CHAPTER 8 PROJECT EVALUATION

8.1 General

The basic assumption for economic evaluation of the Project are summarized as follows:

1) The economic useful life of the Project is 50 years,
2) All prices are expressed at May 1996 prices in Rupee,
3) The exchange rare of US$1.00 = Rs.34 = Yen 107.9 as of May, 1996,
4) A standard conversion factor (SCF) with 0.9 is applied to domestic cost elements such as transport, handling and processing for estimation of economic value,
5) The transfer payment such as tax, duty, subsidy and interest are excluded for the estimation of economic costs and prices,
6) Economic prices of farm inputs (urea, triple super phosphate and muriate potash) and tradable farm produce (wheat, maize, sugarcane, cotton, cotton seed, and citrus) are estimated on the basis of IBRD projection of world market prices for 2005 in constant 1996 terms. Economic prices of other non-tradable farm outputs and farm inputs are set at same financial prices.
7) The part of unskilled labor is converted to the economic value applying the conversion factor of 0.88, and
8) The construction components are converted to ecomnomic value applying Construction Conversion Factors (CCFs) which are calculated on the basis of proportions of local and foreign costs, transfer payment, unskilled labor and other local costs at the local portion.

8.2 Economic Cost

The economic costs for the project, annual O&M and replacement are calculated applying Construction Conversion Factors (CCFs) to those financial costs as follows.

(Rs'000)

Item	Financial	Economic
I. Project Cost	3,119,937	2,345,269
(1) Compensation	3,402	0
(2) Construction	1,985,496	1,794,295
(3) Engineering/Administration	284,236	266,558
(4) Institutional Reform	76,118	68,219
(5) Physical Contingency	234,925	213,206
(6) Price Contingency	535,760	0
II. Annual O&M Cost	22,832	20,549
III. Replacement Cost	794,198	717,718

8.3 Economic Benefit

The direct benefits to be expected from the canal lining are (1) increased production, (2) reduction of tubewell operation cost, and (3) reduction of operation and maintenance cost.

(1) Increased Production

Increased production will be expected from stabilized water supply, application of additional water. In addition, reduction of seepage will improve groundwater table and, hence, results in the mitigation of salinity and waterlogging problem, which contributes to the increase of crop production. For the evaluation, it is assumed that increased irrigation water will be reflected by the increased productivity only and no change in cropping intensity and cropping pattern is assumed. In the Fresh Groundwater Area (FGW), groundwater is used for supplemental irrigation and, accordingly, it can be assumed that available amount of irrigation water will be same even after the implementation of the project. Therefore, benefit from the increased productivity is realized only in the Saline Groundwater Area (SGW). Expected increase in yield is calculated by the present yield multiplied by water saving rate and yield response factor which is estimated by FAO. The net production value of crop production is defined as the difference between "with project case" and "without project case" as summarized below. (See Table 8.3-1)

(Rs.'000)

	SGW (ha)	Without Project	With Project	Net Production Increase
Lower Jhelum	56,350	837,342	999,306	161,964
Lower Chenab	108,740	1,304,706	1,577,321	272,585
Central Bari Doab	58,543	285,806	330,274	44,468
Total	193,633	2,427,884	2,906,901	479,017

It is assumed that production increase will be achieved soon after the completion of lining works of each canal. The benefit for all areas will be realized completely from 7th year.

(2) Reduction of Tubewell Operation Cost

In the Fresh Groundwater Area (FGW), groundwater is presently used for irrigation as the supplemental purpose. However, canal lining makes more irrigation water available from surface system and reduces recharging of groundwater. As a result, groundwater presently pumped up for irrigation in FGW will be replaced by surface irrigation water. Therefore, the operation cost of these pumps will not be required after the lining and the saved operation cost will be considered as a benefit. Total amount of saved water per annum is about 163.2 MCM and the portion for FGW is about 31.5 MCM per year. The benefit from reduction of tubewell operation cost is calculated by multiplying saved water in FGW by unit operation cost of tubewell. The unit operation costs for diesel and electronic tubewells are Rs.0.31/m^3 and

Rs.0.35/m^3, respectively (including depreciation cost). The expected benefit is about Rs.10.1 million per year. (See Table 8.3-2)

(3) Reduction of Operation and Maintenance Cost

As an integrated components of the project, operation and maintenance of distributaries and minors will be transferred to Farmers' Organization (FO). The transfer of the O&M urges rationalization of O&M system and, as a result, the O&M cost will be reduced. This reduction of the cost will be considered as a benefit. The O&M cost for "without project case" is estimated as the cost for maintaining the capacity of the design discharge, and its peronnel cost is assumed to be same as persent situation. In the case of "with project", personnel cost is estimated by multiplying the number of staff required for FO and thier assumed salary (the salary for PID staff is referred). The maintenance and repair cost is calculated based on the necessary cost for maintaining the canal capacity of lined canals. The benefit for the reduction of operation and maintenance cost is defined as the difference between "with project" and "without project" as summarized below.

(Rs.'000)

	Without Project	With Project	Benefit
Personnel Expense	11,968	4,525	7,443
M & R Cost*	13,596	16,023	-2,427
Total	2,565	20,549	5,016

*: Maintenance and Repair Cost
Figures are indicated in economic price.

8.4 Economic Evaluation

Based on the flow of project cost and benefits shown in the Table 8.4-1, the economic rate of return is calculated as 19.9%. EIRR is also calculated also for 12 distribtaries and the results are as follows.

System	Distributary	EIRR
LJC	Pindi	18.5
	Hujjan	24.1
	Kirana	16.5
LCC	Sarangwala	15.0
	Nasrana	26.6
	Gojra	31.2
	Mungi	22.9
	Janiwala/Hamza	29.7
	Pir Mahal	13.2
	Killianwala	17.3
CBDC	Thamman	11.3
	China	22.6
Overall		19.9

For the sensitivity analysis, (i) 10% and 20% increase in initial investment cost, and (ii) 10% and 20% decrease of crop production are assumed. The EIRR for each case is summarized below.

Benefit	Cost Increase		
Decrease	0%	10%	20%
0%	19.9%	18.1%	16.7%
10%	18.0%	16.4%	15.1%
20%	16.1%	14.7%	13.4%

Considering the results that EIRR of the Project (12 distributaries) is 19.9% and that for each distributary is above 12% except Thamman distributaries, the Project is economically feasible. From the result of the sensitivity analysis, it can be concluded that the Project is not sensitive to the increase of initial investment cost and to the decrease of crop production benefit.

8.5 Financial Analysis

(1) Farm Budget Analysis

Farm budget analysis on different farm size has been made for "with project" and "without project" case for three project areas (See Table 8.5-1). It is expected that the farm income will be increase by 10% on average for all farm sizes after the implementation of the Project.

Farmers' capacity to pay for water charges is assessed by the comparison between farmers' net reserve and estimated water charge after the implementation of the Project. Water charge is computed by dividing the O&M cost and replacement cost (assuming 12% of discount rate) by CCA. The share of water charge against net reserve is less than 3% for all size of farmers, and no serious impact is expected. In case of assumption that farmers will also repay initial investment cost, water charge including amortization will be Rs.1,174/ha in Lower Jhelum, Rs.1,161/ha in Lower Chenab and Rs.1,097/ha in Central Bari Doab. Their shares against net reserves will be not more than 15% for all size of farmers.

(Rs)

Item	Marginal	Small	Medium	Large
Lower Jhelum				
1) Farm size (ha)	(1.56)	(3.49)	(6.36)	(16.45)
2) Net Reserve	12,600	33,440	74,980	232,500
3) Water charge	291	650	1,185	3,064
3) / 2) (%)	2.3%	1.9%	1.6%	1.3%
4) + Amortization	1,834	4,096	7,470	19,312
4) /2) (%)	14.6%	12.2%	10.0%	8.3%
Lower Chenab				
1) Farm size (ha)	(1.52)	(3.70)	(6.82)	(13.99)
2) Net Reserve	19,920	54,230	110,170	222,010
3) Water charge	263	642	1,182	2,426
3) / 2) (%)	1.3%	1.2%	1.1%	1.1%
4) + Amortization	1,763	4,301	7,916	16,247
4) /2) (%)	8.8%	7.9%	7.2%	7.3%
Central Bari Doab				
1) Farm size (ha)	(1.48)	(3.47)	(6.36)	(16.01)
2) Net Reserve	10,820	34,530	76,870	225,120
3) Water charge	243	572	1,049	2,638
3) / 2) (%)	2.3%	1.7%	1.4%	1.2%
4) + Amortization	1,621	3,810	6,981	17,564
4) /2) (%)	15.0%	11.0%	9.1%	7.8%

(2) Repayment capability of the Project

The repayment capability of the Project is also studied by preparing cash flow statement. The cash flow statement is prepared on the basis of an annual disbursement schedule of the financial initial investment cost as summarized below.

(Rs.'000)

Item	F.C.	L.C.
Initial Investment Cost	1,388,971	1,195,206
Price Contingency	285,222	250,538
Total	1,674,193	1,445,744

It is assumed that the capital cost required for the implementation of the project will be arranged under the following conditions:

(i) Foreign currency portion of the capital cost is financed by a loan from an international organization.

(ii) Interest rate of the loan is 2.3% per annum and repayment period is 30 years including 10 years grace period.

(iii) Local currency portion of the capital cost is financed by the Government Budget without repayment.

According to the above assumptions, the total fund requirements for construction of the project was estimated with its yearly breakdown as shown below.

(Rs.'000)

Year	International Fund	Governmental Budget	Total
1999	76,602	30,468	107,070
2000	68,114	44,478	112,592
2001	315,383	285,554	600,937
2002	366,983	324,094	691,077
2003	432,352	388,534	820,886
2004	414,760	372,615	787,375
Total	1,674,193	1,445,744	3,119,937

Assuming that repayment of the project cost is arranged by the budget of Government of Pakistan, amortization is estimated at about Rs.76 million in average during the repayment period.

8.6 Indirect Benefits and Socio-economic Impacts

Based on the data collected from the local government offices and the data of 1990's Agricultural Census, the estimated beneficiary is about 134,000 households and about 940,000 farmers. In addition to the tangible benefits mentioned above, following 4 items are considered as the expected indirect benefit and socio-economic impacts.

(1) Improvement of Inequitable Water Distribution

Along the unlined canal, it is often observed that canal bank is broken and excessive water is taken by some farmers at the up-stream and very little of water is available at the down-stream. After the lining of canals, this type of disturbance will be physically impossible. Additionally, institutional reform will make the unfair water utilization be impossible from the social points of view.

(2) Salinity Control

As it is mentioned in section 8.3, expansion of waterlogging and salinity area will be stopped by canal lining. In saline groundwater area, there are some cases that farmers use saline ground water for irrigation when they face extreme water shortage. In this case, soil which is presently in good condition can be affected by salinity and it will turn into unsuitable soil for cultivation. Lining of canals will make farmers have more surface water for irrigation and, as a result, expansion of salinity will be avoided.

(3) Increase of Employment Opportunity

After the implementation of the Project, total labor requirement for farm work will be 12.9 million man-day. Besides, it is expected that increase in agricultural production will activate its

marketing and processing factory and, accordingly, result in the increase of labor requirement at relating factories and agencies.

(4) Securing Stable Food Supply

The project will contribute to the securing of self-sufficiency of agricultural produce. Sufficient supply of food will also make an important contribution to attain economic independence of Pakistan. In addition, the surplus would decrease the annual amount of imports of those produce and thereby save the foreign exchange.

CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

1. The Project broadly comprises two components: (i) physical works including the lining of 540 km of Distributaries and Minors belonging to 12 Distributary systems with a total command area of 241,111 ha and remodelling of related structures and (ii) formulation of farmers organizations in compliance with GOP's institutional reform program. The total cost would be Rs. 3,120 million (US$ 92 million). The Project would be implemented by PID/PIDA for six years from 1999 to 2004 on a pilot project basis.

2. The study revealed that the Project would create new water resources equivalent to 10.7 % of the authorized discharge and be economically viable with an EIRR of 20 % based on a conservative evaluation. The Project would increase farmers' income by about 10 %. The high economic viability could be attributed to the short distance of Distributaries and Minors per CCA (2.2 m/ha) and the low unit cost (Rs. 12,940/ha or US$ 380/ha). In general, prerequisites for high economic viability of a canal lining project would be (i) most of the benefitted area falls in SGW zones; (ii) average seepage rate is 6.3 cfs/msf or more; (iii) canal is designed suitable for lining.

3. Judging from the dialogue at farmers meetings, farmers have a strong will and self-confidence to undertake the O&M of Distributaries and Minors. But they are also cognizant of necessity of technical assistance from experts. It is eagerly anticipated that the farmers' capability demonstrated in the management of watercourses will be exerted for Distributaries and Minors.

4. The Project will realize more equitable and rational water management through (i) physical improvement of canal system including the regularization of canal shape and remodelling of outlets and (ii) farmers' direct participation in water management which will effectively suppress illegal abstractions.

9.2 Recommendations

1. The Project is economically feasible and technically sound. It is recommended that GOP/GOPunjab would implement the Project as soon as possible.

2. It is recommended that GOP/GOPunjab would procure technical services of engineers for the detail design, preparation of tender documents and construction supervision of the Project.

3. It is recommended that GOP/GOPunjab would make arrangement to provide technical assistance for farmers organization to implement the participatory O&M including legal framework establishment and formation of organization, registration, transfer of facilities, formation of O&M plan, assessment and collection of water charges.

4. Reports concerned states that land acquisition outside the canal right of way is very difficult and need a long procedure even one year rent. It is recommended that the GOP and GOPunjab would make a comparative study on the original plan and alternative plans as shown below and adopt more paractical ones for the canal reaches where land acquisition is unavoidable in the current design.

(i) *Construction of diversion canal completely within the right of way using portable* precast concrete flume to omit land acquisition and reduce diversion earthwork volume which may increase construction cost and require further study of working procedure of the concrete flume:

(ii) Lining work within the canal closure period using geomembrane and precast concrete pannel to omit land acquisition as well as diversion work.

5. It is recommended that GOP and GOPunjab would execute the following research and tests prior to commencement of construction at certain stretches of canal and incorporate the results of the research and tests in detailed design and construction plan: (i) measurement of seepage rate (pre and post lining condition); (ii) construction speed and soil compaction test; (iii) measurement of required earth volume; (iv) measurement of hydraulic features of lined channel such as roughness coefficient, velocity and discharge; (v) experiment about temporary outlets; (vi) proportionality of each type of outlet; and (vii) improvement of water tightness and reinforcement of concrete at field condition.

6 Activation of agricultural extension activities is very important for dissemination of technologies on effective use of water and adequate farming practice. It is recommended that GOP/GOPunjab would enhance the efficiency of research and developmet, strengthen extension activities, and allocate necessary budgets.

7. Initial environmental examination (IEE) was conducted on 19 items. Environmantally the Project has more beneficial impacts than adverse impacts and possible adverse impacts that could occur. It is recommended that GOP and GOPunjab would take the following mitigative actions:

(i) Forest plantations in the right of way removed for the construction work should be reforested after the completion of the Project;

(ii) Drinking water supply should be continued during the construction stage and shallow hand pumps be reinstalled at suitable locations. Tubewell schemes should be monitored for loss in fresh water aquifer potential. If they are affected, alternate schemes should be provided;

(iii) Model studies should be undertaken to determine salt water intrusion into the fresh water and loss in aquifer potential;

(iv) The formation of a committee in PIDA to implement the monitoring plan and take corrective action.

8. The Project does not include such components as OFWM, drinking water supply and drainage, of which inclusion in the Project was requested by DOA and other Provincial Departments. The reason is that these items are out of scope of this Study. Nevertheless these items are important for farmers' living and production activities and may be dealt with by FO/WUA. It is proposed that GOP and GOPunjab would implement different projects for these items.

9. It is recommended that GOP and GOPunjab would make adjustments between this Project and NDP-I to avoid overlapping of works and any other inconsistency when detail designs of the latter are started.

9.3 Recommendations for Institutional Reforms

In pursuance of the national policy indicated in the report of the agriculture commission (1988),national conservation strategy 1992, Eighth five years plan (1993) and the recent Punjab Ordinance of May 29, 1997 on reorganization of Irrigation institutions --- the world wide recognition that participation of the beneficiaries in the development of national resources has proved to be more beneficial then public sector unilateral handling, it is a great opportunity to introduce the institutional reforms into this project of lining of distributaries and minors in Punjab on pilot basis . The lining component (hardware) will serve to be a great incentive to the farmers to organize and prepare them selves for this responsibility which has hitherto been considered as an external utility run by the state for which they have been paying service charges .It will also relieve the provincial governments of subsidizing the O&M of the irrigation and drainage system and release its resources for other important social welfare sectors such as education, health and domestic water supply etc. which are starved because of the extreme necessity of diverting resources to keep this life line{irrigation system} of rural Pakistan in reasonable state of operation. It will also improve the investment efficiency on the O&M of the distributaries because of direct and immediate accountability. The greatest social benefit will accrue from the equitable distribution of water among all the farmers irrespective of their geographic position along the length of the distributay. It is our firm belief that if the FOs and

Water Users Association are set up according to our recommendations it will be possible to achieve the same standard of equity as is available on the water courses. The success of these institutional reforms will give a very strong signal, both to the government departments and the farmers, that it is in their interest to replicate the same reforms all over the country. The present skepticism that the farmers are ignorant and they will not be able to handle and operate complicated engineering works - a myth created by interested parties, will be dampened and farmers of other distributaries will come forward with the request for similar reforms. On the analogy of improvement of water courses under OFWM project , there is a strong likelihood of financial participation by the farmers in the future improvement of distributaries in the country. However, the implementation of these reforms in this pilot project is of paramount importance as it is feared that if left to government departments to implement the reforms, the vested interests, the lathergy and the "I know all" attitude of the government officials on one side and the lake of trust of the farmers in the present institutions on the other, there is much less likelyhood of its success.

It is, therefore, essential that an independent team as given in the report [technical assistance required for institutional reforms] is organized to handle these reforms at the grass root level. It will interact with the government on be-half of the farmers as a well informed body to plead their cause.. The drafting of by laws, rules and regulations, the water supply and financial agreements can not be left to the government departments who, the farmers feel, to be biased against the farmers as the opposite party. The farmers will only trust and confide in a party whom they consider to be speaking on their behalf. It is, therefore, recommended that the institutional reforms to be implemented by an independent body should be made an integral rather an essential component of the project . Without such reforms the investment efficiency even in this project would be doubtful as the outlets will be broken again and even the banks of the distributaries will be breached by vested interests.

TABLES

Table 3.1.2-1 (1/4) Meteorological Data

Monthly Mean Temperature (°C) / SARGODHA

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
1986	11.0	13.9	18.3	24.6	29.4	32.5	31.6	31.3	29.2	24.8	19.1	12.8	23.2
1987	13.4	15.9	19.6	26.3	27.0	34.1	32.9	32.7	30.6	24.3	19.1	13.3	24.1
1988	13.3	16.2	18.8	27.2	32.9	33.2	31.2	30.2	29.3	24.6	18.9	13.9	24.2
1989	11.4	13.4	18.9	23.9	31.4	32.9	31.2	30.2	29.3	24.6	18.9	13.9	23.3
1990	13.8	14.5	18.0	24.1	32.6	34.4	29.1	30.8	30.2	24.3	19.2	13.3	23.7
1991	11.6	13.4	18.5	22.9	30.1	33.6	33.6	30.9	29.5	24.1	20.3	15.6	23.7
1992	12.9	14.1	18.3	23.8	29.6	33.3	31.3	30.7	28.6	24.7	18.0	14.9	23.3
1993	11.1	16.6	17.8	25.8	31.5	34.3	30.8	32.7	29.4	24.1	18.9	14.4	24.0
1994	12.7	13.3	20.9	23.8	29.8	35.6	29.7	30.9	28.8	23.5	18.8	13.2	23.4
1995	11.2	14.3	18.8	22.7	32.6	35.2	31.3	30.3	29.9	25.0	18.2	12.8	23.5
Average	12.2	14.6	18.8	24.5	30.7	33.9	31.3	31.1	29.5	24.4	19.0	13.8	23.6

Monthly Rainfall (mm) / SARGODHA xx...missing ( )...Estimate

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1986	3.8	42.4	84.3	55.6	19.3	41.9	52.1	85.3	119.9	13.5	3.3	16.5	537.9
1987	6.6	42.4	83.1	14.0	45.5	13.7	103.6	0.0	41.9	0.0	0.0	0.0	350.8
1988	5.6	0.0	45.5	34.0	0.0	5.8	343.9	154.7	38.4	4.1	0.0	54.1	686.1
1989	8.9	3.6	64.5	4.3	0.0	11.9	132.3	154.2	11.9	0.0	3.8	50.0	445.4
1990	9.9	90.9	60.7	30.0	15.7	22.4	99.8	136.1	34.0	10.7	0.0	51.6	561.8
1991	0.0	57.2	46.4	52.3	25.7	81.8	28.4	158.2	33.3	1.0	0.0	5.8	490.1
1992	xx	36.8	68.8	44.2	25.1	40.1	158.2	106.2	151.6	29.2	14.0	6.1	(680.3)
1993	13.5	20.1	31.0	50.5	3.8	31.0	258.6	0.0	60.5	0.0	3.0	0.0	472.0
1994	3.6	18.0	15.2	51.3	9.4	9.4	128.3	55.6	20.3	20.1	0.0	23.1	354.4
1995	1.5	9.9	76.2	42.7	22.4	40.6	68.1	114.6	0.0	33.3	0.0	0.0	409.3
Average(mm/month)	5.9	32.1	57.6	37.9	20.9	33.2	137.3	96.5	64.0	12.4	2.4	20.7	483.4
Average(mm/day)	0.2	1.1	1.9	1.3	0.7	1.1	4.4	3.1	2.1	0.4	0.1	0.7	1.4

Monthly Humidity(%) 5:00 PM / SARGODHA

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
1986	67.0	61.6	59.2	46.9	35.4	45.2	57.7	66.7	55.8	60.9	70.1	73.9	58.4
1987	64.7	60.1	66.0	55.5	49.4	37.8	48.4	55.9	54.5	60.0	69.5	72.6	57.9
1988	66.2	56.6	52.0	40.3	33.8	40.2	67.0	68.2	65.8	58.3	74.1	75.4	58.2
1989	62.7	45.5	55.9	42.4	38.2	40.9	57.9	66.2	52.5	55.1	66.4	70.5	54.5
1990	69.6	70.2	60.0	48.5	37.6	36.3	51.2	71.1	60.4	58.2	58.1	71.7	57.7
1991	69.3	69.5	66.1	57.9	48.8	44.1	50.9	67.1	61.4	52.8	62.6	69.6	60.0
1992	66.9	61.5	47.5	45.9	40.0	42.8	64.8	67.5	71.7	52.1	62.1	63.9	57.2
1993	55.9	52.0	51.8	42.7	40.8	45.6	63.6	56.0	62.9	43.6	48.3	48.6	51.0
1994	61.0	48.5	42.2	51.1	42.4	44.1	65.4	69.8	60.7	50.2	53.2	58.1	53.9
1995	48.7	46.4	43.3	49.4	47.6	39.7	65.7	72.6	54.9	57.1	53.2	45.6	52.0
Average	63.2	57.2	54.4	48.1	41.4	41.7	59.3	66.1	60.1	54.8	61.8	65.0	56.1

Table 3.1.2-1 (2/4) Meteorological Data

Monthly Mean Temperature (°C) / FAISALABAD

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
1986	10.9	13.9	19.0	25.4	29.8	33.5	21.8	31.3	29.2	24.7	19.2	12.4	22.6
1987	13.4	15.9	20.3	26.7	27.3	21.9	33.1	32.9	31.1	25.1	19.3	13.4	23.4
1988	13.4	16.0	19.2	27.3	33.3	34.6	32.6	30.9	29.7	25.2	19.1	14.0	24.6
1989	11.7	13.5	19.0	24.3	30.8	33.3	31.7	30.7	29.9	25.4	18.9	13.9	23.6
1990	13.5	14.7	18.4	24.7	32.5	34.2	31.8	31.4	30.4	24.5	19.6	13.5	24.1
1991	11.8	13.7	18.7	23.9	28.2	33.3	34.8	32.4	29.5	24.2	19.1	14.7	23.7
1992	13.0	13.6	19.0	24.3	29.5	34.0	31.5	31.1	28.9	25.1	18.6	15.3	23.7
1993	11.9	16.9	18.2	26.1	32.9	34.0	31.2	32.6	29.5	24.9	20.2	14.3	24.4
1994	12.3	13.7	21.3	24.7	32.3	35.2	32.7	31.9	28.7	24.1	19.9	13.9	24.2
1995	11.9	15.1	18.5	23.8	31.4	34.1	32.3	30.6	30.5	25.9	19.2	13.5	23.9
Average	12.4	14.7	19.2	25.1	30.8	32.8	31.4	31.6	29.7	24.9	19.3	13.9	23.8

Monthly Rainfall (mm) / FAISALABAD xx...missing ( )...Estimate

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1986	4.1	17.6	20.0	10.1	7.3	92.0	89.4	71.4	29.2	2.6	0.0	0.0	343.7
1987	3.6	35.0	47.0	22.3	129.0	17.1	92.3	2.6	14.3	0.0	0.0	0.0	363.2
1988	4.1	3.0	44.1	4.5	0.0	0.0	134.4	114.3	7.6	0.0	0.0	16.2	328.2
1989	27.9	3.5	24.3	3.8	xx	18.3	105.9	83.6	xx	0.0	0.0	23.8	(358.3)
1990	26.6	79.4	46.3	16.2	0.0	13.0	75.5	101.8	49.4	0.0	0.0	15.7	423.9
1991	0.0	21.0	12.8	114.9	18.7	26.9	3.9	6.3	51.0	1.0	0.0	4.2	260.7
1992	28.9	13.7	8.5	39.9	9.3	18.4	60.9	101.6	85.4	0.0	0.5	0.5	370.6
1993	1.6	7.0	9.7	25.7	5.7	4.3	145.3	14.3	57.2	0.0	0.0	0.0	270.8
1994	3.3	8.9	0.3	11.0	2.5	xx	37.6	49.5	71.0	0.0	1.0	5.5	(220.8)
1995	1.5	10.0	0.5	6.9	xx	82.2	70.7	0.0	xx	xx	0.0	0.6	#REF!
Average(mm/month)	10.2	19.9	21.4	25.5	21.6	30.2	81.6	54.8	45.6	0.4	0.2	6.7	26.5
Average(mm/day)	0.3	0.7	0.7	0.9	0.7	1.0	2.6	1.8	1.5	0.0	0.0	0.2	0.9

Monthly Humidity(%) 5.00 PM / FAISALABAD

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1986	43.0	41.0	38.0	26.0	21.0	28.0	50.0	52.0	43.0	41.0	45.0	45.0	39.4
1987	42.0	43.0	55.0	23.0	34.0	27.0	39.0	48.0	39.0	36.0	41.0	43.0	39.2
1988	42.0	35.0	38.0	22.0	16.0	25.0	54.0	57.0	47.0	40.0	48.0	52.0	39.7
1989	41.0	30.0	41.0	20.0	16.0	31.0	50.0	52.0	42.0	35.0	43.0	56.0	38.1
1990	55.0	53.0	44.0	26.0	24.0	29.0	43.0	58.0	54.0	43.0	49.0	56.0	44.5
1991	39.0	62.0	46.0	41.0	32.0	29.0	39.0	52.0	55.0	42.0	46.0	57.0	45.0
1992	54.0	46.0	43.0	34.0	23.0	25.0	43.0	54.0	50.0	37.0	53.0	56.0	43.2
1993	46.0	39.0	37.0	56.0	21.0	33.0	48.0	45.0	50.0	33.0	52.0	49.0	42.4
1994	48.0	47.0	33.0	23.0	20.0	24.0	53.0	53.0	46.0	36.0	48.0	52.0	40.3
1995	91.0	41.0	37.0	38.0	26.0	33.0	54.0	62.0	49.0	56.0	44.0	43.0	47.8
Average	50.1	43.7	41.2	30.9	23.3	28.4	47.3	53.3	47.5	39.9	46.9	50.9	42.0

Table 3.1.2-1 (3/4) Meteorological Data

Monthly Sunshine Hour / FAISALABAD — xx...missing — ( )...Estimate

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1986	246.0	209.0	256.6	274.0	xx	268.0	286.0	273.3	267.7	286.6	234.1	191.6	(3096.8)
1987	218.2	216.3	210.6	304.9	264.4	315.6	278.4	260.3	273.5	244.6	256.9	207.5	3051.2
1988	199.7	232.1	203.6	249.7	326.0	214.8	214.0	273.0	256.6	288.8	243.3	215.1	2916.7
1989	239.6	xx	213.3	295.4	314.9	xx	xx	278.0	296.4	292.9	242.1	173.6	(3070.3)
1990	193.3	181.0	260.4	272.1	292.7	224.8	266.3	247.4	261.5	277.1	267.2	189.8	2933.6
1991	232.4	179.7	243.8	258.5	278.2	301.1	256.5	229.4	241.4	277.8	238.1	185.3	2922.2
1992	150.5	210.9	214.9	245.9	296.8	265.8	255.6	259.6	231.3	292.7	222.6	210.1	2856.7
1993	208.7	194.6	243.9	283.8	305.7	259.2	260.1	304.1	xx	285.9	231.1	229.1	(3073.9)
1994	147.8	180.0	257.4	262.7	317.7	273.0	216.7	224.9	283.6	296.2	233.2	207.5	2900.7
1995	227.7	193.4	251.7	263.2	338.4	311.1	253.3	232.6	288.6	267.4	250.9	203.9	3082.2
Average(hr/month)	206.4	199.7	235.7	271.0	303.9	270.4	254.1	258.3	266.7	281.0	241.9	201.4	2990.4
Average(hr/day)	6.7	7.1	7.6	9.0	9.8	9.0	8.2	8.3	8.9	9.1	8.1	6.5	8.2

Monthly Mean Temperature (°C) / LAHORE

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
1986	13.1	15.7	20.5	26.5	29.7	33.7	30.5	31.1	29.6	25.5	20.5	13.9	24.2
1987	14.4	17.1	21.0	27.6	27.3	33.6	33.6	32.5	32.3	26.5	20.6	15.4	25.2
1988	14.8	17.6	15.5	29.1	34.7	34.7	31.3	30.5	29.8	25.8	20.5	15.3	25.0
1989	12.9	15.3	20.5	25.9	31.9	33.7	31.7	29.9	30.2	26.1	20.1	14.9	24.4
1990	15.0	15.5	19.2	26.3	32.3	33.9	31.1	30.3	29.9	24.7	20.7	15.1	24.5
1991	13.3	14.6	19.4	24.5	30.4	32.8	33.0	30.9	30.5	24.9	19.9	15.5	24.1
1992	14.2	15.4	20.6	26.4	30.1	33.9	31.1	30.7	29.5	26.3	20.4	16.6	24.6
1993	12.9	18.3	19.5	27.1	33.6	34.3	30.7	33.2	29.6	26.3	21.0	15.7	25.2
1994	14.1	15.8	22.9	25.7	32.7	35.1	31.9	30.5	28.9	25.1	20.8	15.3	24.9
1995	12.8	16.0	20.1	25.1	33.1	35.1	31.5	29.3	30.1	26.7	20.5	15.1	24.6
Average	13.8	16.1	19.9	26.4	31.6	34.1	31.6	30.9	30.0	25.8	20.5	15.3	24.7

Monthly Rainfall (mm)/ LAHORE — xx...missing — ( )...Estimate

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1986	5.3	43.0	22.6	14.8	20.5	70.8	222.6	134.4	60.6	7.9	0.3	9.5	612.3
1987	28.7	56.6	40.4	9.7	97.9	61.9	125.8	38.1	2.5	29.2	0.0	0.3	491.1
1988	7.6	19.8	73.0	3.4	0.0	56.2	249.1	237.8	116.3	4.4	2.6	45.1	815.3
1989	48.4	8.3	31.1	7.0	10.8	15.4	255.1	167.8	42.9	0.0	7.5	21.4	615.7
1990	4.2	117.5	96.4	18.9	3.9	12.0	181.5	291.9	184.5	1.9	8.9	33.6	955.2
1991	xx	55.7	18.3	58.9	19.1	93.1	32.0	194.7	42.6	5.7	0.0	xx	(560.5)
1992	61.1	30.4	21.0	16.5	26.4	17.4	88.0	196.4	150.8	5.8	9.7	5.7	629.2
1993	10.6	14.9	40.1	31.8	8.0	28.3	182.9	33.5	24.3	0.0	0.5	0.0	374.9
1994	23.8	21.5	6.0	9.8	36.7	13.6	128.3	154.3	115.5	4.3	0.5	27.5	541.8
1995	28.5	114.4	14.6	17.8	0.8	55.6	147.6	351.2	83.6	4.4	5.0	2.5	826.0
Average(mm/month)	24.2	48.2	36.4	18.9	22.4	42.4	161.3	180.0	82.4	6.4	3.5	16.2	53.5
Average(mm/day)	0.78	1.72	1.17	0.63	0.72	1.41	5.20	5.81	2.75	0.21	0.12	0.52	1.8

Table 3.1.2-1 (4/4) Meteorological Data

Monthly Humidity(%) 5:00 PM / LAHORE

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
1986	44.0	44.0	39.0	27.0	27.0	32.0	61.0	58.0	48.0	47.0	49.0	50.0	43.8
1987	50.0	47.0	53.0	27.0	39.0	26.0	39.0	50.0	38.0	45.0	41.0	51.0	42.2
1988	47.0	42.0	39.0	23.0	19.0	30.0	62.0	63.0	55.0	42.0	51.0	55.0	44.0
1989	44.0	37.0	39.0	20.0	17.0	30.0	50.0	61.0	47.0	32.0	44.0	57.0	39.8
1990	49.0	53.0	44.0	25.0	27.0	30.0	59.0	67.0	61.0	46.0	51.0	57.0	47.4
1991	43.0	47.0	42.0	36.0	27.0	34.0	48.0	61.0	50.0	39.0	45.0	55.0	43.9
1992	58.0	44.0	38.0	30.0	29.0	30.0	55.0	66.0	57.0	42.0	56.0	56.0	46.8
1993	44.0	39.0	43.0	27.0	24.0	31.0	58.0	53.0	60.0	39.0	47.0	48.0	42.8
1994	52.0	47.0	35.0	25.0	26.0	29.0	65.0	67.0	52.0	39.0	53.0	57.0	45.6
1995	53.0	50.0	40.0	36.0	27.0	28.0	63.0	76.0	52.0	46.0	49.0	51.0	47.6
Average	48.4	45.0	41.2	27.6	26.2	30.0	56.0	62.2	52.0	41.7	48.6	53.7	44.4

Wind Velocity (knots/hour) / LAHORE xx...missing ( )..Estimate

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
1986	0.8	2.3	2.6	2.2	2.8	2.6	2.2	2.0	1.5	1.2	1.2	1.2	1.9
1987	1.1	1.9	2.2	2.8	2.7	2.5	2.0	2.2	1.5	1.4	0.5	0.3	1.8
1988	0.8	1.6	2.1	0.9	1.6	2.8	3.6	1.9	1.9	1.2	0.6	0.9	1.7
1989	1.7	1.7	2.0	2.6	2.1	4.0	2.3	2.3	1.8	1.0	1.0	0.8	1.9
1990	1.5	2.1	2.3	2.6	2.7	2.6	xx	2.3	1.8	0.8	0.8	1.6	(2.0)
1991	1.0	2.1	2.2	2.6	2.4	2.4	3.3	2.2	1.3	1.1	0.4	0.4	1.8
1992	1.3	1.7	2.7	2.3	2.9	2.6	2.7	2.0	1.4	0.9	0.8	0.5	1.8
1993	1.3	1.6	3.8	2.0	2.3	2.3	2.6	2.1	1.5	0.6	0.8	0.5	1.8
1994	1.0	2.1	2.3	2.5	2.2	2.7	2.6	1.8	0.8	1.2	0.3	0.7	1.7
1995	0.7	1.1	1.3	1.8	1.6	1.7	2.6	1.1	0.6	0.4	0.5	0.3	1.1
Average(knot/hour)	1.1	1.8	2.4	2.2	2.3	2.6	2.7	2.0	1.4	1.0	0.7	0.7	1.74
Average(km/hour)	2.1	3.4	4.3	4.1	4.3	4.8	4.9	3.7	2.6	1.8	1.3	1.3	3.22

Monthly Sunshine Hour/ LAHORE xx...missing

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1987	216.0	200.7	204.0	284.3	250.3	317.4	290.6	257.3	265.0	268.3	279.2	205.0	3038.1
1988	206.0	248.1	245.2	278.2	325.4	258.1	174.0	254.2	248.0	301.3	242.5	209.4	2990.4
1989	218.0	232.8	223.9	300.2	311.7	211.6	243.3	256.6	293.4	305.8	251.2	163.8	3012.3
1990	208.3	169.7	261.3	293.0	310.8	264.7	244.6	223.4	242.1	290.8	273.3	209.1	2991.1
1991	234.7	195.9	243.3	277.6	294.3	299.3	278.6	243.7	241.9	280.1	253.0	166.4	3008.8
1992	150.3	225.4	208.0	251.1	307.5	241.9	xx	xx	204.9	286.6	240.9	213.9	2330.5
1993	211.1	202.7	236.2	257.9	xx	xx	xx	xx	xx	xx	xx	xx	
1994	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	
1995	xx	xx	xx	xx	xx	329.5	230.2	181.7	226.9	286.5	255.6	195.0	
Average(hr/month)	206.3	210.8	231.7	277.5	300.0	274.6	243.6	236.2	246.0	288.5	256.5	194.7	2966.3
Average(hr/day)	6.7	7.5	7.5	9.2	9.7	9.2	7.9	7.6	8.2	9.3	8.6	6.3	

Table 3.1.2-2 Annual Withdrawals for the Three Irrigation Systems

(Unit:Million Acre-feet)

Year	LJC System			LCC System			CBDC System		
	Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total
1985/86	1.79	1.27	3.06	4.27	3.43	7.70	0.81	0.66	1.47
1986/87	1.83	1.29	3.12	4.42	3.64	8.06	0.83	0.67	1.50
1987/88	1.76	1.50	3.26	4.68	3.67	8.35	0.77	0.66	1.43
1988/89	1.76	1.22	2.98	4.28	3.43	7.71	0.83	0.55	1.38
1989/90	1.68	1.13	2.81	4.05	3.30	7.35	0.80	0.65	1.45
1990/91	1.77	1.25	3.02	4.40	3.17	7.57	0.87	0.65	1.52
1991/92	1.82	1.23	3.05	3.97	2.80	6.77	0.85	0.65	1.50
1992/93	1.53	1.02	2.55	4.06	3.07	7.13	0.87	0.62	1.49
1993/94	1.69	1.23	2.92	4.11	3.11	7.22	0.83	0.65	1.48
1994/95	1.80	1.29	3.09	4.07	3.14	7.21	0.72	0.55	1.27
Minimum	1.53	1.02	2.55 (3.15)	3.97	2.80	6.77 (8.36)	0.72	0.55	1.27 (1.57)
Average	1.74	1.25	2.99 (3.69)	4.23	3.28	7.51 (9.27)	0.82	0.63	1.45 (1.79)
Maximum	1.83	1.50	3.33 (4.03)	4.68	3.67	8.35 (10.31)	0.87	0.67	1.52 (1.88)
Ave. depth	1.15 (351)	0.82 (250)	1.97 (601)	1.39 (424)	1.07 (326)	2.46 (750)	1.25 (381)	0.95 (290)	2.2 (671)

Notes : ( ) indicates quantity in million cubic meters.
Average dpth is shown in feet. ( ) indicates depth in mm.

Table 3.1.4 - 1 Extent of Salinity during1995 in the project area

All extents in acres

Canal Circle	Division	Area surveyed	(1) Thur Kohna	(2) Thur Punjasala	(3) Thur Nau	(4) Thur Juzvi	(5) Thur Tirk	Thur Recl	Total Saline area	Saline area
		(Acres)							(Acres)	%
Lower Jehlum	Sargodha	511.690	26.473	10.808	11.195	88.095	176	404	137.151	26.8
	Kirana	589.250	5.207	1.817	4.563	88.473	22	393	100.475	17.1
	Shahpur	235.351	3.045	365	459	4.160	26	0	8.055	3.4
	Rasool	238.149	5.336	1.735	1.932	19.650	0	1.125	29.778	12.5
	Sub total	1.574.440	40.061	14.725	18.149	200.378	224	1.922	275.459	17.5
Lower Chenab	Faisalabad	387.735	4.037	3.103	2.815	28.276	260	1.224	39.715	10.2
	Hifzabad	412.606	9.136	10.223	447	34.419	285	1.551	56.061	13.6
	Jhang	692.270	6.489	2.290	1.234	34.871	166	1.671	46.721	6.7
	Khanki	296.181	2.335	32.715	786	12.393	0	1.685	49.914	16.9
	Upper Gojra	701.133	11.701	10.058	2.816	30.316	0	267	55.158	7.9
	Lower Gojra	566.512	5.550	16.173	14.920	92.244	494	2.687	132.068	23.3
	Burala	588.923	10.971	10.221	3.724	58.986	224	4.426	88.552	15.0
	Sub total	3.645.360	50.219	84.783	26.742	291.505	1.429	13.511	468.189	12.8
CBDC	Lahore	703.013	15.467	3.803	3.586	12.583	633	0	36.072	5.1
	Sub total	703.013	15.467	3.803	3.586	12.583	633	0	36.072	5.1
	TOTAL	5.922.813	105.747	103.311	48.477	504.466	2.286	15.433	779.720	13.2

Explanation of terminology used in salinity surveys

(1) Thur Kohna - Ultra alkaline or Non Saline Alkali soils. Never cultivated saline land since the advent of canal irrigation.. High in salt content & alkanality or low salt content & high alkali.

(2) Thur Panjsala - Highly saline or saline alkali soils. Lands excluded from cultivated for more than 5 years due to salinity. Advance stage of deterioration. pH is 9.0 to 10.0

(3) Thur Nau - Highly saline or saline alkali soils. Lands excluded from cultivation within 5 years due to salinity. These are mostly saline alkali soils in the northern part of the Indus plains.

(4) Thur Juzvi - Saline or saline alkali. Saline lands under cultivation bearing visible patches of salts to the extent of above high salinity in patches & alkalinity show progressively increasing.

(5) Thur Tirk - Lands where salts presnt in root zone hamper opening of cotton balls. Accumalation of salts is well below in the root zone & salts are not visible over the soil surface.

Source: DLR/PID

Table 3.2.2-1 Cropping Intensity in the Study Area

Canal	GCA	CCA	Seasonal Crops		Annual/Perenial Crop		Cropped Area	Cropping Intensity
			Kharif	Rabi	Sugarcane	Orchard		
	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(%)
1 C.B.D.C	284,628	265,648	139,017	169,440	15,542	3,735	327,734	123.4%
2 LCC (East)	773,294	647,479	363,299	434,019	68,938	11,571	877,827	135.6%
LCC (West)	724,114	588,560	305,450	374,673	66,241	6,518	752,882	127.9%
LCC (Total)	1,497,408	1,236,039	668,749	808,692	135,179	18,089	1,630,709	131.9%
3 LJC	662,958	614,467	309,848	330,576	43,130	68,553	752,107	122.4%
Study Area	2,444,994	2,116,154	1,117,614	1,308,708	193,851	90,377	2,710,550	128.1%

Source: Punjab Development Statistics
PID Revenue Department

Table 3.2.2-2 Cultivated Area Classified by Mode of Irrigation

(Unit: ha)

Description	Cultivated Area	Cultivated Area with Irrigation Facilities									Cultivated Area without Irrigation	
		Actually Irrigated								not Irrigated		
		Total	Canal Only	Canal and Tubewell	Tubewell Only	Tank/Bandat Only	Spring/ Rodkohi	Karez	Others		Sailaba	Barani
Punjab	9,893,611	7,851,736	1,957,291	4,142,877	1,569,840	25,843	123,558	0	32,327	168,508	76,430	1,796,922
		79.4%	24.9%	52.8%	20.0%	0.3%	1.6%	0.0%	0.4%			
1 Lahore	114,294	111,860	61,644	18,561	31,188	163	0	0	304	1,809	102	523
		97.9%	55.1%	16.6%	27.9%	0.1%	0.0%	0.0%	0.3%			
2 Kasur	299,169	292,710	120,825	102,969	68,242	505	0	0	169	5,703	186	569
		97.8%	41.3%	35.2%	23.3%	0.2%	0.0%	0.0%	0.1%			
3 Gujranwala	398,685	387,910	26,739	194,958	165,456	357	0	0	400	2,823	6,379	1,574
		97.3%	6.9%	50.3%	42.7%	0.1%	0.0%	0.0%	0.1%			
4 Sheikhupura	387,278	378,207	45,297	286,771	45,257	145	190	0	547	6,740	272	2,055
		97.7%	12.0%	75.8%	12.0%	0.0%	0.1%	0.0%	0.1%			
5 Faisalabad	356,059	351,870	165,031	169,323	17,236	42	0	0	238	3,607	32	554
		98.8%	46.9%	48.1%	4.9%	0.0%	0.0%	0.0%	0.1%			
6 Toba Tek Singh	204,062	200,181	75,410	112,760	11,939	72	0	0	0	3,870	2	8
		98.1%	37.7%	56.3%	6.0%	0.0%	0.0%	0.0%	0.0%			
7 Jhang	565,208	521,757	65,934	288,243	162,827	1,711	50	0	2,992	10,433	1,774	31,246
		92.3%	12.6%	55.2%	31.2%	0.3%	0.0%	0.0%	0.6%			
8 Sargodha	379,849	370,937	170,825	172,435	27,265	267	19	0	127	6,256	1,337	1,322
		97.7%	46.1%	46.5%	7.4%	0.1%	0.0%	0.0%	0.0%			
Districts related to the Study Area	2,704,604	2,615,432	731,704	1,346,021	529,409	3,263	259	0	4,776	41,241	10,085	37,851
		96.7%	28.0%	51.5%	20.2%	0.1%	0.0%	0.0%	0.2%			

Source: Census of Agriculture, 1990, p191

Table 3.3.3-1 (1/3) Seepage Measurement Summary for Lower Jhelum Canal System

No.	Name of Distry/Minor	Test Reach(ft) from	to	distance	Inflow (cfs)	Outflow (cfs)	Outlets (cfs)	Water loss (cfs)	Av. Perimeter (ft)	Wetted Surface(msf)	Seepage loss (cfs/msf)	Remarks	Seepage*1 (%)
1	Fatch Pur	24000	41500	17500	41.351	14.563	23.942	2.846	16.323	0.286	9.963	Old& poor brick lining	16.46
2	Lakh	36200	70000	33800	31.096	4.645	25.622	0.829	10.302	0.348	2.381		
3	Blochera	100	6700	6600	2.987	0.713	2.198	0.076	5.348	0.035	2.153	Partially in filling	2.99
4	Dherana	50	18000	17950	12.524	3.719	7.570	1.235	8.524	0.153	8.072	in filling	12.06
5	Jani	1600	15550	13950	14.234	3.895	10.030	0.309	11.500	0.160	1.926		2.53
6	Pindi	1500	16000	14500	22.727	12.600	7.690	2.437	14.400	0.209	11.671		11.6
7	Old Khatwan	500	24000	23500	20.860	3.700	15.533	1.627	10.460	0.246	6.619		6.47
8	Naurang	15500	61500	46000	98.710	59.380	33.460	5.870	12.500	0.575	10.209		22.05
9	Shergarh	100	14000	13900	9.685	5.210	3.755	0.720	9.635	0.134	5.376	Bank Condition poor	6.27
10	Lakhuwana	4000	10000	6000	11.886	7.395	4.330	0.161	6.834	0.041	3.926	Partially in filling	6.76
11	Sobhi	1000	28000	27000	26.402	8.800	15.840	1.762	11.910	0.322	5.479		9.81
12	Fujjan	63200	95450	32250	79.300	39.170	33.481	6.649	22.381	0.722	9.212	Bank condition poor	13.33
13	Chokera	43000	67800	24800	89.200	54.988	32.635	1.577	25.210	0.625	2.522		3.87
14	Assian 1	133	6800	6667	30.943	22.590	7.920	0.433	13.310	0.089	4.880		3.68
16	Kirana 1	62100	96200	34100	241.890	198.640	30.700	12.550	38.322	1.307	9.604	in Filling	14.62
18	Malkana	13400	22000	8600	30.471	16.210	13.130	1.131	22.180	0.191	5.929	in Cutting	6.39
19	Wasuana	50	12000	11950	14.822	6.994	7.382	0.446	9.446	0.113	3.951		5.53
21	Lalian 1	102200	142100	39900	144.855	38.012	92.333	14.510	31.500	1.257	11.545	in filling	20.02
23	Kohri	100	15000	14900	18.363	7.154	9.370	1.839	9.285	0.138	13.293	in filling	12.67
	sum	368.733	762.600	393.867	942.306	508.378	376.921	57.007	289.370	6.950	128.711		
	average								15.23		6.77		9.84
15	Assian 2	6900	15200	8300	16.947	10.006	6.701	0.240	9.642	0.080	2.999	Lined Channel	2.26
17	Kirana 2	175000	195000	20000	38.344	8.875	28.785	0.684	17.950	0.359	1.905	Concrete lining	2.9
20	Rodian	400	14200	13800	19.452	8.583	10.704	0.165	10.110	0.140	1.183	Rocky Area	
22	Lalian 2	160000	176400	16400	20.878	8.881	11.836	0.161	9.758	0.160	1.006	Concrete lining	1.74
24	Ransdana	1000	18000	17000	16.880	8.006	8.250	0.624	10.010	0.170	3.667	Concrete lining	
25	Lalian	168875		1000							7.497	by ponding method	13
26	Kirana	180370		960							9.371	by ponding method	14.26
27	Ramdana	550		540							9.746	by ponding method	-

Note; Seepage*1 is calculated using head discharge and wetted area of each channel.

Table 3.3.3-1 (2/3) Seepage Measurement Summary for Lower Chenab Canal System

No.	Name of Distry/Minor	Test Reach(ft) from	to	distance	Inflow (cfs)	Outflow (cfs)	Outlets (cfs)	Water loss (cfs)	Av. Perimeter (ft)	Wetted Surface(msf)	Seepage loss (cfs/msf)	Remarks	Seepage*1 (%)
1	Vanike	8400	44800	36400	147.853	85.921	55.780	6.152	34.722	1.264	4.868		5.67
2	Jalal pur	500	26500	26000	17.129	6.212	8.949	1.968	13.310	0.346	5.687		10.97
3	Chiniot	61000	83000	22000	65.162	44.172	19.879	1.111	22.200	0.488	2.275		4.67
4	Sarangwala	31000	49800	18800	49.753	28.979	18.356	2.418	17.410	0.327	7.388		12.49
6	Sultan Pakhara 1	1000	50000	49000	177.405	135.057	27.692	14.656	39.770	1.949	7.521		6.84
7	Sultan Pakhara 2	60000	89000	29000	125.881	84.658	37.090	4.133	33.000	0.957	4.319		
8	Bhaugu	1000	31000	30000	173.838	124.940	46.510	2.388	38.160	1.145	2.086		3.24
9	Dhaular	31000	71000	40000	261.084	216.503	37.055	7.526	54.690	2.188	3.440		
10	Khewara 1	1000	23500	22500	269.100	213.334	44.062	11.704	59.571	1.340	8.732		
11	Khewara 2	96650	124000	27350	59.539	12.517	42.754	4.268	19.440	0.532	8.027		
12	Aruri	710	17000	16290	68.877	42.376	25.461	1.040	21.050	0.343	3.033		2.89
13	Sialwala	875	12500	11625	13.641	3.657	9.330	0.654	7.400	0.086	7.602		5.24
14	Dijkot 1	32200	63000	30800	227.197	151.328	69.877	5.992	36.930	1.137	5.268		6.47
15	Dijkot 2	77000	101008	24008	91.162	60.864	28.402	1.896	21.100	0.507	3.743		
16	Gajiana 1	675	10600	9925	77.561	73.129	3.246	1.186	33.100	0.329	3.610		9.83
17	Gajiana 2	74500	90500	16000	27.041	22.129	4.262	0.650	15.480	0.248	2.624		9.83
18	Karkan	5224	19240	14016	70.230	63.813	5.465	0.952	28.230	0.396	2.406		4.1
19	Ghour Dour	13140	24500	11360	27.701	19.398	6.476	1.827	14.360	0.163	11.200	in filling	24.87
20	Tarkhani	39250	71800	32550	104.139	59.202	40.573	4.364	35.630	1.160	3.763		6.43
21	Mungi 1	500	34800	34300	173.369	121.768	39.525	12.076	31.850	1.092	11.054		12.96
22	Mungi 2	34800	71400	36600	121.768	68.243	47.737	5.788	27.310	1.000	5.791		
24	Bhalak	1000	26000	25000	180.497	143.829	33.487	3.181	43.600	1.090	2.918		5.95
25	Kilian wala 1	35800	72700	36900	172.065	91.481	69.334	11.250	37.700	1.391	8.087	in filling	12.73
27	Ahmad Nagar	70	10000	9930	5.662	2.739	2.400	0.523	6.500	0.065	8.103		
	sum	607,294	1,217,648	610,354	2,707.654	1,876.249	723.702	107.703	692.513	19.541	133.544		
	average								28.855		5.564		8.54
26	Kilian wala 2	101550	114000	12450	12.893	6.547	5.956	0.390	13.640	0.170	2.297	brick lined	3.62
23	Pir Mahal	620	25000	24380	60.413	52.079	6.503	1.831	32.880	0.802	2.284	not runing at FSL	5.21
5	Nasrana	50000	72000	22000	85.658	66.017	15.166	4.475	34.350	0.756	5.922	not runing at FSL	10.99
28	Bhalak	104140		488							2.707	by ponding method	5.52
29	Killian Wala	2150		500							4.759	by ponding at escape	7.49
30	Sumundri	31500		485							7.151	by ponding method	-
31	Pir Mahal	18300		520							6.346	by ponding at escape	14.47

Note; Seepage*1 is calculated using head discharge and wetted area of each channel.

Table 3.3.3-1 (3/3) Seepage Measurement Summary for Central Bari Doab Canal System

No.	Name of Distry/Minor	Test Reach(ft) from	to	distance	Inflow (cfs)	Outflow (cfs)	Outlets (cfs)	Water loss (cfs)	Av. Perimeter (ft)	Wetted Surface(msf)	Seepage loss (cfs/msf)	Remarks	Seepage*1 (%)
1	Chinna	35200	56450	21250	89.427	34.775	49.691	4.961	24.450	0.520	9.548	in filling	13.43
3	Jandal	1500	32800	31300	143.274	102.634	27.852	12.788	31.700	0.992	12.888	breaches in bank	21.46
4	Rakh	10650	38800	28150	285.462	212.087	64.912	8.463	49.560	1.395	6.066		9.18
5	Tarman	26500	56000	29500	86.449	65.617	14.945	5.887	27.129	0.800	7.356	banks in poor condition	
6	Athipur	5500	27800	22300	114.765	90.167	20.113	4.485	30.860	0.688	6.517	banks in poor condition	7.89
	sum	79,350	211,850	132,500	719.377	505.280	177.513	36.584	163.699	4.395	42.376		
	average								32.740		8.475		12.99
2	Turkwind	48000	70000	22000	50.661	14.686	34.669	1.306	15.520	0.341	3.825	concrete lining	
7	Vahn	6950		415							1.458	by ponding at escape	1.67

Note: Seepage*1 is calculated using head discharge and wetted area of each channel.

Table 3.3.3-2 (1/3) Seepage Rate of Selected Canals for LJC Area

No.	Name of Distributary	Name of Minor	Length (km)	Authorize Discharge (m3/s)	Command Area (ha)	Seepage Rate un-lined (cfs/msf)	Seepage Rate lined (cfs/msf)	Total Wet Surface Present (msf)	Total Wet Surface Designed (msf)	Seepage Volume un-lined (m3/s)	Seepage Volume un-lined (%)	Seepage Volume lined (m3/s)	Seepage Volume lined (%)	Water Saving after lining (m3/s)	Water Saving after lining (%)	Remarks
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Pindi		6.86	0.46	2,285	6.32	1.47	0.23	0.18	0.04	8.95	0.01	1.63	0.03	7.32	
2	Hujan		33.98	5.16	11,329	6.32	1.47	2.99	1.67	0.54		0.07		0.47		
3	Hujan	Arian	5.43	0.28	1,392	6.32	1.47	0.14	0.14	0.03		0.01		0.02		
4	Hujjan	Kot Moman	6.78	0.54	2,668	6.32	1.47	0.25	0.18	0.04		0.01		0.04		
5	Hujjan	Kot Raja	2.81	0.17	866	6.32	1.47	0.06	0.06	0.01		0.00		0.01		
6	Hujjan	Bhikhi	6.34	0.39	1,974	6.32	1.47	0.20	0.16	0.04		0.01		0.03		
7	Hujjan	Sahowal	5.76	0.31	1,575	6.32	1.47	0.16	0.15	0.03		0.01		0.02		
8	Hujjan	M.Wala	5.87	0.26	1,311	6.32	1.47	0.15	0.15	0.03		0.01		0.02		
9	Hujjan	Tangu	4.84	0.29	1,470	6.32	1.47	0.13	0.12	0.02		0.01		0.02		
10	Hujjan	Jaspal	8.32	0.54	2,651	6.32	1.47	0.31	0.22	0.05		0.01		0.05		
	sub-total		80.13	5.16	25,236			4.38	2.85	0.78	15.18	0.12	2.30	0.66	12.88	
11	Kirana		62.95	10.52	21,374	6.32	1.47	6.71	4.40	1.20		0.18		1.02		
12	Kirana	Saruli	1.59	0.12	606	6.32	1.47	0.03	0.03	0.00		0.00		0.00		
13	Kirana	Hadda	4.11	0.36	1,639	6.32	1.47	0.12	0.11	0.02		0.00		0.02		
14	Kirana	Malkana	10.16	0.73	3,548	6.32	1.47	0.36	0.28	0.06		0.01		0.05		
15	Kirana	Wasuana	6.89	0.34	1,731	6.32	1.47	0.18	0.18	0.03		0.01		0.02		
16	Kirana	Tandalian	3.96	0.28	1,304	6.32	1.47	0.10	0.10	0.02		0.00		0.01		
17	Kirana	Rodian	6.04	0.49	2,374	6.32	1.47	0.21	0.16	0.04		0.01		0.03		
18	Kirana	Hunde	4.92	0.37	1,778	6.32	1.47	0.15	0.13	0.03		0.01		0.02		
19	Kirana	Killa	4.10	0.23	1,147	6.32	1.47	0.10	0.10	0.02		0.00		0.01		
20	Kirana	Dhabian	2.41	0.16	822	6.32	1.47	0.05	0.05	0.01		0.00		0.01		
	sub-total		107.13	10.52	36,324			8.00	5.52	1.43	13.61	0.23	2.19	1.20	11.43	
	Total		194.12	16.14	63,844			12.61	8.55	2.26	13.98	0.36	2.20	1.90	11.78	

Note; 7: measured/estimated, 9: calculated based on existing canal profile, 10&12: calculated on 5,7 &8, 11&13: ratio of 10&12 to 5
8: average seepage rate at concrete lined portion, 14:10-12, 15: 5*14/100

Table 3.3.3-2 (2/3) Seepage Rate of Selected Canals for LCC Area

No.	Name of Distributary	Name of Minor	Length (km)	Authorize Discharge (m3/s)	Command Area (ha)	Seepage Rate un-lined (cfs/msf)	Seepage Rate lined (cfs/msf)	Total Wet Surface Present (msf)	Total Wet Surface Designed (msf)	Seepage Volume un-lined (m3/s)	Seepage Volume un-lined (%)	Seepage Volume lined (m3/s)	Seepage Volume lined (%)	Water Saving after lining (m3/s)	Water Saving after lining (%)	Remarks
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Sarangwala		25.04	1.99	6,627	6.32	1.47	1.35	0.86	0.24	12.14	0.04	1.79	0.21	10.35	
2	Nasrana		54.64	7.02	25,094	6.32	1.47	5.07	3.11	0.91		0.13		0.78		
3	Nasrana	Saduana	2.76	0.12	720	6.32	1.47	0.05	0.05	0.01		0.00		0.01		
4	Nasrana	Khilliana	4.43	0.26	1,293	6.32	1.47	0.11	0.11	0.02		0.00		0.02		
5	Nasrana	Narwala	5.82	0.41	2,139	6.32	1.47	0.19	0.15	0.03		0.01		0.03		
6	Nasrana	Satiana	3.66	0.20	1,015	6.32	1.47	0.08	0.08	0.01		0.00		0.01		
7	Nasrana	Natheri	4.60	0.38	1,800	6.32	1.47	0.14	0.12	0.03		0.00		0.02		
8	Nasrana	Domra	5.51	0.52	2,616	6.32	1.47	0.20	0.15	0.04		0.01		0.03		
	Sub-total		81.42	7.02	34,677			5.83	3.77	1.04	14.87	0.16	2.23	0.89	12.64	
9	Gojra		15.06	1.64	6,347	6.32	1.47	1.00	0.49	0.18		0.02		0.16		
10	Gojra	Zeera	2.71	0.22	1,193	6.32	1.47	0.06	0.06	0.01		0.00		0.01		
	Sub-total		17.77	1.64	7,540			1.06	0.55	0.19	11.58	0.02	1.40	0.17	10.19	
11	Mungi		36.97	4.05	17,657	6.32	1.47	2.88	1.63	0.52		0.07		0.45		
12	Mungi	Mungi	4.32	0.31	1,504	6.32	1.47	0.12	0.11	0.02		0.00		0.02		
	Sub-total		41.29	4.05	19,161			3.00	1.74	0.54	13.25	0.07	1.79	0.46	11.46	
13	Janiwala/Hamza		10.96	1.31	4,360	6.32	1.47	0.65	0.34	0.12		0.01		0.10		
14	Janiwala	Amirwala	7.62	0.43	2,153	6.32	1.47	0.25	0.20	0.04		0.01		0.04		
	Sub-total		18.58	1.31	6,513			0.89	0.54	0.16	12.23	0.02	1.70	0.14	10.52	
15	Pir Mahal		47.57	3.88	9,902	6.32	1.47	2.92	2.06	0.52		0.09		0.44		
16	Pir Mahal	Thera	4.85	0.19	1,012	6.32	1.47	0.10	0.10	0.02		0.00		0.01		
17	Pir Mahal	Megneja	9.89	0.37	1,818	6.32	1.47	0.30	0.26	0.05		0.01		0.04		
18	Pir Mahal	Junejwala	16.08	0.98	4,703	6.32	1.47	0.81	0.47	0.15		0.02		0.13		
19	Pir Mahal	Jandwala	3.74	0.15	807	6.32	1.47	0.07	0.07	0.01		0.00		0.01		
	Sub-total		82.13	3.88	18,242			4.20	2.96	0.75	19.39	0.12	3.17	0.63	16.22	
20	Killianwala		46.05	5.66	19,278	6.32	1.47	3.34	2.36	0.60		0.10		0.50		
22	Killianwala	Minor #3	6.66	0.33	1,741	6.32	1.47	0.19	0.17	0.03		0.01		0.03		
	Sub-total		52.71	5.66	21,019			3.53	2.53	0.63	11.16	0.11	1.86	0.53	9.30	
	Total		318.94	25.55	113,779			19.87	12.94	3.56	13.92	0.54	2.11	3.02	11.81	

Note: 7: measured/estimated, 9: calculated based on existing canal profile, 10&12: calculated on 5.7 &8, 11&13: ratio of 10&12 to 5
8: average seepage rate at concrete lined portion, 14:10-12, 15: 5*14/100

Table 3.3.3-2 (3/3) Seepage Rate of Selected Canals for CBDC Area

No.	Name of Distributary 1	Name of Minor 2	Length (km) 3	Authorize Discharge (m3/s) 4	Command Area (ha) 5	Seepage Rate un-lined (cfs/msf) 6	Seepage Rate lined (cfs/msf) 7	Total Wet Surface Present (msf) 8	Total Wet Surface Designed (msf) 9	Seepage Volume un-lined (m3/s) 10	Seepage Volume un-lined (%) 11	Seepage Volume lined (m3/s) 12	Seepage Volume lined (%) 13	Water Saving after lining (m3/s) 14	Water Saving after lining (%) 15	Remarks 16
1	Thamman		29.85	7.27	6,599	6.32	1.47	2.55	1.73	0.46		0.07		0.38		
2	Themman	Saharan	7.24	0.71	3,217	6.32	1.47	0.31	0.20	0.06		0.01		0.05		
	sub-total		37.09	7.27	9,816			2.86	1.93	0.51	7.04	0.08	1.11	0.43	5.93	
3	China		25.46	3.60	12,664	6.32	1.47	1.56	1.07	0.28		0.04		0.23		
4	China	Kale Minor	7.81	0.83	3,726	6.32	1.47	0.36	0.22	0.06		0.01		0.06		
	sub-total		33.27	3.60	16,390			1.92	1.29	0.34	9.55	0.05	1.49	0.29	8.06	
	Total		70.36	10.87	26,206			4.78	3.22	0.86	7.87	0.13	1.23	0.72	6.64	

Note; 7: measured/estimated, 9: calculated based on existing canal profile, 10&12: calculated on 5,7 &8, 11&13: ratio of 10&12 to 5
8: average seepage rate at concrete lined portion, 14:10-12, 15: 5*14/100

Table 3.3.5-1 Comparison between Measured and Authorized Discharges

Distributaries and Minors	Total Length (km)	Nos of Watercourses	Total CCA (acre)	Average CCA of Watercourse (acre)	Average Delta (cusec/1000 ac)	Authorized Discharge (cusec)	Actual Measurement (cusec)	Ratio of Actual Measurement over Authorized Discharge (%)		
								Average	Maximum	Minimum
1. LCC										
Mungi - 1	37.0	18	8,595	478	2.96	25.42	33.629	132	227	71
Mungi - 2		26	12,354	475	3.37	41.61	47.530	114	181	55
Kilian wala - 1	46.1	17	8,077	475	2.96	23.94	41.010	171	351	62
Kilian wala - 2		7	3,329	476	2.93	9.76	4.196	43	87	12
Nasarana	54.7	11	6,498	591	2.84	18.45	15.165	82	153	43
Sub-total	137.7	79	38,853	492	3.01	119.18	141.530	108	200	49
2. LJC										
Naurang	52.4	14	9,455	675	2.45	23.18	22.802	98	198	48
Dherana	64.3	3	1,849	616	2.21	4.09	7.570	185	283	110
Kirana - 1	64.3	16	7,934	496	3.05	24.19	29.691	123	174	75
Kirana - 2		9	4,369	485	2.85	12.47	15.911	128	162	101
Pindi	6.9	4	2,345	586	3.28	7.70	7.689	100	159	68
Fujjan	34.0	16	8,332	521	2.81	23.41	24.029	103	676	56
Sub-total	221.9	62	34,284	553	2.78	95.04	107.692	123	275	76
3. CBDC										
Thaman	30.9	8	2,793	349	3.01	8.41	11.304	134	310	50
Athipur	15.9	5	1,937	387	2.88	5.58	8.825	158	425	39
Chinna	25.5	18	8,904	495	3.10	27.59	49.282	179	409	76
Sub-total	72.3	31	13,634	440	3.00	41.58	69.411	157	381	55
Total	431.9	172	86,771	504	2.93	255.80	318.633	129	285	60

Table 3.3.9-1 Current Status of Lining of Distributaries and Minors in the Study Area

(Unit: km)

Name of System	Lining Status (Type)		Length(km) Distributaries	Minors	Disty & Minors	Percentage lined	kind
C.B.D.C	unlined		403.86	274.71	678.58	(80)	
(Lahore)	lined	Concrete	47.95	25.49	73.44		(44)
		Brick	57.17	29.16	86.33		(51)
		Brick(Slope)	0.40	8.00	8.40		(5)
		Total lined	105.52	62.66	168.17	(20)	
	Total length		509.38	337.37	846.75		
LCC	unlined		2,331.46	898.78	3,230.25	(85)	
(Faisalabad)	lined	Concrete	73.74	45.25	118.98		(21)
		Brick	216.63	146.25	362.89		(65)
		Brick(Slope)	57.70	15.21	72.90		(13)
		Total lined	348.07	206.71	554.77	(15)	
	Total length		2,679.53	1,105.49	3,785.02		
LJC	unlined		1,253.69	634.43	1,888.12	(95)	
(Salgodha)	lined	Concrete	50.28	2.66	52.94		(58)
		Brick	3.91	15.81	19.72		(22)
		Brick(Slope)	11.25	7.31	18.56		(20)
		Total lined	65.44	25.78	91.22	(5)	
	Total length		1,319.13	660.21	1,979.34		
Total	unlined		3,989.01	1,807.92	5,796.94	(88)	
	lined	Concrete	171.97	73.40	245.37		(30)
		Brick	277.72	191.23	468.95		(58)
		Brick(Slope)	69.34	30.52	99.86		(12)
		Total lined	519.03	295.15	814.17	(12)	
	Total length		4,508.04	2,103.07	6,611.11		

Note: Many portions are lined near town, parent canal or some facilities, which are not included within the length.
Cost data are in lack for considerable numbers of canal and hence undependable.

Table 3.3.9-2 Present Situation of Structures

No.	Name of Distributary	Outlet(Nos)									Drop(Nos)								Bridge(Nos)																	Step				Aqua-duct	Water Course Cross	Pipe Culvert	Escape	Total
		Total	Type of Outlet					Superannuation			Total	Type			Superannuation				Total	Type of Bridge																	Total	Superannuation							
		nos	A	B	C	D	E	A	B	C/D	nos	A	B	C	A	B	C/D	E	nos	AR				DR				VR				FP				RW	nos	A	B	C/D					
																				All	A	B	C/D	All	A	B	C/D	All	A	B	C/D	All	A	B	C/D									
1	Pindi	10		4		6			10		2	1	1		1	1			4					1		1		3	1	2														16
2	Hujan	131	6	65		60		5	92	34	16	8	8			11	5		87	2	2			7	2	4	1	62		32	30	16		9	7		31		9	22	1		2		268
3	Kirana	187	9	84		87	7	26	152	9	16	1	1	14	13	3			97	1		1		9	3	5	1	68	13	39	16	13	2	6	5	6	21	3	18		2		2		325
	L/C sub-total	328	15	153	0	153	7	31	254	43	34	10	10	14	16	15	5	0	188	3	2	1	0	17	5	10	2	133	14	73	46	29	2	15	12	6	52	3	27	22	3	0	4	0	609
4	Sarangwala	56	4	41		11		2	51	3	72			4	2	2			26					2		2		16	1	13	2	8	1	5	2		12			12	1				99
5	Nasirana	167	11	99		54	3	2	155	10	20	6	5	9	4	11		5	71					5		5		53	6	40	7	10	1	9		3	1			1	3		2		264
6	Gojra	45	5	25		15			34	11	13		13			6	7		10					4		1	3	5		1	4					1								68
7	Mungi	105	3	82		17	3		78	27	6		3	3	2	1	3		21					5	1		4	11	1	6	4	5			5						1		1		134
8	Jamwala/Hamza	36	5	23		8			25	11	6	3	3			4	2		7									7	1	4	2													49
9	Pirmahal	96	5	56		35		1	50	45	11		6	5	3	3	5		45					9	1	5	3	28		15	13	7	1	1	5	1					5	2	1	160
10	Killianwala	81	6	64		10	1		59	22	2			2	1	1			21					4	1	2	1	10		6	4	7	1	3	3		1		1					105
	L/CC sub-total	586	39	390		150	7	4	452	129	130	9	30	23	15	28	17	5	201					29	3	15	11	130	9	85	36	37	4	18	15	5	14		1	13	5	5	4	1	829
11	Thamman	82	15	48		16	3		15	67	9		9			3	6		31					1		1		27		8	19	2		2		1	15		4	11	2				139
12	China	89	3	75		11			4	85	3		3			1	2		25									18		3	15	7			7		4			4	1				122
	C/CC sub-total	171	18	123	0	27	3	0	19	152	12	0	12	0	0	4	8	0	56	0	0	0	0	1	0	1	0	45	0	11	34	9	0	2	2	1	19	0	4	15	3	0	0	0	261
	Project Total	1,085	72	666	0	330	17	36	725	324	176	19	52	37	31	47	30	5	445	3	2	1	0	47	8	26	13	308	23	169	116	75	6	35	34	13	85	3	32	50	11	5	9	1	1,749

Legend and Classification
1) Extent of Superannuation — A: well maintained and to be re-used B: functioning but to be repaired C/D: damaged/broken and to be replaced
2) Type of Outlet — A: Pipe Outlet B: APM Outlet C: AOSM Outlet with Chamber(proposed) D: Open Flume Outlet E: Other Type (not clear or screchly type)
3) Type of Drop — A: Vertical Drop B: Inclined Drop C: Not clear or Other type
4) Type of Bridge — AR: Arterial Road Bridge DR: Divisional Road Bridge VR: Village Road Bridge FP: Footpath Bridge RW: Railway Bridge

Table 3.4.1-1

Statement Regarding Yard stick, Demand and Release of Funds for O & M of L.J.C.

(Rs in million)

Year	Yard stick	Demand	Funds Released	Short fall	Commulative Short fall
1991 - 1992	19.90	19.90	9.74	10.16	10.16
92 - 93	19.90	21.49	7.75	13.74	23.90
93 - 94	19.90	23.21	13.20	10.01	33.91
94 - 95	19.90	25.06	15.77	9.29	43.20
95 - 96	19.90	27.07	3.50	23.57	66.77

Table 3.4.2-1 **Statement of Annual Expenditure in 12 Selected Distributaries of L.I.C, L.C.C. & C.B.D.C.**

(1994-95)

Title	Pindi Disty	Hujjan Disty & Minors	Kirana Disty & Minors	Sarang wala Disty	Nasrana Disty	Gojra Disty	Mungi Disty	Janiwala/ Hamza Disty	Pir Mahal Disty	Killian wala Disty	Thaman Disty	Chhinna Disty & Minors	Total (%)
a) STAFF:													
Engineering/Maintenance Staff	50.000	1,760.000	2,400.000	388.512	426.276	202.000*	364.980	196.140	413.040	260.036	436.820	488.715	7,386.519 44.0%
Revenue Staff	150.000	1,100.000	1,500.000	287.073	880.812	168.000*	338.160	225.180	338.160	274.920	368.425	412.795	6,043.525 36.0%
Total	200.000	2,860.000	3,900.000	675.585	1,307.088	370.000*	703.140	421.320	751.200	534.956	805.245	901.510	13,430.044 80.0%
b) Annual M & R**	70.000	500.000	800.000	–	144.678	96.000*	–	–	476.549	270.000	947.200	58.872	3,363.299 20.0%
Grand Total (a & b)	270.000	3,360.000	4,700.000	675.585	1,451.766	466.000*	703.140	421.320	1,227.749	804.956	1,752.445	960.382	16,793.343
Annual Assessed Water Charges (1994-95)	370.877	6,884.022	5,823.453	1,072.553	4,672.940	930.707	2,828.064	980.150	2,959.144	3,235.848	593.327	1,546.108	31,897.193

* Estimated.

** Average of two years where available

Table 3.4.2-2

Statement showing G.C.A, C.C.A Area Irrigated with Revenue Assessed in L.J.C. Circle (1984-1994)

Year	G.C.A	C.C.A	Area Irrigated in Acres			Revenue Assessed in Rupees		
	Acres	Acres	Kharif	Rabi	Total	Kharif	Rabi	Total
1984 - 1985	1,638,228	1,518,401	855,268	988,649	1,843,917	40,951,315	38,159,627	79,110,942
85 - 86	"	"	874,986	1,015,296	1,890,282	39,412,795	36,971,563	76,384,358
86 - 87	"	"	875,569	1,025,448	1,901,017	41,479,615	37,961,563	79,441,178
87 - 88	"	"	875,218	1,006,746	1,881,964	38,774,333	34,681,616	73,455,949
88 - 89	"	"	896,390	1,004,543	1,900,933	40,136,090	34,825,967	74,962,057
89 - 90	"	"	896,680	1,012,425	1,909,105	39,355,541	34,272,716	73,628,257
90 - 91	"	"	888,451	1,001,141	1,889,592	41,402,048	38,016,026	79,418,074
91 - 92	"	"	893,179	994,014	1,887,193	43,991,207	31,986,993	75,978,200
92 - 93	"	"	888,794	975,814	1,865,608	37,050,585	31,614,044	69,664,629
93 - 94	"	"	876,062	971,317	1,847,379	45,705,643	33,374,850	79,080,493

Table 3.4.2-3 AREA IRRIGATED, ASSESSED AND REMISSIONS OF WATER CHARGES IN TWO TYPICAL DIVISIONS OF LOWER CHANAB CANAL

BARALA DIVISION

No. of Distributaries = 38
Culturable Command Area = 458789 Acres

Area Irrigated & Assessed (in Acres)

Years		Area Irrigated	Area Assessed	Remission
1992-93	Kharif	392,817	391,248	1,569
	Rabi	336,329	335,887	442
	Total	729,146	727,135	2,011
1993-94	Kharif	387,524	373,770	13,754
	Rabi	326,888	326,795	93
	Total	714,412	700,565	13,847
1994-95	Kharif	389,810	389,304	506
	Rabi	325,672	325,594	78
	Total	715,482	714,898	584
Average of 3 years	Kharif	390,050.33	384,774.00	5,276.33
	Rabi	329,629.67	329,425.33	204.33
	Total	719,680.00	714,199.33	5,480.67

Average Area Irrigated with Sugar cane counted twice =		782,719.67
Intensity of Irrigation with Sugar cane counted once	=	156.87%
Intensity of Irrigation with Sugar cane counted twice	=	170.61%
Remission as Percentage of Cropped Area	=	0.70%

HAFIZABAD DIVISION

No. of Distributaries = 24
Culturable Command Area = 329290 Acres

Area Irrigated & Assessed (in Acres)

Years		Area Irrigated	Area Assessed	Remission
1992-93	Kharif	219,883	218,884	999
	Rabi	217,298	217,282	16
	Total	437,181	436,166	1,015
1993-94	Kharif	217,508	217,305	203
	Rabi	211,728	211,724	4
	Total	429,236	429,029	207
1994-95	Kharif	211,465	211,336	129
	Rabi	212,305	211,646	659
	Total	423,770	422,982	788
Average of 3 years	Kharif	216,285.33	215,841.67	443.67
	Rabi	213,777.00	213,550.67	226.33
	Total	430,062.33	429,392.33	670.00

Average Area Irrigated with Sugar cane counted twice =		485,031.00
Intensity of Irrigation with Sugar cane counted once	=	130.60%
Intensity of Irrigation with Sugar cane counted twice	=	147.30%
Remission as Percentage of Cropped Area	=	0.14%

Table 3.4.2-4 Datails of C.C.A. Area Assessed, Remission & Water Charges in 12 Selected Distributaries of L.J.C., L.C.C. & C.B.D.C.

Item	Pindi Disty	Hujjan Disty & Minors	Kirana Disty & Minors	Sarang wala Disty	Nasrana Disty	Gojra Disty	Mungi Disty	Janiwala/ Hamza Disty	Pir Mahal Disty	Killian wala Disty	Thaman Disty	Chhinna Disty & Minors	Total
1. Culturable Commanded Area (C.C.A.) in acres	5,646	62,359	89,754	16,374	85,686	18,632	47,347	16,093	46,196	46,196	12,882	40,498	487,663
2. Area Assessed (3 Yrs. Av. (1992-1995))	9,563	106,039	129,268	27,872	121,436	23,301	68,185	25,132	67,471	87,867	15,801	47,411	729,346
3. Remission (3 Yrs. Av. (1992-1995))	-	365	171	-	10	265	969	110	236	741	-	-	2,867
Remission as % of area assessed	0.00	0.34	0.13	0.00	0.01	1.14	1.42	0.44	0.35	0.84	0.00	0.00	0.40
4. Total Water Charges in 1,000 Rs. (1995)	371	6,884	5,823	1,073	4,673	931	2,828	980	2,959	3,236	593	1,546	31,897
5. Water Charges per Cropped Acre (1995)													
K	38.66	67.53	52.11	42.82	46.32	47.02	57.11	45.22	61.17	43.50	48.05	36.74	
R	38.48	61.77	38.22	31.63	30.29	33.88	30.06	31.28	37.15	30.54	30.12	29.20	
6. Water Charges on Flate Rete per Season (1995)	32.84	55.20	32.44	32.75	27.27	24.98	29.87	30.45	32.03	35.02	23.03	19.09	

Table 3.4.5-1 STATEMENT OF ANNUAL EXPENDITURE
LOWER JEHLUM CANAL (Rs.in Millions)

i) **STAFF**

a) ENGINEERING / EXECUTIVE STAFF :

TITLE	PAY AND ALLOWNCES	UTILITIES, TANSPORT, COMMUNICATION, etc.	
CIRCLE OFF	1.18	0.30	
SARGODHA DIVISION	10.04		
KIRANA DIVISION	9.28	3.83	
SHAHPUR DIVISION	7.78		
RASUL DIVISION	11.28		
TOTAL	39.56	4.13	
TOTAL ENGR / EXEC STAFF			43.69

b) REVENUE STAFF :

SARGODHA DIVISION	6.51		
KIRANA DISION	8.62	7.50	
SHAHPUR DIVISION	3.17		
RASUL DIVISION	2.92		
TOTAL	21.22	7.50	
TOTAL REVENUE STAFF			28.72
GRAND TOTAL (a & b)			72.41

ii) **M AND R EXPENSES OF L.J.C**

YEAR	1991-92	1992-93	1993-94	1994-95	AVERAGE
DEMAND	19.90	21.50	23.50	25.10	22.50
RELEASE	9.70	7.70	13.20	15.70	11.58

COST OF STAFF AND MAINTENANCE OF WORKS (i & ii)	=	83.99
PERCENT EXPENDITURE ON WORKS	=	13.78%
PERCENT EXPENDITURE ON STAFF	=	86.22%

Table 3.4.5-2 **STATEMENT OF ANNUAL EXPENDITURE**
LOWER CHANAB CANAL (Rs.in Millions)

i) **STAFF**

a) ENGINEERING / EXECUTIVE STAFF :

TITLE	L.C.C EAST	L.C.C WEST	TOTAL
PAY & ALLOWNCES	28.58	38.63	67.21
UTILITIES etc.	0.98	1.25	2.23
SUB TOTAL	29.56	39.88	69.44

b) REVENUE ASSESSMENT STAFF :

PAY & ALLOWNCES	22.73	18.15	40.88
UTILITIES etc.	2.09	1.95	4.04
SUB TOTAL	24.82	20.10	44.92
G.TOTAL (a & b)	54.38	59.98	114.36

ii) **M AND R EXPENSES (WORKS) OF L.C.C**

YEAR	1993-94
DEMAND	31.80
RELEASE	5.91

COST OF STAFF AND MAINTENANCE OF WORKS (i & ii)	=	120.27
PERCENT EXPENDITURE ON WORKS	=	4.91%
PERCENT EXPENDITURE ON STAFF	=	95.09%

Table 3.4.5-3 STATEMENT OF EXPENDITURE AND STAFF STRENGTH
CENTRAL BARI DOAB CANAL

STAFF STRENGTH

TOTAL STAFF EXCLUDING TUBE WELL STAFF	696

ANNUAL EXPENDITURE

a) STAFF :

YEAR	1993-94	1994-95	1995-96	AVERAGE
ENGR / EXEC	12.27	14.99	12.56	13.27
REVENUE	9.21	8.91	9.59	9.24
TOTAL	21.48	23.90	22.15	22.51

b) WORKS :

EXPENSES	8.00	10.83	9.69	9.51
G.TOTAL (a & b	29.48	34.73	31.84	32.02

PERCENT COST OF M AND R	=	29.69%
PERCENT OF STAFF	=	70.31%

Table 3.4.5-4 STATEMENT OF STAFF STRENGTH
LOWER CHANAB CANAL

STAFF STRENGTH

a) ENGINEERING / EXECUTIVE STAFF :

TITLE	L.C.C EAST	L.C.C WEST	TOTAL
S.E	1	1	2
XEN	3	4	7
A.E	9	9	18
SUB ENGR	38	50	88
SUB TOTAL	51	64	115

b) OTHER STAFF :

MAINTENANCE STAFF	966	1188	2154
TOTAL O & M STAFF (a & b)	1017	1252	2269

c) REVENUE STAFF:

STAFF	678	554	1232
G.TOTAL (a, b & c)	1695	1806	3501

Table 3.4.5-5 STATEMENT OF STAFF STRENGTH
LOWER JELUM CANAL

STAFF STRENGTH

a) ENGINEERING / EXECUTIVE STAFF :

TITLE	CIRCLE OFFICE	SARGODHA DIVISION	KIRANA DIVISION	SHAHPUR DIVISION	RASUL DIVISION	TOTAL
S.E	1	_	_	_	_	1
XEN	_	1	1	1	1	4
A.Es	_	3	4	3	2	12
SUB ENGRs	_	14	15	11	10	50
S.TOTAL	1	18	20	15	13	67

b) OTHER STAFF :

FIELD STAFF	_	154	141	101	149	545
OFF / MISC	31	181	150	149	236	747
S. TOTAL	31	335	291	250	385	1292
G. TOTAL (a & b)	32	353	311	265	398	1359

c) REVENUE ASSESSMENT STAFF :

STAFF	_	202	247	87	96	632
TOTAL L.J.C STAFF (a,b & c)	32	555	558	352	494	1991

Table 5.1.1-1 SUMMARY TABLE OF CANAL LENGTH IN THE STUDY AREA

1. LOWER JHELUM CANAL CIRCLE
2. LOWER CHENAB CANAL CIRCLE
3. CENTRAL BARI DOAB CANAL CIRCLE

Zone	Circle	Division	Distributaries						Minors						Irrigation Canal System
			Number	Length (canal miles)					Number	Length (canal miles)					
				Total	Lined**	Un-Lined	Perennial	Non-Perennial		Total	Lined**	Un-Lined	Perennial	Non-Perennial	
1. Sargodha Irrigation Zone, Sargodha	1. Lower Jhelum Canal Circle, Sargodha	1. Kirana Canal Division, Sargodha	18	265.64	24.99	240.65	265.64	-	54	183.54	16.92	166.62	183.54	-	Lower Jhelum
		2. Rasul Headworks Division, Rasul	15	122.60	-	122.60	122.60	-	11	26.00	-	26.00	26.00	-	Lower Jhelum
		3. Sargodha Canal Division, Sargodha	33	327.09	17.95	309.14	327.09	-	27	92.73	-	92.73	92.73	-	Lower Jhelum
		4. Shahpur Canal Division, Shahpur	21	150.24	-	150.24	-	150.24	37	130.94	-	130.94	-	130.94	Lower Jhelum
Sub-total			**87**	**865.57**	**42.94**	**822.63**	**715.33**	**150.24**	**129**	**433.21**	**16.92**	**416.29**	**302.27**	**130.94**	
(Sub-total, km)				(1,320)						(661)					
2. Faisalabad Irrigation Zone, Faisalabad	1. Lower Chenab Canal, (West) Circle, Faisalabad	1. Faisalabad Canal Division, Faisalabad	23	206.98	17.15	189.83	206.98	-	33	69.31	14.90	54.41	69.31	-	Lower Chenab
		2. Hafizabad Canal Division, Faisalabad	25	177.37	37.14	140.23	177.37	-	24	73.67	6.24	67.43	73.67	-	Lower Chenab
		3. Jhang Canal Division, Jhang	30	309.38	38.35	271.03	309.38	-	42	136.15	26.39	109.76	136.15	-	Lower Chenab
		4. Khanki Headworks Division, Khanki	16	163.10	3.58	159.52	93.22	69.88	25	65.87	1.82	64.05	18.79	47.08	Lower Chenab
	West Summary		94	856.83	96.22	760.61	786.95	69.88	124	345.00	49.35	295.65	297.92	47.08	
	2. Lower Chenab Canal, (East) Circle, Faisalabad	1. Burala Canal Division, Faisalabad	31	299.77	38.74	261.03	299.77	-	33	128.35	19.73	108.62	128.35	-	Lower Chenab
		2. Lower Gupera Canal Division, Faisalabad	27	295.85	48.34	247.51	295.85	-	33	124.37	26.83	97.54	124.37	-	Lower Chenab
		3. Upper Gupera Canal Division,	26	305.77	45.09	260.68	305.77	-	31	127.67	39.73	87.94	127.67	-	Lower Chenab
	East Summary		84	901.39	132.17	769.22	901.39	0.00	97	380.39	86.29	294.10	380.39	0.00	
Sub-total			**178**	**1,758.22**	**228.39**	**1,529.83**	**1,688.34**	**69.88**	**221**	**725.39**	**135.64**	**589.75**	**678.31**	**47.08**	
(Sub-total, km)				(2,681)						(1,106)					
3. Lahore Irrigation Zone, Lahore	1. Depalpur Canal Circle, Lahore	3. Lahore Canal Division, Lahore	33	329.14	69.24	259.90	329.14	-	68	221.37	41.09	180.28	221.37	-	C. B. D
			1	5.10	-	5.10	5.10	-	-	-	-	-	-	-	B. S. Link
Sub-total			**34**	**334.24**	**69.24**	**265.00**	**334.24**		**68**	**221.37**	**41.09**	**180.28**	**221.37**		
(Sub-total, km)				(510)						(337)					
Total			**299**	**2,958.03**	**340.57**	**2,617.46**	**2,737.91**	**220.12**	**418**	**1,379.97**	**193.65**	**1,186.32**	**1,201.95**	**178.02**	
(Total, km)				(4,511)	(519)					(2,104)					

**: Updated by the JICA Study Team, 1996.

Table 5.1.5-1 (1/3) List of Selected Canals for LJC Area

No.	Name of Distributary	Name of Minor	Length (km)	Outlet (Nos.)	Authorize Discharge (m3/s)	Design Discharge (m3/s)	Command Area (ha)	WUA (Nos.)	Length of trace by ground Water Quality (km)						Seepage Rate (%)	Lining (unit :km)				Remarks
									> 3,000 PPM		3,000 - 1,000 PPM		< 1,000 PPM			from (RD)	To (RD)	Distance	Kind	
									Length	Location	Length	Location	Length	Location						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Pindi		6.86	10	0.46	0.54	2,285	0			2.34	Tail	4.52	Head	11.60					
2	Hujan		33.98	59	5.16	6.46	11,329	30	4.27	Tail	21.38	T,M	8.33	Head	13.33	109,000	111,473	0.75	Brick	
3	Hujan	Arian	5.43	6	0.28	0.33	1,392	4			3.21	Tail	2.22	Head	9.84					
4	Hujjan	Kot Moman	6.78	12	0.54	0.63	2,668	9			4.73	Tail	2.05	Head	9.54					
5	Hujjan	Kot Raja	2.81	5	0.17	0.20	866	2					2.81	Full	8.24					
6	Hujjan	Bhikhi	6.34	9	0.39	0.46	1,974	3			0.90	Tail	5.44	Head	10.62					
7	Hujjan	Sahowal	5.76	7	0.31	0.37	1,575	6			5.76	Full			11.05					
8	Hujjan	M.Wala	5.87	5	0.26	0.31	1,311	3			5.87	Full			10.44					
9	Hujjan	Tangu	4.84	5	0.29	0.34	1,470	2	4.84	Full					9.49					
10	Hujjan	Jaspal	8.32	14	0.54	0.63	2,651	7	8.32	Full					10.71					
	sub-total		80.13	122	5.16	6.46	25,236	66	17.43		41.85		20.85					0.75		
11	Kirana		62.95	112	10.52	12.86	21,374	48	20.13	T,M	29.97	T,M	12.85	Head	14.26(p)	176,100	206,542	9.19	Concrete	
12	Kirana	Saruli	1.59	2	0.12	0.14	606	0					1.59	Full		(160350-176100 of Kirana are within urgent				
13	Kirana	Hadda	4.11	8	0.36	0.41	1,639	5					4.11	Full		programme by PID)				
14	Kirana	Malkana	10.16	16	0.73	0.87	3,548	11	7.32	Middle	2.84	T,H								
15	Kirana	Wasuana	6.89	8	0.34	0.41	1,731	3			6.28	Head	0.61	Tail						
16	Kirana	Tandalian	3.96	10	0.28	0.32	1,304	1			3.96	Full								
17	Kirana	Rodian	6.04	11	0.49	0.57	2,374	6			2.11	Tail	3.93	Head						
18	Kirana	Hunde	4.92	10	0.37	0.43	1,778	7			4.92	Full								
19	Kirana	Killa	4.10	7	0.23	0.27	1,147	3			4.10	Full								
20	Kirana	Dhabian	2.41	4	0.16	0.19	822	3			2.41	Full			14.62					
	(Chokera and Minors)		30.95				14,441													*1
	sub-total		138.08	188	10.52	12.86	50,765	87	27.45		56.59		23.09					9.19		
	Total		225.07	320	16.14	19.86	78,286	153	44.88		100.78		48.46					9.94		

Total length for LJC is 184.18 km. *1: not included for lining

Table 5.1.5-1 (2/3) List of Selected Canals for LCC Area

No.	Name of Distributary	Name of Minor	Length (km)	Outlet (Nos.)	Authonze Discharge (m3/s)	Design Discharge (m3/s)	Command Area (ha)	WUA (Nos.)	Length of trace by ground Water Quality (km)						Seepage Rate (%)	Lining (unit :km)				Remarks
									> 3,000 PPM		3,000 - 1,000 PPM		< 1,000 PPM			from (RD)	To (RD)	Distance	Kind	
									Length	Location	Length	Location	Length	Location						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Sarangwala		25.04	56	1.99	2.46	6,627	6	7.63	Tail	17.41	Middle	0.00	Head	12.49	10,000	11,000	0.20	Side	
2	Nasrana		54.64	131	7.02	8.87	25,094	65	7.93	Tail	46.71	Head			10.99			0.00		
3	Nasrana	Saduana	2.76	3	0.12	0.14	720	2			2.76	Full			4.70			0.00		
4	Nasrana	Khilliana	4.43	5	0.26	0.30	1,293	3			4.43	Full			4.65			0.00		
5	Nasrana	Narwala	5.82	10	0.41	0.48	2,139	7			5.82	Full	0.00		5.64	16,900	19,103	0.67	Brick	
6	Nasrana	Satiana	3.66	6	0.20	0.23	1,015	6	0.61	Tail	3.05	Head			5.26	0	1,300	0.40	Side	
7	Nasrana	Natheri	4.60	8	0.38	0.44	1,800	6			4.60	Full	0.00		4.70	0	13,000	3.97	Side	
8	Nasrana	Domra	5.51	12	0.52	0.61	2,616	7			5.51	Full	0.00		4.79	15,000	18,069	0.94	Side	
	Sub-total		81.42	175	7.02	8.87	34,677	96	8.54		72.88		0.00					5.97		
9	Gojra		15.06	35	1.64	1.95	6,347	20	7.63	Tail	7.43	Middle				28,500	49,414	1.08	Brick	
10	Gojra	Zeera	2.71	4	0.22	0.25	1,193	3	2.71	Full						8,397	8,897	0.10	Brick	
	Sub-total		17.77	39	1.64	1.95	7,540	23	10.34		7.43		0.00					1.18		
11	Mungi		36.97	88	4.05	5.03	17,657	33	5.80	Head	31.17	Tail			12.96	108,300	121,278	3.96	Brick	
12	Mungi	Mungi	4.32	9	0.31	0.36	1,504	1			4.32	Full			5.37	0	6,000	1.83	Brick	
	Sub-total		41.29	97	4.05	5.03	19,161	34	5.80		35.49		0.00					5.79		
13	Janiwala/Hamza		10.96	21	1.31	1.59	4,360	11			10.96	Full	0.00					0.00		
14	Janiwala	Amirwala	7.62	10	0.43	0.51	2,153	7	2.14	Tail	5.48	Head	0.00					0.00		
	Sub-total		18.58	31	1.31	1.59	6,513	18	2.14		16.44		0.00					0.00		
15	Pir Mahal		47.57	51	3.88	5.24	9,902	9			31.07	Head	16.50	Tail	5.21			0.00		
16	Pir Mahal	Thera	4.85	5	0.19	0.23	1,012	0			4.85	Full			2.61			0.00		
17	Pir Mahal	Megneja	9.89	12	0.37	0.45	1,818	1			9.89	Full			4.03			0.00		
18	Pir Mahal	Junejwala	16.08	24	0.98	1.18	4,703	4			11.53	Head	4.55	M.T	7.50			0.00		
19	Pir Mahal	Jandwala	3.74	4	0.15	0.18	807	0			3.74	Full			2.53			0.00		
	Sub-total		82.13	96	3.88	5.24	18,242	14	0.00		61.08		21.05					0.00		
20	Killianwala		46.05	103	5.66	6.96	19,278	38			41.72	Head	4.33	Tail	12.73	100,000	151,586	15.73	Brick	
22	Killianwala	Minor #3	6.66	11	0.33	0.39	1,741	5			6.66	Full			8.66			0.00		
	(Kanjiwani and Minors	Minor #7 & #8)	4.46				6,779													*1
	Sub-total		57.17	114	5.66	6.96	27,798	43	0.00		48.38		4.33					15.73		
	Total		323.40	608	25.55	32.10	120,558	234	34.45		259.11		25.38					28.87		

Total length for LCC is 290.07 km.

*1: not included for lining (Length of Kanjiwalni Distributary System is not available thus not included herewith)

Table 5.1.5-1 (3/3) List of Selected Canals for CBDC Area

No.	Name of Distributary 1	Name of Minor 2	Length (km) 3	Outlet (Nos.) 4	Authorize Discharge (m3/s) 5	Design Discharge (m3/s) 6	Command Area (ha) 7	WUA (Nos.) 8	Length of trace by ground Water Quality (km)						Seepage Rate (%) 15	Lining (unit: km)				Remarks 20
									> 3,000 PPM		3,000 - 1,000 PPM		< 1,000 PPM			from (RD) 16	To (RD) 17	Dist. 18	Kind 19	
									Length 9	Location 10	Length 11	Location 12	Length 13	Location 14						
1	Thamman		29.85	50	7.27	8.29	6,599	6	7.93	H,T	15.67	H,T	6.25	Middle		56,000	66,000	3.02	Brick	
2	Themman	Saharan	7.24	18	0.71	0.82	3,217	8			7.24	Full								
	(Athipur and Kasur)		27.45				16,061													*1
	sub-total		64.54	68	7.27	8.29	25,877	14	7.93		22.91		6.25					3.02		
3	China		25.46	63	3.60	4.33	12,664	19			14.63	Head	10.83	M,T	13.43					
4	China	Kale Minor	7.81	25	0.83	0.96	3,726	9			7.81	Full								
	sub-total		33.27	88	3.60	4.33	16,390	28			22.44		10.83							
	Total		97.81	156	10.87		42,267	42	7.93		45.35		17.08					3.02		

Total length for CBDC is 67.34 km. *1: not included for lining

Table 5.1.6-1 CLASSIFICATION OF CANALS IN FRESH AND SALINE AREAS SEEPAGE TEST RESULTS,AND SEEPAGE TESTS TO BE DONE

Category	Classification of Canals in Fresh and Saline Areas, Seepage Test Results, and Seepage Tests to be Done	LJC System		LCC System		CBDC System		Total	
		No.	Length (km)	No.	Length (km)	No.	Length (km)	No.	Length (km)
A.	Canals in the Study Area	216	1,980.6	399	3,787.4	102	847.3	717	6,615.3
A.1	Distributaries	87	1,320.0	178	2,681.2	34	509.7	299	4,510.9
A.2	Minors	129	660.6	221	1,106.2	68	337.6	418	2,104.4
B.	Canals in the Fresh Area	89	851.9	186	1,779.4	36	250.4	311	2,881.7
B.1	Distributaries	37	581.5	84	1,262.1	20	210.1	141	2,053.7
B.2	Minors	52	270.4	102	517.3	16	40.3	170	828.0
C.	Canals in the Saline Area	127	1,128.7	213	2,008.0	66	596.9	406	3,733.6
C.1	Distributaries	50	738.5	94	1,419.1	14	299.6	158	2,457.2
C.2	Minors	77	390.2	119	588.9	52	297.3	248	1,276.4
D.	Seepage Tests Completed								
D.1	Distributaries	14	326.4	21	720.9	4	112.8	39	1,160.1
D.1.1	Canals in the Fresh Area	3	69.0	7	263.7	1	25.6	11	358.3
D.1.2	Canals in the Saline Area	11	257.4	14	457.2	3	87.2	28	801.8
D.2	Minors	44	227.3	72	366.8	14	104.7	130	698.8
D.2.1	Canals in Fresh Area	12	63.4	26	145.6	2	3.5	40	212.5
D.2.2	Canals in Saline Area	32	163.9	46	221.2	12	101.2	90	486.3
D.3	Distributaries and Minors	58	553.7	93	1,087.7	18	217.5	169	1,358.9
D.3.1	Canals in Fresh Area	15	132.4	33	409.3	3	29.1	51	570.8
D.3.2	Canals in Saline Area	43	421.3	60	678.4	15	188.4	118	1,288.1
D.3.2.1	Selected at this F/S Stage *1	20	200.7	24	324.0	9	131.6	53	656.3
	Distributaries	3	104.9	7	237.8	2	56.4	12	399.1
	Minors	17	95.8	17	86.2	7	75.2	41	257.2
D.3.2.2	To be Selected at the Next Stage	13	129.3	1	19.00	6	56.9	20	205.2
	Distributaries	5	79.6	1	19.00	1	30.8	7	147.4
	Minors	8	31.7	—	—	5	26.1	13	57.8
D.3.2.3	Other Projects (ADB)	—	—	17	152.5	—	—	17	152.5
	Distributaries	—	—	2	82.0	—	—	2	82.0
	Minors	—	—	15	70.5	—	—	—	70.5
D.3.2.4	Little Effect of Lining	10	91.4	18	182.9	—	—	28	274.3
	Distributaries	3	55.0	4	118.3	—	—	7	173.3
	Minors	7	36.4	14	64.6	—	—	21	101.0
E	Seepage Tests to be Done (C-D.3.2)	84	707.4	153	1,329.6	51	408.5	288	2,445.5

*1 Nunber and length of the proposed canals for lining are 45 and 541km, respectively, excluding 8 minors and the existing lined sections.

Table 5.1.7 - 1 Extent of surface salinity in each of the command areas of the selected canals for lining during 1995

Disributory	Minor	Length	Command	Extent (acres) with surface salinity level							Total saline
		Kms.	area (acres)	Thur Kohna	Thur Punjasala	Thur Nau	Thur Juzvi	Thur Tick	Thur Recl	Total saline	%
Thamman		30.64	21,815	1026	289	144	582	18		2059	9%
Chinna		25.48	35,320	315	199	138	510	32		1194	3%
Nasrana		51.67	59,775	810	131	192	800			1933	3%
Nasrana	Doomra	3.65	6,510	50	19	24	247			340	5%
Nasrana	Khilliana	2.94	2,095	6	3	24	318			351	17%
Nasrana	Narwala	3.86	5,348	16		298	169			483	9%
Nasrana	Natheri	3.04	4,425			6	113			119	3%
Nasrana	Saiduana	1.82	1,800				26			26	1%
Nasrana	Satiana	2.42	2,840	6		5	123			134	5%
Pir Mahal		47.61	15,593	79	351	414	4067			4911	31%
Pir Mahal	Jandwala	3.75	1,283	10	65	25	450			550	43%
Pir Mahal	Junejwala	32.21	18,818	45	567	169	2270			3051	16%
Pir Mahal	Magneja	9.90	4,353		641	183	960			1784	41%
Pir Mahal	Thera	4.85	2,530	3	294	92	1098			1487	59%
Mungi		37.00	37,773	11	71	105	2057	7		2251	6%
Mungi	Mungi	2.64	4,060		23		221			244	6%
Sarangwala		25.04	24,753	26		450	2478			2954	12%
Janiwala		10.57	10,858	99	120	72	1746			2037	19%
Kilianwala		46.09	57,780	335	84	82	1181	224	305	2211	4%
Kilianwala	Minor #3	6.66	5,048		67	44	307			418	8%
Gojra		15.07	15,868	12	12	5	1118		141	1288	8%
Gojra	Zeera	2.71	2,773		2	5	363			370	13%
Hujjan		34.00	28,395	59		25	2038			2122	7%
Hujjan	Arianwala	5.43	3,480	47			111			158	5%
Hujjan	Bhikhi	6.79	4,778	57			55			112	2%
Hujjan	Jaspal	8.33	6,835	211		657	958			1826	27%
Hujjan	Kot Momin	6.79	5,950				57			57	1%
Hujjan	Kot Taja	2.81	1,335				284			284	21%
Hujjan	Mianwala	5.77	3,515		120					120	3%
Hujjan	Sahawal	6.34	4,000				147			147	4%
Hujjan	Tangu	5.87	4,460	155	20	164	405			744	17%
Kirana		64.11	55,895	280	17	33	2314			2644	5%
Kirana	Dhabian	7.89	4,773		4		234			238	5%
Kirana	Hadda	4.10	4,098	3	4	12	1307			1326	32%
Kirana	Hunde	4.91	4,445				26			26	1%
Kirana	Killa	4.09	3,293	135		1	184			320	10%
Kirana	Malkana	10.14	8,870	240	435	237	2793			3705	42%
Kirana	Rodian	6.02	5,550		7	7	47			56	1%
Kirana	Sarubi	1.58	1,515				393			393	26%
Kirana	Tandallan	3.95	3,273	67		21	444			532	16%
Kirana	Wasuana	6.87	4,328	98			377			475	11%
Pindi		6.86	5,410	343	18	160	308			829	15%
TOTAL		580.27	505,638	4544	3563	3791	33686	281	446	46309	9%

Explanation of terminology used in salinity surveys

(1) Thur Kohna - Ultra alkaline or Non Saline Alkali soils. Never cultivated saline land since the advent of canal irrigation. High in salt content & alkanality or low salt content & high alkali

(2) Thur Punjsala - Highly saline or saline alkali soils. Lands excluded from cultivated for more than 5 years due to salinity. Advance stage of deterioration. pH is 9.0 to 10.0

(3) Thur Nau - Highly saline or saline alkali soils. Lands excluded from cultivation within 5 years due to salinity. These are mostly saline alkali soils in the northern part of the Indus plains

(4) Thur Juzvi - Saline or saline alkali. Saline lands under cultivation bearing visible patches of salts to the extent of above high salinity in patches & alkalinity show progressively increasing

(5) Thur Tick - Lands where salts present in root zone hamper opening of cotton balls. Accumulation of salts is well below in the root zone & salts are not visible over the soil surface.

Source: DLR

Table 5.2.4-1 Summary of Proposed Structures

No.	Name of Distributry System	Outlet(Nos)				Drop	Bridge(Nos)													Step	Aqui-	Water	Pipe	Escape	Gates	Buffalo	total
		Total nos	Type of Outlet			Type A nos	Total nos	Type of Bridge													Total nos	duct	Course Cross	Culvert			Wallow	
			AOSM	Flume	Pipe			AR				DR				VR				RW								
			A	A	A	A		All	A	B	C	All	A	B	C	All	A	B	C	B	A	B	B	B	A	A	A	
1	Pindi	10	7	3		3	4	0				0				4	1	1	2								1	18
2	Hujjan	126	82	41	3	11	87	2	0	2	0	7	0	2	5	78	46	0	32	0	38	1	0	2	0	0	56	321
3	Kirana	174	136	31	7	12	98	1	0	1	0	9	0	3	6	82	30	13	39	6	21	1	0	2	0	0	52	360
	LJC Total	310	225	75	10	26	189	3	0	3	0	16	0	5	11	164	77	14	73	6	59	2	0	4	0	0	109	699
4	Saranwala	57	43	6	8		26	0				2			2	24	10	1	13		10	1					17	111
5	Nasrana	172	136	26	10	12	71	0	0	0	0	5	0	0	5	63	17	6	40	3	1	3	0	2	0	0	35	296
6	Gojra	40	33	7	0	3	10	0	0	0	0	4	0	0	4	6	1	1	4	0	0	0	0	0	0	0	10	63
7	Mungi	86	83	2	1	1	21	0	0	0	0	4	0	1	3	17	12	1	4	0	0	1	0	1	0	2	12	124
8	Janiwala/Hamza	32	26	6	0	3	8	0	0	0	0	0	0	0	0	8	4	1	3	0	0	0	0	0	0	1	4	48
9	Pirmahal	100	89	11	0	3	50	0	0	0	0	9	0	1	8	40	24	1	15	1	0	0	5	2	1	2	25	188
10	Killianwala	81	77	4	0	1	21	0	0	0	0	4	0	1	3	17	11	0	6	0	1	0	0	0	0	3	21	113
	LCC Total	568	487	62	19	23	207	0	0	0	0	28	0	3	25	175	79	11	85	4	12	5	5	5	1	8	124	943
11	Theman	72	51	7	14	1	31	0	0	0	0	1	0	0	1	29	21	0	8	1	10	2	0	0	0	2	14	130
12	China	88	74	9	5	1	26	0	0	0	0	0	0	0	0	26	23	0	3	0	3	1	0	0	0	2	20	139
	CBDC Total	160	125	16	19	2	57	0	0	0	0	1	0	0	1	55	44	0	11	1	13	3	0	0	0	4	34	269
	Grand Total	1,038	837	153	48	51	453	3	0	3	0	45	0	8	37	394	200	25	169	11	84	10	5	9	1	12	267	1,911

Note: A: New or Replaced, B: Retained and C: Repaired

Table 5.2.5-1 Project Work Volume Summary

No.	Name of Disanbuary	Length			Design Discharge	Command Area	Construction Work Volume											Remarks
							Earthwork in Prism				Earthwork for Diversion		Haulage	Lining Work			Land Compensation	
		Total (km)	Lined (km)	for Lining (km)	(m3/s)	(ha)	Stripping (m3)	Excavation (m3)	Embankment (m3)	Trimming (m2)	Excavation (m3)	Embankment (m3)	Borrow&Haul (m3)	Concrete (m3)	Plaster (m2)	Joints (Linear M.)	(m2)	
1	Pindi	6.86	0.00	6.86	0.54	2,285	2,874.3	17,830.8	33,447.8	22,920.0	5,405.3	18,298.4	28,510.1	1,746.3	22,920.0	7,812.6	13,938.5	
2	Hujan	80.13	1.95	78.18	6.46	25,236	45,269.4	276,813.9	560,866.4	416,803.3	157,713.2	381,506.9	507,846.2	31,755.9	416,803.3	143,002.0	136,959.1	
3	Kirana	107.13	10.64	96.49	12.86	36,324	86,021.9	471,143.3	983,768.3	800,068.3	372,383.4	614,634.1	754,875.7	60,968.8	800,068.3	270,667.3	121,568.9	
	LJC Total	194.12	12.59	181.53	19.86	63,844	134,165.6	765,788.0	1,578,082.4	1,239,791.5	535,501.9	1,014,439.4	1,291,232.0	94,471.0	1,239,791.5	421,481.9	272,466.5	
4	Sarangwala	25.04	0.30	24.74	2.46	6,627	13,853.8	72,199.5	162,495.1	138,954.5	44,151.3	176,203.2	222,347.5	10,588.0	138,954.5	47,306.7	23,436.7	
5	Nasrana	81.42	5.65	75.77	8.87	34,677	63,068.1	364,533.1	763,555.3	545,287.5	533,637.8	276,423.9	141,808.3	41,580.2	545,287.5	61,170.2	305,211.4	
6	Goyra	17.77	2.25	15.52	1.95	7,540	8,712.8	48,274.9	99,850.1	82,510.1	36,175.8	61,583.4	76,982.8	6,287.6	82,510.1	29,359.6	16,669.9	
7	Mungi	41.29	3.98	37.31	5.39	19,161	26,146.3	160,320.2	346,437.0	259,539.6	114,944.9	311,992.6	383,164.4	19,774.2	259,539.6	79,125.8	76,124.7	
8	Janiwala/Hamza	18.58	0.00	18.58	1.59	6,513	8,405.1	48,315.8	95,381.2	69,849.2	27,789.7	56,288.0	75,563.7	5,221.8	69,849.2	35,332.3	2,639.1	
9	Pir Mahal	82.13	0.00	82.13	5.24	18,242	50,361.0	306,817.6	638,323.2	461,798.8	328,315.9	465,610.3	448,800.0	35,194.9	461,798.8	155,346.4	100,125.8	
10	Killianwala	52.71	15.73	36.98	6.96	21,019	35,217.7	217,627.4	454,506.5	328,683.0	140,293.7	589,830.0	686,415.4	25,043.9	328,683.0	110,804.6	192,600.9	
	LCC Total	318.94	27.91	291.03	32.46	113,779	205,764.7	1,218,088.5	2,560,548.2	1,886,622.6	1,225,709.1	1,917,931.4	2,035,082.1	143,790.5	1,886,622.6	518,445.6	716,818.5	
11	Thamman	37.09	3.22	33.87	8.29	9,816	27,122.3	144,321.8	312,375.0	223,425.1	156,107.5	173,015.8	184,961.5	17,023.6	223,425.1	82,392.4	209,499.6	
12	China	33.27	0.19	33.08	4.33	16,390	18,805.0	112,374.4	235,088.4	191,668.2	129,230.0	141,480.5	134,964.5	14,605.2	191,668.2	63,910.7	179,379.7	
	CBDC Total	70.36	3.41	66.95	12.62	26,206	45,927.3	256,696.2	547,463.4	415,093.3	285,337.4	314,496.3	319,926.0	31,628.8	415,093.3	146,303.0	388,879.3	
	Project Total	583.42	43.91	539.51	64.94	203,829.72	385,857.6	2,240,572.7	4,686,094.2	3,541,507.4	2,046,148.4	3,246,867.0	3,646,240.1	269,890.4	3,541,507.4	1,086,230.5	1,376,164.3	

Table 5.3.2-1 Cropping Pattern and Cropping Intensity

Item	Lower Jhelum Canal								Lower Chenab Canal																Central Bari Doab Canal					
	Overall		Pindi		Hujjan		Kirana		Overall		Shangwala		Nasirana		Gojra		Mungi		Janiwala/Hamza		Pirmahal		Killianwala		Overall		Thamman		China	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
CCA	78,286		2,295		25,236		50,765		120,558		6,627		34,677		7,540		19,161		6,513		18,242		27,798		42,267		25,877		16,390	
Kharif Season Crop																														
Sugarcane	6,898	8.8	89	3.9	1,478	5.9	5,330	10.5	19,053	15.8	1,238	18.7	7,181	20.7	1,357	18.0	2,223	11.6	1,003	15.4	2,466	13.5	3,586	12.9	3,775	8.9	1,501	5.8	2,274	13.9
Cotton	3,795	4.8	51	2.2	698	2.8	3,046	6.0	9,804	8.1	73	1.1	1,810	5.2	454	6.0	2,365	12.3	756	11.6	2,068	11.3	2,279	8.2	1,055	2.5	828	3.2	227	1.4
Rice (Basmati)	2,305	2.9	53	2.3	780	3.1	1,472	2.9	5,610	4.5	128	1.9	381	1.1	91	1.2	490	2.6	73	1.1	3,856	21.1	389	1.4	3,724	8.8	3,416	13.2	308	1.9
Vegetable	776	1.0	15	0.7	102	0.4	660	1.3	1,271	1.1	36	0.5	199	0.6	56	0.7	612	3.2	129	2.0	157	0.9	83	0.3	740	1.7	207	0.8	533	3.2
Maize	9,026	11.5	288	12.6	1,682	6.7	7,056	13.9	24,041	19.9	1,844	27.8	7,881	22.7	1,562	20.7	2,902	15.1	1,354	20.8	1,410	7.7	7,088	25.5	4,960	11.7	2,588	10.0	2,373	14.5
Fodder	16,533	21.1	714	31.3	7,442	29.5	8,376	16.5	17,787	14.8	1,454	21.9	5,806	16.7	1,343	17.8	2,797	14.6	930	14.3	2,426	13.3	3,030	10.9	8,248	19.5	3,416	13.2	4,833	29.5
Others	2,093	2.7	32	1.4	792	3.1	1,269	2.5	3,356	2.8	28	0.4	1,522	4.4	322	4.3	369	1.9	512	7.9	160	0.9	445	1.6	104	0.2	52	0.2	52	0.3
Sub-total	41,427	52.9	1,242	54.3	12,975	51.4	27,210	53.6	80,722	67.0	4,802	72.5	24,779	71.5	5,184	68.8	11,758	61.4	4,756	73.0	12,542	68.8	16,901	60.8	22,605	53.5	12,007	46.4	10,599	64.7
Rabi Season Crop																														
Wheat	36,937	44.6	1,270	55.6	9,096	36.0	24,570	48.4	58,765	48.7	3,300	49.8	17,272	49.8	3,614	47.9	8,979	46.9	3,549	54.5	9,847	54.0	12,203	43.9	21,025	49.7	12,214	47.2	8,812	53.8
Fodder (Berseem)	9,621	12.3	69	3.0	3,917	15.5	5,635	11.1	6,596	5.5	374	5.6	1,675	4.8	425	5.6	1,016	5.3	142	2.2	906	5.0	2,057	7.4	5,592	13.2	3,933	15.2	1,658	10.1
Others	2,788	3.6	93	4.1	613	2.4	2,081	4.1	10,440	8.7	471	7.1	3,719	10.7	987	13.1	1,687	8.8	603	9.3	1,528	8.4	1,445	5.2	2,080	4.9	906	3.5	1,175	7.2
Sub-total	47,346	60.5	1,432	62.7	13,627	54.0	32,287	63.6	75,801	62.9	4,146	62.6	22,666	65.4	5,026	66.7	11,682	61.0	4,294	65.9	12,282	67.3	15,706	56.5	28,697	67.9	17,053	65.9	11,645	71.0
Perennial Crops																														
Citrus	13,206	16.9	565	24.7	7,818	31.0	4,823	9.5	4,652	3.9	395	6.0	849	2.4	484	6.4	1,068	5.6	146	2.2	682	3.7	1,029	3.7	896	2.1	492	1.9	405	2.5
Sub-total	13,206	16.9	565	24.7	7,818	31.0	4,823	9.5	4,652	3.9	395	6.0	849	2.4	484	6.4	1,068	5.6	146	2.2	682	3.7	1,029	3.7	896	2.1	492	1.9	405	2.5
Total	101,978	130	3,238	142	34,420	136	64,319	127	161,174	134	9,342	141	48,294	139	10,694	142	24,507	128	9,196	141	25,505	140	33,635	121	52,199	123	29,551	114	22,648	138
Cropping Intensity																														
Kharif	52.9%		54.3%		51.4%		53.6%		67.0%		72.5%		71.5%		68.8%		61.4%		73.0%		68.8%		60.8%		53.5%		46.4%		64.7%	
Rabi	60.5%		62.7%		54.0%		63.6%		62.9%		62.6%		65.4%		66.7%		61.0%		65.9%		67.3%		56.5%		67.9%		65.9%		71.0%	
Perenial	16.9%		24.7%		31.0%		9.5%		3.9%		6.0%		2.4%		6.4%		5.6%		2.2%		3.7%		3.7%		2.1%		1.9%		2.5%	
Overall	130.3%		141.7%		136.4%		126.7%		133.7%		141.0%		139.3%		141.8%		127.9%		141.2%		139.8%		121.0%		123.5%		114.2%		138.2%	
Irrigation Intensity	155.9%		170.3%		173.2%		146.7%		153.4%		165.6%		162.4%		166.3%		145.1%		158.8%		157.1%		137.6%		134.5%		121.9%		154.5%	

Source: PID, Canal Offices

Table 5.5.1 -1 Preliminary evaluation of the magnitude of Impact on items by the project and the importance of the item in the project

Item	Magnitude of Impact on Item (Note 1)	Magnitude of Importance of item in project (Note 2)	Remarks
1. Land acquisition	- B	D	Construction methods to minimize land acquisition
2. Distribution of inequities	+ A	A	Depends on sucess of implementation
3. Canal closure	- A	C	Depends on the construction methodology
4. Institutional changes	+A / -A	A	Depends on sucess of implemenitation
5. Down stream settlements	- U	E	
6. Impairment of transportation	- C	D	
7. Framers income & living standards	+A	A	
8. Impediment to Livestock	- A	B	
9. Changes in farming practice	- C	C	
10. Increase use of agrochemicals	- C	B	
11. Health and sanitation	+ C	C	
12. Drinking water quality	A	A	Drinking water quality survey to be carried out
13. Forestry	- A	D	Further details are necessary at next stage
14. Wild life	D	E	
15. Groundwater table/waterlogging	+ B	A	Further details and monitoring plan is necessary
16. Groundwater quality	- B	A	Further details and monitoring plan is necessary
17. Water quantity	+ A	A	Monitoring plan is neccessary
18. Soil salanisation	+B / -B	B	Fuchet details and monitoring plan is necessary
19. Salt balance	+C	B	Further study is necessary

Note 1. Magnitude of levels of Impact on the Induvidual item by the Project

A : Relative high magnitude of Impact is expected
B : Relative medium magnitude of Impact is expected
C : Relative low magnitude of Impact is expected
D : No effect is expected
U : Impact is unknown
+ : Positive impact is expected
- : Negative impact is expected

Note 2. Magnitude of the Importane of the Item in the overall project

A : Very high importance in the overall project.
B : High importance in the overall project.
C : Medium importance on the overall project.
D : Low importance in the overall project.
E : No importance in the overall project.

Table 5.5.1.-2 Reservation Widths along canals selected for lining in LJC

Distributory	Minor	Length	Command	Canal section		* Reservation		Remarks
		km.	area (ha)	From - RD	To - RD	Left	Right	
Pindi		6.86	2,164	0	248			Within the reservation of Northern Branch
				248	22,500	55	55	Crown waste land on right side
Hujjan		34	11,358	0	21,000	57.75	57.75	
				21,000	23,500	79.75	79.75	
				23,500	43,113	57.75	57.75	
				43,113	69,000	55	55	
				69,000	70,000	77	77	
				70,000	79,500	55	55	
				79,500	81,000	77	77	
				81,000	83,225	55	55	
				83,225	85,500	49.5	49.5	
				85,500	86,000	71.5	49.5	
				86,000	87,500	71.5	71.5	
				87,500	105,000	49.5	49.5	
				105,000	107,500	71.5	71.5	
				107,500	111,492	49.5	49.4	
	Arrian	5.43	1,392	0	5,000	33	33	
				5,000	18,000	30.25	30.25	
	Bhikhi	6.79	1,911	0	5,000	35.75	35.75	
				5,000	14,000	33	33	
				14,000	22,540	30.25	30.25	
	Jaspal	8.33	2,724	0	3,000	41.25	41.25	
				3,000	7,000	52.25	52.25	
				7,000	12,500	41.25	41.25	
				12,500	16,000	49.5	49.5	
				16,000	25,100	35.75	35.75	
	Kot Momin	6.79	2,380	0	22,000	33	33	
	Kot Raja	2.81	534	0	15,000	30.25	30.25	
	M. Wala	5.77	1,406	0	1,300	33	33	
				13,000	20,000	30.25	30.25	
	Sahowal	6.34	1,600	0	5,000	32.25	17.25	
				5,000	11,500	30.95	15.95	
				11,500	15,000	41.37	26.37	
				15,000	18,700	30.95	15.95	
	Tangu	5.83	1,784	0	14,833	30.25	30.25	
Kirana		64.11	22,358	0	9,500	101.75	101.75	RD 7800 to 16700 : Crown waste land
				9,500	27,000	99	99	RD 28200 to 76639 : Crown waste land
				27,000	58,000	110	110	RD 82264 to 146000. Crown waste land
				58,000	84,500	88	88	
				84,500	126,000	82.5	82.5	
				126,000	132,250	77	77	
				132,250	146,000	57.75	57.75	
				146,000	210,922			
	Dhablan	7.89	1,909	0	11,000	60.5	60.5	Crown waste land
				11,000	26,700	55	55	"
	Hadda	4.1	1,639	0	Tail	Not available		
	Hunde	4.91	1,278	0	17,000	55	55	"
	Killa	4.09	1,317	0	13,700	55	55	"
	Malkana	10.14	3,548	0	15,000	77	77	"
				15,000	24,000	66	66	"
				24,000	40,300	60.5	60.5	"
	Rodan	6.02	2,220	0	13,000	46.75	46.75	"
				13,000	19,500	66	66	"
	Saruli	1.58	606	0	9,300	55	55	"
	Wasuana	6.87	1731	0	15870	60.5	60.5	Crown waste land
	Tandlian	3.95	1,309	0	12,929	11.5	29.5	

* Note: The reservation widths to the Left and Right is from the centerline of canal and given in feet

Table 5.5.1- 3 Reservation widths along canals selected for lining in LCC

Distributory	Minor	Length	Command	Canal section		Reservation width		Remarks
		Kms.	area (ha)	From - RD	To - RD	Left (ft)	Right (ft)	
Nasrana		54.67	23,910	0	50,000	65	65	Government Waste land on right hand side
				50,000	100,000	60	60	do
				100,000	125,000	55	55	do
				125,000	150,000	50	50	do
				150,000	170,000	45	45	do
				170,000	175,000	40	40	do
	Doomra	3.65	2,604	0	21,000	35	35	do
	Khilliana	2.94	838	0	14,565	35	35	do
	Narwala	3.86	2,139	0	19,200	40	40	
	Natherl	3.04	1,770					Data not available at Xen office
	Saiduana	1.82	720	0	7,900	38.5	38.5	
	Saliana	2.42	1,136	0	12,000	30	30	Government Waste land on right hand side
Pir Mahal		47.61	6,237	0	18,150			Data not available
				18,150	27,500	64	64	Bhagat Reservoir plantation
				27,500	29,500	47	86	do
				29,500	32,500	59	59	do
				32,500	36,000	58	58	do
				36,000	36,500	58	87	
				36,500	39,000	47	87	
				39,000	46,000	46	80	
				46,000	61,410	48	83	
				61,410	66,000	86	44	Crown waste land on both sides begin at 62,000
				66,000	69,000	65	65	Crown waste land on both sides of canal reservation
				69,000	70,500	64	64	do
				70,500	78,000	61	61	do
				78,000	81,000	60	60	do
				81,000	90,000	58	58	do
				90,000	130,000	52	52	Crown waste land on right hand side
				130,000	137,500	49	49	do
				137,500	156,000	42.5	42.5	do
	Jandwala	3.35	513	0	10,000	40	40	
				10,000	18,000	38	38	
	Junejwala	37.21	7,539	0	11,500	41	41	
				11,500	18,000	39	39	
				18,000	40,000	40	40	
				40,000	60,452	41	41	
	Magneja	9.90	1,741	0	20,000	40	40	Crown waste land on both sides
				20,000	33,500	41	40	
	Thera	4.85	1,012	0	9,000	41	41	
				9,000	15,600	36	36	
Mungi		37.00	15,109	0	1,500	80	80	
				1,500	51,820	60	60	
				51,820	108,260	55	55	
				108,260	123,000	40	40	
	Mungi	2.61	1,624	0	14,000	40	40	
Sarangwala		25.04	3,901	0	43,700	50	50	
				43,700	79,260	45	45	
Janiwala		10.57	4,343	0	42,060	40	40	
	Aminwala	7.63	2,077	0	25,301	40	40	
Kilianwala		46.09	23,112	0	8,000	60.5	60.5	
				8,000	18,000	66	66	
				18,000	43,000	69.5	68	
				43,000	49,000	67	65	
				49,000	51,000	62	59	
				51,000	63,000	66	66	
				63,000	73,000	65	62	
				73,000	75,000	72	60+52	
				75,000	82,000	60.5	60.5+52	
				82,000	92,000	47.5	96	
				92,000	96,000	52	94.5	
				96,000	118,760	48.5	94.5	
				118,760	126,674	48	87	
				126,674	140,275	44	44	
				140,275	150,910	41	41.5	
	Minor #3	6.66	2,019	0	21,480	50	50	
	Zeera	2.71	1,109	0	20,000	40	40	

Table 5.5.1- 4 Reservation widths along canals selected for lining in CBDC

Distributory	Minor	Length Kms.	Command area (ha)	Canal section From - RD	Canal section To - RD	Reservation Left	Reservation Right	Remarks
Thaman		30.64	8,726	0	1,800	50	50	
				1,800	3,400	50	47	
				3,400	6,000	50	44	
				6,000	10,000	50	40	
				10,000	10,200	47	40	
				10,200	13,600	40	38	
				13,600	16,000	43	36	
				16,000	17,500	40	39	
				17,500	26,000	45	40	
				26,000	29,500	40	29	
				29,500	41,000	45	35	
				41,000	43,500	39	29	
				43,500	51,000	39	31	
				51,000	60,000	36	31	RD 56 to 66 is Brick Lined
				60,000	68,500	36	28.5	
				68,500	79,000	33.5	28.5	
				79,000	80,000	32	27	
				80,000	97,000	32	27	Tail at 97000 RD.
China		25.48	14,128	0	2,730	44	42	
				2,730	19,760	44	35	
				19,760	20,000	45	32.5	
				20,000	23,750	40	32.5	
				50,000	75,000	35	35	
				75,000	79,000	32.5	32.5	
				79,000	85,000	36.5	32.5	
				85,000	99,000	34	32.5	
				99,000	100,600	32	32.5	
	Kala Minor	7.82	2,610	0	500	20	20	
				500	6,550	17.5	17.5	
				6,550	7,100	17.5	22.5	
				7,100	8,000	17.5	17.5	
				8,000	11,500	20	20	
				11,500	18,075	15	15	
				18,075	21,500	17.5	17.5	
				21,500	23,000	15	15	
				23,000	24,746	10	10	

Note: The reservation widths to the Left and Right is from the centerline of canal

Table 5.5.1-5 Canalside Forest Plantations - Number of trees on the selected canals

Disributory	Minor	Length	Number of Trees on canal length	
		kms.	Number	Remarks
Thammun		30.64	3669	Total on full length on both sides
Chinna		25.48	2085	"
Chinna	Kala Minor	7.82	728	"
Nasrana		54.67	8471	"
Nasrana	Doomra	3.65	481	"
Nasrana	Khilliana	2.94	278	"
Nasrana	Narwala	3.86	414	"
Nasrana	Natheri	3.04	472	"
Nasrana	Saiduana	1.82	105	"
Nasrana	Satiana	2.42	139	"
Pir Mahal		47.61	8722	"
Pir Mahal	Jandwala	3.75	1084	"
Pir Mahal	Junejwala	37.21	2798	"
Pir Mahal	Magneja	9.90	901	"
Pir Mahal	Thera	4.85	0	Not available
Mungi		37.00	4358	Total on full length on both sides
Mungi	Mungi	2.64		Not available
Sarangwala		25.04	2628	Total on full length on both sides
Janiwala		10.57	803	"
Janiwala	Amirwala	7.63	1272	"
Kilianwala		46.09	5806	"
Kilianwala	Minor #3	6.66	645	"
Kilianwala	Minor #7	4.17	982	"
Kilianwala	Minor #8	2.62	374	"
Gojra		15.07	794	"
Gojra	Zeera	2.71	208	"
Hujjan		34.00	5114	"
Hujjan	Arianwala	5.43	950	"
Hujjan	Bhikhi	6.79	1027	"
Hujjan	Jaspal	8.33	834	"
Hujjan	Kot Momin	6.79	699	"
Hujjan	Kot Raja	2.81		Not available
Hujjan	Mianwala	5.77	1240	Total on full length on both sides
Hujjan	Sahawai	6.34	562	"
Hujjan	Tangu	5.87	960	"
Kirana		64.11	7630	"
Kirana	Dhabian	7.89	396	"
Kirana	Hadda	4.10	531	"
Kirana	Hunde	4.91	105	"
Kirana	Killa	4.09	73	"
Kirana	Malkana	10.14	1085	"
Kirana	Rodian	6.02	1430	"
Kirana	Sarubi	1.58	343	"
Kirana	Tandallan	3.95		"
Kirana	Wasuana	6.87	902	"
Pindi		6.86	1017	"
Total		602.51	73148	

Table 5.5.1- 6 Results of the drinking water quality tests

No.	Canal	Chak	pH	TDS	Ca	Mg	Total Hardness	Total Alkalinity	SO4	Cl	F	Fe	Conductivity	Nitrate	Nitrite	Bacterological Result
			W.H.O. maximum permissible level (adopted by Public Health Engineering Department, Punjab)													
			6.5-9.2	1500	200	150	500		400	600		1				
1	Tamman	Jeevan singh	8	966	60	22	240	410	260	74	0.4	Nil	1.380	Nil	Nil	Fit
2	Kala Minor	Kot Shajoo Kahn	8.7	1.610	24	Nil	60	670	580	92	0.3	Nil	2.300	Nil	Nil	Fit
3	Kala Minor	Kot Shajoo Kahn	8.6	2.380	84	35	340	340	615	111	0.3	Nil	3.400	Nil	Nil	Unfit
4	Chinna Dv	Haveli Jhanger	8.2	1.190	28	2	80	760	340	225	0.2	Nil	1.700	Nil	Nil	Fit
5	Pir Mahal Dv.	261/GB	7.6	1.232	28	45	250	540	410	167	0.4	Nil	1.760	Nil	Nil	Unfit
6	Pir Mahal Dv.	688-28	7.5	1.085	52	30	250	540	230	108	0.4	Nil	1.550	Nil	Nil	Unfit
7	Juneiwala M	681-22 GB	7.3	371	52	18	200	290	98	27	0.5	Nil	530	Nil	Nil	Unfit
8	Megneia M	665/5	7.4	679	40	30	220	440	178	40	0.5	Nil	970	Nil	Nil	Unfit
9	Sarangwala Dv	107/GB	7.6	1.435	100	138	860	800	418	236	0.4	Nil	2.050	Nil	Nil	Unfit
10	Mungi Dv	245/GB	7.6	5.250	132	Nil	140	800	1.320	1.190	0.3	Nil	7.500	Nil	Nil	Unfit
11	Goira Dv	366/JB	7.8	9.100	104	153	870	710	1.980	1.203	0.3	1	13.000	Nil	Nil	Unfit
12	Janiwala Dv.	162/GB	7.3	420	100	138	800	760	120	113	0.3	Nil	600	Nil	Nil	Unfit
13	Amirwala M	157/GB	7.5	917	80	165	860	620	200	140	0.3	Nil	1.310	Nil	Nil	Unfit
14	Killianwala D	441/GB	7.7	1.470	48	42	290	680	210	117	0.4	Nil	2.100	Nil	Nil	Unfit
15	Killianwala D	458/GB	7.7	1.085	100	58	470	680	245	167	0.3	3	1.550	Nil	Nil	Unfit
16	Minor #3	445/GB	7.8	1.085	16	10	80	740	240	59	0.3	Nil	1.550	Nil	Nil	Unfit
17	Nasrana Dv.	51/JB	7.7	1.295	152	80	700	940	300	232	0.2	Nil	1.850	Nil	Nil	Unfit
18	Nasrana Dv.	81/JB	7.9	2.240	88	25	320	610	545	481	0.4	Nil	3.200	Nil	Nil	Unfit
19	Doomra M	87/JB	7.6	1.855	84	53	420	630	450	345	0.3	Nil	2.650	Nil	Nil	Unfit.
20	Narwala M	67/JB	7.9	2.660	36	25	190	780	660	490	0.5	Nil	3.800	Nil	Nil	Unfit
21	Dherma Dv	68/NB	8.2	1.200	80	Nil	130	550	321	120	0.3	Nil	1.500	Nil	Nil	Unfit
22	Hurjian Dv.	Liliani	8.5	840	64	67	430	450	230	115	0.4	Nil	1.050	Nil	Nil	Unfit
23	Jaspal M	16/SB	7.9	1.400	56	85	480	560	360	225	0.4	Nil	1.750	Nil	Nil	Fit
24	Kot Momin M	Kot Momin	8.2	1.160	48	60	360	460	291	115	0.3	Nil	1.450	Nil	Nil	Unfit
25	M'wala M	M'wala	8.1	1.520	32	40	240	650	386	198	0.4	Nil	1.900	Nil	Nil	Fit
26	Kirana Dv.	25/SB	7.9	800	36	58	320	280	198	69	0.3	Nil	1.000	Nil	Nil	Fit
27	Kirana Dv.	137/SB	8.2	1.280	36	12	140	410	329	239	0.4	Nil	1.600	Nil	Nil	Unfit
28	Malkana M	104/SB	7.8	6.400	80	175	900	810	1.600	3.028	0.3	Nil	8.000	Nil	Nil	Unfit
29	Rodion M	121/SB	7.5	1.920	128	75	620	130	480	248	0.3	Nil	2.400	Nil	Nil	Unfit
30	Wasuna M	114/SB	7.9	4.000	116	72	580	870	970	2.254	0.1	Nil	5.000	Nil	Nil	Unfit
31	Pindi Dv	91/NB	8.2	3.440	56	25	240	1.630	865	1.564	0.4	Nil	4.300	Nil	Nil	Unfit
32	Killianwala Dv	Killianwala Dv	7.6	208	28	20	150	140	Nil	23	0.4	Nil	260	Nil	Nil	Unfit
33	Nasrana Dv.	Nasrana Dv.	7.5	192	36	15	150	130	Nil	18	0.5	Nil	240	Nil	Nil	Unfit
34	Mungi Dv.	Mungi Dv.	7.5	200	36	15	150	160	Nil	36	0.5	Nil	250	Nil	Nil	Unfit
	Average of drinking water samples		7.86	2009	69	62	390	630	498	445	0.34		2732			

Note: Shaded values indicates the items which are higher than the maximum permissible level for that parameter.

Table 5.5.1-7 Rural Water Supply Schemes of the Public Health Engineers Department Located on Canal Reservations

No.	Distrbutory	RD	Chak served	Population	Source
1	Nasrana	59.7, 60.28	230/RB	6,000	2 tubewells
2	Nasrana	55.97,56.47,56.97	61/JB	12,500	3tubewells
3	Nasrana	63.86, 64.74	62/JB	5,300	2 tubewells
4	Nasrana	68,69	63/JB	5,300	2 tubewells
5	Nasrana	32,35	08/JB	6,265	2 tubewells
6	Nasrana	90.5	67/JB	12,783	2 tubewells
7	Nasrana	93.79	71/JB	8,700	1tubewell
8	Nasrana	54.32	217/RB	7,125	1 tubewell
9	Nasrana	52.82, 53.32	57/RB	5,870	2 tubewells
10	Nasrana	62.38, 62.88	66/JB	16,669	2 tubewells
11	Nasrana	54.47	60/JB	7,175	1 tubewell
12	Nasrana	70.79,80.85	68/JB	6,426	2 tubewells
13	Nasrana	97.24	77/JB	7,276	1tubewell
14	Nasrana	104.98	76/JB	5,500	1tubewell
15	Nasrana	113.092	80/JB	4,432	1tubewell
16	Nasrana	121.552	89/JB	5,580	1tubewell
17	Nasrana	113.10, 115.9	84/JB	5,580	2 tubewells
18	Nasrana	*Yet to b e installed	86/JB	4,464	Canal source
19	Nasrana	*Yet to b e installed	85/JB	6,100	Canal source
20	Kirana	RD data not available	89/SB	4,415	Tubewells
21	Kirana	RD data not available	128/SB	4,408	Tubewells
22	Kirana	RD data not available	107/SB	9,240	Tubewells
23	Kirana	RD data not available	113/SB	7,432	Tubewells
24	Kirana	RD data not available	127/SB	7,432	Tubewells
25	Kirana	RD data not available	126/SB	8,612	Tubewells
26	Kirana	RD data not available	131/SB	4,410	Tubewells
27	Kirana	RD data not available	90/SB	5,508	Tubewells
28	Kirana	RD data not available	105/SB	3,321	Tubewells
29	Kirana	RD data not available	94/SB	1,810	Tubewells
30	Kirana	RD data not available	98/SB	4,429	Tubewells
31	Kirana	RD data not available	100/SB	3,687	Tubewells
32	Kirana	RD data not available	116/SB,119/SB	5,848	Tubewells
33	Kirana	RD data not available	103/SB	4,097	Tubewells
34	Kirana	RD data not available	112/SB	2,135	Tubewells
35	Kirana	RD data not available	114/SB	3,306	Tubewells
36	Kirana	RD data not available	130/SB	4,140	Tubewells
37	Kirana	RD data not available	84/SB	4,445	Tubewells
38	Kirana	RD data not available	102/SB	4,225	Tubewells
39	Kirana	RD data not available	123/SB, 124/SB	7,078	Tubewells
40	Kirana	RD data not available	110/SB	3,743	Tubewells
41	Kirana	RD data not available	40/SB	4,767	Tubewells
42	Kirana	RD data not available	121/SB	4,390	Tubewells
43	Kirana	RD data not available	129/SB	4,843	Tubewells
44	Kirana	RD data not available	132/SB	5,069	Tubewells
45	Kirana	RD data not available	135/SB	5,463	Tubewells
46	Kirana	RD data not available	92/SB, 93/SB	5,477	Tubewells
47	Kirana	RD data not available	39/SB	3,768	Tubewells
48	Kirana	RD data not available	35/SB	2,836	Tubewells
49	Kirana	RD data not available	95/SB	2,402	Tubewells
50	Kirana	RD data not available	85,88,91/SB, Sadeona	11,785	Tubewells
51	Kirana	RD data not available	101/SB	2,140	Tubewells
52	Hujjan	RD data not available	65/SB	7,171	Tubewells
53	Hujjan	RD data not available	17/SB	5,811	Tubewells
54	Hujjan	RD data not available	13-A/SB	5,477	Tubewells

Table 5.5.2-1 Environmental Management Plan (1/2)

Item	Activity / Parameter	Measures to be taken	Timing	Execution	Super vison	Related Institution
1. Land requirements						
1.1 Fixing of Right of Way & Clearing						
	(a) Translate Land Plans to ground	Inform public of project and the requirement of the R-O-W	Detail design stage	P.O. /CE	PID	
	(b) Removal of farmer encroachers	Inform farmers not to cultivate next season and to move out of R-O-W	One season before construction	CE	PID	
	(c) Removal of other encroachers	Notice to move out of reservation and give any support necessary	One year before construction	CE	PID	Commissioner
	(d) Removal of other structures	Instruct encroachers to find alternate accomadation	One year before construction	CE	PID	Commissioner
1.2 Private Land required for construction						
	(a) Land for diversion canals	(i) Negotiate compensation for useage on crop loss basis & damages	Before construction	P.O. / CE	PID	
		(ii) Land to be returned in simmilar condition as original	Within 3 months of completion	CE	PID	
	(b) Land for borrow areas	(i) Negotiate compensation on the basis of purchase of land	One year before construction	CE	PID	
	(If required from outside the	(The land not to be an environmental hazard after construction)				
	reservation only)	(ii) If all posible negotiations fail to acquire under Acquistion Act	18 months required for activity	CE	PID	LAC/DC
	(c) Land for water supply schemes	Negotiate to purchase land or on failing only to acquire	Detail design stage	PHED	PHED	LAC/DC
2. Restoration of equitable water rights						
	(a) Shortage of water towards the tail	Equitible distribution of water to all to be made by design and	Detail design	P.O.	PIDA	
		institutional changes. Redistribution of 'lost water'	With implementation of FO	PIDA	Consultant	Ag. Dept.
3. Institutional changes						
	(a) Taking over of canals by FO	Training of farmers in all aspects of canal maintenance	Before and after formation of FO	PIDA	PIDA	
	(b) Improved canal maintenance	Training of farmers and FO employees	After formation of FO	Consultant	PIDA	
	(c) Allowing FOs to undertake other	Dessimation of information	After formation of FO and this	PIDA	PIDA	
	activities including marketing		to be a continous process			
4. Farmers income and living standards						
	(a) Improved cropping pattern	Introduction of proper farming systems	After construction	FO/Ag. Dp.		
	(b) Higher disposable income	Monitoring of agricultural and socio economic conditions	Regularly after construction	Consultant	PIDA	P&D/Ag. Dp.
		Periodic evaluation	Every 2 years after construction	Consultant	PIDA	P&D/Ag. Dp.

Environmental Management Plan (2/2)

Item	Activity / Parameter	Measures to be taken	Timing	Execution	Super-vison	Related Institution
5. Canalside plantations						
	(a) Removal of plantations	Follow procedure to obtain permission from Chief Minister	9 months before construction	P.O./CE/CF	F/D	Chief Minister
	(b) Replanting	Reforestation of full width of ROW, tree selection by Forset Dept.	After construction	F/D, FO	PIDA	FO
	(c) Handing over plantation to FO	FO to maintain plantations	After handing over of canals to FO	PIDA/FO	PIDA	FD
6. Drinking water supply						
	(a) Shortage of drinking water due to	(i) Provide drinking water to affected population	During construction	CE	PID	Commissioner
	seepage not reaching Tube wells	(ii) Provide new schemes to replace affected ones	Construction period	PHED	PHED	PHED
	(b) Loss of quality of drinking water	(i) Where canal water is used, it should be treated and supplied	During water scheme construction	PHED	PHED	PHED
		(ii) Monitoring of drinking water quality	During and after construction	Consultant	PHED	
7. Impediment to Livestock						
	(a) Reduction of Livestock crossings	Provision of livestock crossings at suitable locations	Detail design	PID	PID	FO
	(b) Elimination of bathing in canal	Provision of sufficient number of ponds on watercourses	Discuss with FO for locations	PID	PID/Ag. Dp	FO/Ag. Dept.
8. Groundwater table						
	Changes of water table	Monitor ground water table at observation wells	June and October	PID/WAPDA	PIDA	WAPDA
		Monitor reduction of seepage from canals lined in the saline zone	After construction	IRI	PIDA	
9. Groundwater quality						
	(a) Increase use of agro chemicals	Introduction of proper farming systems to reduce water pollution	After construction	Ag. Dp./ FO	Ag. Dept.	
	(b) Changes in water quality	Monitor water quality with baseline data of Study	After construction annually	Consultant	PIDA	
10. Water quantity						
	(a) Loss by seepage to saline zone	Monitor quantities available	After construction	PIDA	PIDA	FO
	(b) Excess use of water at head	Monitoring programmes to de deveolped	After construction	PIDA	PIDA	FO
11. Soil salanisation						
	(a) Use of saline water for irrigation	Discourage use of saline water by providing additional saved water	After construction	PIDA	PIDA	Ag. Dept.
	(b) Insufficient water for leaching	Provide an allocation of saved water for leaching and reclamation	After construction	PIDA	PIDA	DLR/PIDA

Table 5.5.3-1Environmental Monitoring Plan

Description of Impact	Environmental issue	Methodology	Sampling regime	Frequency	Monitoring agency	Related Institution
1. Deterioration of Water quality						
(A) Drinking Water						
	(a) Drinking water quality	Direct observation /Sampling	pH. Odour, Colour. Taste.Turbidity.TDS Ca. Mg. Na. SO4. Cl.Hardness.Alkalinity E. Coli. Coliform on sampling locations fixed for baseline data in study	Half yearly	Consultant/PHED	PHED
	(b) Availability of drinking water	Interviews	Inspection	Monthly during construction	PIDA/PHED	PHED
(B) Ground Water						
	(a) Ground water quality	Direct observation /Sampling	pH. EC. Na. Ca. Mg. K. CO3. HCO3. Cl. SO4. NO3. on same locations	Yearly	IRI	WAPDA
	(b) Loss of aquifer potential due to reduced recharge	Solute transport modelling		Once	Consultant/PIDA	
	(c) Salanisation of fresh water zones due to saline water intrusion	Solute transport modelling / Observation		Once	Consultant/PIDA	
	(d) Farming practice /Agro chemical use	Interviews / observations		Yearly	PIDA	Agri. Dp.
2. Changes in Water table						
	(a) Water table depth	Direct observation	Water table depth at observation wells	June and October	SMO/WAPDA	
	(b) Ground water extraction by tube wells	Direct observation	Numbers operating and pumpage	Half yearly	PIDA	Agri. Dp.
3. Soil Salanisation						
	(a) Surface salinity	Direct observation	pH. EC. Na. Ca. Mg. K. CO3. HCO3	Yearly	DLR	IRI/Agri. Dp.
4. Increase in availbility of canal irrigation water						
	(a) Reduction in seepage	Direct observation	Seepage volume on selected canals	Yearly	IRI	
5. Restoration of equal water rights						
	(a) Ensuring availability of fair share of water	Direct observation / interviews	Quantity of water received	Half yearly	Consultant/PIDA	FO
6. Farmers living standards						
	(a) Socio - economic conditions	Data collection /interview	Disposable income	Two years	Consultant/PIDA	FO
7. Others						
	(a) Water related diseases	Data collection	Number treated in hospitals for water related diseases	Yearly	PIDA	Health Dp.
	(b) Issues raised by local people	Interviews	Any constraints	Quarterly	PIDA	
	(c) Other issues	As required	As required	When required	PIDA	

Table 7.2-1 Financial Cost for Lining of Distributaries and Minors

Work Item	Specificaion	Unit	Unit Cost(Rs.) Total	F	L	Work Volume	Cost(1,000Rs.) Total	F	L
I Compensation									
1.1 Compensation for Land, House etc		L.S.					2,421.9	0.0	2,421.9
1.2 Compensation for Hand Pump etc		L.S.					980.0	0.0	980.0
	Sub-total						3,401.9	0.0	3,401.9
II Direct Construction Cost									
1. Gate and Installation	at Disty's Head	nos	892,000	300,000	592,000	12	10,704.0	3,600.0	7,104.0
2. Earthwork									
2.1 Stripping (0.2 m)	by machine	m3	22.5	17.4	5.1	385857.7	8,681.8	6,713.9	1,967.9
2.2 Excavation for Canal Prism	by machine&manual	m3	38.5	27.0	11.5	2240573	86,262.0	60,495.5	25,766.6
2.3 Embankment and Compaction of Bank	by machine, normal	m3	57.9	44.9	13	4686094	271,324.9	210,405.6	60,919.2
2.4 Borrow & Haulage	Excavation and haul within 500 m	m3	54.6	42.6	12	3646240	199,084.7	155,329.8	43,754.9
2.5 Trimming & Surface Finishing	Manual	m2	9.1	0.0	9.1	3541508	32,227.7	0.0	32,227.7
2.6 Excavation for Diversion Work	by machine	m3	38.5	27.0	11.5	2046149	78,776.7	55,246.0	23,530.7
2.7 Embankment for Diversion Work	by machine	m3	51.5	41.0	10.5	3246867	167,213.7	133,121.6	34,092.1
	Sub-total						834,889.7	614,598.5	220,291.2
3. Lining Work									
3.1 Mortar Pluster	1" mortar	m2	51.8	12.3	39.5	3541508	183,450.1	43,560.5	139,889.6
3.2 Concrete insitu	3" thick	m3	2,996.2	1,072.3	1923.9	269890.5	808,645.9	289,403.6	519,242.3
3.3 Precast Panel	2" thick	m3	3,300.0	1,200.0	2100		0.0	0.0	0.0
3.4 Joint	Rubber/Bituinen	m	25.0	20.0	5	1086231	27,155.8	21,724.6	5,431.2
3.5 Geomembrane with geotextile	1 mm	m2	340.0	300.0	40		0.0	0.0	0.0
	Sub-total						1,019,251.8	354,688.7	664,563.0
(New/Replace Installation)									
Outlet		nos	26000	7800	18200	1038	26,988.0	8,096.4	18,891.6
VR Bridge		nos	40000	12000	28000	200	8,000.0	2,400.0	5,600.0
Drop		nos	60000	18000	42000	51	3,060.0	918.0	2,142.0
Washing Step		nos	60000	18000	42000	84	5,040.0	1,512.0	3,528.0
Buffalo Wallow		nos	70000	21000	49000	267	18,690.0	5,607.0	13,083.0
Spillway		nos	70000	21000	49000	1	70.0	21.0	49.0
(Repair Work)	10% of New								
DR Bridge		nos	8000	2400	5600	37	296.0	88.8	207.2
VR Bridge		nos	4000	1200	2800	169	676.0	202.8	473.2
	Sub-total						62,820.0	18,846.0	43,974.0
5. Miscellaneous Items	3% of Item 1-4 above	L.S.					57,830.0	29,752.0	28,078.0
Direst Cost							1,985,495.5	1,021,485.2	964,010.2
III Administration and Consulting Cost							284,236.3	206672.0	77564.3
IV Institutional Reform Cost							76,118.2	34544.0	41574.2
V Physical Contingency (10% of item I, II,III and IV)							231,925.2	126,270.1	108,655.1
Base Construction Cost							2,584,177.0	1,388,971.3	1,195,205.7
Price Escaration							535,760.1	285,222.1	250,538.0
Total Project Cost							3,119,937.1	1,674,193.4	1,445,743.7

Table 7.2-2 Financial Cost for Each Distributary Systems

No.	Name of Distributary	Length			Design Discharge	Command Area	Construction Cost (Rs. in Million)												Remarks
		Total (km)	Lined (km)	for Lining (km)	(m3/s)	(ha)	Compen-sation	Gate	Earth-work	Lining	Structure	Other	Direct Cost	Admi & Conti	Institu-tion	Phisical Conti.	Base Cost	Price Conti.	Total Cost	
	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Pindi	6.86	0.00	6.86	0.54	2,285	0.05	0.00	5.54	6.61	0.56	0.38	13.09	1.88	0.50	1.55	17.08	3.54	20.62	
2	Hujjan	80.13	1.95	78.18	6.46	25,236	0.56	0.00	100.37	120.31	12.14	6.98	239.81	34.34	9.19	28.39	312.30	64.75	377.05	
3	Kirana	107.13	10.64	96.49	12.86	50,765	0.33	0.00	169.59	230.88	11.55	12.36	424.38	60.30	16.30	50.13	551.45	114.33	665.78	
	LJC Total	194.12	12.59	181.53	19.86	78,286	0.94	0.00	275.50	357.81	24.25	19.73	677.29	96.52	26.00	80.08	880.83	182.62	1,063.45	
4	Sarangwala	25.04	0.30	24.74	2.46	6,627	0.14	0.00	36.37	40.10	3.74	2.41	82.62	11.95	3.16	9.79	107.65	22.32	129.97	
5	Nasrana	81.42	5.65	75.77	8.87	34,677	0.72	0.00	105.73	154.36	8.58	8.06	276.73	38.71	10.68	32.68	359.52	74.54	434.06	
6	Gojra	17.77	2.25	15.52	1.95	7,540	0.07	0.00	17.16	23.85	2.01	1.29	44.30	6.27	1.70	5.23	57.58	11.94	69.51	
7	Mungi	41.29	3.98	37.31	5.39	19,161	0.18	1.78	70.01	74.67	3.66	4.50	154.62	22.45	5.90	18.32	201.48	41.77	243.25	
8	Janiwala/Hamza	18.58	0.00	18.58	1.59	6,513	0.03	0.89	16.11	20.45	1.46	1.17	40.08	5.72	1.54	4.74	52.11	10.80	62.91	
9	Pir Mahal	82.13	0.00	82.13	5.24	18,242	0.22	1.78	113.07	133.26	5.68	7.61	261.40	37.61	10.01	30.92	340.16	70.52	410.69	
10	Killianwala	52.71	15.73	36.98	6.96	27,798	0.37	2.68	110.94	94.83	4.18	6.38	219.01	32.53	8.31	26.02	286.24	59.34	345.58	
	LCC Total	318.94	27.91	291.03	32.46	120,558	1.73	7.14	469.38	541.51	29.32	31.42	1,078.77	155.24	41.30	127.70	1,404.74	291.24	1,695.97	
11	Thamman	37.09	3.22	33.87	8.29	25,877	0.39	1.78	50.70	64.64	4.39	3.65	125.16	17.81	4.81	14.82	162.98	33.79	196.77	
12	China	33.27	0.19	33.08	4.33	16,390	0.34	1.78	39.31	55.29	4.86	3.04	104.28	14.66	4.02	12.33	135.63	28.12	163.75	
	CBDC Total	70.36	3.41	66.95	12.62	42,267	0.72	3.57	90.01	119.93	9.25	6.68	229.44	32.48	8.82	27.15	298.61	61.91	360.52	
	Project Total	583.42	43.91	539.51	64.94	241,111.13	3.40	10.70	834.89	1,019.25	62.82	57.83	1,985.50	284.24	76.12	234.93	2,584.18	535.76	3,119.94	

Table 7.2-3 Disbursement Schedule for Lining of Distributaries and Minors

Work Item	Total Cost(1,000Rs.)			Disbursement Schedule											
	Total	Foreign	Local	1999		2000		2001		2002		2003		2004	
				F	L	F	L	F	L	F	L	F	L	F	L
I Conpensation	3,401.9	0.0	3,401.9				134		1134		1134		1000		
II Direct Construction Cost															
1. Gate and Installation	10,704	3,600	7,104			300	592	600	1184	1500	2960	1200	2368		
2. Earthwork	834,890	614,598	220,291			11132	3903	123075	44709	145001	51448	167695	60116	167695	60116
3. Lining Work	1,019,252	354,689	664,563			6387	11815	75374	141098	80532	151148	96198	180251	96198	180251
4. Structure	62,820	18,846	43,974			466	1088	4263	9947	4072	9501	5023	11719	5023	11719
5. Miscellaneous Items	57,830	29,752	28,078			549	522	6099	5908	6933	6452	8103	7634	8067	7563
Direst Cost Total	1,985,495	1,021,485	964,010	0	0	18834	17921	209411	202845	238038	221508	278219	262088	276983	259649
III Administration and Consulting Cost	284,236	206,672	77,564	62002	23269	31001	11635	31001	11635	31001	11635	31001	11635	20667	7756
IV Institutional Reform Cost	76,118	34,544	41,574	1727	2079	5182	6236	6909	8315	10363	12472	10363	12472		
V Physical Contingency	234,925	126,270	108,655	6373	2535	5502	3593	24732	22393	27940	24675	31958	28719	29765	26741
Base Construction Cost	2,584,177	1,388,971	1,195,206	70102	27883	60518	39518	272052	246322	307343	271424	351541	315914	327415	294146
VI Price Escaration	535,760	285,222	250,538	6500	2585	7596	4960	43331	39233	59641	52670	80810	72620	87345	78469
Total Project Cost	3,119,937	1,674,193	1,445,744	76602	30468	68114	44478	315383	285554	366983	324094	432352	388534	414760	372615

Table 8.1-1 Financial and Economic Farm Gate Prices of Agricultural Inputs and Outputs

Outputs				Input			
Item	Unit	Financial Price	Economic Price	Item	Unit	Financial Price	Economic Price
Cerals				Seed/seedling			
Wheat	Rs./kg	4.30	6.59	Wheat	Rs./kg	5.29 =	5.29
Rice (Basmati)	Rs./kg	5.27	5.52	Rice (Basmati)	Rs./kg	6.17 =	6.17
				Maize	Rs./kg	6.93 =	6.93
Pulses				Mungbeans	Rs./kg	15.77 =	15.77
Maize	Rs./kg	5.20	5.69	Mustard	Rs./kg	13.58 =	13.58
Mungbeans	Rs./kg	12.89 =	12.89	Sugarcane	Rs./marla	18.51 =	18.51
				Seed Cotton	Rs./kg	17.43 =	17.43
Oil Seeds				Vegetables (Watermelon)	Rs./kg	100.40 =	100.40
Mustard	Rs./kg	11.46 =	11.46	Citrus	Tree	6.77 =	6.77
				Sorgam (Maize fodder)	Rs./kg	12.60 =	12.60
Sugarcane	Rs./kg	0.90	0.51	Berseem	Rs./kg	85.50 =	85.50
Seed Cotton	Rs./kg	18.90	18.30	Fetilizer			
				N	Rs./kg	14.41	16.26
Other Crops				P	Rs./kg	19.57	14.50
Vegetables (Watermelon)	Rs./kg	2.51 =	2.51	K	Rs./kg	18.00	9.05
				Manure	Rs./40kg	2.72 =	2.72
Fruits				Agro-chemicals			
Citrus	Rs/ton	17,500	17,784	Insecticide	Rs./kg	44 =	44
				Pesticide	Rs./kg	290 =	290
Fodders							
Sorgam	Rs./kg	0.84 =	0.84				
Berseem	Rs./kg	0.57 =	0.57	Labor	Rs./day	72.00	63.36
By-Products				Mchinery and Animal Power			
Wheat Straw	Rs./kg	0.40 =	0.40	Land preparation by Tractor	hours	74.65	67.18
Rice Straw	Rs./kg	0.18 =	0.18	Land preperation by bullocks	days	69.98	62.99
Sugarcane	Rs./kg	0.41 =	0.41	Interculture by bullocks	days	69.98	62.99
Maize	Rs./kg	0.35 =	0.35	Harvesting	maunds	64.15	57.74
Mung	Rs./kg	0.30 =	0.30				
Cotton	Rs./kg	0.27 =	0.27				

Table 8.3-1 (1/3) Crop Production Benefit

	Pindi (1,533 ha)										Hasan (20,290 ha)										Kahuta (34,257 ha)									
	Sown	Without			With			Incremental			Sown	Without			With			Incremental			Sown	Without			With			Incremental		
	Area (ha)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Area (ha)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Area (ha)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)
Kharif Season																														
Sugarcane	60	40.98	2,459	805	44.58	2,675	946	3.60	216	141	1,188	40.98	48,698	15,935	47.31	56,224	20,736	6.33	7,527	4,800	3,676	40.98	148,601	48,627	46.60	168,983	61,680	5.62	20,382	13,053
Cotton	34	1.42	48	563	1.51	51	611	0.09	3	48	562	1.42	798	9,311	1.58	885	10,764	0.16	87	1,454	2,060	1.42	2,926	34,145	1.56	3,211	38,846	0.14	284	4,701
Rice (Basmati)	36	1.18	42	53	1.28	46	69	0.10	4	16	627	1.18	741	92X	1.36	855	1,312	0.18	115	584	1,015	1.18	1,199	1,501	1.34	1,363	2,322	0.16	164	821
Vegetable	10	19.85	199	367	21.45	215	406	1.60	16	39	82	19.85	1,621	2,986	22.66	1,851	3,552	2.81	230	567	451	19.85	8,957	16,497	22.34	10,083	19,269	2.50	1,126	2,769
Maize	193	1.48	286	351	1.58	305	467	0.10	19	116	1,353	1.48	2,002	2,459	1.65	2,234	3,890	0.17	232	1,431	4,800	1.48	7,103	8,725	1.63	7,836	13,232	0.15	731	4,507
Fodder	479	12.84	6,153	1,343	13.68	6,555	1,483	0.85	405	360	5,964	12.84	76,831	16,774	14.33	85,737	24,250	1.49	8,906	7,477	5,708	12.84	73,291	16,001	14.16	80,831	22,330	1.32	7,539	6,329
Mung	21	0.51	11	97	0.54	12	107	0.03	1	10	637	0.51	324	2,916	0.58	367	3,461	0.07	43	545	852	0.51	434	3,902	0.57	484	4,548	0.06	51	647
	833			3,578			4,769			711	10,433			51,308			68,165			16,858	18,513			170,197			167,223			32,826
Rabi Season																														
Wheat	852	2.26	1,927	8,204	2.43	2,068	9,094	0.17	141	890	7,314	2.26	16,536	70,401	2.55	18,663	84,320	0.29	2,130	13,920	16,712	2.26	37,785	160,870	2.52	42,104	188,935	0.26	4,319	28,066
Fodder	46	30.71	1,417	329	32.28	1,490	359	1.57	73	29	3,150	30.71	96,725	22,468	33.48	105,446	26,613	2.77	8,721	4,145	3,829	30.71	117,580	27,313	33.17	126,987	31,671	2.46	9,408	4,358
Oil Seeds	62	1.43	89	519	1.52	95	563	0.09	6	45	493	1.43	705	4,098	1.60	787	4,745	0.17	82	647	1,418	1.43	2,027	11,777	1.58	2,236	13,416	0.15	209	1,639
	951			9,052			10,016			964	10,957			96,967			115,678			18,711	21,958			199,959			234,022			34,062
Perennial Crops																														
Citrus	379	9.69	3,669	13,223	10.36	3,924	14,677	0.67	255	1,454	6,286	9.69	60,891	219,462	10.87	68,342	257,791	1.19	7,451	38,329	3,277	9.69	31,740	116,395	10.74	35,186	132,444	1.05	3,446	18,049
	379			13,223			14,677			1,454	6,286			219,462			257,791			38,329	3,277			116,395			132,444			18,049
Total	2,173			25,853			28,962			3,129	27,676			367,737			441,634			73,897	43,748			443,751			533,689			84,937

	Sarangwala (6,627 ha)										Nawana (34,677 ha)										Gojra (7,540 ha)									
	Sown	Without			With			Incremental			Sown	Without			With			Incremental			Sown	Without			With			Incremental		
	Area (ha)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Area (ha)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Area (ha)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)	Yield (t/ha)	Prod'n (tons)	Value (Rs'000)
Kharif Season																														
Sugarcane	1,238	40.98	50,717	16,596	46.07	57,016	20,680	5.09	6,299	4,084	7,181	40.98	294,284	96,299	47.20	338,921	124,984	6.22	44,637	28,684	1,357	40.98	55,626	18,203	45.99	62,428	22,578	5.01	6,802	4,375
Cotton	73	1.42	104	1,206	1.55	113	1,358	0.12	9	151	1,810	1.42	2,571	30,004	1.57	2,848	34,625	0.15	276	4,621	454	1.42	645	7,521	1.54	700	8,438	0.12	56	917
Rice (Basmati)	128	1.18	152	190	1.33	170	283	0.15	19	94	381	1.18	450	566	1.36	519	916	0.18	68	352	91	1.18	108	135	1.33	121	199	0.14	13	64
Vegetable	36	19.85	715	1,317	22.11	796	1,516	2.26	81	199	199	19.85	3,944	7,264	22.61	4,493	8,617	2.76	548	1,352	56	19.85	1,109	2,042	22.07	1,233	2,346	2.22	124	304
Maize	1,844	1.48	2,730	3,352	1.62	2,984	4,944	0.14	254	1,593	7,881	1.48	11,665	14,325	1.65	12,992	22,608	0.17	1,327	8,283	1,562	1.48	2,312	2,839	1.62	2,524	4,146	0.14	212	1,307
Fodder	1,454	12.84	18,674	4,077	14.04	20,414	5,562	1.20	1,740	1,485	5,806	12.84	74,547	16,275	14.36	83,027	23,492	1.46	8,480	7,217	1,343	12.84	17,246	3,795	14.02	18,827	5,093	1.18	1,582	1,328
Mung	28	0.51	14	130	0.56	16	149	0.05	1	19	1,522	0.51	775	6,964	0.57	872	8,241	0.06	98	1,277	322	0.51	164	1,473	0.56	180	1,690	0.05	17	218
	4,802			26,869			34,492			7,623	24,780			171,699			223,683			51,787	5,185			35,926			44,489			8,513
Rabi Season																														
Wheat	3,300	2.26	7,462	31,789	2.49	8,234	36,761	0.23	772	4,992	17,273	2.26	39,052	166,265	2.55	43,958	198,499	0.29	4,936	32,234	3,614	2.26	8,172	34,792	2.49	9,005	40,170	0.23	833	5,378
Fodder	374	30.71	11,496	2,670	32.93	12,329	3,047	2.22	833	377	1,675	30.71	51,439	11,949	33.43	55,991	14,104	2.72	4,551	2,155	425	30.71	13,049	3,031	32.90	13,980	3,450	2.19	931	419
Oil Seeds	471	1.43	674	3,917	1.56	737	4,407	0.13	63	490	3,719	1.43	5,318	30,899	1.59	5,923	35,680	0.16	605	4,782	987	1.43	1,411	8,197	1.56	1,540	9,206	0.13	129	1,009
	4,146			38,376			44,215			5,859	22,667			209,112			248,283			39,171	5,026			46,020			52,826			6,806
Perennial Crops																														
Citrus	395	9.69	3,826	13,789	10.64	4,204	15,792	0.95	376	2,002	849	9.69	8,228	29,655	10.85	9,216	34,752	1.16	988	5,096	484	9.69	4,688	16,898	10.62	5,142	19,320	0.94	454	2,422
	395			13,789			15,792			2,002	849			29,655			34,752			5,096	484			16,898			19,320			2,422
Total	9,343			79,015			94,499			15,484	48,296			410,466			506,518			96,054	10,695			98,844			116,636			17,742

Table 8.3-1 (2/3) Crop Production Benefit

Munge (19,161 ha)

	Sown Area (ha)	Without Yield (t/ha)	Without Prod'n (tons)	Without Value (Rs'000)	With Yield (t/ha)	With Prod'n (tons)	With Value (Rs'000)	Incremental Yield (t/ha)	Incremental Prod'n (tons)	Incremental Value (Rs'000)
Kharif Season										
Sugarcane	2,111	40.98	86,513	28,310	46.62	98,411	35,987	5.64	11,897	7,677
Cotton	2,246	1.42	3,191	37,234	1.56	3,502	42,410	0.14	311	5,175
Rice (Basmati)	466	1.18	550	689	1.34	626	1,073	0.16	76	384
Vegetable	581	19.85	11,534	21,244	22.35	12,988	24,819	2.50	1,454	3,575
Maize	2,756	1.48	4,080	5,010	1.63	4,500	7,640	0.15	421	2,630
Fodder	2,656	12.84	34,101	7,445	14.16	37,618	10,442	1.32	3,517	2,997
Mung	350	0.51	178	1,602	0.57	199	1,869	0.06	21	266
	11,166			101,534			124,239			22,705
Rabi Season										
Wheat	8,528	2.26	19,280	82,087	2.52	21,490	96,447	0.26	2,210	14,360
Fodder	905	30.71	29,623	6,881	33.17	32,000	7,983	2.46	2,376	1,102
Oil Seeds	1,602	1.43	2,291	13,308	1.58	2,527	15,165	0.15	236	1,857
	11,034			102,276			119,594			17,319
Perennial Crops										
Citrus	1,014	9.69	9,820	35,398	10.74	10,889	40,990	1.05	1,069	5,597
	1,014			35,398			40,990			5,597
Total	23,214			239,203			284,823			45,620

Jamwala/Mamza (6,513 ha)

	Sown Area (ha)	Without Yield (t/ha)	Without Prod'n (tons)	Without Value (Rs'000)	With Yield (t/ha)	With Prod'n (tons)	With Value (Rs'000)	Incremental Yield (t/ha)	Incremental Prod'n (tons)	Incremental Value (Rs'000)
Kharif Season										
Sugarcane	1,003	40.98	41,098	13,669	46.15	46,286	16,782	5.17	5,188	3,353
Cotton	756	1.42	1,074	12,533	1.55	1,170	14,113	0.13	96	1,580
Rice (Basmati)	73	1.18	87	108	1.33	97	162	0.15	11	54
Vegetable	129	19.85	2,554	4,705	22.35	2,850	5,430	2.50	296	725
Maize	1,354	1.48	2,004	2,461	1.62	2,195	3,630	0.14	190	1,170
Fodder	930	12.84	11,946	2,808	14.05	13,077	3,557	1.22	1,131	949
Mung	512	0.51	260	2,341	0.56	288	2,698	0.05	28	357
	4,756			38,704			46,373			8,168
Rabi Season										
Wheat	3,549	2.26	8,025	34,165	2.50	8,869	39,626	0.24	844	5,462
Fodder	142	30.71	4,375	1,016	32.97	4,697	1,162	2.26	322	146
Oil Seeds	603	1.43	862	5,006	1.57	943	5,644	0.14	82	638
	4,294			40,187			46,433			6,246
Perennial Crops										
Citrus	146	9.69	1,411	5,084	10.65	1,562	5,835	0.97	141	749
	146			5,084			5,835			749
Total	9,196			83,478			98,640			15,163

Pir Mahal (19,242 ha)

	Sown Area (ha)	Without Yield (t/ha)	Without Prod'n (tons)	Without Value (Rs'000)	With Yield (t/ha)	With Prod'n (tons)	With Value (Rs'000)	Incremental Yield (t/ha)	Incremental Prod'n (tons)	Incremental Value (Rs'000)
Kharif Season										
Sugarcane	1,622	40.98	66,485	21,756	48.96	79,426	29,954	7.98	12,941	8,198
Cotton	1,360	1.42	1,932	22,569	1.62	2,199	27,028	0.20	266	4,459
Rice (Basmati)	2,537	1.18	2,996	3,752	1.41	3,579	6,831	0.23	583	3,079
Vegetable	103	19.85	2,045	3,767	23.39	2,410	4,672	3.54	365	905
Maize	927	1.48	1,372	1,685	1.70	1,573	2,921	0.22	200	1,235
Fodder	1,596	12.84	20,491	4,474	14.71	23,482	6,985	1.87	2,991	2,512
Mung	105	0.51	54	481	0.59	62	595	0.08	9	113
	8,251			58,484			78,985			20,521
Rabi Season										
Wheat	6,478	2.26	14,647	62,359	2.63	17,023	78,029	0.37	2,376	15,670
Fodder	596	30.71	18,313	4,254	34.20	20,392	5,283	3.49	2,079	1,029
Oil Seeds	1,005	1.43	1,437	8,349	1.64	1,647	10,027	0.21	210	1,678
	8,080			74,962			93,339			18,377
Perennial Crops										
Citrus	449	9.69	4,345	15,660	11.18	5,015	19,004	1.49	670	3,344
	449			15,660			19,004			3,344
Total	16,779			149,086			191,328			42,242

Kiltanwala (22,798 ha)

	Sown Area (ha)	Without Yield (t/ha)	Without Prod'n (tons)	Without Value (Rs'000)	With Yield (t/ha)	With Prod'n (tons)	With Value (Rs'000)	Incremental Yield (t/ha)	Incremental Prod'n (tons)	Incremental Value (Rs'000)
Kharif Season										
Sugarcane	2,999	40.98	122,921	40,224	45.55	136,639	49,082	4.57	13,718	8,859
Cotton	1,913	1.42	2,716	31,713	1.53	2,933	35,219	0.11	215	3,506
Rice (Basmati)	326	1.18	385	482	1.31	428	687	0.13	43	205
Vegetable	71	19.85	1,400	2,579	21.88	1,543	2,928	2.03	143	350
Maize	5,903	1.48	8,737	10,730	1.60	9,468	15,239	0.12	731	4,509
Fodder	2,529	12.84	32,470	7,089	13.91	35,187	9,370	1.07	2,718	2,281
Mung	369	0.51	188	1,690	0.56	205	1,918	0.05	17	228
	14,110			94,505			114,443			19,938
Rabi Season										
Wheat	10,171	2.26	22,995	97,903	2.47	25,134	111,638	0.21	2,139	13,736
Fodder	1,708	30.71	52,451	12,186	32.71	55,866	13,682	2.00	3,415	1,496
Oil Seeds	1,199	1.43	1,714	9,958	1.55	1,858	11,070	0.12	143	1,112
	13,077			120,045			136,390			16,346
Perennial Crops										
Citrus	861	9.69	8,337	30,047	10.54	9,073	34,044	0.86	737	3,996
	861			30,047			34,044			3,996
Total	28,048			244,597			284,877			40,280

Thammon (25,877 ha)

	Sown Area (ha)	Without Yield (t/ha)	Without Prod'n (tons)	Without Value (Rs'000)	With Yield (t/ha)	With Prod'n (tons)	With Value (Rs'000)	Incremental Yield (t/ha)	Incremental Prod'n (tons)	Incremental Value (Rs'000)
Kharif Season										
Sugarcane	1,037	40.98	42,493	13,905	43.90	45,517	15,907	2.92	3,024	2,002
Cotton	576	1.42	818	9,543	1.49	859	10,189	0.07	41	646
Rice (Basmati)	2,362	1.18	2,790	3,494	1.27	2,989	4,306	0.08	199	812
Vegetable	151	19.85	3,003	5,531	21.14	3,199	5,999	1.29	196	468
Maize	1,783	1.48	2,639	3,241	1.56	2,780	4,109	0.08	141	869
Fodder	2,944	12.84	30,349	6,626	13.52	31,999	7,985	0.69	1,650	1,359
Mung	32	0.51	16	145	0.54	17	158	0.03	1	12
	8,305			42,486			48,653			6,168
Rabi Season										
Wheat	8,447	2.26	19,099	81,312	2.40	20,231	88,325	0.13	1,133	7,013
Fodder	2,723	30.71	83,628	19,426	31.98	87,100	20,691	1.27	3,471	1,265
Oil Seeds	635	1.43	908	5,273	1.51	956	5,632	0.08	48	359
	11,805			106,011			114,648			8,637
Perennial Crops										
Citrus	347	9.69	3,360	12,109	10.23	3,549	13,245	0.55	189	1,136
	347			12,109			13,245			1,136
Total	20,457			160,606			176,546			15,940

China (16,390 ha)

	Sown Area (ha)	Without Yield (t/ha)	Without Prod'n (tons)	Without Value (Rs'000)	With Yield (t/ha)	With Prod'n (tons)	With Value (Rs'000)	Incremental Yield (t/ha)	Incremental Prod'n (tons)	Incremental Value (Rs'000)
Kharif Season										
Sugarcane	1,477	40.98	60,509	19,800	44.94	66,361	33,917	3.96	5,852	14,117
Cotton	147	1.42	209	2,444	1.52	224	2,676	0.10	14	232
Rice (Basmati)	200	1.18	236	296	1.30	259	401	0.11	23	105
Vegetable	346	19.85	6,864	12,642	21.61	7,473	14,120	1.76	609	1,477
Maize	1,541	1.48	2,280	2,800	1.59	2,446	3,820	0.11	165	1,020
Fodder	3,138	12.84	40,289	8,796	13.77	43,212	11,249	0.93	2,923	2,453
Mung	34	0.51	17	154	0.55	19	172	0.04	1	18
	6,882			46,932			66,354			19,421
Rabi Season										
Wheat	5,722	2.26	12,936	55,076	2.44	13,979	61,707	0.18	1,043	6,632
Fodder	1,077	30.71	33,069	7,682	32.66	34,934	8,463	1.73	1,866	781
Oil Seeds	763	1.43	1,091	6,337	1.53	1,170	6,943	0.10	79	606
	7,561			69,095			77,113			8,019
Perennial Crops										
Citrus	263	9.69	2,545	9,174	10.43	2,740	10,261	0.74	195	1,088
	263			9,174			10,261			1,088
Total	14,706			125,200			153,728			28,528

Table 8.3-1 (3/3) Crop Production Benefit

	LIC (56,350 ha)							LCC (108,740 ha)							CBDC (28,543 ha)							Total (193,633 ha)						
	Sown	Without		With		Incremental		Sown	Without		With		Incremental		Sown	Without		With		Incremental		Sown	Without		With		Incremental	
	Area (ha)	Prod'n (tons)	Value (Rs'000)	Prod'n (tons)	Value (Rs'000)	Prod'n (tons)	Value (Rs'000)	Area (ha)	Prod'n (tons)	Value (Rs'000)	Prod'n (tons)	Value (Rs'000)	Prod'n (tons)	Value (Rs'000)	Area (ha)	Prod'n (tons)	Value (Rs'000)	Prod'n (tons)	Value (Rs'000)	Prod'n (tons)	Value (Rs'000)	Area (ha)	Prod'n (tons)	Value (Rs'000)	Prod'n (tons)	Value (Rs'000)	Prod'n (tons)	Value (Rs'000)
Kharif Season																												
Sugarcane	4,876	199,757	65,367	227,882	83,361	28,125	17,994	43,271	717,665	234,637	819,127	300,046	101,482	65,210	6,211	103,002	33,706	111,878	49,825	8,876	16,119	54,356	1,020,404	333,909	1,158,887	433,232	138,483	99,323
Cotton	2,655	3,772	44,018	4,147	50,221	375	6,203	21,278	12,235	142,761	13,464	163,191	1,229	20,430	1,787	1,027	11,987	1,083	12,865	56	877	25,720	17,035	198,766	18,694	226,277	1,660	27,511
Rice (Basmati)	1,678	1,982	2,482	2,266	3,903	283	1,421	9,890	4,727	5,920	5,540	10,151	813	4,231	6,331	3,026	3,790	3,248	4,707	221	917	17,899	9,735	12,192	13,052	18,761	1,317	6,569
Vegetable	583	10,777	19,850	12,149	23,224	1,372	3,374	2,901	23,301	42,916	26,313	50,328	3,012	7,411	1,228	9,867	18,173	10,671	20,119	804	1,946	4,672	43,946	80,939	49,134	93,670	5,188	12,731
Maize	6,346	9,393	11,534	10,374	17,388	982	6,054	34,923	32,899	40,402	36,234	61,127	3,335	20,726	8,213	4,919	6,041	5,226	7,930	306	1,888	49,481	47,211	57,977	51,834	86,646	4,623	28,668
Fodder	12,172	156,275	34,118	173,126	48,264	16,851	14,146	40,315	209,474	45,732	231,633	64,501	22,159	18,769	13,395	70,639	15,422	75,181	19,233	4,542	3,812	66,081	436,388	95,271	479,940	131,998	43,552	36,726
Mung	1,511	799	6,914	863	8,116	94	1,202	7,926	1,633	14,681	1,823	17,160	190	2,479	162	33	299	36	330	2	30	9,598	2,435	21,895	2,722	25,606	287	3,711
	29,779		184,283		234,478		50,394	160,503		527,049		666,305		139,256	37,526		89,418		115,007		25,589	247,807		809,950		1,016,189		215,239
Rabi Season																												
Wheat	24,878	56,247	239,476	62,837	282,350	6,590	42,876	130,746	119,633	509,336	133,742	601,170	14,109	91,832	35,011	32,035	136,388	34,210	150,032	2,175	13,645	190,635	207,915	885,200	230,789	1,033,552	22,874	148,352
Fodder	7,025	215,722	58,110	233,923	58,643	18,201	8,532	14,543	180,747	41,986	195,254	48,712	14,507	6,726	9,390	116,697	27,108	122,034	29,153	5,337	2,046	30,958	513,166	119,204	551,211	136,508	38,045	17,304
Oil Seeds	1,973	2,822	10,390	3,118	18,724	296	2,330	23,685	13,707	79,634	15,175	91,199	1,468	11,566	3,453	1,998	11,610	2,126	12,575	128	965	29,112	18,527	107,638	20,419	122,499	1,892	14,861
	33,876		305,976		359,717		53,738	168,975		630,958		741,081		110,123	47,854		175,106		191,761		16,655	250,705		1,112,042		1,292,558		180,517
Perennial Crops																												
Guava	9,942	90,300	347,080	107,452	404,912	11,152	57,831	10,371	40,656	146,530	45,090	169,736	4,434	23,206	1,506	5,905	21,283	6,289	23,506	384	2,223	21,820	142,860	514,892	158,831	598,153	15,971	83,261
	9,942		347,080		404,912		57,831	10,371		146,530		169,736		23,206	1,506		21,283		23,506		2,223	21,820		514,892		598,153		83,261
Total	73,596		837,342		999,106		161,964	359,849		1,304,736		1,577,321		272,585	86,886		285,806		330,274		44,468	520,332		2,437,884		2,906,901		479,017

Table 8.3-2 Benefit from Saved Pump Operation Cost

	Authorized Discharge (m^3/s)	Total Discharge (m^3/year)	Water Saving after Lining: Total Saved Water (%)	Total Saved Water (m^3/year)	FGW* (%)	Saved Water in FGW	% of Pump Type: Diesel (%)	Electric (%)	Unit Pumping Cost: Diesel (Rs/m^3)	Electric (Rs/m^3)	Saved Pumping Cost: Diesel (Rs'000)	Electric (Rs'000)	Total (Rs'000)
LJC													
Pindi	0.46	13,314,240	7.32	974,602	32.91	320,744	80.1	19.9	0.31	0.35	80	22	102
Hujjan	5.16	149,351,040	12.88	19,236,414	19.60	3,770,142	80.1	19.9	0.31	0.35	936	263	1,199
Kirana	10.52	304,490,880	11.43	34,803,308	31.99	11,132,131	80.1	19.9	0.31	0.35	2,764	777	3,541
Sub-total	16.14	467,156,160		55,014,324		15,223,017					3,780	1,062	4,843
LCC													
Sarangwala	1.99	57,598,560	10.35	5,961,451	0.00	0	79.5	20.5	0.31	0.35	0	0	0
Nasrana	7.02	203,186,880	12.64	25,682,822	0.00	0	79.5	20.5	0.31	0.35	0	0	0
Gojra	1.64	47,468,160	10.19	4,837,006	0.00	0	79.5	20.5	0.31	0.35	0	0	0
Mungi	4.05	117,223,200	11.46	13,433,779	5.04	676,562	79.5	20.5	0.31	0.35	167	48	215
Janiwala/Hamza	1.31	37,916,640	10.52	3,988,831	0.00	0	79.5	20.5	0.31	0.35	0	0	0
Pir Mahal	3.88	112,302,720	16.22	18,215,501	34.22	6,232,933	79.5	20.5	0.31	0.35	1,537	447	1,984
Killianwala	5.66	163,823,040	9.3	15,235,543	16.59	2,527,279	79.5	20.5	0.31	0.35	623	181	805
Sub-total		739,519,200		87,354,931		9,436,774					2,328	676	3,004
CBDC													
Thamman	7.27	210,422,880	5.93	12,478,077	30.82	3,846,025	40.6	59.4	0.31	0.35	484	800	1,284
China	3.6	104,198,400	8.06	8,398,391	35.07	2,945,330	40.6	59.4	0.31	0.35	371	612	983
Sub-total		314,621,280		20,876,468		6,791,355					855	1,412	2,267
Total		1,521,296,640		163,245,723		31,451,146					6,963	3,151	10,114

*: Fresh Groundwater Area

Table 8.3-3 Benefit from the Reduction of O & M Cost

Financial (Rs.'000)

Name of Distributaries	Without Project			With Project			Incremental		
	Staff	M&R	Total	Staff	M&R	Total	Staff	M&R	Total
LCC									
Pindi	143	192	335	315	226	541	172	34	206
Hujjan Disty	1,666	2,189	3,855	480	2,580	3,059	-1,187	391	-796
Kirana Disty	2,227	2,702	4,929	529	3,184	3,713	-1,698	482	-1,216
sub-total	4,036	5,083	9,119	1,323	5,990	7,313	-2,713	907	-1,806
LJC									
Sarang wala	521	693	1,214	364	816	1,180	-157	123	-34
Nasrana	1,693	2,122	3,815	480	2,500	2,980	-1,214	378	-835
Gojra	370	435	805	348	512	860	-23	77	55
Mungi	858	1,045	1,903	397	1,231	1,628	-461	186	-275
Janiwala/	387	520	907	348	613	961	-40	93	54
Pir Mahal	1,708	2,300	4,008	480	2,710	3,190	-1,229	410	-818
Killian wala	1,239	1,035	2,274	430	1,220	1,650	-809	185	-624
sub-total	6,776	8,150	14,926	2,845	9,604	12,449	-3,931	1,454	-2,477
CBDC									
Thaman	1,795	948	2,743	480	1,118	1,597	-1,316	170	-1,146
Chhinna	691	926	1,617	381	1,092	1,472	-311	166	-145
sub-total	2,486	1,874	4,360	860	2,209	3,069	-1,626	335	-1,291
Total	13,298	15,107	28,405	5,028	17,804	22,832	-8,270	2,697	-5,573

Economic (Rs.'000)

Name of Distributaries	Without Project			With Project			Incremental		
	Staff	M&R	Total	Staff	M&R	Total	Staff	M&R	Total
LCC									
Pindi	129	173	302	283	204	487	154	31	185
Hujjan Disty	1,499	1,970	3,470	432	2,322	2,753	-1,068	352	-716
Kirana Disty	2,004	2,432	4,436	476	2,866	3,342	-1,528	434	-1,094
sub-total	3,632	4,575	8,207	1,191	5,391	6,582	-2,442	817	-1,625
LJC									
Sarang wala	469	624	1,093	328	735	1,062	-141	111	-30
Nasrana	1,524	1,910	3,434	432	2,250	2,682	-1,092	341	-752
Gojra	333	392	725	313	461	774	-20	69	49
Mungi	772	941	1,713	357	1,108	1,465	-415	168	-247
Janiwala/	348	468	816	313	552	865	-36	84	48
Pir Mahal	1,537	2,070	3,607	432	2,439	2,871	-1,106	369	-736
Killian wala	1,115	932	2,047	387	1,098	1,485	-728	167	-561
sub-total	6,098	7,335	13,433	2,561	8,644	11,201	-3,538	1,309	-2,229
CBDC									
Thaman	1,616	853	2,469	432	1,006	1,437	-1,184	153	-1,031
Chhinna	622	833	1,455	342	982	1,325	-279	149	-130
sub-total	2,237	1,687	3,924	774	1,988	2,762	-1,463	302	-1,162
Total	11,968	13,596	25,565	4,525	16,023	20,549	-7,443	2,427	-5,016

Table 8.4-1 Cost and Benefit Flow

(Rs.'000)

No	Year	Cost										Benefit						Total	B - C
		Without				With				Incremental									
		Capital	O&M	Rep.	Total	Capital	O&M	Rep.	Total	Capital	O&M	Rep.	Total	Crop Production			Pumping cost				
														W/O	With	Incremental	W/O	With	Incremental		
1	1,999		25,565		25,565	88,926	25,565		114,490	88,926	0	0	88,926	2,427,884	2,427,884	0		0	0	0	-88,926
2	2,000		25,565		25,565	90,787	25,565		116,352	90,787	0	0	90,787	2,427,884	2,427,847	-37		0	0	-37	-90,825
3	2,001		25,565		25,565	470,450	25,472		495,922	470,450	-93	0	470,357	2,427,884	2,436,335	8,451		187	187	8,638	-461,719
4	2,002		25,565		25,565	525,259	24,430		549,689	525,259	-1,134	0	524,125	2,427,884	2,535,748	107,863		2,287	2,287	110,151	-413,974
5	2,003		25,565		25,565	605,749	23,269		629,018	605,749	-2,295	0	603,454	2,427,884	2,646,536	218,651		4,628	4,628	223,279	-380,174
6	2,004		25,565		25,565	564,097	21,904		586,002	564,097	-3,660	0	560,437	2,427,884	2,776,893	349,008		7,380	7,380	356,389	-204,049
7	2,005		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
8	2,006		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
9	2,007		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
10	2,008		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
11	2,009		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
12	2,010		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
13	2,011		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
14	2,012		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
15	2,013		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
16	2,014		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
17	2,015		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
18	2,016		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
19	2,017		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
20	2,018		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
21	2,019		25,565		25,565		20,549	358,859	379,408	0	-5,016	358,859	353,843	2,427,884	2,906,901	479,017		10,114	10,114	489,131	135,287
22	2,020		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
23	2,021		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
24	2,022		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
25	2,023		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
26	2,024		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
27	2,025		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
28	2,026		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
29	2,027		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
30	2,028		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
31	2,029		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
32	2,030		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
33	2,031		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
34	2,032		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
35	2,033		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
36	2,034		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
37	2,035		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
38	2,036		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
39	2,037		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
40	2,038		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
41	2,039		25,565		25,565		20,549	358,859	379,408	0	-5,016	358,859	353,843	2,427,884	2,906,901	479,017		10,114	10,114	489,131	135,287
42	2,040		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
43	2,041		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
44	2,042		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
45	2,043		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
46	2,044		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
47	2,045		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
48	2,046		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
49	2,047		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146
50	2,048		25,565		25,565		20,549		20,549	0	-5,016	0	-5,016	2,427,884	2,906,901	479,017		10,114	10,114	489,131	494,146

Economic Internal Rate of Return= 19.9%

Table 8.5-1 Farm Budget by Farm Size

Lower Jhelum (Rs.)

Item	Marginal (1.56)		Small (3.49)		Medium (6.36)		Large (16.45)	
	without	with	without	with	without	with	without	with
A. Gross farm income from crop production	35,080	37,410	78,340	83,550	142,870	152,370	369,350	393,910
B. Crop production cost	10,140	10,240	22,630	22,860	41,280	41,690	106,710	107,770
C. Net farm income from crop production (A-B)	24,940	27,170	55,710	60,690	101,590	110,680	262,640	286,140
D. Other Income	33,070	33,070	34,630	34,630	44,930	44,930	58,960	58,960
E. Living expense	47,640	47,640	61,880	61,880	80,630	80,630	112,600	112,600
F. Net reserve (C+D-E)	10,370	12,600	28,460	33,440	65,890	74,980	209,000	232,500

Lower Chenab (Rs.)

Item	Marginal (1.52)		Small (3.70)		Medium (6.82)		Large (13.99)	
	without	with	without	with	without	with	without	with
A. Gross farm income from crop production	38,670	40,290	94,360	98,320	173,660	180,940	356,390	371,340
B. Crop production cost	10,280	10,360	25,090	25,270	46,180	46,520	94,770	95,460
C. Net farm income from crop production (A-B)	28,390	29,930	69,270	73,050	127,480	134,420	261,620	275,880
D. Other Income	37,630	37,630	43,060	43,060	56,380	56,380	58,730	58,730
E. Living expense	47,640	47,640	61,880	61,880	80,630	80,630	112,600	112,600
F. Net reserve (C+D-E)	18,380	19,920	50,450	54,230	103,230	110,170	207,750	222,010

Central Bari Doab (Rs.)

Item	Marginal (1.48)		Small (3.47)		Medium (6.36)		Large (16.01)	
	without	with	without	with	without	with	without	with
A. Gross farm income from crop production	35,190	36,070	82,720	84,790	151,560	155,360	381,310	390,870
B. Crop production cost	10,400	10,470	24,450	24,610	44,790	45,090	112,690	113,450
C. Net farm income from crop production (A-B)	24,790	25,600	58,270	60,180	106,770	110,270	268,620	277,420
D. Other Income	32,860	32,860	36,230	36,230	47,230	47,230	60,300	60,300
E. Living expense	47,640	47,640	61,880	61,880	80,630	80,630	112,600	112,600
F. Net reserve (C+D-E)	10,010	10,820	32,620	34,530	73,370	76,870	216,320	225,120