sr. Project Engineer; k = Manager, AWFN; l = Sr. Project Specialist; m = Director, ECAE; n = Chief, NGO Center; o = Director, SAAE; p = Sr. Social Development Specialist; q = Counsel; r = Principal Project Specialist; s = PAU Head, PRM; t = Country Director, PRM; u = Chairman, CRP; v = Member, CRP; w = Assistant Chief, OCRP; x = PAU Head, SANS; y = PAU Head, CWAE; z = PAU Head, CWEN; aa = Sr. Clerk, Project Administration; bb = Asst. Project Administration; cc = Sr. Project Implementation Officer, PRM; dd = Project Implementation Officer, PRM; ee = Compliance Coordinator Officer; ff = National Officer, CWEN; gg = National Officer, PRM; hh = Consultant/Irrigation Specialist; ii = Consultant/Agriculture Specialist; jj = Consultant/Irrigation Engineer; kk = Consultant/Irrigation & Drainage Specialist; ll = Consultant/Agriculture Economist; mm = Consultant/Agriculture Extension Specialist; nn = Consultant/M&E Specialist; oo = Consultant/Civil Engineer & Channel Morphologist.



## I. PROJECT DESCRIPTION

### A. Background

1. The Chashma Right Bank Irrigation Project (CRBIP) envisaged the irrigation of a cultivable command area (CCA) of about 230,000 hectares (ha), resulting from construction of (i) 260 kilometers (km) of a main canal and 600 km of distributary and minor canals; (ii) service roads and bridges along the main and distributary canals; and (iii) remodeling of about 110 km of the existing Paharpur canal system. The feasibility report was prepared by the Water and Power Development Authority (WAPDA) in November 1970, followed by a PC-I in December 1973.

2. The Chashma Right Bank Irrigation Project was approved in December 1977 and became effective in May 1978. Following suspension of disbursements in mid-1980 because of significant cost overruns, it was proposed that CRBIP be undertaken in three stages. In early 1984, the Asian Development Bank (ADB) reactivated this loan and Stage I was completed in December 1986. Preparation for Stage II was completed in August 1987, and Stage II was approved in December 1987. Preparation of Stage III was completed in March 1990. Stage I included construction of 80 km of the main canal and Stage II 36 km, with associated distributary and minor canals and structures. Reviews of Stages I and II<sup>1</sup> indicate that the first two stages of CRBIP were successful. It was concluded that subsequent stages should start immediately after completion of each stage of the main canal system.

3. Stage III, or the Project, which was declared effective in November 1992, added a further 144 km to the main canal and 685 km of distributary and minor canals, providing irrigation to a CCA of 135,000 ha, of which 35% was in D.I. Khan District in Khyber Pakhtunkhwa province, formerly North-West Frontier Province, and 65% in D.G. Khan District of Punjab province. The project area was characterized by: (i) large tracts of barren but potentially highly productive land, (ii) low and unpredictable rainfall, (iii) short, seasonal irrigation supplies in the limited area served by the Masawah inundation canal, (iv) inadequate and unsuitable groundwater for agriculture or municipal use, (v) the undependable and risky practice of harvesting the short-duration flood flows from small intermittent streams for supplementary irrigation, (vi) poor access, and (vii) inadequate agricultural support services. Because of these constraints, agricultural production and economic development were severely limited. The average net per capita income in the area was below \$100 per year at project preparation.

### B. Objectives and Scope

4. The appraisal report<sup>2</sup> defined the project objectives as sustained growth with improved income distribution and a rural development program emphasizing employment and poverty alleviation. The objectives would be achieved through construction of a new irrigation system and basic rural infrastructure that would increase productivity, diversify production, increase employment, and strengthen institutional support. The Project included four main components:

- (i) Part A: Main canal and related structures;
- (ii) Part B: Distributary and minor canals and surface drainage;
- (iii) Part C: On-farm water management; and
- (iv) Part D: Agriculture and livestock extension.

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<sup>1</sup> ADB. 1989. *Completion Report: Chashma Right Bank Irrigation Project in Pakistan (Loan 330-PAK [SF])*. Manila; and ADB. 1995. *Completion Report: Chashma Right Bank Irrigation Project in Pakistan Stage II (Loan 874-PAK [SF])*. Manila.

<sup>2</sup> ADB. 1991. *Appraisal Report: Chashma Right Bank Irrigation Project Stage II in Pakistan*. Manila.

5. Part A included dovetailing works with the Stage II main canal, and construction of a concrete-lined main canal of 144 km. At the start of Stage III, the main canal was designed with a capacity of 75 cumecs. Forty cross-drainage structures were proposed to safely accommodate a 1-in-40 year flood. The design also included a flood protection embankment along the entire right bank of the main canal. Part B provided for the construction of 36 distributaries and minor canals and structures—concrete-lined (80%) and earthen (20%)—totaling about 500 km. Both main and distributary canal sections were designed to provide for access roads suitable for public use. Part C included construction of 1,450 compacted earthen watercourses, totaling about 2,750 km to convey water from the distributaries and minor canals. It also provided technical support to farmers through the provincial directorates of On-farm Water Management (OFWM) for rough land leveling across the entire Stage III command area. Part D included support for extension activities through provision of physical facilities for extension staff in D.I. Khan, as well as demonstration and training centers across the project area.

## II. EVALUATION OF DESIGN AND IMPLEMENTATION

### A. Relevance of Design and Formulation

6. The project design was consistent with Pakistan's development priorities at the time and ADB's lending strategy in agriculture and irrigation as recommended by the 1984 Pakistan Basic Strategy Study. The Project's objective<sup>3</sup> was to bring uncultivated land into production while protecting the resource base in agriculture and addressing environmental issues of water logging, salinity, and flooding through investments in the water sector. It also aimed to build WAPDA's capacity for resource management through the provision of consulting services. Lessons learned from the implementation of CRBIP Stages I and II and WAPDA's experience in the water sector in Pakistan were incorporated into the project design. Since, about 54% of the discharge capacity of the main canal was to be conveyed to the Stage III command area, the full benefit of CRBIP could, therefore, only be achieved after completion of the Project.

7. In September 1995, it became clear that the costs of Parts A and B were likely to be substantially higher. As a result, WAPDA, ADB, and the project implementation consultants jointly reviewed the design to introduce cost savings. Cost saving measures adopted for the main canal resulted in reducing the pre-bid cost estimate of the main canal Contract No.65 from \$184 million to \$130 million.

8. During project preparation, a gender analysis entitled "Women in the Project Area" was prepared, based on data gathered from the field and documented in the consultant's Technical and Economic Feasibility Report (1990). The gender analysis established women's significant roles in agricultural production in contrast to their lack of access to (i) incomes as unpaid family workers in the agriculture sector; (ii) economic opportunities; and (iii) resources such as land and political power. Potentially harmful effects<sup>4</sup> of the Project to women were identified, as well as the strategies<sup>5</sup> to address gender issues.

<sup>3</sup> The appraisal report did not include a design and monitoring framework in which specific goals or objectives (now impact and outcome) were stated.

<sup>4</sup> These include: (i) increased demand for women's physical (and unpaid) labor as a result of increased agricultural productivity; (ii) decreased incomes of employed women as a consequence of social expectations on families with improved socio-economic status to keep their women within their own household.

<sup>5</sup> The recommended strategies include: (i) increasing assistance to livelihood support services for women through training and credit; (ii) improving access, adequacy, and quality of support services on health, education, water and sanitation facilities; (iii) creating alternative work opportunities for women that may be displaced by a shift to mechanization of traditional tasks in the farm; and (iv) establishing monitoring mechanisms to measure the Project's effects on women's welfare (i.e., time use).

9. The appraisal report adopted the recommendation of the gender analysis to engage a nongovernment organization (NGO) as community-based monitors and responders to potentially adverse effects of the Project on women. The NGO would help the provincial coordination and monitoring units implement Part D of the Project. In subsequent project-related documents, however, the role of the NGO in mitigating potentially harmful effects to women was not articulated, and the words “women” and “gender” totally disappeared. Any gender-related activity and relevant success indicator justified by the gender analysis, which could have been easily incorporated into the project design, were not included. This reflected a lack of consistency and continuity in ensuring gender mainstreaming. The opportunity was clearly missed for increasing the participation of women stakeholders, establishing and tracking gender-differentiated effects through collection and analysis of sex-disaggregated data, protecting the rights of women from any harmful effects caused by the Project, and for optimizing social and economic project benefits for women.

10. Towards the end of the project period, a number of affected people, supported by NGOs, filed a request for inspection of the Project<sup>6</sup> with ADB’s Board Inspection Committee (BIC). The BIC recommended that inspection begin after the Grievance Redress and Settlement Committee (GRSC),<sup>7</sup> established by the Government of Pakistan with ADB assistance, had completed its work. Following approval of the recommendation by ADB’s Board of Directors (Board), an inspection panel conducted an investigation in early 2004 and submitted its final report to the BIC. The inspection panel recommended project-specific remedial actions to bring the Project back into compliance, and made general recommendations for managing future large-scale irrigation projects. In August 2004, the Board considered the BIC recommendations and directed ADB to discuss with the government the possibility of extending the project completion date and using surplus loan proceeds to address the most significant of the remaining problems. The Board also mandated the Compliance Review Panel (CRP) to monitor implementation of the project-specific remedial actions.

11. The CRP prepared and issued annual monitoring reports from 2005 up to 2009.<sup>8</sup> After five years of monitoring, the CRP concluded that ADB had complied with 24 of the original 29 recommendations and partially complied with 4 recommendations, while 1 recommendation had already been superseded by events. For the 4 partially complied recommendations, the CRP concluded that sufficient progress had been made and, in the circumstances, further monitoring was not needed.

## **B. Project Outputs**

12. The main outputs of the Project were the construction of: (i) 143.2 km of the main canal, (ii) 43 distributaries (13 in Khyber Pakhtunkhwa and 30 in Punjab) and 40 minors (8 in Khyber Pakhtunkhwa and 32 in Punjab) with a combined length of 647.5 km, and (iii) 1,527 watercourses with a total length of 2,960 km. The system provides irrigation to a CCA of about

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<sup>6</sup> The requesters claimed ADB had breached its operational policies and procedures in formulating and processing the Project, resulting in material adverse effects on Chashma inhabitants. Various issues were raised including (i) project-induced flooding and involuntary resettlement; (ii) inadequate compensation for loss of land, other assets, and livelihoods; (iii) adverse impacts on traditional spate irrigation farmers; (iv) design related social and environmental problems; and (v) insufficient information for consultation with, and participation of, affected people.

<sup>7</sup> The GRSC was established in February 2003 to reach a solution to all outstanding problems raised by land acquisition, resettlement, compensation, and rehabilitation. The GRSC carried out its activities from its inauguration in May 2003 until December 2003, and also hired a Social and Gender Specialist to assist in preparing plans for implementing gender-design features at the community level. In October 2003, GRSC recommendations were forwarded to the Ministry of Water and Power for implementation by responsible agencies. The end-of-tenure report of the GRSC is at <http://www.adb.org/documents/inspection/pak/GRSC-Report/Appendix1-End-of-Tenure.pdf>.

<sup>8</sup> The reports are in <http://www.compliance.adb.org/dir0035p.nsf/alldocs/BDAO-7XW4XE?OpenDocument>.

135,000 ha. In addition, the Project provided flood control and drainage works. Rough land leveling was carried out on 47,470 ha. The physical targets set out at appraisal were largely met or exceeded, as tabulated below. The Project has also provided access roads, 144 km on both sides of the main canal and 647.5 km along the distributaries. These roads are used by farmers to transport produce to market. A new food grain market and a new training hall and hostel were constructed in D.I. Khan.

Part	Appraisal Target	Actual Achievement
<b>A</b>	<b>Main Canal and Related Facilities</b>	
1	144 km main canal and appurtenant structures	143.2 km main canal and appurtenant structures
2	285 km gravel surface all weather roads along the main canal	286.3 km gravel surface fair weather roads along the main canal
3	Flood protection facilities including about 570 km of flood carrier channels (FCCs)	Flood protection facilities including about 272 km of flood carrier channels (FCCs)
4	Mapping of project area	Mapping of project area
5	Extension and improvement of communication system	Extension and improvement of communication system
6	Erosion protection through planting of erosion control vegetation along the main canal and FCCs	This activity was canceled as a cost saving measure
<b>B</b>	<b>Distributary Canal and Drainage Facilities</b>	
1	500 km of concrete-lined and earth-lined distributaries and minor canals with appurtenant structures	647.5 km of concrete lined and earth-lined distributaries and minor canals with appurtenant structures
2	500 km of gravel surface all-weather roads along distributary canals	647.5 km of gravel surface fair weather roads along distributary canals
3	Construction of surface drainage facilities	This activity was canceled as a cost saving measure
<b>C</b>	<b>On Farm Water Management</b>	
1	Construction of 1,450 water courses	Construction of 1,527 water courses
<b>D</b>	<b>Agricultural and Livestock Extension</b>	
1	Demonstration plots and 220 ha of demonstration farms Upgrading of market facilities and two feeder markets	Revised during implementation. 271 demonstration plots and 15 field days. One new grain market established in D. I. Khan.
2	Institutional strengthening of provincial livestock departments through provision of equipment and facilities	Revised during implementation. 182 field days held; 87 visits by mobile cinema; 89 fodder demonstrations and vaccinations. One new training hall and hostel in D. I. Khan.

13. The project completion review (PCR) mission assessed the status of the entire length of the main canal from the dovetailing section with Stage II to the tail end. Details of the assessment are in Appendix 1. In the main canal there was evidence of cracks, some of which had been repaired and others proposed for repair during the next canal closure. The earthen fill above the lining showed ruts caused by rain water and needed dressing. Vegetation was observed in the joints between concrete panels, but there was no evidence of overtopping of the concrete lining and adequate freeboard was available above the maximum water level mark. The quality of construction of the main canal is considered satisfactory. The quality of concrete on bridges and cross drainage works looked reasonable and no apparent distress was visible.

14. The shingle layer on top of the main canal inspection roads had disappeared in certain places, making travel very difficult. The road downstream of Taunsa was in poor condition



because of the passage of heavy trucks. The poor road condition is in part attributable to the absence of the gravel base proposed in the design but excluded as part of the cost saving measures introduced in 1995. A gravel base would distribute load more evenly and slow the rate of deterioration.

15. Unlined distributaries showed evidence of siltation as well as erosion of berms and vegetation on the sides, reducing carrying capacity. This has resulted in lower than expected water levels at watercourse turnouts and led farmers to construct temporary obstructions in the canal to divert supplies into their watercourses. This, in turn, has resulted in a shortage of water at the tail end. The inspection roads along several distributaries were in poor condition because of the passage of heavy trucks. In the rainy season, unpaved roads become impassable. Some roads along the distributaries are now paved and provide good farm to market access.<sup>9</sup>

16. Overall, the original design and the construction of project infrastructure are considered cost-effective. However, some of the design modifications made in 1995, to save costs, did not prove to be technically sound and have resulted in increased operation and maintenance (O&M) requirements. Such modifications include the removal of gravel from the main canal access road, as well as elimination of provision of Vetiver grass slope protection on main canal flood embankments and FCC embankments. In addition, the concrete lining of distributary canals was reduced from 100% to 60% lined and 40% unlined, and this has had impacts both on water delivery and the long-term maintenance costs of the distributaries. Details of O&M arrangements and cost recovery through irrigation service charges are presented in Appendix 1.

17. Land acquisition had a major impact on the people in the project area and delayed the construction of flood channels and the distribution system. Although all land, land rights, and rights of way required for implementation were acquired before the scheduled start of the civil works, the procedure was lengthy because of the involvement of numerous government departments and the notifications required under the Land Acquisition Act of Pakistan of 1894. Payment of compensation to the people took place long after the land was actually taken over. The affected people considered the land price to be higher than that assessed by WAPDA and were not willing to accept lower compensation, and hence filed the inspection request.

18. Based on the BIC's views on the remaining problems, following the inspection of the Project (para. 10), ADB discussed with the government the implementation of project-specific remedial actions, using the remaining balance of the loan and extending the loan closing date to 30 June 2009. The project-specific remedial actions were agreed in February 2005, consisting of (i) recommendations made by the GRSC to address the grievance of the project-affected people and the inspection requesters; (ii) an environmental management plan (EMP); and, (iii) the Hill Torrent Management Project (HTMP).<sup>10</sup> However, some GRSC recommendations, the EMP, and the HTMP all required prior approval of a PC-I,<sup>11</sup> which took a long time to obtain.

<sup>9</sup> In early August 2010, shortly after completion of the PCR mission, Pakistan suffered serious flooding along the Indus River. The floods damaged the main canal at 17 locations and its distribution system at several locations. Flash floods from the hill torrents caused the main damage, interrupting irrigation water supplies. Temporary restoration of water supplies for the winter crop was the first priority of WAPDA, with work starting immediately after the flood waters had receded. By the time this report was being finalized, most of the breaches had been filled and water supplies restored for most of the area. WAPDA and the provincial governments are now preparing a complete rehabilitation plan to be implemented in 2011, at a total cost estimate of about US\$2 million.

<sup>10</sup> ADB approved a major change in project scope on 4 February 2008 to allow financing of the GRSC recommendations and EMP from the remaining loan proceeds. The HTMP was fully financed by the Punjab provincial government.

<sup>11</sup> Planning Commission proforma I (PC-I) is a document of the Government of Pakistan for approval of project implementation.

This delayed implementation of some remedial actions, requiring a final extension of the loan closing date to 31 December 2009. By the final loan closing date, most of the remedial actions were completed except for two FCCs and provision of basic facilities for one village that could not proceed because of severe disagreements among the communities concerned.

19. The project-specific remedial actions (i) improved irrigation water management and flood protection, (ii) provided communities in the project area with basic facilities including domestic water supply schemes, and (iii) constructed additional bridges along the main and distributary canals to improve people's access. Gender mainstreaming strategies were integrated into the remedial actions satisfactorily, and women from extremely poor and non-land owning households had improved access to water supply.<sup>12</sup> Participation of women beneficiaries was sought by the Irrigation Department in formulating domestic water supply sanction policies to promote women's empowerment and ensure sustainability.<sup>13</sup> WAPDA also provided training activities and network links to support the capacity building of local residents, especially women and the poor, and to give them access to information, programs, and services on education, health, sanitation, agriculture, and microcredit.<sup>14</sup>

### C. Project Costs and Financing

20. The ADB loan amount was Special Drawing Rights (SDR) 135.38 million, or \$185 million equivalent. Additional financing of \$40 million equivalent was to be provided by KfW, and the balance of \$62.5 million by the government.

21. The total cost of the Project was \$273.0 million<sup>15</sup> compared with \$287.5 million estimated at appraisal. ADB financed \$181.2 million, KfW \$38.8 million, and the government \$53.0 million. In 1999, following implementation delays and the identification of potential cost increases, the project cost estimate was revised to \$336.4 million, an increase of \$48.9 million.<sup>16</sup> However, based on funds already disbursed and the value of available funds at the exchange rates prevailing at the time of re-estimation, a funding gap of \$50.5 million was identified. Of this, ADB agreed to finance \$33.5 million (equivalent to SDR 24.2 million), raising the loan amount to \$218.5 million (equivalent to SDR 159.58 million). On 4 September 2001, the Board approved a partial cancellation of loan proceeds equivalent to \$5.0 million (SDR 3.972 million) for the purpose of emergency assistance for drought impact mitigation and recovery in Pakistan. Details of the project costs are in Appendix 2.

22. Variations in project costs resulted from: (i) increases in (a) the main canal civil works from \$103.6 million to \$174.4 million, (b) land acquisition from \$12.5 million to \$17.6 million because of an increase in land values, (c) consultancy services from \$18.8 to \$19.5 million, and (d) project support from \$15.5 million to \$25.4 million; and (ii) decreases in the cost of (a) distributary canals from \$31.3 million to \$28.8 million, (b) on-farm works from \$5.1 million to \$3.4 million, (c) agricultural services from \$1.2 million to \$0.1 million, (d) vehicles and equipment from \$5.3 million to \$2.5 million, and (e) project mapping from \$3.4 million to \$1.0 million.

### D. Disbursements

23. At the time of the PCR mission, total disbursements under the loan were \$194.4 million, inclusive of service charges (\$6.1 million) and unliquidated imprest advances (\$7.1 million),

<sup>12</sup> ADB Compliance Review Panel 2010. Recommendation #6, Appendix 4

<sup>13</sup> Ibid.

<sup>14</sup> Ibid. Recommendation #7, Appendix 4.

<sup>15</sup> Excluding service charges of \$6.1 million, and unliquidated imprest advances totaling \$7.1 million.

<sup>16</sup> ADB. 1999. *Optimizing Existing Investments in the Water Sector in the Islamic Republic of Pakistan*. Manila.

leaving an undisbursed balance of \$22.5 million<sup>17</sup> to be cancelled. A breakdown of annual disbursements is in Appendix 3. The first disbursement took place in April 1993, nearly five months after loan effectiveness (November 1992). The final disbursement for the original project design was made in March 2003. At the time of agreement of the project-specific remedial actions in 2005, \$174.8 million had been disbursed out of the total loan amount of \$215.7 million (at the prevailing exchange rate). Of the remaining \$40.9 million, \$13.2 million was allocated to settle outstanding liabilities. The balance of \$27.7 million was allocated for the implementation of the remedial works action plan. Only \$12.5 million was actually disbursed for this purpose.

24. For the implementation of the remedial works action plan, three imprest accounts were maintained with a total imprest advance of \$7.6 million to prevent delays in civil works and facilitate payments to contractors. Of this advance, \$5.0 million was for Punjab provincial government. During the PCR mission, the Public Health Engineering Department in Punjab provided documentation to facilitate liquidation of their advance.

### **E. Project Schedule**

25. The Project was designed for implementation over 8 years from January 1992 to December 1999. The loan for the Project was approved on 17 December 1991, but only became effective on 19 November 1992. Fielding of the inception mission was deferred to October 1993 until after the project director had been appointed in September 1993. Project implementation was delayed by 24 months principally because of a delay of 20 months in recruiting the implementation consultants, and in land acquisition. The Project was physically completed by December 2002.

26. The loan was originally scheduled to close in September 2000 but was extended to 31 December 2001 to allow more time for the government to resolve issues related to cost-sharing arrangements between Khyber Pakhtunkhwa and Punjab for the O&M of the main canal. The loan closing date was further extended to 31 December 2003 to allow for the review of concerns expressed by people affected by the Project (para. 10), and then to 30 September 2004 to complete the inspection process. On 8 March 2005, the government requested an extension of the loan closing date to 30 June 2009 to use the surplus loan proceeds to implement agreed project-specific remedial actions. ADB approved the extension on 29 March 2005. The loan closing date was finally extended to 31 December 2009 to complete the agreed project-specific remedial actions. The project implementation schedule is in Appendix 4.

### **F. Implementation Arrangements**

27. The Project was implemented following the arrangements envisaged at appraisal. WAPDA, the executing agency, was responsible for execution of Parts A and B of the Project, including (i) approval of detailed design and construction of all irrigation and drainage works encompassing the main canal, FCCs, distributary and minor canals, appurtenant structures, watercourses, crossings and roads, erosion protection, mapping, and communications, (ii) land acquisition for all irrigation and drainage works, and (iii) physical monitoring and evaluation of project implementation. The provincial governments of Khyber Pakhtunkhwa and Punjab were the executing agencies responsible for execution of Part C (on-farm water management) through their respective departments of on-farm water management, and Part D (agriculture and livestock extension) through their agriculture (Part D[1]) and livestock departments (Part D[2]).

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<sup>17</sup> The final figure will be determined after liquidation of the remaining imprest advance is completed.

28. WAPDA appointed a project director, who had overall responsibility for project implementation. The project director was assisted by four provincial project coordinators, two from each provincial government, and technical and administrative staff.

29. The Project Supervision and Coordination Committee (PSCC), established under CRBIP Stage I and which continued under Stage II, continued under the Project with responsibility for overall supervision and coordination of project activities. The PSCC was chaired by the Secretary of the Ministry of Water and Power and comprised representatives from the Ministry of Food, Agriculture and Cooperatives, provincial governments, and WAPDA.

## **G. Conditions and Covenants**

30. Out of the total of 38 loan covenants, 29 were complied with, 5 partly complied with, 3 not complied with, and 1 still not yet applicable. The status of compliance is shown in Appendix 5. The partly complied covenants relate to: (i) land acquisition, as the process was delayed, causing delays in the construction of flood carrier channels and the distribution system, (ii) provision of agricultural credit, which was provided for the farmers in Khyber Pakhtunkhwa and Punjab provinces merely as part of routine government policy, (iii) reassessment of the value of lands in terms of produce index units, which was not carried out within one year of the lands' receiving irrigation water from the project facilities, (iv) inadequate maintenance of watercourses by Water Users Associations (WUAs), and (v) provision of all funds, staff, and equipment required for O&M of the project facilities. The O&M cost estimates prepared by WAPDA are often disputed by the provinces and their release of funds to WAPDA is delayed.

31. The covenants that were not complied with relate to (i) on-farm drains in the project area, as these were not constructed, and (ii) Irrigation service fees, as (a) collection was not adequate and (b) rates were not commensurate with the accrual of project benefits to fully recover O&M costs. One covenant, which is still not yet applicable, relates to the need to promptly provide subsurface drainage facilities in the project area as required, and to make all necessary funds available for this purpose if sustained groundwater levels reach within five feet of the surface after project completion. WAPDA, through its Salinity Control and Reclamation Projects Monitoring Organization, continues to monitor groundwater levels in April and October. The government is committed to take action when the event arises, to avoid land degradation and maintain productivity.

## **H. Related Technical Assistance**

32. As requested by the government, a TA for Strengthening Environmental Management for Water Resources Development for \$1 million was approved together with the loan. The focus of the TA was institutional strengthening, with two main objectives: to create within WAPDA technical capacity in environmental management, and to recommend an appropriate environmental institutional framework. The four main tasks were: (i) provision of environmental guidelines for water resource management, (ii) preparation of an environmental management plan for CRBIP, (iii) environmental, institutional, and manpower development within WAPDA, and (iv) establishment of an environmental data management and information system within WAPDA's Environmental Cell (WEC).

33. In-country training was delivered to 15 professional staff in WEC through a combination of training courses, seminars, participatory field investigations, case study implementation, and refresher courses. All training and seminars were well received by participants, in line with needs, and well attended with the highest level of government support. This was confirmed by

ADB missions and the TA Completion Report.<sup>18</sup> The work of the consultants was considered satisfactory, and, in spite of a delay in appointing a new director for WEC and implementing other organizational improvements recommended by the consultants, the input of the government was considered appropriate.

34. During the TA period, WEC was raised to directorate status and its professional staff increased from 2 at inception in 1986 to 15 as a result of the TA. The professional competence of WEC staff was strengthened through formal and on-the-job training. Reports and manuals prepared under the TA were regarded as high quality and included a comprehensive environmental impact assessment (EIA) for CRBIP. Overall, the TA contributed to WAPDA's institutional capacity to address the environmental requirements of water resources projects, with specific coverage of all stages of CRBIP. It promoted the practical application of EIAs, participatory approaches, and other ADB environmental policies.

### **I. Consultant Recruitment and Procurement**

35. The selection of consultants was done in accordance with ADB's *Guidelines on the Use of Consultants*. At appraisal 1,800 person-months (456 international and 1,344 national) of long-term professional services, and 60 person-months of specialized short-term consultant services were proposed. The consulting services contract, however, included a total of 1,982 person-months (448 international and 1,534 national), plus 2,904 person-months of support staff. The selection and recruitment of consultants took more than 20 months from the date of submission of proposals. The consulting services contract was signed on 28 July 1993, almost 8 months after loan effectiveness. On project completion, a total of 5,396 person-months had been used (455 international and 4,941 national including support staff).

36. A separate contract for project monitoring was signed on 22 May 2000. Phase I of the contract provided for 25 person-months of international consultants and 126 person-months of national consultants. Phase II provided for 24 person-months of international and 259 person-months of national consultants. There were no revisions to this contract.

37. The procurement of goods and services was carried out following ADB's *Procurement Guidelines*. Civil works were procured according to international competitive bidding. Five civil works contracts were awarded, comprising two contracts for the main canal and structures (Contracts 64 and 65), and three contracts for distributary and minor canals and related structures (Contracts 66, 67, and 68). Two contracts were awarded to local contractors and three to international contractors. The first contract (Contract 64) was awarded in February 1995 and completed in December 1995. The last contract (Contract 68) was awarded in March 2000 and completed in December 2002. Vehicles and equipment were procured under the Project and were deployed at various WAPDA projects. A list of vehicles and equipment procured and their present state of deployment is in Appendix 6.

38. Civil works contracts implemented under the project-specific remedial actions were procured through competitive bidding among prequalified local contractors following procedures acceptable to ADB. Contracts were awarded for improved irrigation water management, provision of domestic water supply schemes to communities in the project area, improved flood protection, and improved access for people through construction of additional bridges.

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<sup>18</sup> ADB. 1997. *Technical Assistance Completion Report: Strengthening Environmental Management for Water Resources Development in WAPDA in Pakistan (TA 1629-PAK)*. Manila.

## **J. Performance of Consultants, Contractors, and Suppliers**

39. Taking the role of project engineer, the project consultants prepared designs and bid documents, and supervised project implementation. The performance of the consultants was satisfactory. Notwithstanding delays of between 2 and 11 months in the completion of three civil works contracts, the performance of contractors and suppliers engaged under the Project was generally satisfactory. Inspection reports of various ADB missions indicate that the quality of works and materials was satisfactory.

## **K. Performance of the Borrower and the Executing Agency**

40. The performance of the Borrower during implementation was generally satisfactory. The Borrower convened regular PSCC meetings and for the most part complied with covenants under the loan. A key issue of concern is the under-funding of O&M and poor recovery of water charges (Appendix 1), which are critical for the sustainability of the Project.

41. The performance of WAPDA as the executing agency was generally satisfactory. WAPDA coordinated well with ADB and KfW, provincial governments, the consultants, and contractors. It supported ADB missions and provided unrestricted access to project records. However, WAPDA's performance with respect to selection and appointment of consultants and evaluation of bids was generally not satisfactory, taking longer than expected. The performance of the provincial governments in the execution of their respective parts of Part C: On-farm Water Management was satisfactory. Their performance in implementation of Part D: Agricultural and Livestock Extension was partly satisfactory as the component was not fully implemented.

## **L. Performance of the Asian Development Bank**

42. ADB supervised the project extensively, with a total of 45 missions both independently and together with KfW, including six review missions from July 1989 to February 1993 to assist WAPDA in project start-up. ADB played a key role in the reformulation of the Project both when initial cost overruns were identified, and when grievances were raised by people affected by the Project (para. 10). It also maintained a positive relationship and close coordination with WAPDA, the provincial governments, and KfW. However, ADB was unable to prevent the initial delays in the appointment of consultants. Overall, ADB's performance is assessed as satisfactory.

# **III. EVALUATION OF PERFORMANCE**

## **A. Relevance**

43. The Project was highly relevant to the stated government and ADB objectives of sustained growth, with improved income distribution and rural development emphasizing employment and poverty alleviation. Through the construction of a new irrigation system bringing previously underutilized land into productive use, and through strengthening agricultural institutions, the Project supported increased productivity and diversification in agriculture, thereby increasing farm household incomes and employment opportunities.

## **B. Effectiveness in Achieving Outcome**

44. The Project has attained the objective of increasing and diversifying agriculture production.<sup>19</sup> An area of 135,000 ha has been supplied with perennial irrigation with a cropping

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<sup>19</sup> In the absence of a project design and monitoring framework in the appraisal report, no specific outcome was identified for the Project.

intensity of 110% that is expected to further increase in the coming years subject to the effective implementation of infrastructure maintenance (para. 40). Before project implementation, the area was partly irrigated by tubewells (8,300 ha) and partly rainfed and/or inundated by seasonal floods (126,700 ha), with an average intensity over the whole area of 12%. There has been a significant shift in the cropping pattern in the area for major crops. At the time of the PCR mission (based on data for the latest season for each crop), the area under paddy had increased to almost 15,100 ha (from 580 ha in 1990), sugarcane to 11,000 ha (from zero in 1990), cotton to 27,740 h (from 500 ha in 1990), and wheat to 61,630 ha (from 6,480 ha in 1990).

45. The current cropping pattern reflects a significant change from that projected at appraisal. The relative importance of cash crops (sugarcane and cotton) has increased compared with food crops (paddy and wheat) and fodder crops.

### **C. Efficiency in Achieving Outcome and Outputs**

46. Notwithstanding the delay in implementation and the design modifications necessitated by cost overruns identified early during implementation, the Project was efficient in developing irrigation and drainage facilities for the entire CCA of 135,000 ha proposed at appraisal, which were previously largely barren and unproductive. The quantitative analysis of efficiency is provided in Appendix 7. The economic internal rate of return (EIRR) of the Project has been re-evaluated at 13.9%. This compares with an EIRR of 20% estimated at appraisal. The lower EIRR derives from (i) the current structure of the cropping pattern, (ii) a lower level of cropping intensity, and (iii) lower economic gross margins for crops that make up a larger part of the cropping pattern than that proposed at appraisal. However, despite lower economic gross margins, if the cropping pattern and cropping intensity expected at appraisal had been achieved by 2010, the resulting EIRR would have been 18.1%. This highlights the need for improved O&M to ensure adequate delivery of water to enable cropping intensity to continue to rise towards the 143% expected at appraisal.

### **D. Preliminary Assessment of Sustainability**

47. The assessment of project infrastructure (Appendix 1) revealed that the general condition of the irrigation and drainage system is satisfactory, but also identified concerns relating to growth of vegetation and siltation in FCCs and unlined distributary canals, thereby reducing carrying capacity. The O&M of the main canal and distributary off-takes for the entire CRBIP (Stages I, II, and III) is the responsibility of WAPDA. Provincial irrigation departments are responsible for distributary and minor canals. Despite clearly defined cost-sharing agreements between WAPDA and the provincial governments, adequate funds are not being provided by the provinces to WAPDA, resulting in part from poor collection of water charges from farmers.

48. In Khyber Pakhtunkhwa, in the absence of farmers' organizations that were to be established under the Project, the Irrigation Department is responsible for assessing and collecting water charges. To date, its collection rate is 68% of the amounts assessed since the irrigation scheme became operational. Also in Khyber Pakhtunkhwa, the Chashma Right Bank Canal Division of the Irrigation Department is responsible for O&M of those sections of Stages II and III lying within the province. However, neither additional staff nor budget was provided when Stage III became operational. As a result, the O&M of the system is carried out from the budget for Stage II, which negatively affects O&M of both Stages II and III. In Punjab, 30 farmers' organizations were formed in 2006–2007 and given responsibility for assessing and collecting water charges from members. They would retain 50% of the charges collected and transfer 50% to the provincial government. However, collection performance has been dismal, with only 9% of assessed charges actually collected. In both provinces, any water charges collected (except the

50% retained by farmers' organizations in Punjab) are absorbed in the general provincial budget and not earmarked for O&M of the Project.

49. The under-funding of O&M has serious implications for the sustainability of the Project, which is less likely, and for the extent to which irrigation intensity can be further increased towards the appraisal target of 150%. During the PCR mission, it was clear that the importance of O&M and the need for significant cost recovery from project beneficiaries is now fully recognized by the provincial governments, who recently introduced fundamental changes in their water sector policies. This is supported by institutional reforms, specifically including the creation of Provincial Irrigation and Drainage Authorities and Area Water Boards as autonomous service organizations for irrigation and drainage. Reforms also include the transfer of part of the responsibility for O&M to farmers' organizations.

## E. Impact

50. **Socio-economic impact.** As a result of the Project, farms covering an area of 135,000 ha have access to perennial irrigation. Much of this area was previously either unproductive or failing to realize its economic potential. There has been a significant increase in cropping intensity, crop yields, and production. Although food grain production was not in line with what was expected at appraisal, the increases in cereals and vegetables have improved the food security of the project area population. Increased availability of fodder has encouraged an expansion in livestock husbandry, resulting in both higher incomes and an improved, diversified diet for the project area population. Drinking water facilities have also improved and become much more reliable. One concern is that the increase in area under sugarcane has given rise to a greater demand for water, since sugarcane is more water dependent. Given the concern over the long-term sustainability of the Project with respect to O&M, there may need to be a shift in the cropping pattern away from such crops. This will have broader economic implications for household cash incomes and agribusiness. Although no documented gender equity results were found, it can be assumed that the project has delivered considerable benefits to poor women in the project area, who have easier access to domestic water supply.

51. The marketing of food grain surpluses and the significant increase in the production of cash crops have led to a marked increase in farm household incomes (Appendix 7). The total annual household income of the average project area farm in 2010 is PRs196,710 (\$2,350), with 67% deriving from crop production. This by far exceeds the prevailing poverty line income of PRs17,100 per year. There has been a significant increase in farm family employment, rising from 82 days to 112 days per year. The need to find off-farm employment and the corresponding out-migration of labor have been reduced. The share of off-farm income in household income has fallen from 70% in 1991 for the average rainfed farm to 19% for the average project area farm in 2010. In fact, there has been a large increase in the project area population from 377,630 at appraisal to 935,480 in 2009. This reflects the economic development that has taken place in the area. The increase in agricultural activity has given rise to significant on-farm employment opportunities, and the expansion of sugarcane cultivation has prompted the establishment of two sugar mills. However, the influx of people has resulted in an increase in the number of farmers, with a downward effect on average farm size. In 1991, there were 34,000 farms in the project area with an average size of 3.97 ha. Estimates for 2010 indicate that the number of farms has increased to 41,150 and the average size fallen to 2.99 ha. This has not, however, adversely affected farm incomes.

52. **Impact on institutions.** The impact on institutions has been limited. No farmers' organizations were established in Khyber Pakhtunkhwa, and the 30 organizations that were established in Punjab are only partially successful, since they have not been effective in assessing and collecting water charges. Although a sound framework was established for



cooperation between WAPDA and the provincial governments with respect to the responsibilities and sharing of O&M costs, this has not been effectively implemented. Failure to properly address the O&M issues now risks the future sustainability of the Project. The opportunity to build the capacity of project area farmers and, to some extent, provincial agriculture and livestock extension services, was not fully realized since these programs in Part D were cut back. Physical training facilities were, however, provided under the Project as planned.

53. **Environment.** The Project has had no major adverse environmental effects. However, the request for inspection of the Project (para. 10) claimed that in the project planning process and preparation of an Initial Environmental Examination, the Project had failed to fully comply with the guidelines in ADB's *Environmental Considerations in Bank Operations*,<sup>20</sup> which were in effect at the time. It was also claimed that the Project should have been classified as environmental Category C. In February 2005, implementation of the Environmental Management Plan (EMP) for the Project was recommended. The EMP had originally been prepared in 1995,<sup>21</sup> and updated in May 2004 by the Federal Environmental Management Unit (FEMU) under the National Drainage Programme (NDP).<sup>22</sup>

54. The EMP was implemented in two phases<sup>23</sup> by FEMU. Four programs were implemented in phase 1: (i) studies of ecological changes induced by the Project; (ii) participatory irrigation management; (iii) a survey of drainage barriers and sandy soils; and, (iv) an environmental awareness program. The outcomes of the phase 1 reports were disseminated to the stakeholders through workshops and training under the environmental awareness program. The results of the survey on drainage barriers and sandy soils were disseminated under publication no. 279 of the International Waterlogging and Salinity Research Institute for use by managers and planners for long-term planning and development. The implementation of phase 2, however, was delayed because of the delay in obtaining PC-I approval. By the final loan closing date of 31 December 2009, only the environmental awareness program and an afforestation program had been implemented in the project area. The CRP, in its progress review, concluded that ADB had partly complied with this recommendation, but it also did not see benefit in further monitoring this action.

#### IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

##### A. Overall Assessment

55. Overall, the Project is rated successful. Physical targets in terms of the area to be irrigated were met. The project area cropping pattern is highly diversified and overall crop production is significantly higher than the appraisal estimate, even though the expected areas under the major crops have not been attained (with an emphasis on cash crops rather than food grains). In addition, project area household incomes are considerably higher than at appraisal, and the objective of sustained growth with improved income distribution, employment generation, and poverty alleviation has been realized.

<sup>20</sup> ADB.1997. *Environmental Considerations in Bank Operations. Guidelines on Operational Procedures*. Manila

<sup>21</sup> ADB. 1997. *Technical Assistance Completion Report: Strengthening Environmental Management for Water Resources Development in WAPDA in Pakistan (TA 1629-PAK)*. Manila.

<sup>22</sup> The NDP was partly financed by Loan 1413-PAK: *National Drainage Sector Project*, approved on 12 December 1995. The NDP was closed on 30 December 2006.

<sup>23</sup> The second phase comprised: (i) environmental monitoring and evaluation, (ii) an environmental awareness program, (iii) afforestation along the Chashma Right Bank Canal (CRBC) in Tehsil Taunsa, Dera Ghazi Khan, (iv) conservation of wildlife along CRBC Tehsil Taunsa, D.G. Khan, (v) wildlife conservation in CRBIP D.I. Khan, (vi) a salinity management plan—CRBIP Stage III, (vii) a socioculture program, and (viii) strengthening the role of women in development.

56. However, the long-term sustainability of the Project is questionable because of inadequate funding of O&M and the low level of irrigation service charge recovery from beneficiaries, particularly in Punjab. If current funding levels continue, project benefits are likely to start declining within the next few years and the estimated 50-year economic life of the Project will not be met without a significant deferred-maintenance project in 10–15 years' time.

## **B. Lessons Learned**

57. Major lessons to be learned from the Project include the following:

- (i) All formalities, including approval of government project documents, should be completed before the loan agreement is concluded, thus avoiding potential delays between loan effectiveness and project start-up. This should specifically include project management staffing, appointment of implementation consultants, allocation of counterpart staff, and advance preparation of procurement packages;
- (ii) The incorporation of a bonus payment for early completion in civil works contracts improved the responsiveness of the contractors in correcting deficiencies in works undertaken;
- (iii) Care is needed in undertaking cost-cutting measures to ensure that these do not compromise the long-term sustainability of a project by increasing the requirement for O&M;
- (iv) Institutional frameworks and agreements related to project O&M, in particular cost recovery from project beneficiaries, must be implemented effectively. In particular, where responsibility for O&M is to be shared between a number of stakeholders (e.g., provincial and local governments, beneficiaries), all parties should be actively involved in project design from the outset;
- (v) The most effective approach to compliance is to specifically address environmental and social safeguard issues (including beneficiary consultations) at the earliest stage of the project cycle;
- (vi) Lost opportunities for gender mainstreaming at the beginning of the project were partly due to the lack of established mechanisms and clear guidelines on gender mainstreaming on the part of ADB before 2008.<sup>24</sup> However, because of the inspection request that extended the Project, adjustments were made, producing gender equality results with the guidance of up-to-date manuals on gender<sup>25</sup> and increased support to hire gender specialists. Similar irrigation projects in the future may want to pick up missed opportunities and explore effective ways to maximize results by building on other gender and development initiatives within the same geographical area.

## **C. Recommendations**

### **1. Project-Related**

58. **Farmer awareness and training.** Greater emphasis is needed to increase the awareness of project area farmers of the consequences of (i) illegal extraction of water on farmers downstream, (ii) excessive levels of water use both on downstream farmers and their own crop yields, (iii) concentration on crops with a large water requirement, and (iv) the failure

<sup>24</sup> ADB adopted a Policy on the Role of Women in Development as early as 1985, but operational guidelines were not instituted.

<sup>25</sup> ADB. 2010. Gender and Development in ADB Operations. *Operations Manual*. Manila.

to pay water charges on the future sustainability of the Project. Provincial agriculture extension departments should take responsibility for improving farmer awareness and training.

59. Consideration should be given to developing projects to support farmers in using water from hill torrents to the west of the main canal. This should help to prevent the illegal extraction of water from the right bank of the main canal.

60. **O&M funding.** The provincial governments of Khyber Pakhtunkhwa and Punjab should ensure that adequate and timely funds are made available to ensure sustainability of the Project. Necessary maintenance work should be undertaken immediately to prevent further damage to project infrastructure. Renewed efforts are required to strengthen farmers' organizations in Punjab and establish them in Khyber Pakhtunkhwa to address issues such as illegal extraction of water and the assessment and collection of water charges.

61. **Future monitoring.** Future project monitoring should include regular reviews of project infrastructure to ensure sustainability. In this context, a committee comprising the chief engineers from WAPDA and each province should be established to oversee monitoring and resulting O&M works. There should also be continued monitoring and evaluation of cropping patterns and intensity, crop yields; project impact on household income and poverty; and broader economic development within the area. Monitoring of groundwater levels in the project area by the Salinity and Monitoring Organization in April and October should continue. If sustained groundwater levels reach within five feet of the surface in the project area, the government should promptly ensure that subsurface drainage facilities are provided.

62. **Timing of Project Performance Evaluation Report.** The Project is ready for a performance evaluation review.

## 2. General

63. The following should be taken into consideration:

- (i) Where implementation of provincial or inter-provincial projects is undertaken by a national or non-provincial entity, the arrangements for undertaking O&M and cost-sharing agreed in advance of implementation must be followed post-implementation to ensure sustainability;
- (ii) Estimation of civil works contract packages should be based on realistic quantities and rates. Preparation of government project documents after completion of detailed designs will minimize the need for frequent revisions;
- (iii) Recruitment of project implementation consultants should commence before loan negotiations in order to avoid delays in project start-up.

## **ASSESSMENT OF PROJECT INFRASTRUCTURE AND STATUS OF OPERATION AND MAINTENANCE (O&M) AND COST RECOVERY**

### **A. Main Canal**

1. A member of the PCR Mission visited the site and observed that the canal was flowing nearly full so the concrete surfaces below water and the head regulators of the distributaries were not visible. The concrete lining above water in the upper reaches of the main canal showed longitudinal cracks, which had been repaired. There was no evidence of overtopping of the concrete lining and adequate freeboard was available above the maximum water level mark. Some concrete panels had been washed but repairs had been undertaken or will be undertaken during the next closure of the canal. In certain sections vegetation was observed growing in the joints between the panels. The earthen fill above the lining shows ruts due to rain water and needs dressing. The quality of concrete on bridges and cross drainage works looked reasonable and no apparent distress was visible. The quality of construction was satisfactory.

2. The inspection road had a shingle layer on top, which had gone in certain sections making travel in the affected sections very difficult. Downstream of Taunsa the road is in poor condition due to the passage of heavy trucks which has caused ruts in the road. At the time of the inspection, due to overnight rain the road was in very poor condition, and it was not possible to go beyond RD 806+000. In this context, it is noted that the gravel base originally proposed for the road was canceled as a cost saving measure in September 1995, when the potential project cost overrun was identified.<sup>1</sup> A gravel base would have distributed the traffic load more evenly. Its absence has resulted in more rapid deterioration of the road, which now needs rehabilitation. In addition, measures are needed to check the flow of heavy traffic on the road through erection of barriers to save it from further deterioration.

3. Flood Carrier Channels (FCCs) have vegetation and silt deposits in the beds, resulting in higher water levels and often cause flooding of adjoining villages. Some protective works were constructed as part of the remedial works agreed following the review by the Grievance Redress and Settlement Committee. Additional similar protection works are still needed.

### **B. Distributary and Minor Canals**

4. Unlined distributaries show evidence of siltation as well as erosion of berms and vegetation on the sides, which reduces carrying capacity. During the visit, some farmers complained that in some distributaries water levels are inadequate and allocated supplies cannot be diverted at watercourse turnouts. As a result, farmers often construct temporary obstructions in the distributary beds to force supplies in their watercourses, causing shortage of water at the tail end. In some distributaries downstream of the fall structures the canal floor is damaged.

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<sup>1</sup> The cost saving measures adopted resulted in the following key design changes: (i) replacement of six super-passages by five canal culverts and an aqueduct, (ii) removal of the requirement for compaction of the flood carrier channel (FCC) embankment, with compaction achieved by movement of equipment only, (iii) reduction of the right bank flood embankment crest width from 4.57 meter (m) to 3.66 m, (iv) replacement of the baffled apron stilling basin by a chute and stilling basin on super-passages/culverts, (v) reduction in compaction requirement of embankment and dowel of the main canal from 95% to 85%, (vi) reduction in right bank road width from 6.10 m to 3.66 m, (vii) removal of gravel base material from the right side canal access road, (viii) reduction of freeboard above maximum flood levels on flood embankment from 1.21 m to 0.91 m, (ix) removal of Vetiver grass slope protection on main canal flood embankments and FCC embankments, (x) elimination of spur and armour protection along the main canal embankment, and (xi) elimination of concrete cut-off walls of gabion drop structures and causeways on FCCs.

5. The inspection roads along several distributaries are in poor condition due to the passage of heavy trucks. When it rains the unpaved roads become impassable. However, some roads along the distributaries have been paved and provide good farm to market access.

### C. Operation and Maintenance Arrangements

6. An agreement between the provincial governments of Khyber Pakhtoon Khwa (KP) and Punjab signed on 10 May 2002 specifies the Operation and Maintenance (O&M) of the canal and distributary off-takes in the entire length of CRBIP main canal to be carried out by WAPDA. The O&M cost sharing agreement includes the following provisions:

- (a) The entire O&M cost of feeder canal and Chashma Right Bank Canal (CRBC) lying in KP shall be borne by the governments of KP and Punjab in the light of yardstick<sup>2</sup> work plan approved by the provinces.
- (b) The O&M cost of feeder canal and part of CRBC and its appurtenant structures located in KP shall be shared as 50:50 between the provinces. The application of this formula shall be reckoned from December 2003 i.e. on the expiry of one year test running period.
- (c) The entire O&M cost of CRBC lying in Punjab shall be borne by the government of Punjab in the light of yardstick/work plan approved by the province.
- (d) O&M of FCCs located in KP shall be the responsibility of KP. Those located in Punjab shall be the responsibility of Punjab.
- (e) One time renovation of FCCs located in KP shall be shared on 50:50 basis between KP and Punjab.
- (f) WAPDA shall work out the O&M cost of CRBC to be borne by each province. WAPDA will submit O&M cost estimates/work plan to the provinces for approval well in time. Details of O&M cost estimate should be prepared on yardsticks approved by the provinces.
- (g) KP and Punjab shall ensure adequate O&M funds made available to WAPDA.
- (h) Water share of each province shall be in accordance with Water Accord 1991 determined by the Indus River System Authority (IRSA).

7. The O&M cost of CRBC comprises the following components:

- (i) The canal prism
- (ii) Both inspection roads
- (iii) All structures including distributary head regulators
- (iv) The flood protection bund and the flood protection works of west of CRBC
- (v) 1,000 ft (304.8 m) of FCCs immediately downstream of the cross drainage work and channels connecting the escapes to the respective FCCs

8. The O&M Cost of FCCs and its structures East of CRBC shall be the responsibility of the provinces excluding the first 1,000 ft (304.8 m) downstream of the cross drainage structures.

9. WAPDA has established an O&M Circle for CRBC project with its head quarter at D.I. Khan. The Circle is headed by the Superintending Engineer who is assisted by two executive engineers, 2 junior engineers and 7 sub engineers (civil 4; mechanical 3) and a support staff of 47 persons. The total strength is 59 which is more or less in line with yardstick requirements of 58, however the PC-I provides for a total staff strength of 122. As per requirements of PCI there

<sup>2</sup> The Yardsticks are based on experience of operating the system and estimating the needed quantities and unit costs to repair the deterioration that occurs during a year.

is a demand of one more position of Superintending Engineer, two executive engineers, 2 junior engineers and 7 sub engineers (civil 4; mechanical 3) and a support staff of 49 persons.

10. Despite the well laid out cost sharing agreement adequate funds are not being provided by the provinces to WAPDA. As outlined in Superintending Engineer CRBC (O&M) WAPDA's letter No. DK/CRBC/SE(O&M)/A-1/3547-53 of 1 September 2009 the total expenditure incurred by WAPDA on O&M by 30 June 2009 amounted to Rs518.19 million and the receipts from the provinces amounted to Rs216.63 million showing outstanding amount of Rs301.56 million. After adding the demand for 2009-10 the total outstanding amount from the provinces amounted to Rs583.58 million. Due to paucity of funds the O&M of the main canal cannot be carried out properly. The condition of the main canal is deteriorating and is reportedly not taking full discharge resulting in farmers complaining about shortage of water. Details of the expenditure by WAPDA, receipt from provinces and outstanding amounts are shown in Table A1.1.

**Table A1.1: O&M Expenditure on Main Canal and Outstanding Amounts**

No.	Year	Expenditure by WAPDA		Funds Received		Outstanding	
		KP	Punjab	KP	Punjab	KP	Punjab
1.	2001-02	5.321	6.100	7.500	16.197	2.179	-10.097
2.	2002-03	0.000	0.000	0.000	0.000	0.000	0.000
3.	2003-04	16.534	17.269	0.000	23.886	16.534	-6.617
4.	2004-05	24.981	33.170	0.000	0.000	24.981	33.170
5.	2005-06	14.539	44.521	0.000	57.812	14.539	-13.291
6.	2006-07	29.150	54.839	10.000	28.000	19.150	26.839
7.	2007-08	14.514	36.745	5.000	40.450	9.514	-3.705
8.	2007-08	60.192	60.193	0.000	27.780	60.192	32.413
9.	Cross-drainage structures	50.061	50.061	0.000	0.000	50.061	50.061
<b>Total</b>		<b>215.292</b>	<b>302.898</b>	<b>22.500</b>	<b>194.125</b>	<b>197.150</b>	<b>108.773</b>
Required for 2009-10						92.590	189.424
<b>Total Outstanding</b>						<b>289.740</b>	<b>298.197</b>

11. The provinces manage the distribution system. In KP the CRBC Division is responsible for O&M of Stages II and III lying within KP. There is neither additional O&M budget for Stage III nor has additional O&M staff been provided to the Division. As a result O&M of the system is carried out from the O&M budget of Stage II which affects the performance of both stages II and III systems. According to data supplied by Executive Engineer CRBC Irrigation Division Rs37.47 million has been spent on O&M of Stage III from 2002-2003 to 2009-2010.

12. If current funding levels were to continue, the estimated 50-year life of the Project would be shortened with a deferred-maintenance project probably arising in about 10-15 years. Monitoring of past irrigation system rehabilitation projects showed that, without adequate O&M particularly desilting, cropping intensities gradually decrease. Studies conducted by the Punjab Economic Research Institute indicated that there was a decrease of about 7% in cropping intensity over a period of five years in a poorly maintained distributary. There is also evidence that supplies to tail-ends of distributaries reduce whenever silt is allowed to accumulate.

#### **D. Recovery of O&M Costs**

13. Sustainability can be achieved only if adequate funds are available for O&M, which preferably should come from the beneficiaries through payment of irrigation service fee

(abiana). The importance of O&M and cost recovery is now fully recognized by all the provincial governments, which have introduced fundamental changes in its water sector policy. Institutional reforms in water sector have been introduced at provincial levels, which envisage creation of autonomous service organizations for irrigation and drainage: Provincial Irrigation and Drainage Authorities (PIDAs) and Area Water Boards (AWBs), and transfer of part of the O&M responsibilities to Farmer Organizations (FOs).

14. In the CRBC areas falling in KP, FOs have not been established and all distributaries and minors are operated and maintained by the provincial Irrigation Department, which also assesses and collects the abiana. The assessment and collection figures for Stage III are not available separately but combined figures for Stages II and III in KP were collected from the office of the Executive Engineer CRBC Division and given in Table A1.2.

**Table A1.2: Assessed Abiana and Recovery Stages II and III in KP**

Season	Year	Assessment	Recovery	Recovery %
K	2002	21,389,557		
R	2002-03	23,364,257		
Annual		44,753,814	14,146,652	31.61
K	2003	27,639,127		
R	2003-04	23,201,919		
Annual		50,841,046	33,982,792	66.84
K	2004	27,741,981		
R	2004-05	23,465,121		
Annual		51,207,102	36,530,292	71.34
K	2005	28,753,192		
R	2005-06	23,720,098		
Annual		52,473,290	39,471,903	75.22
K	2006	31,780,774		
R	2006-07	22,773,609		
Annual		54,554,383	42,031,505	77.05
K	2007	37,896,696		
R	2007-08	22,019,889		
Annual		59,916,585	35,827,328	59.80
K	2008	19,390,508		
R	2008-09	20,660,471		
Annual		40,050,979	39,950,075	99.75
<b>Total 2002-2009</b>		<b>353,797,199</b>	<b>241,940,547</b>	<b>68.38</b>

Note: K = Kharif; R = Rabi.

15. It is noted that the total assessed abiana over the 7 year period (2002-2009) is Rs353.80 million, and the corresponding recovery is Rs241.94 million. The average annual assessment is of the order of Rs50.54 million and recovery is Rs34.56 million, 68.4% of the assessed amount.

16. Flat rate of abiana assessment system has been implemented in Punjab with effect from Kharif-2003. The discretionary role of assessing staff has practically been eliminated. In 2006-07, the Government of Punjab approved broad principles for the cost sharing of recurring costs on O&M of irrigation and drainage system as outlined in Table A1.3.

**TABLE A1.3: Cost Sharing Principles Punjab Irrigation System**

No.	Asset	Cost Sharing
1	Headworks / Barrages	<b>Public Goods:</b> O&M and rehabilitation costs will continue to be borne by the Government.
2	main canal Systems	<b>Private Goods:</b> O&M cost to be entirely borne by the beneficiaries.
3	Distributaries and Minor Canals	<b>Private Goods:</b> O&M cost to be entirely borne by the beneficiaries.
4	Inter-river Link Canals	<b>Public Goods:</b> O&M and rehabilitation costs will continue to be borne by the Government.
5	Tubewells Fresh GW	Saline/Fresh GW tubewells are either closed down or handed over to private sector. Fresh GW tubewells treated as private goods, O&M cost entirely borne by the beneficiaries. Saline tubewells treated as public goods O&M cost borne by the Government.
6	Tubewells Saline GW	
7	Drainage System	O&M cost of surface drainage may be shared (private public partnership) in the ratio of 40% Government, 50% agricultural beneficiaries, and 10% non agricultural beneficiaries. O&M cost of subsurface drainage may be borne 30% by the Government for the outfall by the beneficiaries.
8	Flood Embankments	(i) Works for protection of canal system; 70% of O&M cost borne by the Government and 30% by beneficiaries. (ii) Multipurpose works protecting canal systems and other areas; 50% of O&M cost borne by the Government and 50% by beneficiaries (cities, towns or owners of other infrastructure). (iii) Works specifically constructed for protection of cities, towns and other infrastructure. 100% of O&M cost borne by the beneficiaries. (iv) For simplification the shares of the Government, agricultural beneficiaries and other beneficiaries are taken as 60:20:20.
9	Spurs	
10	Small Dams	<b>Small Dams</b> and appurtenant structures treated as <b>public goods</b> , O&M paid by the Government and <b>the distribution system treated as private goods</b> , O&M paid by beneficiaries.
11	Lift Schemes	O&M cost shared between the Government 60% and beneficiaries 40% (private public partnership)
12	Irrigation Research Institute	Turn into a corporate body either entirely owned by <b>IPD or a private public partnership.</b>
13	Design Directorate	
14	Buildings	Charged to respective cost centers.
15	Land Reclamation Directorate	<b>Public Goods:</b> costs to be borne by the Government.
16	Machinery	Proposals for effective utilization of machinery are being worked out.
17	Workshops	<b>Private Public Partnership:</b> Convert into a public limited company with management by private sector.
18	Establishment costs	75% Government and 25% agriculture beneficiaries.



17. In Punjab 30 FOs were established in 2006-07, responsible for the O&M of distributaries and minor canals. The stipulated 3 year tenure of the FOs has since been completed and elections for establishment of new FOs are still to take place. The FOs are responsible for assessment and collection of abiana, and are empowered to retain 50% of abiana with the remainder to be deposited with PIDA. The retained amount is utilised for O&M of distributaries and minor canals. The assessment and collection of abiana by FOs in CRBC area in Punjab, is given in Table A1.4 showing a dismally low recovery rate at 9.3%. With this poor rate of recovery FOs cannot maintain the distribution system and in a few years time the system will deteriorate needing a major rehabilitation intervention.

**Table A1.4: Abiana Assessment and Collection in CRBC Area in Punjab**

<b>Period: 2007-08 to 2009-10</b>	
Area (ha)	91,226
Assessed Amount (Rs)	76,576,833
Recovered Amount (Rs)	7,101,353
Recovery % of Assessment	9.27

Source: PIDA Punjab.

#### **E. Recommendation**

18. Unless adequate funds are provided for O&M, sustainability of the Project would become uncertain. Provincial governments need to provide adequate O&M funds for the main canal to WAPDA and for the distribution system to the irrigation divisions responsible for O&M. The collection of abiana charges by FOs in Punjab need to be improved through training and possible imposition of penalties for non recovery of abiana and poor O&M performance. Emphasis may be laid on improving recovery of abiana to ensure sustainability.

**PROJECT COSTS**  
(\$ million)

	Appraisal Estimate			Actual		
	Foreign	Local	Total	Foreign	Local	Total
<b>A. Investment Costs</b>						
<b>1. Civil Works</b>						
a. Main Canal (Part A)	42.29	61.31	103.59	149.36	25.07	174.42
b. Distributaries and Minors (Part B)	7.43	23.89	31.32	24.71	4.07	28.78
c. On-farm Works (Part C)	1.01	4.11	5.12	2.92	0.51	3.43
d. Agricultural Package (Part D)	0.33	0.86	1.19	0.08	0.00	0.08
e. Project Mapping (Part A)	1.86	1.54	3.39	0.75	0.25	1.00
<b>Subtotal</b>	<b>52.91</b>	<b>91.71</b>	<b>144.62</b>	<b>177.82</b>	<b>29.90</b>	<b>207.72</b>
<b>2. Land Acquisition</b>	-	12.51	12.51	-	17.57	17.57
<b>3. Vehicles and Equipment</b>	2.38	2.87	5.25	1.94	0.58	2.52
<b>4. Consulting Services</b>	6.55	12.24	18.80	14.61	4.87	19.49
<b>5. Project Monitoring</b>	0.02	0.40	0.42	0.02	0.36	0.38
<b>Subtotal Investment Costs</b>	<b>61.86</b>	<b>119.73</b>	<b>181.59</b>	<b>194.39</b>	<b>53.28</b>	<b>247.67</b>
<b>B. Project Support</b>	0.06	15.45	15.50	-	25.37	25.37
<b>Total Project Costs</b>	<b>61.92</b>	<b>135.18</b>	<b>197.09</b>	<b>194.39</b>	<b>78.65</b>	<b>273.03</b>
Contingencies	24.87	57.95	82.83			
Service Charge	7.58	-	7.58	6.06	-	6.06
<b>Total Costs Financed</b>	<b>94.37</b>	<b>193.13</b>	<b>287.50</b>	<b>200.45</b>	<b>78.65</b>	<b>279.10</b>

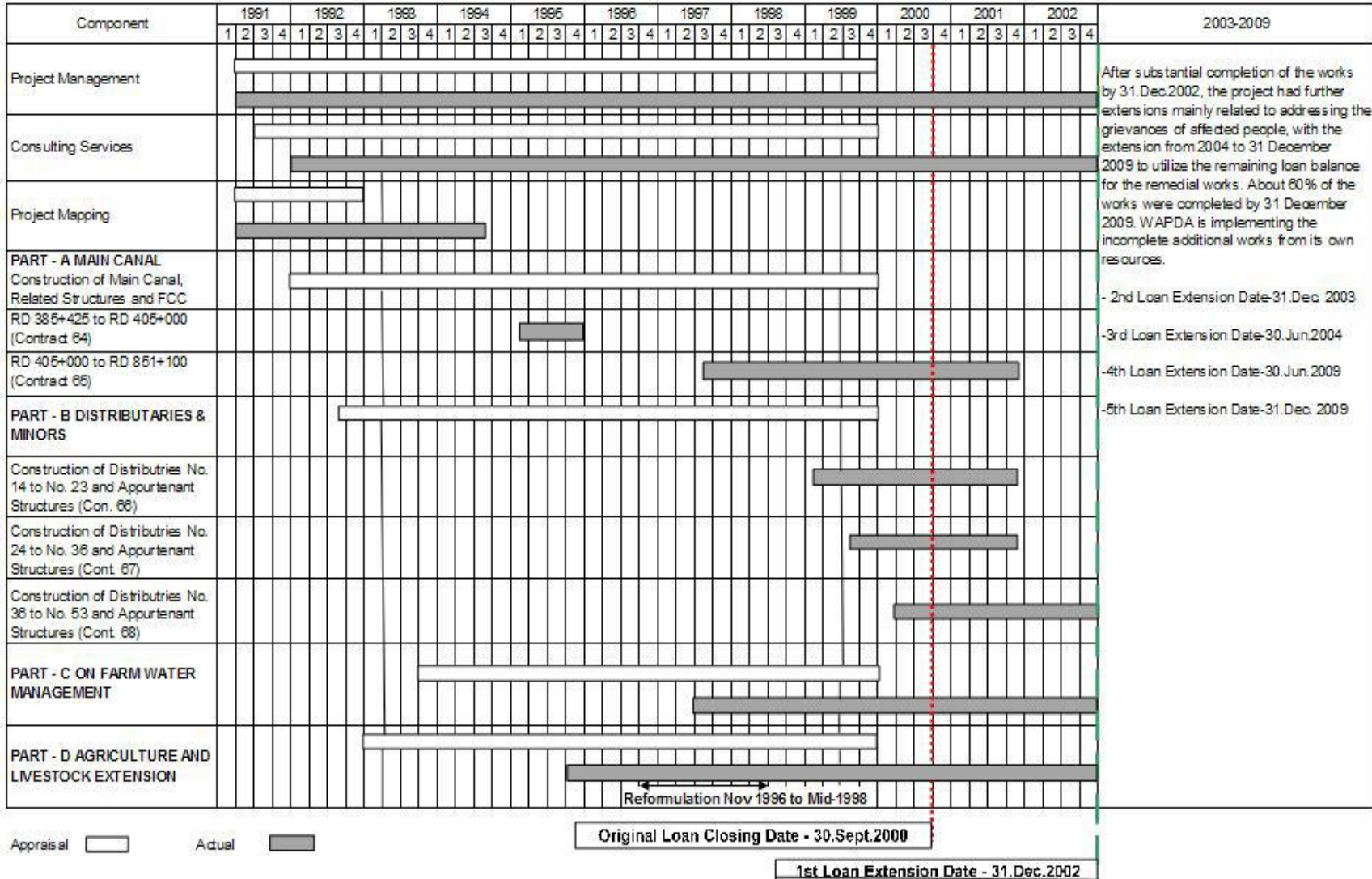
Note: Actual costs include contingencies within each cost item. Appraisal estimates are base costs.

## ADB DISBURSEMENTS BY YEAR (\$ million)

Component	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total <sup>a</sup>	
<b>A. Investment Costs</b>																					
<b>1 Civil Works</b>																					
(a) Main Canal (Part A)	5,320,769	1,380,570	3,418,480	6,778,347	10,182,481	20,043,619	17,579,818	20,374,294	12,523,366	4,471,995	1,072,716	423,729	529,065	-	192,621	7,211,242	4,874,354	-	-	116,377,466	
(b) Distributaries and Minors (Part B)			139,603	789,646	-	-	2,636,474	7,139,280	5,387,257	1,979,541	584,486	-	200,317	-	18,715	-	-	-	-	18,875,319	
(c) On-farm Works (Part C)				170,908	-	265,370	-	297,302	654,203	1,077,358	408,975	43,932	-	-	-	-	-	-	-	2,918,048	
(d) Agricultural Package (Part D)										83,186	-	-	-	-	-	-	-	-	-	83,186	
(e) Project Mapping (Part A)			433,787	37,016	-	277,809	-	(317,718)	(547,265)	-	-	-	-	-	-	-	-	-	-	748,612	
<b>2 Land Acquisition</b>																					
(a) Part A																					
(b) Part B																					
(c) Part C																					
<b>3 Vehicles, Equipment and Supplies</b>																					
(a) Part A	315,085	2,723	405,586	195,180	12,356	685,203	-	-	-	-	-	-	-	-	-	-	-	-	-	1,616,133	
(b) Part B																					
(c) Part C										61,722	-	-	-	-	-	-	-	-	-	-	61,722
(d) Part D						44,014	-	-	-	184,172	33,938	-	-	-	-	-	-	-	-	262,124	
<b>4 Consulting Services</b>	1,002,440	1,646,787	1,834,792	1,449,166	1,447,752	1,114,426	1,713,478	1,311,260	1,637,745	1,050,823	263,659	2,969	114,841	-	-	-	23,893	-	-	14,614,031	
<b>5 Project Monitoring (Part A)</b>		587	2,973	5,540	1,169	-	-	847	-	4,192	-	-	-	-	-	-	-	-	-	15,308	
LC	10,278	52,029	96,936	20,458	-	-	14,835	-	-	73,371	-	-	-	-	-	-	-	-	-	267,907	
<b>B. Project Support</b>																					
(a) Part A																					
(b) Part B																					
(c) Part C																					
(d) Part D	1,108,860	908,435	2,938,465	5,082,759	845,117	3,484,766	2,415,724	2,305,864	3,884,094	940,005	409,127	-	-	-	-	943,655	100,361	-	-	25,367,232	
<b>Total Costs</b>	<b>7,758,019</b>	<b>3,993,517</b>	<b>9,273,189</b>	<b>14,524,649</b>	<b>12,487,706</b>	<b>25,915,207</b>	<b>24,361,176</b>	<b>31,428,000</b>	<b>24,090,857</b>	<b>9,922,173</b>	<b>2,772,901</b>	<b>470,630</b>	<b>844,223</b>	<b>-</b>	<b>211,336</b>	<b>8,178,790</b>	<b>4,974,715</b>	<b>-</b>	<b>-</b>	<b>181,207,088</b>	

<sup>a</sup> Total cost excludes Service Charge of \$6,060,927 and Imprest Advance of \$7,134,105.

## PROJECT IMPLEMENTATION SCHEDULE



### COMPLIANCE WITH LOAN COVENANTS

Covenant	Reference in Loan Agreement	Status
The Borrower shall cause WAPDA, NWFP and Punjab to carry out the Project with due diligence and efficiency and in conformity with sound administrative, financial, engineering, environmental, agricultural, irrigation, drainage and public-utility practices.	Article IV, Section 4.01(a)	Complied with. Major components of the Project were completed satisfactorily.
The Borrower shall furnish, or cause to be furnished, to the Bank all such reports and information as the Bank shall reasonably request concerning (i) the Loan, and the expenditure of the proceeds and maintenance of the service thereof; (ii) the goods and services and other items of expenditure financed out of the proceeds of the Loan; (iii) the Project; (iv) to the extent relevant to the Project, the operations and financial condition of WAPDA, NWFP, and Punjab and other agencies of the Borrower responsible for the carrying out of the Project and operation of the Project facilities, or any part thereof; (v) financial and economic conditions in the territory of the Borrower and the international balance-of-payments position of the Borrower; and (vi) any other matters relating to the purposes of the Loan.	Article IV, Section 4.04	Complied with. See also PA, Art II, Sect. 208(b)
The Borrower shall enable the Bank's representatives to inspect the Project, the goods financed out of the proceeds of the Loan, and any relevant records and documents.	Article IV, Section 4.05	Complied with.
The Borrower shall take all action which shall be necessary on its part to enable WAPDA, NWFP and Punjab to perform their obligations under their respective Project Agreements, including their obligations under Schedule 6 to this Loan Agreement, and shall not take or permit any action which would interfere with the performance of such obligations.	Article IV, Section 4.06	Complied with.
The Borrower shall promptly inform the Bank of any amendment to the Act or the WUA Ordinances.	Article IV, Section 4.07	Complied with.
(a) It is the mutual intention of the Borrower and the Bank that no other external debt owed a creditor other than the Bank shall have any priority over the Loan by way of a lien on the assets of the Borrower. To that end, the Borrower undertakes (i) that, except as the Bank may otherwise agree, if any lien shall be created on any assets of the Borrower as security for any external debt, such lien will <u>ipso facto</u> equally and ratably secure the payment of the principal of, and service charge and any other charge on the Loan; and (ii) that the Borrower, in creating or permitting the creation of any such lien, will make express provision to that effect.	Article IV, Section 4.08	Complied with.

Covenant	Reference in Loan Agreement	Status
<p>(b) The provisions of paragraph (a) of this Section shall not apply to (i) any lien created on property, at the time of purchase thereof, solely as security for payment of the purchase price of such property; or (ii) any lien arising in the ordinary course of banking transactions and securing a debt maturing not more than one year after its date.</p> <p>(c) The term "assets of the Borrower" as used in paragraph (a) of this Section includes assets of any political subdivision or any agency of the Borrower and assets of any agency of any such political subdivision, including the State Bank of Pakistan and any other institution performing the functions of a central bank for the Borrower.</p>		
<p><u>Project Executing Agencies:</u></p> <p>(a) WAPDA shall be responsible for (i) overall execution of Parts A, B and C of the Project, including (1) construction of all irrigation and drainage works encompassing the Main Canal, flood-carrier facilities, distributary and minor canals, appurtenant structures, watercourses and erosion protection, (2) land acquisition, and (3) physical monitoring and evaluation of the progress of the Project implementation; and (ii) approval of detailed design of irrigation and drainage works under Parts A, B and C.</p> <p>(b) NWFP and Punjab. On behalf of WAPDA, in accordance with designs approved by WAPDA, (i) NWID and PIPD shall undertake, in those parts of the Project Area located in NWFP and Punjab respectively, construction of works, land acquisition, and physical monitoring and evaluation of the progress of the Project implementation under Part B of the Project; and (ii) NWFP's and Punjab's DOFWM shall undertake, in those parts of the Project Area located in NWFP and Punjab respectively, construction of works, land acquisition, and physical monitoring and evaluation of the progress of Project implementation under Part C.</p>	Schedule 6, para. 1(a), (b)	Complied with. The Project was implemented following the arrangements envisaged at appraisal. WAPDA was responsible for execution of Parts A and B of the Project. The provincial governments of KP (formerly NWFP) and Punjab were responsible for execution of Part C through their DOFWMs.
<p>NWFP and Punjab shall be responsible for execution of those portions of Part D of the Project located in NWFP and Punjab, including construction of works, land acquisition, institutional strengthening, and physical monitoring and evaluation of the progress of Project implementation under Part D. NWFP and Punjab shall execute their portions of Part D of the Project through, respectively, NWAD and PAD for Part D(1) and NWLD and PLD for Part D(2).</p>	Schedule 6, para 3	Complied with. KP and Punjab were responsible for execution of Part D.
<p><u>Project Management</u></p> <p>The Borrower shall cause to be appointed from WAPDA a Project Director, having the administrative,</p>	Schedule 6, para. 4(a)	Complied with. WAPDA appointed a Project Director (PD), who was overall responsible for project

<b>Covenant</b>	<b>Reference in Loan Agreement</b>	<b>Status</b>
financial and approval authority of a General Manager, who shall have overall responsibility for execution of the CRBI Project. The Project Director shall be assisted by four Provincial Project coordinators (one each from the DOFWMs, NWID and PIPD) and qualified technical and administrative staff concerned of the Project Executing and Implementing Agencies as shall be necessary to ensure timely and effective Project implementation.		implementation. The PD was assisted by four provincial project coordinators, two from each provincial government.
The Engineering Consultants shall be engaged by WAPDA to provide services as the Engineer to WAPDA, NWFP and Punjab for Project implementation. The Engineering Consultants shall carry out their services under the supervision and at the direction of the Project Director and shall be headed by a team leader. The team leader, who shall be delegated full powers as the Engineer for the Project by the Engineering Consultants, shall (a) have day-to-day responsibility for implementation of the Project; (b) directly supervise (i) the staff of the Engineering Consultants and (ii) the qualified technical and administrative staff, as required, who shall be appointed by the Project Executing and Implementing Agencies, with the consent of the team leader of the Engineering Consultants, to assist full-time in implementation of the Project; and (c) be provided with any other assistance and resources by the Project Executing and Implementing Agencies as may be necessary to ensure timely and effective implementation of the Project.	Schedule 6, para. 4(b)	Complied with. The appointment of Engineering Consultants was delayed by 20 months. The team leader, was delegated full powers as the Engineer for the Project.
<u>Project Supervision and Coordination</u> The Project Supervision and Coordination Committee (PSCC) established under Stage I and continued under Stage II, shall continue to function for the purposes of the Project and shall be responsible for overall supervision and coordination of Project activities among the Project Executing Agencies. The PSCC shall continue to be chaired by the Secretary of Ministry of Water and Power of the Borrower and comprised of representatives of the Ministry of Food, Agriculture and Cooperatives of the Borrower, NWFP, Punjab and WAPDA.	Schedule 6, para. 5	Complied with. PSCC meetings were convened regularly.
The Project Coordination Committee (PCCs) established for NWFP under Stage I and under Stage II shall function for the purposes of the Project and shall be responsible for supervision and coordination of Project-implementation activities of departments and agencies concerned of NWFP and Punjab respectively. The PCCs shall also take up problems unresolved by the division-level Project Coordination Committees and shall refer problems unresolved by the PCCs to the PSCC. The PCCs shall be chaired by the Additional Chief Secretary, NWFP and Punjab,	Schedule 6, para. 6	Complied with. PCC was established and regular meetings were convened during project implementation.

<b>Covenant</b>	<b>Reference in Loan Agreement</b>	<b>Status</b>
the General Manager of WAPDA, the Commissioners of D.I. Khan Division of NWFP and D.G. Khan Division of Punjab, and the Project Director. The PCCs shall meet as required but not less than once every quarter.		
The Project Coordination Committee established for D.I. Khan Division of NWFP and utilized for Stage II and a division-level Project Coordination Committee for D.G. Khan Division of Punjab (DPCCs) shall function for the purposes of the Project and shall be responsible for detailed coordination of Project implementation activities and report to the appropriate PCCs. The DPCCs shall refer problems unresolved by them to the appropriate PCCs. The DPCCs respectively shall be chaired by the Commissioners of D.I. Khan Division of NWFP and D.G. Khan Division of Punjab, and shall be comprised of representatives of departments and agencies concerned of NWFP and Punjab, D.I. Khan Division of NWFP and D.G. Khan Division of Punjab, and WAPDA. The DPCCs shall meet as required but not less than once every quarter.	Schedule 6, para. 7	Complied with. DPCCs for D.I. Khan and D.G. Khan Divisions were constituted and meetings were held as stipulated.
The Borrower shall cause to be established two Provincial Coordination and Monitoring Units (PCMUs) within NWPD and PPD, reporting to the Additional Chief Secretary, NWPD and the Chairman, PPD, to assist the respective PCCs and DPCCs in NWFP and Punjab. The PCMUs shall be responsible for (a) ensuring effective communication and liaison with the Project Executing and Implementing Agencies, and other departments and agencies concerned of the Borrower, NWFP and Punjab; (b) preparing briefing reports and position papers for DPCC and PCC meetings, together with summary financial reports; (c) preparing the PC-1(s) for Parts C and D of the Project; (d) arranging for the consulting services; and (e) arranging for Project Benefit Monitoring and Evaluation (PBME), including surveys and any special data-collection programs that may be required.	Schedule 6, para. 8	Complied with. PCMUs coordination function was improved. PCMUs were established at provincial headquarters with sub offices in D.I. Khan. PCMU provincial coordinators were provided strengthened authority for them to represent the provinces on project issues.
<u>Land Acquisition</u> The Borrower shall take, or cause to be taken by WAPDA, NWFP and Punjab, such action as shall be necessary to acquire, prior to the scheduled start of civil works under the Project, all land and rights in land, including rights of way and riparian rights, as shall be required for implementation of the Project.	Schedule 6, para. 9	Partly complied with. The process was delayed which caused delay in construction of flood carrier channels and distribution system.
<u>Monitoring and Evaluation</u> WAPDA, in connection with the Main Canal, and NWFP through NWID and Punjab through PID, in connection with the distributary and minor canals, shall be responsible for monitoring physical operation of the Project facilities as part of their normal O&M	Schedule 6, para. 10	Complied with. WAPDA is responsible for O&M and monitoring of main canal, and provinces are responsible for O&M and monitoring of distributary and minor canals as part of their normal O&M.



<b>Covenant</b>	<b>Reference in Loan Agreement</b>	<b>Status</b>
including recording all system inflows and outflows; water levels and silt deposits; and surveys of flood carrier channels before and after floods.		
WAPDA, through its salinity control and reclamation projects monitoring organization, shall monitor physical impact of the Project, especially on the depth of the water table, drainage discharge, water quality and soil salinity in the Project Area. WAPDA shall include the project Area within its basin-wide groundwater monitoring program, with observation points established on the normal 3,000 meter grid pattern and measurements made at least twice annually in April and October. Such program shall become applicable in the Project Area within one year of commissioning of each portion of the Main Canal. WAPDA shall also, in consultation with the Bank, prepare a program of system performance monitoring no later than 31 December 1993.	Schedule 6, para. 11	Complied with. In March 2001, a salinity management plan was prepared by IWASRI and SMO. The proposal was reviewed by ADB/KfW mission, which fully endorsed its immediate implementation.  SMO is observing the water levels in April and October.
<u>Environment Impact Assessment</u> WAPDA shall develop a comprehensive environmental monitoring program and undertake an environmental impact assessment of the CRBI Project with the assistance of the consultants and the support of the facilities provided under the Technical Assistance.	Schedule 6, para. 12	Complied with. Environmental monitoring program was prepared and implemented.
<u>Project Benefit Monitoring and Evaluation</u> The Borrower shall cause PBME to be carried out in accordance with the Bank's Guidelines for Project Benefit Monitoring and Evaluation for Agriculture, Irrigation and Rural Development Projects". On the basis of the agrosocioeconomic benchmark survey carried out in 1989 under a Bank-financed technical assistance to be reviewed and updated, the Borrower shall cause agrosocioeconomic assessment of the Project to be carried out, with the assistance of the PCMUs, through (i) a limited impact study of distributary canals in the Project Area to be completed by 31 December 1994, and (ii) a complete socioeconomic survey upon completion of the Project. Such PBME activities will be in addition to the scheduled midterm and project-completion studies for the projects financed under the Stage II.	Schedule 6, para. 13	Complied with. PBME Consultant was recruited in June 2000. The Phase I and Phase II reports were completed incorporating all the comments received.
In connection with the upgrading of the Indus Highway (N-55) and local roads passing through the CRBI Project area, including the Project Area, the Borrower shall cause its National Highways Authority and the departments and agencies concerned of NWFP and Punjab to consult and coordinate with WAPDA on design and implementation plans, specifically to ensure adequate cross drainage of and water conveyance across the highway and roads.	Schedule 6, para. 14	Complied with. The National Highways Authority and the concerned departments of the provincial governments consulted and coordinated with WAPDA on design and implementation plans, to ensure adequate cross drainage of and water conveyance across the highwa and roads.

<b>Covenant</b>	<b>Reference in Loan Agreement</b>	<b>Status</b>
<p><u>Water Users Associations</u> The Borrower shall ensure that, prior to commencement of improvement of existing watercourses or construction of new watercourses under Part C of the Project, the beneficiary farmers, whose lands are located within the cultivable command area of any such watercourse, are organized into WUAs by the DOFWMs under NWFP's and Punjab's WUA Ordinances. The Borrower shall ensure that beneficiary farmers, through the WUAs, improve existing watercourses and assist in the finishing work of new watercourses under the technical guidance of the DOFWMs.</p>	Schedule 6, para. 15(a)	Complied with. WUAs were established for improvement of existing watercourses or construction of new watercourses under Part C of the Project,
<p>The DOFWMs shall monitor and determine the requirements of construction of on-farm drains in the Project Area. On the basis of such requirements, the Borrower shall cause WUAs to construct such drains under the technical guidance of the DOFWMs.</p>	Schedule 6, para. 15(b)	Not Complied. Construction of on farm drains did not form part of PCI of on farm works and on farm drains were not constructed.
<p>At least 25% of the cost of materials for the construction or improvement of structures for watercourses and the full cost of earthwork construction and skilled labor for structures for new watercourses shall be recovered from the water users at no interest over a five-year period (including a one-year grace period). NWFP and Punjab shall ensure that such amounts will be collected by their revenue boards.</p>	Schedule 6, para. 15(c)	Complied with. This has been applied throughout the project implementation.
<p><u>Agricultural Credit</u> The Borrower shall continue to ensure that the Agricultural Development Bank of Pakistan, nationalized commercial banks and Federal Bank of Cooperatives make available to all qualified farm operators, on a timely basis, an adequate amount of short-term production credit for the purchase of fertilizer and other cash costs of production, and development credit to meet rough-land leveling and the medium-term and long-term investment requirements of all qualified farm operators in the Project area. In addition, the Borrower shall annually discuss with the Bank policies affecting the operations of agricultural financial institutions in Pakistan as well as mobilizing domestic savings and providing adequate and effective credit to farmers, particularly to small farmers, including those in the Project area.</p>	Schedule 6, para. 16	Partly complied. Physically supervisory coordinated efforts are not performed by the Borrower through credit institutions involved in credit disbursement, to ensure provision of agriculture credit to the farm operators. All financial institutions provided credit according to their own policies through procedure framed by provincial governments. No special emphasis or plan was made for Stage III area. Efforts are still required by the borrower for providing adequate and effective credit.
<p><u>Water Allocation</u> For the purpose of meeting the total irrigation water required for the CRBI Project, the Borrower shall ensure the availability annually of a minimum of 2.47 million acre feet (MAF) of water encompassing 1.52 MAF for NWFP and 0.95 MAF for Punjab.</p>	Schedule 6, para. 17(a)	Complied with. Water Allocation Accord was agreed in 1991. Actual discharge has been slightly lower than the designed 4,879 cusecs at peak and is regulated by IRSA according to water availability in rivers and provincial requirements.

<b>Covenant</b>	<b>Reference in Loan Agreement</b>	<b>Status</b>
<p><u>Produce Index Units</u> NWFP and Punjab shall cause their revenue boards to reassess the value of all lands in the Project Area irrigated by the Main Canal to reflect, in terms of produce index units (PIUs), increased productivity as a result of the Project. Reassessment of such lands shall be carried out within one year of the lands receiving irrigation water from the Project facilities.</p>	Schedule 6, para. 18	Partly Complied. The revenue boards did not reassess the value of lands in the project area within one year of the lands receiving irrigation water from the Project facilities. The lands, in terms of Produce Index Unit (PIU) were assessed during 2008-09.
<p><u>CRBI Project Communications System</u> The Borrower shall cause to be provided as soon as possible, on a permanent basis, international telecommunications facilities to the Project Area to ensure connection between the communications system of the CRBI Project and the Borrower's public communications system. To facilitate immediate communications between the communications system of the CRBI Project and other communications systems, the Borrower shall cause to be provided interim facilities, including international lines for telex, telephone and telefax, at the CRBI Project office in D.I. Khan District.</p>	Schedule 6, para. 19	Complied with. At present the system is not functioning due to the security situation in the area. Mobile phones, which also have limited connectivity, due to the security situation in the area, are used to communicate instructions otherwise the instructions are conveyed through messengers.
<p><u>Project Facilities</u> WAPDA, on behalf of NWFP and Punjab, shall be responsible for operation and maintenance of the Main Canal and the other Project facilities under Part A of the Project. For this purpose, WAPDA shall establish an O&amp;M circle for the CRBI Project. NWFP and Punjab, through NWID and PIPD respectively, shall be responsible for O&amp;M of all distributary and minor canals and all surface drainage facilities under the CRBI Project, including the Project facilities under Part B, located in their respective territories.</p>	Schedule 6, para. 20(a)	Complied with. WAPDA has established an O&M Circle for CRBC Project with its head quarter at D.I. Khan. Provincial Irrigation Departments are responsible for O&M of all distributary and minor canals
<p>The Borrower shall cause to be provided all funds, staff and equipment required for O&amp;M of the Project facilities. Without limitation of the above, NWFP and Punjab shall provide all funds and other resources necessary for O&amp;M of the Project facilities under Parts A and B of the Project. The funds and other resources required for O&amp;M of the Main Canal, flood-carrier channels and appurtenant structures shall be apportioned between NWFP and Punjab on an equitable basis no later than one year after the Effective Date.</p>	Schedule 6, para. 20(c)	Partly Complied. EAs started to comply only after it has been tied up as a condition to loan extension. O&M cost sharing agreement was signed in May 2001. Estimates of O&M cost prepared by WAPDA are often disputed by the provinces and release of O&M funds by the provinces to WAPDA is delayed. Because of this O&M of the main canal is not carried out properly.
<p>WUAs, under the technical guidance of the DOFWMs, shall be responsible for O&amp;M of all watercourses, appurtenant structures of the CRBI Project below watercourse outlets, and onfarm drains under Part C of the Project.</p>	Schedule 6, para. 20(d)	Partly Complied. Although WUAs are responsible, O&M of water courses and appurtenant structures is not adequate. This could be due to lack of technical guidance.
<p><u>Irrigation Service Fees</u> The Borrower shall ensure that NWFP and Punjab establish and collect irrigation services fees in such amounts and at such levels as will be adequate to recover the full costs of O&amp;M of irrigation and</p>	Schedule 6, para. 21(a)	Not Complied. Collection of irrigation services fees in NWFP was 68.3% of assessed amount, increased to 99.75% in 2008-09. In Punjab only 9.27% of the assessed

Covenant	Reference in Loan Agreement	Status
drainage systems of the Project. For this purpose, NWFP and Punjab shall allow farmer beneficiaries a grace period of one (1) year, after completion and full operation of the Project irrigation and drainage systems, before initiating or increasing irrigation service fees to contribute toward O&M costs.		amount in 3 years (2007-10) was collected. Full costs of O&M of irrigation and drainage (I&D) system of the Project are not being assessed or recovered. Punjab approved broad principles for cost sharing of O&M costs of I&D system in Punjab but is not being fully adhered to.
NWFP and Punjab shall periodically review, and adjust accordingly, if necessary, irrigation service fees in respect of the Project, commensurate with the accrual of Project benefits, except as the Borrower and the Bank may otherwise agree. Full O&M costs will be recovered by 31 December 2000 or such other date as the Borrower and the Bank may agree upon.	Schedule 6, para. 21(b)	Not Complied. Cost recovery in Punjab is low and full O&M cost is not being recovered. Irrigation service fees in respect of the Project are not commensurate with the accrual of Project benefits.
<u>Expansion of Drainage Facilities</u> In the event that sustained groundwater levels reach within five feet of the surface in the Project Area after Project completion as determined under the monitoring program referred to in paragraph 11 of this Schedule, the Borrower shall promptly cause subsurface drainage facilities to be provided in the Project Area, as required, and shall cause all necessary funds to be made available for this purpose.	Schedule 6, para. 22	Not yet applicable.
Provincial PC I: Approval of separate PC Is for Parts C & D of the Project.	LA, Sched. 3, para 9	Complied with. PC-Is for Parts C and D were approved.
Fielding of Consultants Selection/engagement of Engineering Consultants & Technical Advisor.	LA, Sched. 5, para 2(b)	Complied with. Technical Advisor replaced by project management consultant recruited 1 Apr 1999 to assist NWFP prepare the provincial action plan.
WAPDA, NWFP and Punjab to submit certified audit project accounts and financial statement not later than 9 months after the end of its fiscal year.	PA, Art. II, Sect. 2.09(a)	Complied with. Certified audit project accounts and financial statements were submitted regularly.
Submission of quarterly progress reports.	PA, Art II, Sect. 208(b)	Complied with. Quarterly progress reports were submitted.
Preparation and submission to the Bank of a report on physical completion of WAPDA/Punjab/ NWFP parts.	PA, Art II, Sect. 2.08(c)	Complied with. A Project Completion Report was prepared in September 2002 on substantial project completion.

## LIST OF VEHICLES AND EQUIPMENT PROCURED

S. No.	Particular	Date Purchased	Qty Purchased	Issued										Remarks
				CRBC	GZDP	GTC	Kachi Canal	SBZ	Mangla Raising	Chashma Barrage	Other Wapda Offices	Dispossed off	Irrigation Divn.	
1	Road Roller	5/93	2	2	-	-	-	-	-	-	-	-	-	CRBC own purchases
2	Hino Bus	8/94	3	-	3	-	-	-	-	-	-	-	-	-- do --
3	Toyota d/Cabin	11/94, 7/95	21	3	9	3	1	-	-	-	GM(P) = 3 Peshawar	2	-	-- do --
4	Mitsubishi Van	12/94	1	-	1	-	-	-	-	-	-	-	-	-- do --
5	Honda Civic Car (LOX-2978)	6/98	1	-	-	-	-	-	-	-	WAPDA Head/Office Lahore = 1	-	-	Purchased by other Wapda project (HEPO)
6	Toyota D/Cabin	2/99	9	3	2	1	-	3	-	-	-	-	-	Purchased by Pat Feeder
7	Pajero 5 door	2/99	1	-	-	-	-	-	-	-	CE/PD = 1 Chashma Barrage	-	-	-- do --
8	Pajero 3 door	2/99	1	-	-	-	-	-	1	-	-	-	-	-- do --
9	Toyota Hiace Van	2/99	1	-	1	-	-	-	-	-	-	-	-	-- do --
10	Toyota D/Cabin	2/99	9	5	1	3	-	-	-	-	-	-	-	-- do --
11	Potohar Jeep	2/99	2	-	-	-	2	-	-	-	-	-	-	-- do --
12	Toyota D/Cabin	7/93	9	1	4	1	1	-	-	-	-	-	2	Project Consultant (PMO)
13	Baleno Car Suzuki	7/2000	1	-	-	-	-	-	-	-	GM(F) Lahore = 1	-	-	PIME Studies Sheladia consultant
14	Suzuki Van	7/2000	1	-	-	1	-	-	-	-	-	-	-	-- do --

S. No.	Particular	Date Purchased	Qty Purchased	Issued										Dispossed off	Irrigation Divn.	Remarks
				CRBC	GZDP	GTC	Kachi Canal	SBZ	Mangla Raising	Chashma Barrage	Other Wapda Offices					
15	Suzuki Potohar Jeep	8/2000	3	1	-	-	-	-	1	-	-	1	-	-- do --		
16	Motor Cycle Yamaha 1000 cc	9/2000	7	2	-	-	-	-	-	5	-	-	-	-- do --		
17	Pajero 3 door	9/93	8	2	2	-	1	-	1	1		1	-	Project Consultant (PMO)		
18	Pajero 5 door	9/93	3	-	-	-	-	-	-	-	GM(P) North Peshawar = 1 + CE CRBC = 1 Director Transport = 1	-	-	-- do --		
			83	19	23	9	5	3	3	6	9	4	2			

## ECONOMIC EVALUATION

### A. Agricultural Production Benefits

1. The Project extended the cultivable command area (CCA) of the Chashma Right Bank Irrigation Project (CRBIP) by 135,000 ha. The provision of irrigation to this area, parts of which were previously barren or cultivated with a low level of cropping intensity, resulted in (i) changes in cropping patterns to crops that are of higher value and/or reflect market demand, (ii) increases in farm productivity resulting from perennial irrigation, and (iii) productive use of land previously uncultivated.

2. There has been a significant change in the cropping pattern and cropping intensity within the project CCA, as indicated in Table A7.1. As of the Mission (based on data for the latest season for each crop), the area under paddy had increased to almost 15,100 ha (from 580 ha in 1990), sugarcane to 11,000 ha (from zero in 1990), cotton to 27,740 ha (from 500 ha in 1990), and wheat to 61,630 ha (from 6,480 ha in 1990). The current cropping pattern reflects a significant change from that projected at appraisal with respect to an increase in the relative importance of cash crops (sugarcane and cotton) compared with food crops (paddy and wheat) and fodder crops. At appraisal, the combined area of sugarcane and cotton at full development was expected to be 22,950 ha, whereas it is currently 38,750 ha. The area under paddy and wheat was expected to be 86,400 ha but it is currently 76,700 ha. Before the Project, the area was partly irrigated by tubewell (8,300 ha) and partly rainfed and/or inundated by seasonal floods (126,700 ha). Cropping intensities in these areas were 5% and 127% respectively, with an average intensity over the whole area of 12%. As of the Mission, the overall cropping intensity had reached 102%. This compares with an appraisal estimate of 144%.<sup>1</sup> Reasons for the failure to reach the level of intensity expected at appraisal include the delayed start-up of the Project, illegal extraction of water that limits access towards the tail of the scheme, and reduced water flow resulting from inadequate canal maintenance. These failings are expected to be addressed in the future, in which case cropping intensity will continue to rise. If O&M funding remains a problem, however, cropping intensity may well decline.

3. Average yields of the major crops have exceeded appraisal targets (Table A7.2). The yield of paddy has risen from 2.46 tons per ha (t/ha) in 1990 to 3.62 t/ha in 2010 compared with an appraisal estimate of 3.1 t/ha. The yield of wheat increased from 2.2 t/ha in 1990 to 3.34 t/ha compared with 3.0 t/ha expected at appraisal. The yield of cotton in 2010 at 2.19 t/ha is significantly higher than both the without-project yield of 1.26 t/ha and the appraisal estimate of 1.49 t/ha. The yield of sugarcane in 2010 is 45.39 t/ha. Although it has yet to reach the level expected at appraisal of 49.60 t/ha, it is significantly higher than the yield achieved in 1990 (36.55 t/ha) in areas close to the project area (sugarcane was not cultivated before the Project). Although there have been major increases in yields of key crops compared with 1990 and expectations at appraisal, the shift in cropping pattern compared with that projected at appraisal means that incremental production of some crops has not reached appraisal estimates while for others yields have exceeded appraisal estimates. Incremental production of paddy amounts to 53,150 tons (93% of the appraisal estimate), and wheat 170,620 tons (81% of the appraisal estimate). By contrast, incremental production of sugarcane is 498,240 tons (18 times that projected at appraisal), and incremental production of cotton is 60,130 tons (2.6 times the appraisal estimate). In addition to increases in key food and cash crops, there has been a significant increase in production of fodder crops that has facilitated major (but unquantified) increase in output from the livestock sector.

<sup>1</sup> The appraisal report refers to an intensity of 150%. This is the irrigation intensity which differs from cropping intensity to the extent that perennial crops (such as sugarcane, orchards, etc) are included in the cropping pattern. The area under such crops has access to irrigation in both seasons whereas they are harvested in only one season. As of the Mission, the irrigation intensity had reached 110%.

**Table A7.1: Without-project, Appraisal and 2010 Cropping Patterns**

Cropping Pattern (ha) and Intensity (%)	Crop Areas		Appraisal	Variation from Without Project		Variation from Appraisal		Irrigation Intensity	
	ha	ha	Estimate	ha	%	ha	%	Actual	Appraisal
	1990	2010	ha	ha	%	ha	%	ha	ha
<b>Kharif</b>									
Paddy	581	15,077	18,900	14,496	2,495.0	-3,823	-20.2	15,077	18,900
Sugarcane	0	11,001	6,750	11,001	n/a	4,251	63.0	11,001	6,750
Cotton	498	27,744	16,200	27,246	5,471.1	11,544	71.3	27,744	16,200
Sorghum/millet (I)	415	0	0	-415	-100.0	0	n/a	0	0
Sorghum/millet (R)	3,167	0	0	-3,167	-100.0	0	n/a	0	0
Maize	0	518	27,000	518	n/a	-26,482	-98.1	518	27,000
Fodder (I)	748	5,920	10,800	5,172	691.4	-4,880	-45.2	5,920	10,800
Fodder (R)	507	0	0	-507	-100.0	0	n/a	0	0
Grain legumes (I)	748	5,052	0	4,304	575.4	5,052	n/a	5,052	0
Grain legumes (R)	1,140	0	0	-1,140	-100.0	0	n/a	0	0
Vegetables	0	57	2,025	57	n/a	-1,968	-97.2	57	2,025
Sunflower	0	1,151	0	1,151	n/a	1,151	n/a	1,151	0
Orchards	0	0	2,025	0	n/a	-2,025	-100.0	0	2,025
<b>Total Kharif</b>	<b>7,804</b>	<b>66,520</b>	<b>83,700</b>	<b>58,716</b>	<b>752.4</b>	<b>-17,180</b>	<b>-20.5</b>	<b>66,520</b>	<b>83,700</b>
<b>Rabi</b>									
Wheat (I)	6,479	61,626	67,500	55,147	851.2	-5,874	-8.7	61,626	67,500
Wheat (R)	760	0	0	-760	-100.0	0	n/a	0	0
Sugarcane	0			0	n/a	0	n/a	11,001	6,750
Oilseeds (I)	166	679	20,250	513	309.0	-19,571	-96.6	679	20,250
Oilseeds (R)	253	0	0	-253	-100.0	0	n/a	0	0
Gram	415	2,377	6,850	1,962	472.8	-4,473	-65.3	2,377	6,850
Fodder	498	6,290	13,500	5,792	1,163.1	-7,210	-53.4	6,290	13,500
Vegetables	0	0	2,025	0	n/a	-2,025	-100.0	0	2,025
Orchards	0	0	0	0	n/a	0	n/a	0	2,025
<b>Total Rabi</b>	<b>8,571</b>	<b>70,972</b>	<b>110,125</b>	<b>62,401</b>	<b>728.0</b>	<b>-39,153</b>	<b>-35.6</b>	<b>81,973</b>	<b>118,900</b>
<b>Total</b>	<b>16,375</b>	<b>137,492</b>	<b>193,825</b>	<b>121,117</b>	<b>739.6</b>	<b>-56,333</b>	<b>-29.1</b>	<b>148,493</b>	<b>202,600</b>
<b>Cultivable command area (ha)</b>	135,000								
<b>Cropping Intensity</b>	12.1	101.8	143.6					110.0	150.1

Source: CRBIP RRP 1991; PCR Mission estimates 2010.



**Table A7.2: Without-project, Appraisal and 2010 Crop Yields**

Crops by Season	Crop Yields		Appraisal	Variation from Without		Variation from Appraisal		PIME (2002) Yields (t/ha)	
	ton/ha	ton/ha	Estimate	Project				Crop Year 1999-00	
	1990	2010	ton/ha	ton/ha	%	ton/ha	%	Stage I	Stage II
<b>Kharif</b>									
Paddy	2.46	3.62	3.10	1.16	47.2	0.52	16.8	2.59	3.79
Sugarcane		45.29	49.60	45.29	n/a	-4.31	-8.7	42.36	30.46
Cotton	1.26	2.19	1.49	0.93	73.8	0.70	47.0	0.99	0.99
Sorghum/millet (I)	1.20			-1.20	-100.0	0.00	n/a	0.00	0.00
Sorghum/millet (R)	1.00			-1.00	-100.0	0.00	n/a	0.00	0.00
Maize		2.00	1.93	2.00	n/a	0.07	3.6	0.00	0.00
Fodder (I)	11.00	12.00	29.10	1.00	9.1	-17.10	-58.8	0.00	0.00
Fodder (R)	3.00			-3.00	-100.0	0.00	n/a	0.00	0.00
Grain legumes (I)	0.48	0.70		0.22	45.8	0.70	n/a	0.00	0.00
Grain legumes (R)				0.00	n/a	0.00	n/a	0.00	0.00
Vegetables		8.40	27.00	8.40	n/a	-18.60	-68.9	0.00	0.00
Sunflower		1.80	1.86	1.80	n/a	-0.06	-3.2	0.00	0.00
Orchards		14.90	9.00	14.90	n/a	5.90	65.6	0.00	0.00
<b>Rabi</b>									
Wheat (I)	2.20	3.00	3.34	0.80	36.4	-0.34	-10.2	2.02	1.86
Wheat (R)	1.58			-1.58	-100.0	0.00	n/a	0.00	0.00
Sugarcane				0.00	n/a	0.00	n/a	42.36	30.46
Oilseeds (I)	0.64	1.07	1.09	0.43	67.2	-0.02	-1.8	0.00	0.00
Oilseeds (R)	0.48			-0.48	-100.0	0.00	n/a	0.00	0.00
Gram	1.05	1.50	1.27	0.45	42.9	0.23	18.1	1.30	1.25
Fodder	9.20	31.58	13.00	22.38	243.3	18.58	142.9	0.00	0.00
Vegetables		14.20	25.00	14.20	n/a	-10.80	-43.2	0.00	0.00
Orchards		14.90	9.00	14.90	n/a	5.90	65.6	0.00	0.00

Note: Where no yield appears, the crop in question did not feature in the without-project (1990) cropping pattern.  
Source: CRBIP RRP, 1991; Project Impact Monitoring and Evaluation Report, 2002; PCR Mission estimates 2010.

## B. Economic Analysis of the Project

### 1. Methodology

4. The economic analysis of the Project is based on data collected during the Project Completion Report (PCR) Mission, from which incremental agricultural costs and benefits have been derived by a comparison with without-project estimates presented in the appraisal report. Data on physical inputs and outputs, prices, cropping patterns and related variables are derived from the Mission's investigations in the field, through discussions with selected farmers, project staff, and local government officials. These have been compared for consistency with data from official sources, notably that provided in the agriculture census statistics covering the project area.

5. The key general features of this PCR economic analysis methodology are presented below:

- (i) The use of the domestic price numeraire;
- (ii) Constant mid-2010 prices and the Pakistani Rupee (PRs) as the unit of account;
- (iii) A standard conversion factor (SCF) of 0.9, in common with other recent project appraisals and reviews undertaken in Pakistan;
- (iv) A shadow wage rate factor (SWRF) for unskilled labor of 0.8, reflecting the relatively high levels of unemployment and underemployment in the project area;
- (v) The economic internal rate of return (EIRR) is based on a 50-year cash flow;
- (vi) In determining 2010 constant-price cost estimates, actual project costs by year are separated into foreign and local cost components to which escalation factors based on the World Bank manufactures unit value (MUV) index and the Pakistan gross domestic product (GDP) deflator respectively are applied.<sup>2</sup> Tax and duty elements of project costs have been excluded in deriving economic costs;<sup>3</sup>
- (vii) Annual operation and maintenance (O&M) cost estimates are derived from actual expenditures incurred by the three executing agencies, Water and Power Development Authority (WAPDA) for the main canal, and provincial irrigation departments for distributary and minor canals. On-farm maintenance undertaken by farmers is assumed to be included under crop costs;
- (viii) Incremental agricultural benefits are estimated from crop budgets prepared for the 10 major crops in the without- and with-project cropping pattern. All physical parameters for the without-project situation are derived from the appraisal report. Crop yields, input usage, crop cultivation operations, labor input, etc are derived from Mission investigations. Without- and with-project crop budgets have been estimated based on constant mid-2010 prices, also estimated from Mission field investigations;
- (ix) The economic price of tradable inputs and outputs (which include paddy, wheat, sugarcane, cotton, and fertilizers) are based on import and export parity prices estimated on the basis of prevailing World Bank commodity price forecasts. All other project inputs and outputs are assumed to be non-traded;

<sup>2</sup> The MUV index is taken from World Bank Manufactures Unit Value Index, June 2010. The Pakistan GDP deflator up to 2008 is taken from the ADB's Development Indicators 2009 and from the State Bank of Pakistan thereafter.

<sup>3</sup> The estimate of costs is based upon actual costs recorded by the ADB Loan Financial Information System (including costs financed by KfW), and by government project data. These do not include estimates of taxes and duties paid. In deriving these for the economic re-evaluation, the percentage of taxes and duties calculated at appraisal for each cost category.

- (x) Project-wide incremental benefits are estimated by applying crop gross margins per ha from without- and with-project crop budgets to project area without- and with-project cropping patterns respectively. In the absence of periodic monitoring reports, there is nothing on which to estimate the progression from the without-project cropping pattern to that observed during the Mission. Rather, an equal annual increase/decrease from the without- to with-project cropping pattern has been assumed over the period 1990 (without-project) to 2010 (with-project). Although such a linear progression does not reflect reality, it does reflect a gradual build up to the 2010 cropping pattern and is more conservative than assuming the with-project cropping pattern was achieved immediately upon project completion. In this context, no attempt has been made to estimate future changes in either cropping pattern or cropping intensity;
- (xi) No data were available during the Mission or other project-related statistics that would enable an estimate to be made of the benefits from increased livestock production or from agribusiness development resulting from the Project. In the case of livestock, this significantly understates the total value of incremental benefits;
- (xii) The impact on farm incomes is based on farm budget analysis that assumes a cropping pattern and cropping intensity the same as the project area as a whole applied to an average farm size of 3 ha, and gross margins from crop budgets.

## **2. Crop Gross Margins and Prices**

6. With-project financial gross margins range from PRs103 per ha for maize to PRs 864 per ha for sugarcane. For those crops grown in both the without- and with-project situations, increases in financial gross margins range from 44% to 320%. With the exception of cotton, with-project economic gross margins are also significantly higher than those in the without-project situation. For cotton, although higher than its without-project level, the with-project economic gross margin remains negative at minus \$326 per ha. The economic gross margin for cotton is significantly lower than the financial gross margin as a result of a much lower economic farm-gate output price than financial price. Higher economic than financial prices for traded inputs and an increase in input usage also contributes to higher costs per ha.

7. Crop price estimates at appraisal indicated that for all the major project-area crops (paddy, wheat, sugarcane and cotton), economic prices exceeded financial prices by up to 184%, and that long-term economic prices were higher than economic prices at the time of appraisal. At the time of the Mission, economic prices of paddy, wheat and sugarcane are higher than financial prices, by between 11% and 27%, the economic price of cotton is well below its financial equivalent.

## **3. Economic Analysis**

8. Based on the foregoing analysis, the EIRR is estimated at 13.9%. This suggests that the Project is economically viable when assessed against an assumed opportunity cost of capital (OCC) of 12%. The EIRR estimated at appraisal was 20%. Sensitivity analysis indicates that benefits could fall by 19%, or investment costs increase by 23% before the EIRR would fall to 12%. The ERR is not sensitive to O&M costs. Switching values for benefits and costs are presented in. Table A7.3.

**Table A7.3: Sensitivity Analysis**

<b>Variable</b>	<b>Switching Value (%)</b>
Benefits	18.7
Investment Costs	23.1
O&M Costs	4,247.4

9. The key reason for the actual EIRR being lower than that at appraisal is the nature of the cropping pattern, a lower level of cropping intensity, and lower economic gross margins for crops that make up a relatively large part of the cropping pattern compared with that proposed at appraisal. However, in spite of lower economic gross margins, if the cropping pattern and cropping intensity expected at appraisal had been achieved by 2010, the resulting EIRR would have been 18.1%. This highlights the need for improved O&M to ensure adequate delivery of water to enable cropping intensity to continue to rise towards the 143% expected at appraisal. It also points to the need for improving awareness amongst project area farmers of the increased water requirements of the current cropping pattern, which in turn affects water delivery for tail-end farmers. This will be more difficult to achieve since, while economic benefits appear lower from the current cropping pattern, the prevalence of cash crops such as sugarcane and cotton results in higher financial returns to farmers.

#### **4. Unquantified Benefits**

10. The contribution of the Project to increased livestock production has been significant. Mission field investigations with farmers point to a large increase in livestock numbers. This is supported by the large increase in the area under fodder crops in the project area, increased fodder production, which amounted to almost 260,000 tons in 2010, to support a larger livestock industry, and the increased contribution of livestock to farm incomes (para. 12). The Project also stimulated local agribusiness with the establishment of two sugar mills serving project area farmers. It has not, however, been possible to determine the economic viability of project area livestock development and sugar processing due to lack of data available to the Mission.

#### **C. Impact on Farm Incomes**

11. Farm budget analysis indicates that in 2010, an average farm of 3 ha earned PRs131,050 (\$1,565) from crop production, equivalent to PRs43,680 (\$520) per ha. By comparison, in the without-project situation based on without-project yields and input usage and 2010 prices, a 3 ha farm irrigated by tubewell would have had an income of PRs51,260 (\$610). Although the without-project irrigation intensity for a tubewell irrigated farm was 127%, compared with the with-project intensity of 110%, with-project crop yields are significantly higher than without-project yields resulting in higher crop gross margins. Without-project income for a rainfed 3 ha farm would have amounted to only PRs740 (\$245). The with-project cropping pattern requires an increase in both hired and family labor compared with the without-project situation. The with-project requirement for family labor is estimated at 112 days per year. This compares with a without-project tubewell irrigated farm for which the requirement is 82 days. In spite of the higher family labor input, farm income per family labor day has increased significantly, from PRs625 (\$7.50) per day to PRs1,170 (\$14.00) in the without- and with-project scenarios respectively.

12. Total farm income from all sources amounts to PRs196,710 (\$2,350). Field investigations with project area farmers during the Mission indicate that on average farmers earn PRs37,750 (\$450) from off-farm employment, and PRs27,910 (\$335) from livestock, representing 19% and 14% respectively of total farm income, with 67% deriving from crop production. In the without-project situation, an average tubewell irrigated farm had a total

income of PRs33,190 (\$1,345 at the 1990 exchange rate), of which crop income accounted for 60%, livestock income 11%, and off-farm income 29%. By comparison, a rainfed farm had a total income of PRs13,385 (\$550), of which 70% derived from off-farm income, and only 3% from crop production. For farms previously irrigated by tubewell or rainfed, the Project has brought about not only a major increase in income from crops but also both an increase in the relative importance of livestock, and a reduction in the need for off-farm employment, especially for rainfed farms. This is particularly significant with respect to former rainfed farms since they constituted 94% of the project area prior to implementation.

13. The estimated project area monthly household poverty line income as of 2010 is PRs1,425, based on the official 2005-06 estimate (PRs879) and applying the GDP deflator to 2009-10.<sup>4</sup> This equates to PRs17,100 on an annual basis. Current average farm household incomes exceed this by a considerable margin. Although no estimates are available of the proportion of the project area population living below the poverty line at appraisal or in 2010, it is clear that the majority of project beneficiaries now have incomes well in excess of the prevailing poverty line income, whereas in 1990 a significant proportion of rainfed area farm households in particular would have been below the poverty line or vulnerable to poverty.

14. At appraisal it was expected that an average farmer would be required to contribute to project operation and maintenance at an average rate of PRs208 per ha, equivalent to 6% of the net cash surplus from crop production at full project development. In 2010, the maximum rate of water charges levied by the provincial irrigations departments is PRs625 per ha for non-food crops. This represents only 1% of the gross margin of the main cash crops (sugarcane, cotton and sunflower) in 2010, suggesting that water charges do not represent a significant expense for the average farm and are easily affordable.

#### **D. Employment**

15. The shift in cropping pattern and the large increase in cropping intensity over the major part of the project area has led to a large increase in on-farm labor. In addition to an increase in the need for family labor from 82 days to 112 days on a farm previously irrigated by tubewell, the use of hired labor has increased from 46 days to 85 days. For a rainfed farm, the with-project labor requirement is almost entirely incremental, since such farms did not use hired labor. Based on the incremental labor requirements for each type of without-project farm and the proportion of the project area occupied by each farm, the annual incremental family labor requirement across the 135,000 ha project area is estimated at 4.4 million days and incremental hired labor requirement 3.9 million days, representing a total annual incremental labor requirement of 8.3 million days across the whole project area.

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<sup>4</sup> The 2005-06 official poverty line figure is from the Pakistan *Economic Survey 2005-06*, and GDP deflator from ADB *Key Indicators 2009* and State Bank of Pakistan statistics.

