ANNEX–I

CONSTRUCTION PLAN AND COST ESTIMATE

ANNEX - I

CONSTRUCTION PLAN AND COST ESTIMATE

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ANNEX-I CONSTRUCTION PLAN AND COST ESTIMATE

I.1 INTRODUCTION

This ANNEX presents all the results of the construction plan and cost estimate of the Khadeji dam with a live storage capacity of 35.5 MCM, and the Mol dam of 35.0 MCM, and related project facilities, based on the results of the comparative study discussed in ANNEX-H (Chapter H.4).

I.2 CONSTRUCTION PLAN

I.2.1 General

The construction works of the project consist of the new construction works of the Khadeji dam, the Mol dam, causeways, a pilot demonstration farm and project office related to the project implementation. According to the optimization study concerning the dam type and capacity, the Khadeji dam is concluded to be concrete gravity type with a live storage capacity of 35.5 MCM, and the Mol dam is rockfill(zone) type of 35.0 MCM. Major construction works having big volume of concrete works for Khadeji dam and earth works for Mol dam would be executed by the heavy duty construction machinery and equipment and minor construction works would be executed by combination of heavy equipment and manpower.

I.2.2 Basic Assumption of Construction Plan

I.2.2.1 Workable Days

Earth works are mostly affected by rainfall. Since embankment of impervious materials of the dam is controlled by moisture contents, special attention must be paid to execute the construction woks during rainy days. Suspension days of these earth works caused by rainfall are assumed as following criteria according to the daily rainfall intensity.

Daily Rainfall Intensity (mm/day)	Suspension of Work (day)
0 - 10	0
10 - 30	1
30 - 50	2
50 - 100	3
more than 100	4

Annual mean workable days were estimated based on the above criteria and the rainfall records in Malir Super Highway for recent 10 years, and the computed result is shown in Table I.2.1 and its summary is as follows:

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Workable Days	30.9	27.8	30.8	29.7	31.0	29.7	28.0	26.7	30.0	30.9	30.0	30.7

The result shows that the above workable days of all months are more than 25 days of standard workable days of civil works. Therefore, workable days for the construction works , even for impervious materials, were decided to be 25 days throughout a year, and total workable days are 280 days in a year, taking into public holidays in the country.

I.2.2.2 Conversion Rate of Earth Volume

Earth volumes are changeable according to the natural conditions as they are. Earth materials naturally placed would increase in volume after excavation and decrease after compaction. These changes of volume should be considered for estimate of produced volumes by construction equipment and machinery or earth moving plan. The conversion rates of earth volumes are assumed as follows:

Abbreviation	Class of Earth	Conversion Rate		
		Natural Condition	Loose Condition	Compacted Condition
C	Core	1.00	1.35	0.90
Ra	Random	1.00	1.25	0.90
Ro	Rock	1.00	1.60	1.30
F	Filter	1.00	1.20	0.95

I.2.2.3 Basic Method of Earth Works

Earth works consist of excavating, loading, hauling, spreading and compacting. Since there are various methods for these earth works, due consideration must be given to the choice of the suitable combination of a heavy duty equipment.

Following equipment would be basically introduced on these earth works of the project.

Earth-works	Earth Materials	Proposed Equipment
Excavation	Common Soil Weathered Rock, Rock	Bulldozer with ripper, back-hoe shovel Crawler drill
Loading	Any kind of Materials	Wheel loader Back-hoe shovel
Hauling	Any kind of Materials	Dump truck
Spreading	Any kind of Materials	Bulldozer
Compacting	Impervious Materials, Coarse Materials	Tamping Roller Vibration-Roller

I.2.3 Khadeji Dam

I.2.3.1 General

According to the optimization study described in Chapter H.4 of ANNEX-H, dam type and capacity are concluded to be concrete gravity type and a live storage capacity of

35.5 MCM. The location of damsite is proposed at about 7 km upstream on Khadeji river from the confluence of Khadeji and Mol rivers

I.2.3.2 Construction Procedure and Method of the Dam

(1) Excavation Works

Stripping and normal soil excavation would be mainly made by bulldozer and back-hoe shovel, while weather rock would be excavated by ripper dozer and sometime by blasting. Rock excavation would be made by blasting (bench cut method), and collected by bulldozer.

(2) Concrete Works

Main Plants and Equipment

Taking into account of concreting conditions such as the geology of damsite, scale of concreting blocks (Vmax = 640 m^3), design mix, etc., a cable crane and a batcher plant for concrete work are proposed as follows:

Cable Crane	:	Bucket capacity	3.0 m^3
		Capacity	9 ton
Batcher Plant	:	Capacity	1.5 m^3 x 2

Design Concrete Mix

A standard design mix of concrete is to be determined by testings, and the following is assumed as a tentative design mix of concrete for Khadeji Dam.

Type	Max. Size of Coarse Aggregate (mm)	Water Cement (%)	Sand/Fine Aggregate (%)	Slump (cm)	Air Volume (%)
A Type	150	45	23	2.5	4
B Type	150	63	24	2.5	4

Remarks: (A type) : Internal concrete
(B type) : External concrete

Crushed coarse aggregates are obtained at the quarry located at the left bank of upstream and fine aggregates are taken from the upstream river bed. Storage bins for aggregates and cement silos are provided near the dam left abutment. A batching plant, a bunker truck and a cable crane are installed for the concreting of the dambody and other appurtenant structures.

(3) Foundation Treatment

After excavation of the dam core trench, the curtain grouting along the dam axis and the consolidation grouting at the dam foundation would be executed. The curtain grouting would be by means of the stage grouting method. After completion of grout hole drilled by hydraulic boring machines, cement milk mixed by grout mixer would be poured into the holes under the controlled pressure by grouting pump. For making sure the grouting condition, test hole would be drilled and grouted effect be checked by observation of the lifted core. If ineffective condition is observed, supplemental grouting around there is required.

(4) Access Roads

In order to access the construction damsite and transport the construction materials to the damsite smoothly, three routes are planned for access roads as shown in Fig. I.2-1. The breakdown of access roads are as follows:

Unit: km

Route	Utilization of Existing R.	Improvement		Total
		Gravel Pave.	Asphalt Pave.	
K-A	2.0	2.5	-	4.5
K-B	-	-	5.5	5.5
K-C	-	6.0	-	6.0
Total	2.0	8.5	5.5	16.0

Routes K-B and K-C are planned to be used as operation and maintenance after the completion of the construction works.

I.2.3.3 Major Construction Equipment and Machinery Required

Major works required for the dam construction are the excavation works of about 304 x 10^3 m^3, foundation treatment of about 1,500 m for grouting works and concrete works of 175 x 10^3 m^3. The major construction equipment and machinery required are shown in Table I.2.2 based on the implementation schedule of Fig. I.2-6.

I.2.4 Mol Dam

I.2.4.1 General

According to the optimization study described in Chapter H.4 of ANNEX-H, dam type and capacity are decided to be rockfill type and a live storage capacity of 35.0 MCM. The location of damsite is proposed at about 9 km upstream from the confluence of the Khadeji and Mol rivers.

I.2.4.2 Earth Moving Plan

From the results of the soil mechanical and geological investigations, each zone material of the dam would be obtained from the following places:

Zone	Type of Earth	Place*
Zone 1	Core	Borrow Area
Zone 2	Random	Borrow Area, Spillway, Quarry
Zone 3	Rock	Spillway, Quarry
Rock Facing	Rock	Quarry
Filter	Rock	River Bed

Remarks:

Taking into account these available materials, most economical construction method, combination of suitable construction machinery, etc., the earth moving plan for the dam is established as tabulated in Table I.2.3 and illustrated in Fig. I.2-2.

I.2.4.3 Construction Procedure and Method of the Dam

(1) Diversion Works

Diversion works would be executed prior to commencement of the excavation works of the dam foundation, which enables flood discharge of 1,090 m^3/sec with 20-year return period to flow downstream safely and smoothly during the construction period. From a topographical and economical point of view, temporary closure of a half section of the stream with protection lining on side slope would be planned rather than full-width coffer dam as shown in Fig.H.6-10 of ANNEX-H. In this method, foundation excavation, grouting and embankment would be executed first in the closed section. Works in the remaining section would be executed later during the non-rainy season (from October to June) after the water flow is diverted into the intake facility to be constructed in parallel with the construction works in the closed section.

(2) Excavation of Dam Foundation

Stripping and normal soil excavation would be mainly made by bulldozer and back-hoe shovel, while weather rock would be excavated by ripper dozer. Rock excavation would be made by blasting(bench cut method) and piled by bulldozer.

(3) Foundation Treatment

After excavation of the dam core trench, curtain grouting and consolidation grouting along the core zone foundation would be executed. After completion of grout hole drilled by hydraulic boring machines, cement milk mixed by grout mixer would be poured into the holes under the controlled pressure by grouting pump. For making

sure the grouting condition, test hole would be drilled and grouted effect be checked by observation of the lifted core. If ineffective condition is observed, supplemental grouting around there is required.

(4) Embankment

Embankment following the stripping, excavation and foundation treatment, would be executed at those zones of core, filter, random and rock. According to the earth moving plan described in Sub-section I.2.1, embankment materials to be transported from the proposed areas would be spread by the bulldozer at the specified thickness and compacted by suitable compacting machines. The specified thickness of spreading, number of compaction pass and suitable compacting machines are proposed as follows:

Embankment Zone	Thickness of Layer Spread (cm)	No. of Pass	Compaction Machine
Zone 1(Core)	20	8	Tamping roller 12-20
Zone 2(Random)	50	5	Vibrating roller 8-10
Zone 3(Rock)	80	5	Vibrating roller 8-10
Filter	30	5	Vibrating roller 8-10

Impervious materials of Zone 1 would be strictly controlled by the D-value, and other materials be done by the relation between minimum and maximum dry density. The water contents would be checked throughout the construction period and in case of a low water contents ratio, some amount of water would be added to the materials by tank lorry so as to approximate the optimum water content at the borrow area and/or compaction sites.

(5) Construction of Spillway

After completion of excavation works of spillway based on the earth moving plan for dam embankment, concrete works would be commenced.

No rock materials of the course aggregates qualified except mass concrete for spillway as well as intake facility could be found in and around the damsite as a result of geological survey. As considerable amount of coarse aggregates would be required for concrete of the spillway and intake facility, continuous and constant supply of the materials from market would be unexpected. Therefore, it is planned that the materials would be collected at the quarry site near the Khadeji damsite about 20 km far from the Mol damsite shown in Fig. I.2-3, and then transported to the aggregate production plant installed near the Mol damsite. While, rock materials for coarse aggregate at the upstream of spillway of the Mol damsite as shown in Fig.I.2-4 could be used for mass concrete subject to the further confirmation by the field investigation.

Concrete would be mixed by fully automatic batching plant and placed mainly by concrete pump and additionally by man power.

(6) Construction of Intake Facility

The construction of intake facility would commence at the same time of the main body and placing concrete, and steel pipe of 1.0 m and 2.4 m diameter would commence after the foundation treatment at the core portion.

(7) Concrete Works

Fresh concrete is batched and mixed at batching plant installing two mixers with capacity of 0.75 m^3. The capacity of the plant is planned to be 26 m^3/hr (1.5 m^3 x 20 batches x 85%).

In order to prevent from cracking caused by hydration heat for the massive concrete, to reduce water the special admixtures are used cement ratio without lowering workability together with adopting the proper curing method.

(8) Access Road

In order to access the construction damsite and transport the construction materials to the damsite smoothly, the three routes are planned for access roads as shown in Fig. I.2-5. The breakdown of access roads are as follows:

Unit: km

Route	Improvement		Newly Construction		Total
	Gravel Pave.	Asphalt Pave.	Gravel Pave.	Asphalt Pave.	
M-A	-	0.0	-	1.0	11.0
M-B	-	-	1.0	-	1.0
M-C	7.0	-	-	-	7.0
Total	7.0	10.0	1.0	1.0	19.0

All of the above routes are planned to be also used as operation and maintenance and farm roads subsequently to the completion of the construction works.

I.2.4.4 Major Construction Equipment and Machinery Required

Major works required for the dam construction are the foundation excavation of about 953 x 10^3 m^3, foundation treatment of about 16,100 m for grouting works and embankment works comprising 324 x 10^3 m^3 of core, 566 x 10^3 of random soil, 181 x 10^3 m^3 of filter and 571 x 10 3 m^3 of rock. The major construction equipment and machinery required are shown in Table I.2.4 based on the implementation schedule of Fig. I.2-7.

I.2.5 Implementation Schedule

The project implementation schedules for the Khadeji dam and the Mol damsite are shown in Figs. I.2-6 and I.2-7 respectively. First year and second quarter would be necessary time for the field survey on the topography and geology, detailed design works, and contract procedures, and the construction works would be commenced from the quarter of the third year. Dam construction of both Khadeji and Mol dams would need four(4) years in total, and would be completed by quarter of the fourth year. Pilot demonstration farm would be constructed by middle of the third year so as to demonstrate the new irrigation system such as drip and sprinkler, organize the model of water users association.

I.3 COST ESTIMATE

I.3.1 Basic Conditions and Assumption for the Cost Estimate

The project cost comprises direct construction cost, compensation cost for the land acquisition, administration cost, engineering services, and physical contingency. Following basic conditions and assumption are made for the estimate of the project cost.

1) The unit prices are analyzed in constant big-1990 current price basis for the cost estimate.

2) The exchange rate used in the cost estimate is shown as follows.

US$ 1.0 =Rs.21.5 = ¥ 150.0 as of February, 1990

3) Construction works would be executed by full contract basis through international competive bidding. The machinery and equipment required for construction works would be provided by the contractors themselves. Therefore, depreciation costs of machinery and equipment are considered in the estimate of the construction unit cost.

4) Taxes on the construction materials, machinery and equipment to be imported from abroad are excluded from the cost estimate.

5) The construction cost integrated by construction unit costs is divided into both foreign and local currency portions. Local currency portion is estimated on the basis of the current price as at February, 1990 and of the data collected from the on-going projects around the project area. Foreign currency portion is estimated based on the CIF prices at Karachi.

6) The physical contingency estimated at 15 % of the direct construction cost is included in the construction cost of both foreign and local currency portions.

I.3.2 Estimate of the Project Cost

Based on the conditions and assumption mentioned above, the construction costs for both the Mol and Khadeji dams with alternative cases by the live storage volume as stipulated in the Section I.2 1 are summarized below and their breakdowns are shown in Tables I.3.1 and I.3.2.

Damsite	Live Storage Volume (MCM)	Construction* Cost (10^6 Rs.)
Khadeji Dam	30.0	532
	35.5	539
Mol Dam	30.0	417
	35.0	440
	43.8	459

Remarks: * Excluding the construction cost of pilot demonstration farm, causeway and project office.

According to the optimization study of the dam capacity mentioned in Chapter H.4 of ANNEX-H, optimum dam capacity is fixed at 35.5 MCM for the Khadeji dam and 35.0 MCM for the Mol dam, respectively. The summary of the total project cost for each dam is shown in Tables I.3.3 and I.3.4.

I.3.3 Breakdown of Project Cost

(1) Direct Construction Cost

Direct construction cost was estimated for the individual item by unit cost basis as discussed in the following Subsection I.3.5. The breakdown is shown in Tables I.3.5. and I.3.6.

(2) Land Acquisition and Compensation Cost

Cost for land acquisition and compensation for the project is Rs. 86.7 million for Khadeji dam and Rs. 0.9 million for Mol dam. Details are shown in Table I.3.7.

(3) O&M Equipment

All the construction equipment and materials necessary for the construction of the Project would be provided by the contractors. While, O&M equipment would be procured by the Government for the smooth operation and maintenance of the Project facilities after the completion of the construction works.

The number of O&M equipment and their procurement costs were estimated as listed in Table I.3.8.

(4) Administration Cost and Engineering Costs

Project office would be established on commencement of the construction works in order to supervise the construction works as well as to monitor wells and organize the water users association. After competion of the construction works, the project office will be reorganized into the Malir O&M Project Office for operation and maintenance works of the project facilities and supervise the water users associations. Tentative

organization chart is shown in Fig. I.3.1. Administration costs during implementation stage comprise staff salary, and direct costs such as office equipment, operation and maintenance costs for the vehicles and office operation costs. The breakdown of costs are shown in Table I.3.9.

Engineering services by foreign Consultants would be required for the detailed design and construction supervision stages. Total required man-month of the engineers including local consultant is 38 M/M for the detailed design and 210 M/M for the construction supervision. The breakdown of the costs and required man-month are shown in Tables I.3.10 and I.3.11.

I.3.4 Annual Disbursement Schedule

The annual disbursement schedule for the Mol dam with a live storage capacity of 35 MCM is worked out as shown in Table 3.12 based on the project implementation schedule illustrated in Fig. I.2-5, and the summary is as follows.

Unit: Rs. 10^6

Financial Year	Total	Foreign Currency	Local Currency
1991	15.1	10.6	4.5
1992	171.1	130.4	40.7
1993	269.5	210.5	59.0
1994	192.1	149.1	43.0
1995	37.8	30.3	7.5
Total	685.6	530.9	154.7

I.3.5 Unit Cost Analysis

Construction cost was calculated by use of detailed unit cost. Each unit cost is composed of the basic unit cost and working rate of labour and/or construction machinery. Basic costs of labour and materials surveyed and those classifications of foreign and local portions are shown in Table I.3.13.

Summary of CIF prices of the major construction machinery and equipment, and their hourly costs including the depreciation costs, operation and maintenance costs are shown in Table I.3.14. Unit cost was calculated by each, according to the proposed work items which were designed by construction method. Analyzed unit cost is summarized in Table I.3.15.

I.3.6 Annual Operation and Maintenance Cost

Annual operation and maintenance cost comprise of the salaries for administrative and technical staff, the materials and labour costs for replace and maintenance of the project

facilities , and the costs for operation and maintenance of O&M equipment. The summary of the annual operation and maintenance cost is shown in Table I.3.16.

I.3.7 Replacement Cost

Some of the facilities installed or constructed in the Project have some shorter useful life than the Project life and will require replacement at a certain time within the project useful life. The replacement costs and the useful lives of these facilities are listed in Table I.3.17 .

TABLES

Table I.2.1. MONTHLY WORKABLE DAYS

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1978	30	28	31	30	31	29	25	25	30	31	30	31
1979	31	26	31	30	31	30	31	28	30	31	30	30
1980	31	29	31	30	31	28	29	31	30	30	30	29
1981	31	27	29	30	31	30	29	24	30	31	30	31
1982	31	27	31	30	31	30	26	25	30	31	30	31
1983	31	28	31	28	31	30	27	27	30	31	30	31
1984	31	29	31	30	31	30	31	18	30	31	30	31
1985	31	28	31	29	31	30	28	31	30	31	30	31
1986	31	28	31	30	31	30	31	27	30	31	30	31
1987	31	28	31	30	31	30	31	31	30	31	30	31
Total	309	278	308	297	310	297	288	267	300	309	300	307
Workable Days	30.9	27.8	30.8	29.7	31.0	29.7	28.8	26.7	30.0	30.9	30.0	30.7

Table I.2.2 MAJOR CONSTRUCTION EQUIPMENT AND MACHINERY REQUIRED FOR KHADEJI DAM

No.	Description	Capacity (Class)	Q'ty
1.	Bulldozer	17 ton	2
2.	Bulldozer	21 ton	2
3.	Bulldozer	32 ton	2
4.	Bulldozer w/ripper	32 ton	1
5.	Wheel Loader	2.2 m3	4
6.	Wheel Loader	3.2 m3	2
7.	Wheel Loader	5 m3	2
8.	Backhoe	1 m3	1
9.	Backhoe	0.7 m3	1
10.	Motor Grader	3.7 m	1
11.	Dump Truck	32 ton	10
12.	Dump Truck	11 ton	5
13.	Dump Truck	4 ton	2
14.	Crawler Drill	17 m3	3
15.	Compressor	17 m3/mm	3
16.	Batching Plant	0.75 m2 x 3 nos.	1
17.	Crushing Plant	dia. 600mm, 45 kw	1
18.	Generator	200 KVA	3
19.	Generator	100 KVA	2
20.	Cargo Truck	10	1
21.	Cement Roller	11 ton	1
22.	Grout Pump	11 kw	4
23.	Grout Mixer	11 kw	4
24.	Boring Machine	3.7 kw	4
25.	Cable Crane	5 ton	1
26.	Cable Crane	7.5 ton	1
27.	Fuel Tanker	10 k lit.	1
28.	Cooling Plant		1
29.	Workshop Car		1

Table I.2.3 EARTH MOVING PLAN OF MOL DAM

Item		Filling								Spoil Area
		Main Dam					Saddle Dam			
		Zone 1 (298,900)	Zone 2 (566,000)	Zone 3 (566,900)	Rock Facing (83,000)	Filter (181,100)	Zone 1 (24,800)	Zone 3 (4,200)	Rock Facing (4,400)	481,400
1. Main Dam										
Common (Back)	38,100	-	-	-	-	-	-	-	-	38,100
Common (Bull)	88,900	-	44,400 (40,000)	-	-	-	-	-	-	44,500
W. Rock	122,900	-	86,000 (77,400)	-	-	-	-	-	-	36,900
Rock	52,600	-	-	36,800 (47,800)	-	-	-	-	-	15,800
2. Saddle Dam										
Common (Bull)	10,300	-	5,100 (4,600)	-	-	-	-	-	-	5,200
W. Rock	51,300	-	35,900 (32,300)	-	-	-	-	-	-	15,400
Rock	41,100	-	-	25,600 (33,300)	-	-	-	3,200 (4,200)	3,200 (4,200)	12,300
3. Spillway										
Common (Bull)	71,200	-	35,600 (32,000)	-	-	-	-	-	-	35,600
W. Rock	106,800	-	74,800 (67,300)	-	-	-	-	-	-	32,000
Rock	178,000	-	-	124,600 (162,000)	-	-	-	-	-	53,400
4. Intake Facilities										
Common (Bull)	14,900	-	-	-	-	-	-	-	-	14,900
W. Rock	124,100	-	-	-	-	-	-	-	-	124,100
Rock	53,200	-	-	-	-	-	-	-	-	53,200
5. Borrow Area	359,700	332,100 (298,900)	-	-	-	-	27,600 (24,800)	-	-	-
6. Quarry										
W. Rock	347,100	-	347,100 (312,400)	-	-	-	-	-	-	-
Rock	310,000	-	-	249,100 (323,800)	57,500 (74,800)	-	-	-	-	-
6. River Bed	190,800	-	-		-	190,600 (181,100)	-	-	-	-

Table I.2.4 MAJOR CONSTRUCTION EQUIPMENT AND MACHINERY REQUIRED FOR MOL DAM

No.	Description	Capacity (Class)	Q'ty
1.	Bulldozer	17 ton	3
2.	Bulldozer	21 ton	3
3.	Bulldozer	32 ton	3
4.	Bulldozer w/ripper	32 ton	2
5.	Wheel Loader	2.2 m3	2
6.	Wheel Loader	3.2 m3	2
7.	Wheel Loader	5 m3	3
8.	Backhoe	1 m3	2
9.	Backhoe	0.7 m3	2
10.	Motor Grader	3.7 m	1
11.	Dump Truck	32 ton	12
12.	Dump Truck	11 ton	10
13.	Dump Truck	4 ton	2
14.	Crawler Drill	17 m3	4
15.	Compressor	17 m3/min.	4
16.	Tire Roller	11-30 ton	1
17.	Tamping Roller	17 ton	2
18.	Vibration Roller	15 ton	4
19.	Water Tanker	10 m3	3
20.	Batching Plant	0.75 x 3 nos.	1
21.	Truck Mixer	4.2 m3	5
22.	Crushing Plant	dia. 600 mm, 45 kw	1
23.	Generator	200 KVA	3
24.	Generator	100 KVA	2
25.	Cargo Truck	10 ton	1
26.	Cement Roller	11 ton	1
27.	Grout Pump	11 kw	4
28.	Grout Mixer	11 kw	4
29.	Boring Machine	4 kw	4
30.	Fuel Tanker	10 k lit.	1
31.	Cooling Plant		1
32.	Workshop Car		1

Table I.3.1 BREAKDOWN OF CONSTRUCTION COST FOR ALTERNATIVE CASES OF KHADEJI DAM

Unit : 1,000 Rs.

Work Item	Unit	Unit Rate (Rs.)	Case 35.5 MCM Q'ty	Case 35.5 MCM Amount	Case 30 MCM Q'ty	Case 30 MCM Amount
1 Excavation						
a) Common (Backhoe)	m3	67.5	4,100	277	4,040	273
b) Common (Bulldozer)	m3	105.3	9,500	1,000	9,360	986
c) W. Rock	m3	145.5	46,200	6,722	45,530	6,625
d) Rock	m3	215.9	144,000	31,090	141,920	30,641
Sub-total				39,089		38,523
2 Concrete Works						
a) Internal	m3	1,429.5	61,000	87,200	60,230	86,099
b) External	m3	1,607.4	74,500	119,751	73,560	118,240
c) Concrete (210 kg/cm2)	m3	1,849.6	16,500	30,518	16,290	30,130
d) Fillet	m3	1,607.4	7,600	12,216	7,500	12,056
e) Reinforcement bar	ton	22,830.5	660	15,068	650	14,840
Sub-total				264,754		261,364
3 Foundation Treatment						
a) Curtain Grouting	m	977.4	12,400	12,120	12,400	12,120
b) Consolidation Grouting	m	977.4	2,500	2,444	2,500	2,444
Sub-total				14,563		14,563
4 Gate Works						
a) Radial Gate , 7sets	ton	150,000.0	266	39,900	260	39,000
5 Spillway						
A. Excavation						
a) Common (Backhoe)	m3	67.5	10,000	675	9,850	665
b) Common (Bulldozer)	m3	105.3	30,100	3,170	29,660	3,123
c) W. Rock	m3	145.5	40,200	5,849	39,620	5,765
d) Rock	m3	215.9	20,100	4,340	19,810	4,277
Sub-total				14,033		13,830
B. Concrete Works						
a) Concrete (210 kg/cm2)	m3	2,081.6	22,000	45,795	21,680	45,129
b) Reinforcement bar	ton	22,830.5	880	20,091	860	19,634
c) Concrete (brigdge)	m3	2,081.6	500	1,041	500	1,041
d) Reinforcement bar (b)	ton	22,830.5	50	1,142	50	1,142
Sub-total				68,068		66,946
6 Intake Structure						
A. Concrete Works						
a) Concrete (210 kg/cm2)	m3	2,081.6	1,300	2,706	1,280	2,664
b) Reinforcement bar	ton	22,830.5	26	594	20	457
Sub-total				3,300		3,121
B. Metal Works						
c) Steel pipe	ton	28,600.0	20	572	10	286
a) High pressure gate,	set	L.S.	2	9,000	2	9,000
b) Gates	set	L.S.	3	8,000	3	8,000
Sub-total				17,572		17,286
7 Land Acquisition Costs		L.S.		86,389		86,389
8 Access Road		L.S.		6,800		6,800
Total				554,468		547,823

Table I.3.2 BREAKDOWN OF CONSTRUCTION COST FOR ALTERNATIVE CASES OF MOL DAM

Work Item	Unit	Unit Rate (Rs.)	30 MCM Q'ty	30 MCM Amount (1000 Rs.)	35 MCM Q'ty	35 MCM Amount (1000 Rs.)	43.8 MCM Q'ty	43.8 MCM Amount (1000 Rs.)
A. Main Dam								
1) Excavation								
a) Common (Backehoe)	m3	45.5	36,700	1,670	38,100	1,734	40,900	1,861
b) Common (Bulldozer) (1)	m3	65.1	42,850	2,790	44,500	2,897	47,800	3,112
c) Common (Bulldozer) (2)	m3	65.1	42,800	2,786	44,400	2,890	47,600	3,099
d) W. Rock (1)	m3	99.5	35,550	3,537	36,900	3,672	39,600	3,940
e) W. Rock (2)	m3	44.9	82,850	3,720	86,000	3,861	92,300	4,144
f) Rock (1)	m3	153.7	15,200	2,336	15,800	2,428	17,000	2,613
g) Rock (2)	m3	103.0	35,450	3,651	36,800	3,790	39,500	4,069
2) Filling								
a) Zone 1 (Core)	m3	136.3	279,600	38,109	298,900	40,740	337,500	46,001
b) Zone 2 (Random) (1)	m3	72.8	144,350	10,509	154,300	11,233	174,200	12,682
c) Zone 2 (Random) (2)	m3	72.8	92,900	6,763	99,300	7,229	112,100	8,161
d) Zone 2 (Random) (3)	m3	99.1	292,250	28,962	312,400	30,959	352,700	34,953
e) Zone 3 (Rock) (1)	m3	91.9	75,850	6,971	81,100	7,453	91,600	8,418
f) Zone 3 (Rock) (2)	m3	91.9	151,550	13,927	162,000	14,888	182,900	16,809
g) Zone 3 (Rock) (3)	m3	159.9	302,900	48,434	323,800	51,776	365,600	58,459
h) Rock facing	m3	159.9	82,250	13,152	83,000	13,272	84,500	13,512
i) Filter	m3	189.6	178,750	33,891	181,100	34,337	185,800	35,228
3) Foundation Treatment								
a) Curtain Gronting	m	977.4	9,500	9,285	9,500	9,285	9,500	9,285
b) Blanket Gronting	m	977.4	6,600	6,451	6,600	6,451	6,600	6,451
Total (A)				236,944		248,895		272,795
B. Saddle Dam								
1) Excavation								
a) Common (Bulldozer) (1)	m3	65.1	5,000	326	5,200	339	5,600	365
b) Common (Bullozoer) (2)	m3	18.5	4,900	91	5,100	94	5,500	102
c) W. Rock (1)	m3	99.5	14,850	1,478	15,400	1,532	16,500	1,642
d) W. Rock (2)	m3	44.9	34,600	1,554	35,900	1,612	38,500	1,729
e) Rock (1)	m3	153.7	11,850	1,821	12,300	1,891	13,200	2,029
f) Rock (2)	m3	103.0	27,750	2,858	28,800	2,966	30,900	3,183
2) Filling								
a) Zone 1 (Core)	m3	136.3	22,900	3,121	24,800	3,380	28,600	3,898
b) Zone 3 (Rock)	m3	91.9	3,900	358	4,200	386	4,800	441
c) Rock Facing	m3	159.9	4,050	648	4,400	704	5,100	815
Total (B)				12,254		12,904		14,203
C. Spillway								
1) Excavation								
a) Common (1)	m3	65.1	43,800	2,851	35,600	2,318	22,900	1,491
b) Common (2)	m3	18.5	43,800	810	35,600	659	22,900	424
c) W. Rock (1)	m3	99.5	39,400	3,920	32,000	3,184	20,600	2,050
d) W. Rock (2)	m3	44.9	92,000	4,131	74,800	3,359	48,100	2,160
e) Rock (1)	m3	153.7	65,700	10,098	53,400	8,208	34,400	5,287
f) Rock (2)	m3	80.6	153,200	12,348	124,600	10,043	80,200	6,464
2) Concrete Works								
a) Concrete (210 kg/cm2)	m3	1,938.8	1,400	2,714	1,400	2,714	1,400	2,714
b) Concrete (180 kg/cm2)	m3	1,540.3	18,800	28,958	18,800	28,958	18,800	28,958
c) Reiforcement bar	ton	22,830.5	400	9,132	400	9,132	400	9,132
Total (C)				74,963		68,573		58,679
D. Intake Facilities								
1) Earth Works								
a) Common Excavation	m3	65.1	14,350	934	14,900	970	16,000	1,042
b) W. Rock	m3	99.5	119,550	11,895	124,100	12,348	133,200	13,253
c) Rock	m3	167.3	51,250	8,574	53,200	8,900	57,100	9,553
2) Concrte Works								
a) Concrete (210kg/cm2)	m3	1,938.8	10,700	20,745	11,100	21,521	11,900	23,072
b) Reinforcement bar	ton	22,830.5	410	9,361	440	10,045	500	11,415
c) Steel pipe	ton	28,600.0	100	2,860	100	2,860	100	2,860
d) High pressure gate	set	L.S.	2	11,424	2	11,424	2	11,424
e) Gates	set	L.S.	4	14,000	4	14,000	4	14,000
Total (D)				79,793		82,068		86,619
E. Diversion Works		L.S.		13,440		13,440		13,440
F. Acess Road		L.S.		12,540		12,540		12,540
G. Land Acquisition		L.S.		1,076		1,076		1,076
Total				431,011		439,496		459,352

Table I.3.3 PROJECT COST FOR KHADEJI DAM (35.5 MCM)

(Unit: 1,000 Rs.)

Item	Foreign Currency	Local Currency	Total
1. Direct Construction Cost			
1.1 Preparatory Works	40.6	17.9	58.5
1.2 Dam Construction	382.7	171.8	554.5
A. Main Dam	296.0	62.3	358.3
B Spillway	61.8	20.3	82.1
C Intake Facility	20.1	0.8	20.9
D Access Road	4.8	2.0	6.8
E Land Acquisition	0.0	86.4	86.4
1.3 Causeway	2.4	3.8	6.2
1.4 Pilot Demonstration Farm	10.4	2.9	13.3
1.5 Project Office	0.4	0.8	1.2
Sub-total	436.5	197.2	633.7
2. Procurement of O & M Equipment	10.3	0.0	10.3
3. Physical Contingency	61.1	26.9	88.0
4. Administration Cost	0.0	8.0	8.0
5. Engineering Services	74.3	19.7	94.0
Total	582.2	251.8	834.0
6. Price Contingency	0.0	17.6	17.6
Grand Total	582.2	269.4	851.6

Table I.3.4 PROJECT COST FOR MOL DAM (35 MCM)

Unit: Rs.10^6

Item	Foreign Currency	Local Currency	Total
1. Direct Construction Cost			
1.1 Preparatory Works	27.0	5.9	32.9
1.2 Mol Dam	362.6	76.8	439.4
A. Main Dam	212.3	36.5	248.8
B. Saddle Dam	10.9	2.0	12.9
C. Spillway	51.8	16.7	68.5
D. Intake Facility	68.9	13.2	82.1
E. Diversion Works	9.9	3.5	13.4
F. Access Road	8.8	3.8	12.6
G. Land Acquisition	0.0	1.1	1.1
1.3 Causeway	2.4	3.8	6.2
1.4 Pilot Demonstration Farm	10.4	2.9	13.3
1.5 Project Office	0.4	0.8	1.2
2. Procurement of O & M Equipment	10.3	0.0	10.3
3. Physical Contingency	58.2	12.8	71.0
4. Administration Cost	0.0	6.7	6.7
5. Engineering Services	59.6	16.4	76.0
Total	530.9	126.1	657.0
6. Price Contingency	0.0	28.6	28.6
Grand Total	530.9	154.7	685.6

Table I.3.5 BREAKDOWN OF DIRECT CONSTRUCTION COST FOR KHADEJI DAM (35.5 MCM)

Unit : 1,000 Rs.

Work Item	Unit	Unit Rate F/C	Unit Rate L/C	Q'ty	Amount F/C	Amount L/C	Amount Total
1 Preparatory Works				10%	40,616	17,927	58,544
2 Main Dam							
1) Excavation							
a) Common (Backhoe)	m3	57.6	9.9	4,100	236	41	277
b) Common (Bulldozer)	m3	92.9	12.4	9,500	883	118	1,000
c) W. Rock	m3	129.4	16.1	46,200	5,978	744	6,722
d) Rock	m3	183.6	32.3	144,000	26,438	4,651	31,090
Sub-total					33,535	5,553	39,089
2) Concrete Works							
a) Internal	m3	1,196.0	233.5	61,000	72,956	14,244	87,200
b) External	m3	1,318.2	289.2	74,500	98,206	21,545	119,751
c) Concrete (210 kg/cm2)	m3	1,488.8	360.8	16,500	24,565	5,953	30,518
d) Fillet	m3	1,318.2	289.2	7,600	10,018	2,198	12,216
e) Reinforcement bar	ton	13,003.4	9,827.1	660	8,582	6,486	15,068
Sub-total					214,328	50,426	264,754
3) Foundation Treatment							
a) Curtain Grouting	m	555.8	421.6	12,400	6,892	5,228	12,120
b) Consolidation Grouting	m	555.8	421.6	2,500	1,390	1,054	2,444
Sub-total					8,281	6,282	14,563
4) Gate Works							
a) Radial Gate , 7sets	ton	150,000.0		266	39,900	0	39,900
5) Spillway							
A. Excavation							
a) Common (Backhoe)	m3	57.6	9.9	10,000	576	99	675
b) Common (Bulldozer)	m3	92.9	12.4	30,100	2,796	373	3,170
c) W. Rock	m3	129.4	16.1	40,200	5,202	647	5,849
d) Rock	m3	183.6	32.3	20,100	3,690	649	4,340
Sub-total					12,265	1,769	14,033
B. Concrete Works							
a) Concrete (210 kg/cm2)	m3	1,664.6	417.0	22,000	36,621	9,174	45,795
b) Reinforcement bar	ton	13,003.4	9,827.1	880	11,443	8,648	20,091
c) Concrete (brigdge)	m3	1,664.6	417.0	500	832	209	1,041
d) Reinforcement bar (b)	ton	13,003.4	9,827.1	50	650	491	1,142
Sub-total					49,547	18,522	68,068
6) Intake Structure							
A. Concrete Works							
a) Concrete (210 kg/cm2)	m3	1,664.6	417.0	1,300	2,164	542	2,706
b) Reinforcement bar	ton	13,003.4	9,827.1	26	338	256	594
Sub-total					2,502	798	3,300
B. Metal Works							
c) Steel pipe	ton	28,600.0		20	572	0	572
a) High pressure gate,	set			2	9,000	0	9,000
b) Gates	set			3	8,000	0	8,000
Sub-total					17,572	0	17,572
7) Land Acquisition Costs					0	86,389	86,389
8) Access Road					4,760	2,040	6,800
Total (2)					382,690	171,778	554,468
3 Causeway	Nos.	605,328	946,553	4	2,421	3,786	6,208
4 Pilot Demonstration Farm					10,393	2,869	13,262
5 Project Office					360	840	1,200
6 O & M Equipment					10,300	0	10,300
Total (1- 6)					446,780	197,201	643,981

Table I.3.6 BREAKDOWN OF DIRECT CONSTRUCTION COST FOR MOL DAM (35 MCM)

Work Item	Unit	Unit Rate (Rs.) F/C	Unit Rate (Rs.) L/C	Q'ty	Amount (1000 Rs.) F/C	Amount (1000 Rs.) L/C	Amount (1000 Rs.) Total
1. Preparatory Works				7%	27,029	5,903	32,933
2. Mol Dam					362,656	76,840	439,496
A. Main Dam							
1) Excavation							
a) Common (Backehoe)	m3	39.0	6.5	38,100	1,486	248	1,734
b) Common (Bulldozer) (1)	m3	57.7	7.4	44,500	2,568	329	2,897
c) Common (Bulldozer) (2)	m3	57.7	7.4	44,400	2,562	329	2,890
d) W. Rock (1)	m3	88.7	10.8	36,900	3,273	399	3,672
e) W. Rock (2)	m3	40.1	4.8	86,000	3,449	413	3,861
f) Rock (1)	m3	129.2	24.5	15,800	2,041	387	2,428
g) Rock (2)	m3	76.1	26.9	36,800	2,800	990	3,790
2) Filling							
a) Zone 1 (Core)	m3	119.9	16.4	298,900	35,838	4,902	40,740
b) Zone 2 (Random) (1)	m3	63.7	9.1	154,300	9,829	1,404	11,233
c) Zone 2 (Random) (2)	m3	63.7	9.1	99,300	6,325	904	7,229
d) Zone 2 (Random) (3)	m3	87.4	11.7	312,400	27,304	3,655	30,959
e) Zone 3 (Rock) (1)	m3	81.9	10.0	81,100	6,642	811	7,453
f) Zone 3 (Rock) (2)	m3	81.9	10.0	162,000	13,268	1,620	14,888
g) Zone 3 (Rock) (3)	m3	136.4	23.5	323,800	44,166	7,609	51,776
h) Rock facing	m3	136.4	23.5	83,000	11,321	1,951	13,272
i) Filter	m3	168.5	21.1	181,100	30,515	3,821	34,337
3) Foundation Treatment							
a) Curtain Gronting	m	555.8	421.6	9,500	5,280	4,005	9,285
b) Blanket Gronting	m	555.8	421.6	6,600	3,668	2,783	6,451
Total (A)					212,336	36,558	248,895
B. Saddle Dam							
1) Excavation							
a) Common (Bulldozer) (1)	m3	57.7	7.4	5,200	300	38	339
b) Common (Bullozoer) (2)	m3	16.1	2.4	5,100	82	12	94
c) W. Rock (1)	m3	88.7	10.8	15,400	1,366	166	1,532
d) W. Rock (2)	m3	40.1	4.8	35,900	1,440	172	1,612
e) Rock (1)	m3	129.2	24.5	12,300	1,589	301	1,891
f) Rock (2)	m3	76.1	26.9	28,800	2,192	775	2,966
2) Filling							
a) Zone 1 (Core)	m3	119.9	16.4	24,800	2,974	407	3,380
b) Zone 3 (Rock)	m3	81.9	10.0	4,200	344	42	386
c) Rock Facing	m3	136.4	23.5	4,400	600	103	704
Total (B)					10,886	2,018	12,904
C. Spillway							
1) Excavation							
a) Common (1)	m3	57.7	7.4	35,600	2,054	263	2,318
b) Common (2)	m3	16.1	2.4	35,600	573	85	659
c) W. Rock (1)	m3	88.7	10.8	32,000	2,838	346	3,184
d) W. Rock (2)	m3	40.1	4.8	74,800	2,999	359	3,359
e) Rock (1)	m3	129.2	24.5	53,400	6,899	1,308	8,208
f) Rock (2)	m3	63.8	16.8	124,600	7,949	2,093	10,043
2) Concrete Works							
a) Concrete (210 kg/cm2)	m3	1435.1	503.7	1,400	2,009	705	2,714
b) Concrete (180 kg/cm2)	m3	1134.4	405.9	18,800	21,327	7,631	28,958
c) Reiforcement bar	ton	13003.4	9827.1	400	5,201	3,931	9,132
Total (C)					51,851	16,722	68,573
D. Intake Facilities							
1) Earth Works							
a) Common Excavation	m3	57.7	7.4	14,900	860	110	970
b) W. Rock	m3	88.7	10.8	124,100	11,008	1,340	12,348
c) Rock	m3	133.5	33.8	53,200	7,102	1,798	8,900
2) Concrte Works							
a) Concrete (210kg/cm2)	m3	1435.1	503.7	11,100	15,930	5,591	21,521
b) Reinforcement bar	ton	13003.4	9827.1	440	5,721	4,324	10,045
c) Steel pipe	ton	28600.0	0.0	100	2,860	0	2,860
d) High pressure gate	set			2	11,424	0	11,424
e) Gates	set			4	14,000	0	14,000
Total (D)					68,905	13,164	82,068
E. Diversion Works					9,900	3,540	13,440
F. Acess Road					8,778	3,762	12,540
G. Land Acquisition					0	1,076	1,076
3. Causeway	Nos.	605,328	946,553	4	2,421	3,786	6,208
4. Pilot Demonstration Farm					10,393	2,869	13,262
5. Project Office					360	840	1,200
6. O & M Equipment		10,300	0		10,300	0	10,300
Total(1-6)					413,160	90,238	503,398

Table I.3.7 COST OF LAND ACQUISITION AND COMPENSATION

Itne	Unit	Q'ty	Unit Rate (Rs.)	Amount (1000 Rs.)
I. Khadeji Site				
A Land Aquisition Costs				
1 Cultivated area	ha	277	15,000	4,155
2 Wasted area	ha	540	12,000	6,480
B Exsisting				
1 Residence	Nos.	270	200,000	54,000
2 Power Transmission line	km	5.7	255,000	1,454
3 Poultry farm	Nos.	3	2,500,000	7,500
4 Mosque	Nos.	2	180,000	360
5 Primary school	Nos.	3	180,000	540
6 Lower secondary school	Nos.	1	200,000	200
7 Sui Gas Camp	L.S.	1	11,700,000	11,700
Total				86,389
II. Mol Site				
A Land Aquisition Costs				
1 Wasted area	ha	70	12,000	840
2 Compensation for borrow area		L.S.		236
Total				1,076

Table. I.3.8 LIST OF O & M EQUIPMENT

Item		Unit Price (x 1,000 Rs)	Required No.	Amount (x 1,000 Rs)
1. Bulldozer	11 ton	2,100	1	2,100
2. Dump Truck	4 ton	500	1	500
3. Wheel Loader	1 m3	1,200	1	1,200
4. Back-hoe	0.6 m3	2,700	1	2,700
5. Vibration Roller	3 ton	900	1	900
6. Vehicle	Stationwagon 4WD	400	4	1,600
7. Office Equipment		L.S.		400
8. Spare Parts		L.S.		900
Total				10,300

Table I.3.9 ADMINISTRATION COST

Item	Required Number		Required M/M	Monthly Rate (Rs)	Amount (1,000 Rs.)
1. Administration Staff					
- Exe. Eng. (Dam)	1	Person	36	7,000	252
- Assistant Exe. Eng.	3	Persons	108	5,000	540
- Administrator	1	Person	36	5,000	180
- Engineer	4	Persons	120	3,500	420
- Sub-eng.	4	Persons	144	2,500	360
- Labour	5	Persons	360	1,500	540
- Driver	5	Persons	180	2,000	360
Sub-total			984		2,652
2. Office Equipment	-			L.S.	318
- Copy Machine	1	no.			43
- Computer	1	no.			71
- Typewriter	1	no.			29
- Air Condition	5	nos.			143
- Others					32
3. Vehicles (small jeep)	5	nos.		L.S.	850
4. Office Operation Cost	36	months		80,000	2,880
Total					6,700

Table I.3.10 COST OF ENGINEERING SERVICES

Unit: 1,000 Rs.

Item	Foreign Currency	Local Currency	Total
I. Detailed Design Stage			
(i) Basic Design			
1. Remuneration (Foreign 14 M/M)	5,000	-	5,000
2. Remuneration (Local 5 M/M)	-	275	275
3. Direct	1,000	300	1,300
4. Costs for geological and soil mechanical investigations	-	3,650	3,650
(ii) Detailed Design			
1. Remuneration (Foreign 19 M/M)	6,800	-	6,800
2. Direct cost	1,300	575	1,875
Sub-total (I)	14,100	4,800	18,900
II. Construction Supervision Stage			
1. Remuneration (Foreign 110 M/M)	39,300	-	39,300
2. Remuneration (Local 100 M/M)	-	5,500	5,500
3. Special equipment	2,300	-	2,300
4. Direct cost	3,900	6,100	10,000
Sub-total (II)	45,500	11,600	57,100
Total	59,600	16,400	76,000

Table I.3.11 REQUIRED MAN-MONTHS OF CONSULTANT ENGINEERS

Unit: Man-Month

Specialist	Man-Month		
	Foreign Consultant	Local Consultant	Total
I. Detailed Design Stage			
(i) Basic Design	14.0	5.0	19.0
1. Dam Engineer	2.0	-	
2. Structure Engineer	2.0	-	
3. Soil Mechanical Engineer	2.0	2.0	
4. Geologist	4.0	3.0	
5. Cost Estimate Engineer	2.0	-	
6. Building Engineer	2.0	-	
(ii) Detailed Design	19.0	-	19.0
1. Project Director	1.0	-	
2. Team Leader	4.0	-	
3. Dam Engineer	4.0	-	
4. Structure Engineer	3.0	-	
5. Building Engineer	2.0	-	
6. Mechanical Engineer	1.0	-	
7. Building Engineer	2.0	-	
8. Specification Specialist	2.0	-	
II. Construction Supervision Stage	110	100	210
1. Project Director	3	-	
2. Resident Project Engineer (Sr. Dam Eng.)	36	-	
3. Construction Engineer	24	36	
4. Concrete Engineer	10	18	
5. Geologist	12	18	
6. Mechanical Engineer	3	-	
7. Soil Mechanical Engineer	12	24	
8. Groundwater Specialist	5	-	
9. Specialist as required	5	4	
Total	143	105	248

Table I.3.12 DISBURSEMENT SCHEDULE FOR CONSTRUCTION OF MOL DAM (35 MCM)

(Unit: Rs.10^6)

Work Item	Amount			1,991			1,992		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
1. Preparatory Works	27,029	5,903	32,933	-	-	-	27,029	5,903	32,933
2. Mol Dam									
A. Main Dam	212,336	36,558	248,895	-	-	-	15,479	4,254	19,733
B. Saddle Dam	10,886	2,018	12,904	-	-	-	-	-	-
C. Spillway	51,851	16,722	68,573	-	-	-	16,320	3,119	19,438
D. Intake Facilities	68,905	13,164	82,068	-	-	-	26,103	4,665	30,768
E. Diversion Works	9,900	3,540	13,440	-	-	-	9,900	3,540	13,440
F. Acess Road	8,778	3,762	12,540	-	-	-	8,778	3,762	12,540
G. Land Acquisition	0	1,076	1,076	0	538	538	0	538	538
Sub-total(2)	362,656	76,840	439,496	0	538	538	76,579	19,878	96,457
3. Causeway	2,421	3,786	6,208	-	-	-	-	-	-
4. Pilot Demonstration Farı	10,393	2,869	13,262	-	-	-	-	-	-
5. Project Office	360	840	1,200	-	-	-	360	840	1,200
6. O & M Equipment	10,300	0	10,300	-	-	-	-	-	-
Total (2-6)	386,131	84,335	470,465	0	538	538	76,939	20,718	97,657
7. Physical Contingency	58,152	12,750	70,902	0	81	81	11,564	3,118	14,682
Total (1 - 7)	471,311	102,989	574,300	0	619	619	115,533	29,739	145,272
8. Administration Cost	0	6,700	6,700	-	-	-	0	1,675	1,675
9. Engineering Services	59,600	16,400	76,000	10,575	3,600	14,175	14,900	4,100	19,000
Total (1 - 8)	530,911	126,089	657,000	10,575	4,219	14,794	130,433	35,514	165,947
10. Price Contingency	0	28,642	28,642	0	295	295	0	5,146	5,146
Grand Total	530,911	154,730	685,642	10,575	4,514	15,089	130,433	40,660	171,093

Work Item	1,993			1,994			1,995		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
1. Preparatory Works	-	-	-	-	-	-	-	-	-
2. Mol Dam									
A. Main Dam	91,524	16,191	107,715	82,183	12,778	94,961	23,151	3,335	26,486
B. Saddle Dam	-	-	-	10,886	2,018	12,904	-	-	-
C. Spillway	24,830	9,003	33,833	10,701	4,600	15,302	-	-	-
D. Intake Facilities	42,801	8,499	51,300	-	-	-	-	-	-
E. Diversion Works	-	-	-	-	-	-	-	-	-
F. Acess Road	-	-	-	-	-	-	-	-	-
G. Land Acquisition	-	-	-	-	-	-	-	-	-
Sub-total(2)	159,155	33,693	192,848	103,771	19,396	123,167	23,151	3,335	26,486
3. Causeway	0	0	0	2,421	3,786	6,208	-	-	-
4. Pilot Demonstration Farı	10,393	2,869	13,262	-	-	-	-	-	-
5. Project Office	-	-	-	-	-	-	-	-	-
6. O & M Equipment	-	-	-	10,300	0	0	-	-	-
Total (2-6)	169,548	36,562	206,110	116,492	23,182	129,374	23,151	3,335	26,486
7. Physical Contingency	25,524	5,524	31,049	17,543	3,507	21,050	3,521	520	4,041
Total (1 - 7)	195,072	42,086	237,159	134,035	26,690	160,724	26,672	3,855	30,527
8. Administration Cost	0	2,233	2,233	0	2,233	2,233	0	558	558
9. Engineering Services	15,167	3,867	19,033	15,167	3,867	19,033	3,792	967	4,758
Total (1 - 8)	210,239	48,186	258,425	149,201	32,790	181,991	30,463	5,380	35,843
10. Price Contingency	0	10,844	10,844	0	10,191	10,191	0	2,166	2,166
Grand Total	210,239	59,030	269,269	149,201	42,980	192,182	30,463	7,545	38,009

Table I.3.13 UNIT COST OF LABOUR AND CONSTRUCTION MATERIALS

No.	Item	Unit	Cost (Rs.)	Component F (%)	Component L (%)	Unit Costs F (Rs.)	Unit Costs L (Rs.)
A. Labour							
1	Forman	man-day	100.0	0%	100%	0	100
2	Assist. forman	man-day	80.0	0%	100%	0	80
3	Heavy equi. ope	man-day	80.0	0%	100%	0	80
4	Assist. heavy equi. ope	man-day	70.0	0%	100%	0	70
5	Dump truck driver	man-day	70.0	0%	100%	0	70
6	Assist. dump driver	man-day	60.0	0%	100%	0	60
7	Common driver	man-day	60.0	0%	100%	0	60
8	Blaster	man-day	100.0	0%	100%	0	100
9	Carpenter	man-day	90.0	0%	100%	0	90
10	Bar bender	man-day	80.0	0%	100%	0	80
11	Mason	man-day	80.0	0%	100%	0	80
12	Common labor	man-day	50.0	0%	100%	0	50
B. Construction Materials							
1	Aggregates						
	a) Sand	m3	50.0	30%	70%	15	35
	b) Coarse Aggregate	m3	70.0	30%	70%	21	49
	c) Boulder	m3	60.0	30%	70%	18	42
2	Lumber						
	a) Plywood 1/2 x4x8	pc	390.0	30%	70%	117	273
	b) Plywood 3/4x4x8	pc	520.0	30%	70%	156	364
3	Rainforced iron bar	ton	13000.0	70%	30%	9100	3900
4	Portrand cement	ton	1700.0	70%	30%	1190	510
5	Fuel						
	a) Gasoline	lit	7.8	0%	100%	0	7.8
	b) Diesel	lit	3.9	0%	100%	0	3.9
	c) Engine oil	lit	18.0	0%	100%	0	18
6	Blasting						
	a) Dynamite	kg	58.0	70%	30%	40.6	17.4
	b) ANFO	kg	10.0	70%	30%	7	3
	c) Detonator	pc	28.0	70%	30%	19.6	8.4
	d) Drilling rod	pc	2800.0	70%	30%	1960	840
	e) Drilling bit	pc	3800.0	70%	30%	2660	1140
7	RC Pipe (l=1.0 m)						
	a) Dia. 300 mm	pc	160.0	40%	60%	64	96
	b) Dia. 450 mm	pc	250.0	40%	60%	100	150
	c) Dia. 600 mm	pc	390.0	40%	60%	156	234
	d) Dia. 800 mm	pc	1150.0	40%	60%	460	690
	e) Dia. 1000 mm	pc	1400.0	40%	60%	560	840
	f) Dia. 1200 mm	pc	2060.0	40%	60%	824	1236
	g) Dia. 1500 mm	pc	2700.0	40%	60%	1080	1620
8	Steel plate	ton	13000.0	70%	30%	9100	3900
9	H-, L- beam	ton	13000.0	70%	30%	9100	3900
10	Steel Pipe , l = 6m						
	a) Dia. 1	pc	290.0	70%	30%	203	87
	b) Dia. 2	pc	520.0	70%	30%	364	156
	c) Dia. 3	pc	830.0	70%	30%	581	249
	d) Dia. 4	pc	830.0	70%	30%	581	249

Table I.3.14 SUMMARY OF OPERATION COST OF CONSTRUCTION EQUIPMENT

Group	No.	Equipment	Specifications Spec.	PS	Total FC (Rs./hr)	LC (Rs./hr)	Total (Rs.)
A		Earth Moving Equipment					
	1.	Bulldozer (D 50), D6	11t	110	679	72	751
	2.	Bulldozer (D 65), D7	17 t	150	849	104	952
	3.	Bulldozer (D 85), D8	21 t	230	1,301	128	1,429
	4.	Bulldozer (D 155), D9	32 t	320	1,906	192	2,097
	5.	Bulldozer w/ripper, D8	21 t	210	1,531	143	1,673
	6.	Bulldozer w/rippe , D9	32 t	320	2,125	226	2,351
	7.	Tractor shovel	1.2m3	100	527	101	629
	8.	Tractor shovel	3.2m3	250	1,477	128	1,605
	9.	Excavator	0.7m3	140	883	75	957
	10.	Excavator	1.0m3	190	1,384	94	1,478
	11.	Excavator	1.2m3	210	1,670	104	1,774
	12.	Wheel loader	2.2m3	160	914	94	1,008
	13.	Wheel loader	3.2m3	220	1,337	157	1,494
	13.	Wheel loader	5.0m3	380	2,701	245	2,946
	14.	Dump truck	11 t	310	376	71	447
	15.	Dump truck	20 t	290	1,249	172	1,421
	16.	Dump truck	32 t	430	1,944	255	2,199
B.		Compacting					
	17.	Tire roller	11-30t	100	465	78	544
	18.	Tamping roller (C. dozer)	17t	170	1,070	104	1,174
	19.	Tamping roller (C. dozer)	30t	310	1,675	177	1,852
	20.	Vibration roller	3t	25	339	43	382
	21.	Vibration roller	15t	160	1,359	109	1,468
	22.	Motor grader	3.7m	140	803	99	902
	23.	Water tank rolly, 10m3	11 t	320	416	71	487
C.		Other Equipment					
	24.	Cargo truck	10t	280	443	66	509
	25.	Cargo truck w/ 2t crane	4t	160	272	52	323
	26.	Trailer 32 t	32 t	320	980	104	1,084
	27.	Compressor	11m3	110	345	81	426
	28.	Compressor	17m3	190	508	120	628
	29.	Crawler drill , 17m3	150kg	-	624	31	655
	30.	Truck mixer	3.2m3	220	404	66	471
	31.	Truck mixer	4.4m3	280	558	71	629
	32.	Batching plant ,0.6m3	41kw	-	913	31	944
	33.	Concrete mixer 1m3	4kw	-	444	31	475
	34.	Generator	100kVA	130	144	86	230
	35.	Generator	200kVA	240	297	125	421
	36.	Crushing plant, dia.=600mm	45kw	Corn T.	378	31	409
	37.	Geo-crusher,610x380mm	37kw	-	292	19	311
	38.	Vibration seieve 1200x2400	6kw	-	272	31	302
	39.	Belt conveyor, per 10m	450mm	-	46	0	46
	40.	Boring machine,	3.7kW	-	81	31	111
D		Concrete Gravity Dam					
	41.	Batching plant, 0.75m3x3	30kw		1,704	31	1,735
	42.	Baket elevater,30t/hr	20m		144	31	174
	43.	Screw conveyor, 30t/hr	35m		112	31	143
	44.	Cemment silo	500t		229	31	260
	45.	Epron feeder, 1000x3500mm	3.7kw		400	31	431
	46.	Geo-crusher, 800x1000mm	130kw	W.t	1,308	31	1,339
	47.	Scraba, 1500x3000mm	30kw		517	31	547
	48.	Vibration seave, 1200x3000	7.5kw		107	31	138
	49.	Corncrusher,1200mm mant.	95kw	O.type	1,152	31	1,182
	50.	Vibration seave, 1200x3000	7.5kw		107	31	138
	51.	Flush fire, 600x5000mm	2.2kw		98	31	129
	52.	Cable crane, 7.5t	335kw		6,597	31	6,627
	53.	Deisel locomotive, 6t	78PS		325	70	394
	54.	Concrete backet, 1.5m3	-		103	9	112
	55.	Concrete backet, 3m3	-		163	9	172
	56.	Cooling plant, 200JRT	-		495	31	526
	57.	Water s. plant, dia=250mm	55kw		112	31	143

Table I.3.15 SUMMARY OF UNIT CONSTRUCTION COST

Work Item				Unit	Unit Rate F.C. (Rs.)	Unit Rate L.C. (Rs.)	Total (Rs.)
A Mol Dam							
I. Earth Works							
I-1 Spillway							
ME - 1 Excavation	common	for	spoil	m3	57.7	7.4	65.1
ME - 2 Excavation	common	for	randam f.	m3	16.1	2.4	18.5
ME - 3 Excavation	w. rock	for	spoil	m3	88.7	10.8	99.5
ME - 4 Excavation	w. rock	for	randam f.	m3	40.1	4.8	44.9
ME - 5 Excavation	rock	for	spoil	m3	129.2	24.5	153.7
ME - 6 Excavation	rock	for	rock f.	m3	63.8	16.8	80.6
I-2 Dam Body							
ME - 7 Ex. by backhoe	common	for	spoil	m3	39.0	6.5	45.5
ME - 8 Ex. by bulldozer	common	for	spoil	m3	57.7	7.4	65.1
ME - 9 Excavation	w. rock	for	spoil	m3	88.7	10.8	99.5
ME - 10 Excavation	rock	for	spoil	m3	133.5	33.8	167.3
ME - 11 Excavation	rock			m3	76.1	26.9	103.0
ME - 12 Filling, L=3000m	core	from	borrow	m3	119.9	16.4	136.3
ME - 13 Filling, l=1000m	randam	from	spillway	m3	63.7	9.1	72.8
ME - 14 Filling, l=1000m	randam	from	borrow	m3	79.3	10.6	89.9
ME - 15 Filling, l=1500m	randam	from	quarry	m3	87.4	11.7	99.1
ME - 16 Filling,l=400,1500m	filter	from	river bed	m3	168.5	21.1	189.6
ME - 17 Filling, l=1000m	rock	from	spillway	m3	81.9	10.0	91.9
ME - 18 Filling, l=1500m	rock	from	quarry	m3	136.4	23.5	159.9
ME - 19 Collection	filter	from	river bed	m3	80.9	10.3	91.2
ME - 20 Ex. by blasting		at	quarry	m3	61.2	16.1	77.3
II. Conctere Works and others							
MC - 1 Concrete, 210kg/cm2	max.40mm	for	structure	m3	1,435.1	503.7	1,938.8
MC - 2 Concrete, 210kg/cm2	max.80mm	for	spillway	m3	1,170.5	421.5	1,592.0
MC - 3 Concrete, 180kg/cm2	max.80mm	for	spillway	m3	1,134.4	405.9	1,540.3
MC - 4 Reinforcement bar				ton	13,003.4	9,827.1	22,830.5
MC - 5 Grouting, 60kg/m				m	555.8	421.6	977.4
MC - 6 Course aggregate		at Mol site		ton	80.5	16.5	97.0
MC - 7 Course aggregate		from	Khadeji	ton	143.9	28.4	172.3
MC - 8 Fine aggregate		from	river bed	ton	29.5	4.4	33.9
B Khadeji Dam							
I. Earth Works							
KE - 1 Ex., backhoe, dump 11t	common	for	spoil	m3	57.6	9.9	67.5
KE - 2 Ex., w. loader, dump 32t	common	for	spoil	m3	92.9	12.4	105.3
KE - 3 Ex. bulldozer	w. rock	for	spoil	m3	129.4	16.1	145.5
KE - 4 Ex. for abutment	rock	for	spoil	m3	167.4	40.9	208.3
KE - 5 Ex. mass rock	rock	for	spoil	m3	183.6	32.3	215.9
II. Conctere Works and others							
KC - 1 Concrete, 210kg/cm2	structure	max.	40mm	m3	1,664.6	417.0	2,081.6
KC - 2 Concrete, external	mass c.	max.	150mm	m3	1,318.2	289.2	1,607.4
KC - 3 Concrete, internal	mass c.	max.	150mm	m3	1,196.0	233.5	1,429.5
KC - 4 Concrete, 210kg/cm2		max.	80mm	m3	1,488.8	360.8	1,849.6
KC - 5 Reinforcemant bar				ton	13,003.4	9,827.1	22,830.5
KC - 6 Grouting, 60kg/m				m	555.8	421.6	977.4
KC - 7 Course aggregate		at	Khadeji	ton	138.4	21.2	159.6
KC - 8 Fine aggregate		from	riverbed	ton	65.2	8.8	74.0

Table I.3.16 ANNUAL OPERATION AND MAINTENANE COST

Item		Required M/M	Monthly Rate (Rs)	Amount (1,000 Rs.)
A. Malir Project Office				
1. O&M Staff				
- Exe. Eng. (Dam)	1 Person	12	7,000	84
- Assistant Exe. Eng.	3 Persons	12	5,000	180
- Engineer	3 Persons	12	3,500	126
- Sub-engineer	8 Persons	12	2,500	240
- Guard and office boy	5 Persons	12	1,000	60
- Driver	5 Persons	12	1,500	90
- Labors, and others	L.S.		L.S.	300
2. Operation Cost of O & M Equipment			L.S.	600
3. Office Operation Cost			160,000	1,920
Subtotal (A)				3,600
B. Pilot Demonstration Farm				
1. O&M Staff				
- Assistant Exe. Eng.	1 Persons	12	5,000	60
- Agronomist, irr.eng.	3 Persons	12	3,500	126
- Sub-engineer	5 Persons	12	2,500	150
- Guard and office boy	3 Persons	12	1,000	36
- Driver	2 Persons	12	1,500	36
- Labors and others	L.S.			92
2. Operation Cost of O & M Equipment			L.S.	250
3. Office Operation Cost			50,000	600
4. Farm input and others			L.S.	150
Subtotal (B)				1,500
Total				5,100

Table I.3.17. REPLACEMENT COST

Item	Useful Life (Year)	Replacement Cost (1,000 Rs.)
1. O & M Equipment with Spare Parts	10	10,300
2. Gate	25	25,500

FIGURES

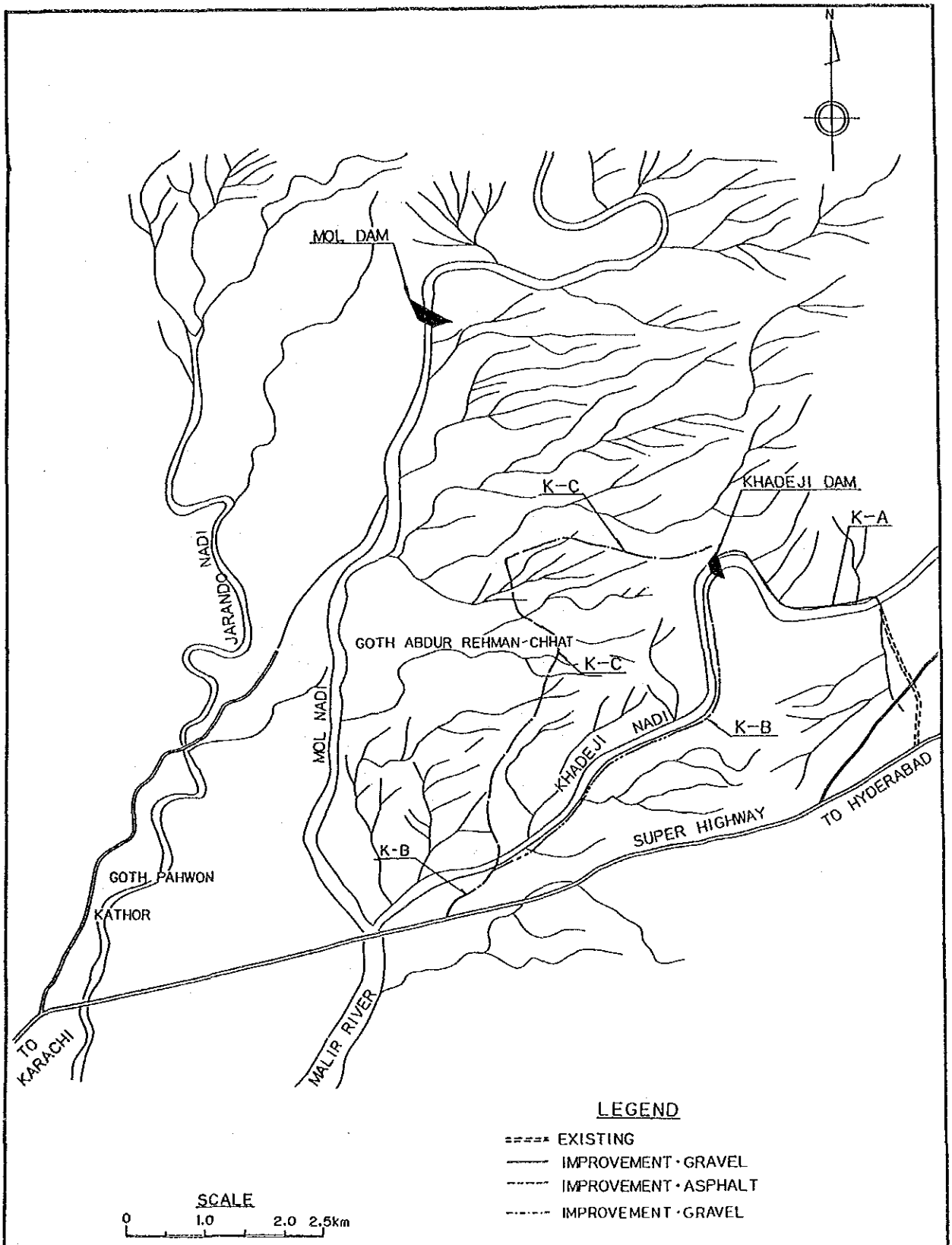

Fig. I.2-1 Location of Access Road for Khadeji Dam

ISLAMIC REPUBLIC OF PAKISTAN GOVERNMENT OF SIND
FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT PROJECT IN THE MALIR BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

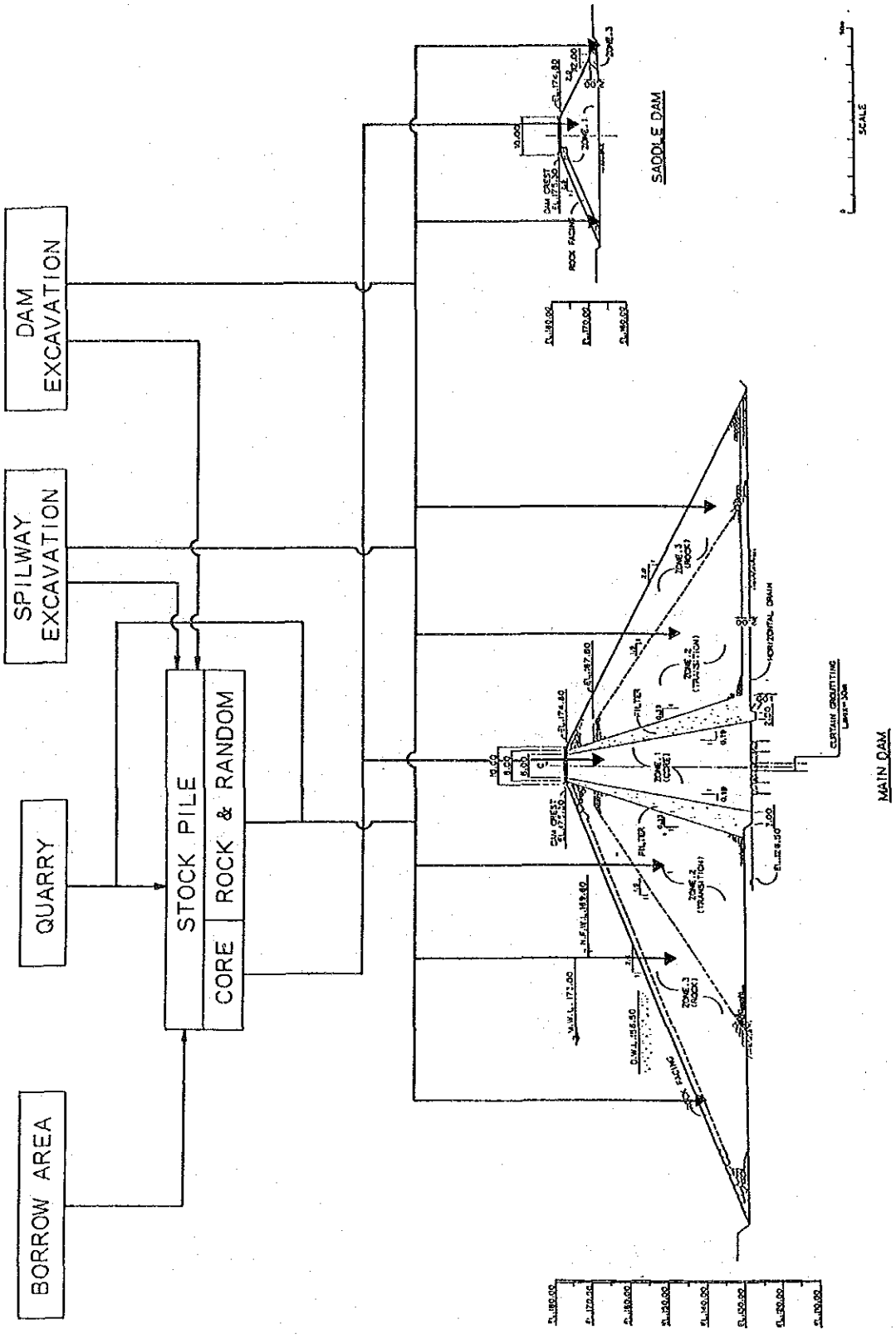

Fig. I.2-2 Material Distribution Chart at Mol Dam

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FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT PROJECT IN THE MALIR BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

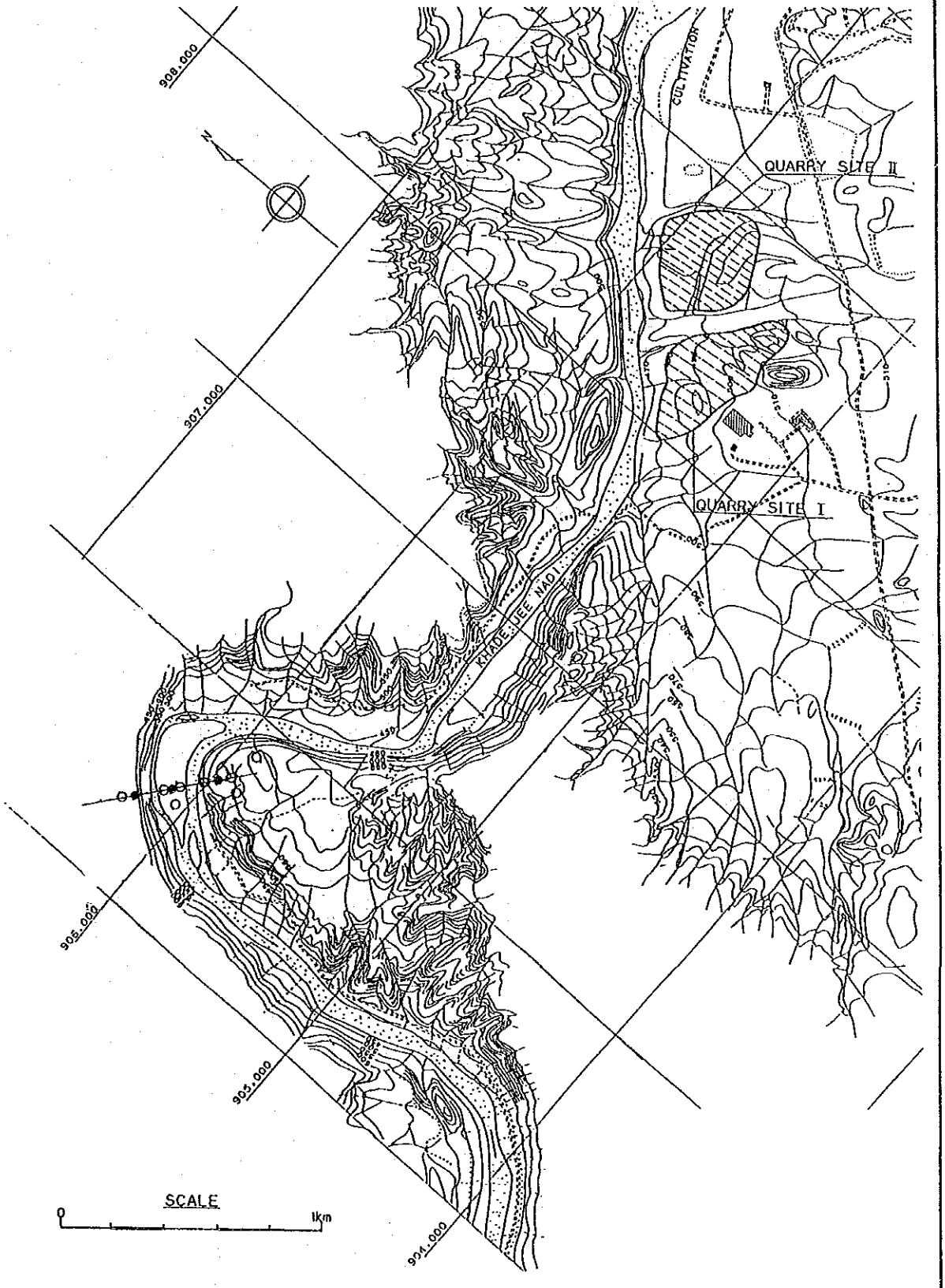

Fig. I.2-3 Location of Quarry Site at Khadeji Damsite

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FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT PROJECT IN THE MALIR BASIN
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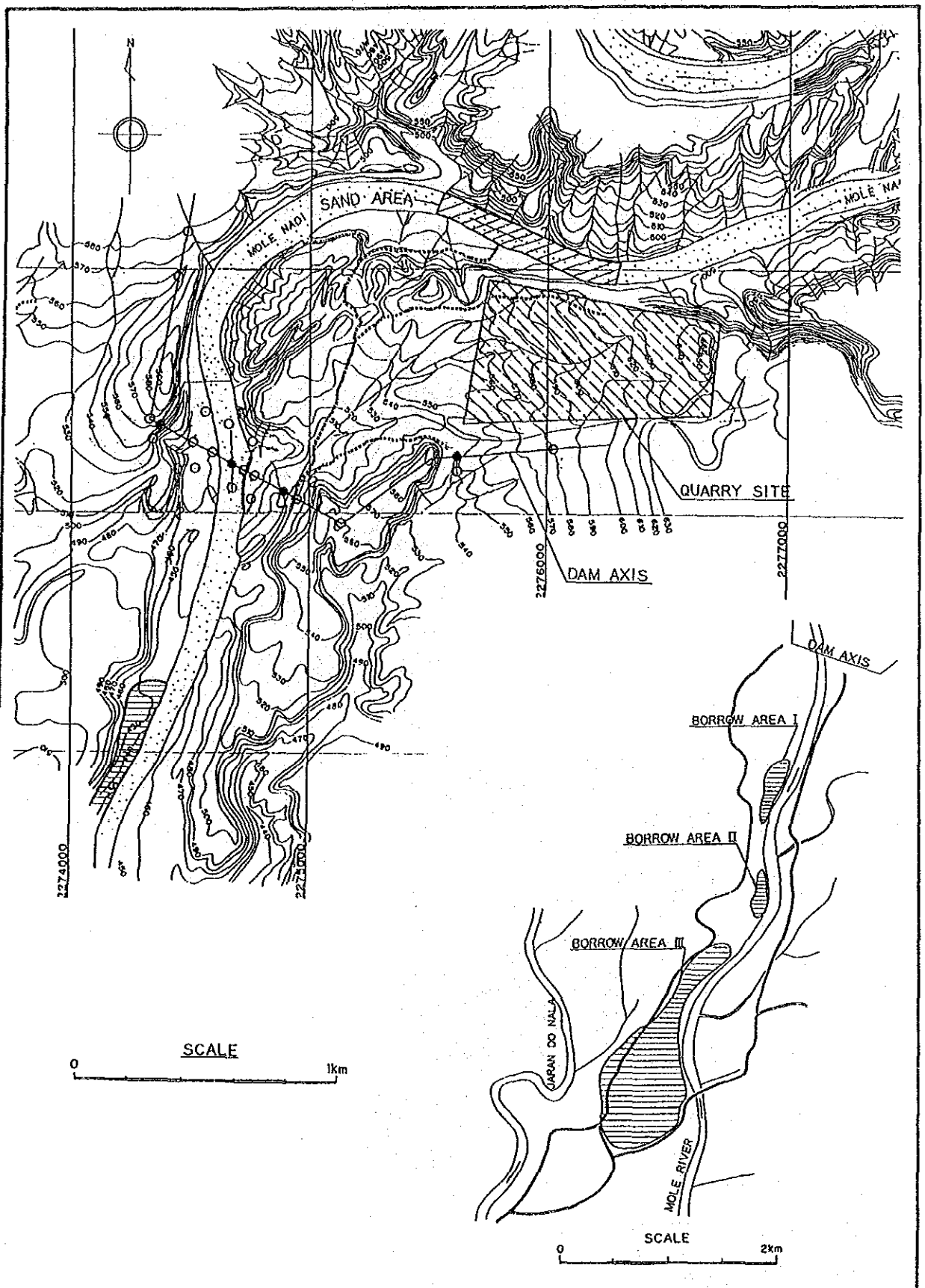

Fig. I.2-4 Location of Quarry Site at Mol Damsite

ISLAMIC REPUBLIC OF PAKISTAN GOVERNMENT OF SIND
FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT PROJECT IN THE MALIR BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

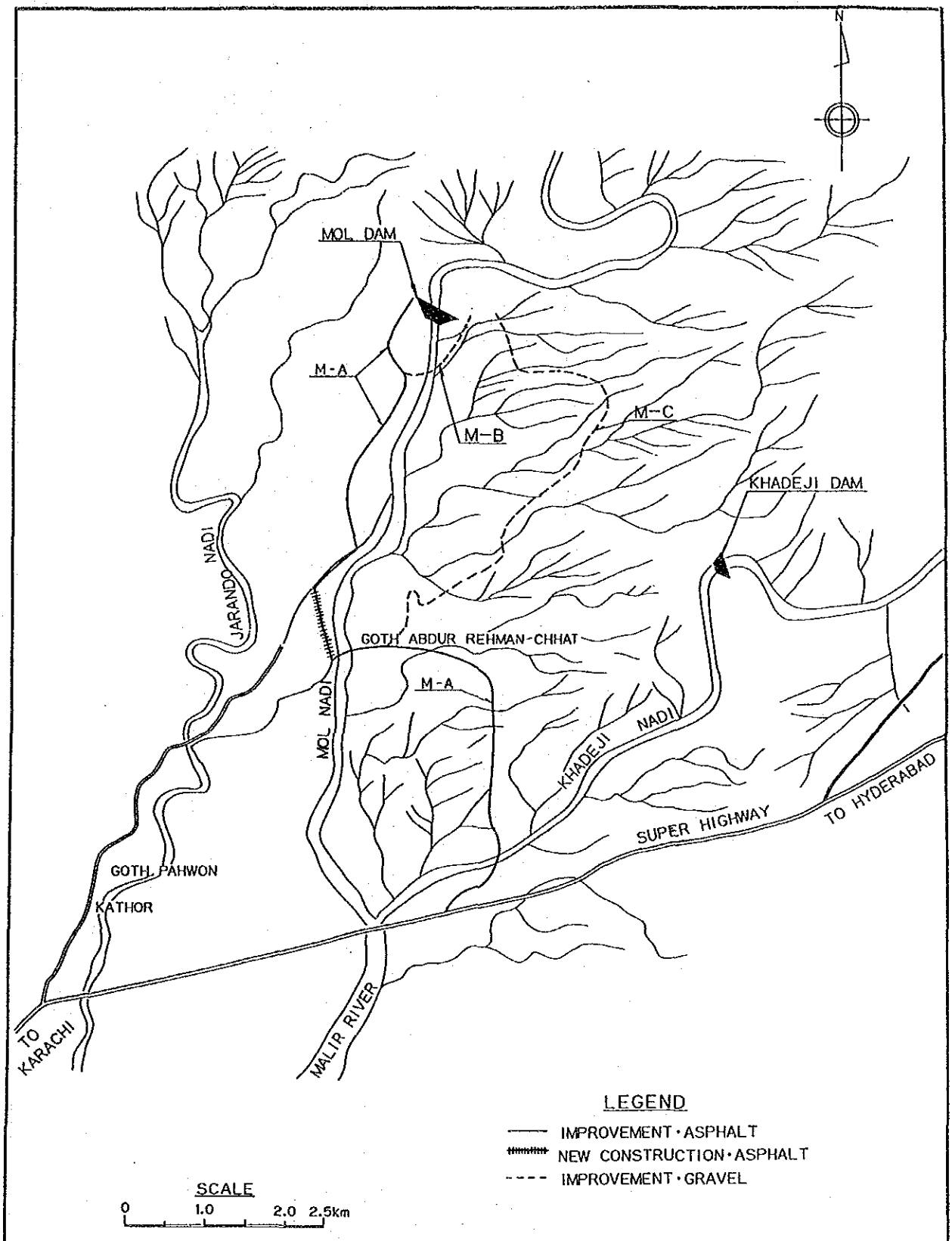

Fig. I.2-5 Location of Access Road for Mol Dam

ISLAMIC REPUBLIC OF PAKISTAN GOVERNMENT OF SIND
FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT PROJECT IN THE MALIR BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

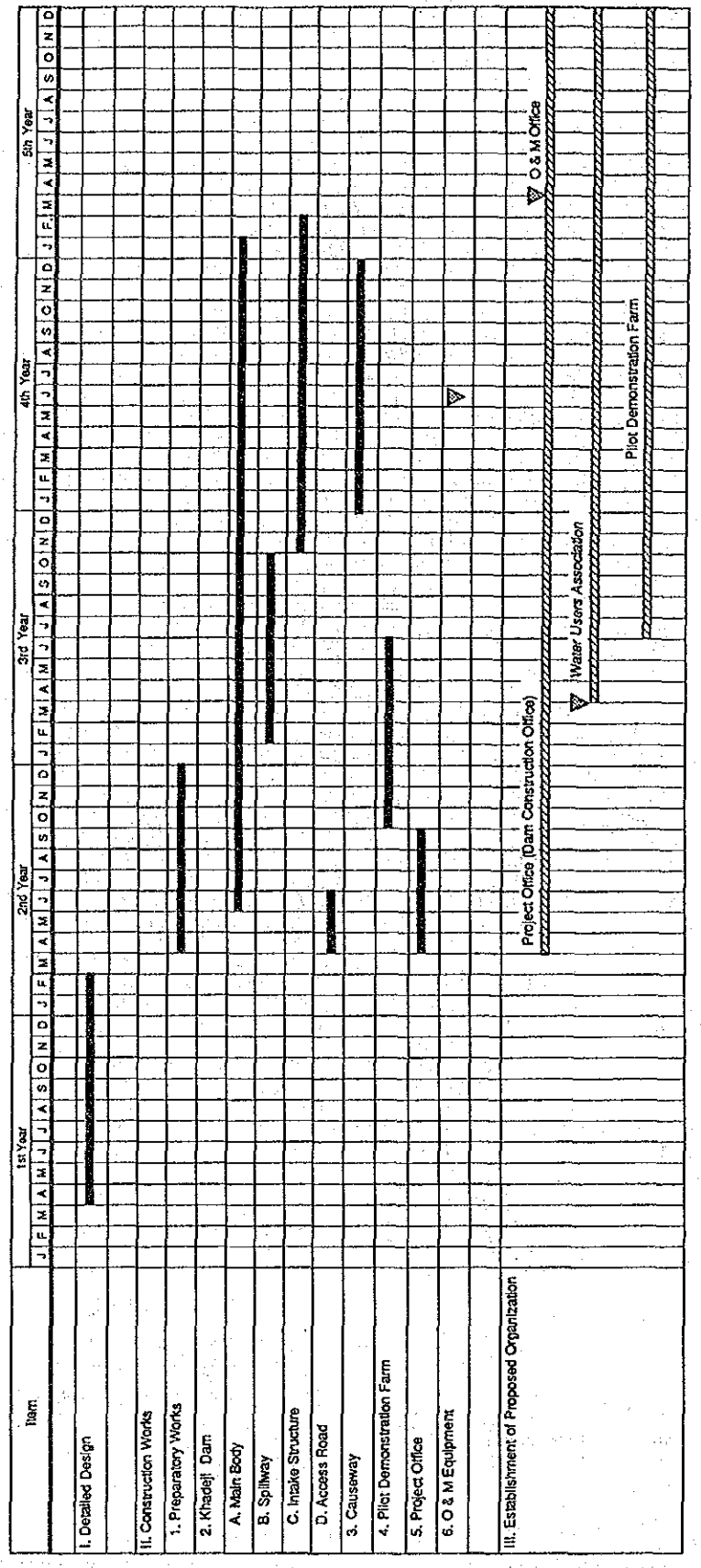

Fig. I.2-6 *Implementation Schedule for Khadeji Dam*

ISLAMIC REPUBLIC OF PAKISTAN
GOVERNMENT OF SIND

FEASIBILITY STUDY ON
WATER RESOURCES DEVELOPMENT PROJECT
IN THE MALIR BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

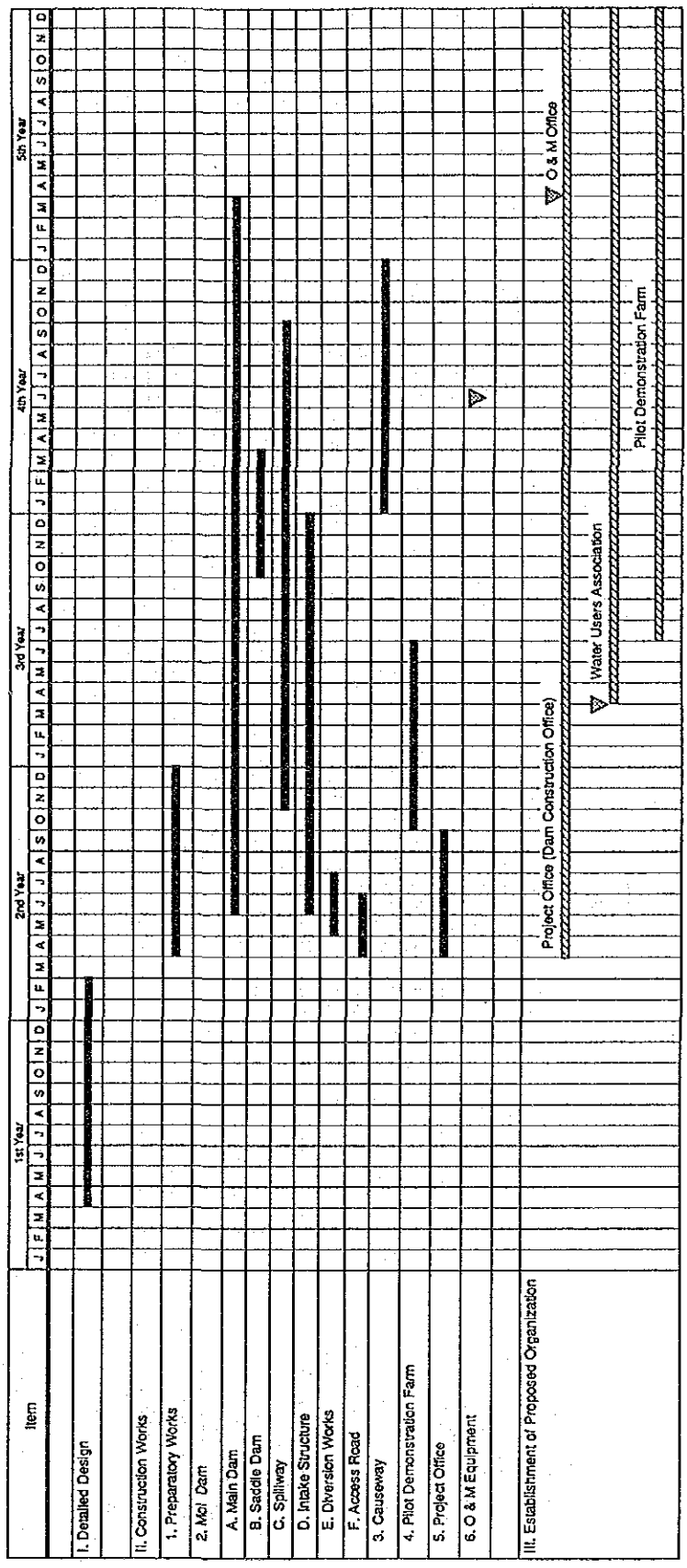

Fig. I.2-7 Implementation Schedule for Mol Dam

ISLAMIC REPUBLIC OF PAKISTAN GOVERNMENT OF SIND
FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT PROJECT IN THE MALIR BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

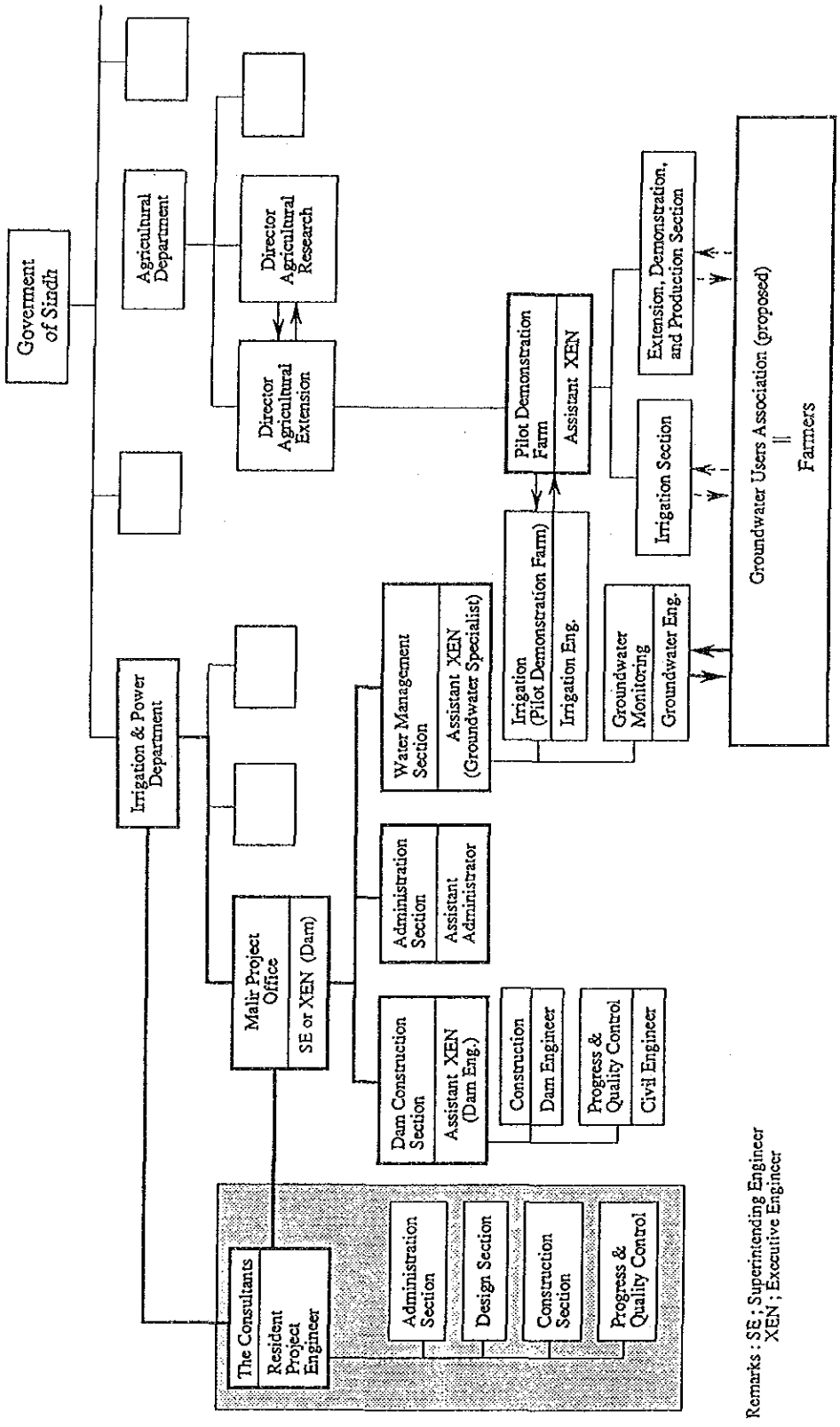

Fig. I.3-1 Organization Chart of Project Office

ISLAMIC REPUBLIC OF PAKISTAN
GOVERNMENT OF SIND

FEASIBILITY STUDY ON
WATER RESOURCES DEVELOPMENT PROJECT
IN THE MALIR BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

ANNEX–J

PROJECT EVALUATION

ANNEX - J

PROJECT EVALUATION

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LIST OF TABLES

ANNEX-J PROJECT EVALUATION

J.1 GENERAL

The present Project aims at increasing crop production by recovering irrigation area in the Malir area through the dam construction and groundwater management, as well as by introducing intensive farming practice. Released water from dam(s) is expected to recharge to the phreatic layer of the area along the Malir river, thereby to augment the groundwater volume in the basin. Increased groundwater resources will make it possible to recover irrigation area that has been decreasing year by year due to the overdrafting of groundwater. Increased crop production will contribute to improve living standard of the beneficiaries in the Malir area as well as to stabilize the supply of fresh vegetables and fruit to the Karachi city.

As for dam construction, preliminary economic evaluation is made for seven (7) alternative development options as part of the project optimization process, as discussed in ANNEX-H and Chapter 4 of the main report. Upon making comparison among them from the viewpoint of cost-benefit ratio and social impact, the Mol dam is proposed with a live storage capacity of 35 MCM.

The results from these initial evaluations, which revealed a number of economically feasible options, lead to the selection of the proposed irrigation area of 4,350 ha with a cropping intensity of 1.5. The irrigation area includes 2,600 ha of existing farmland and 1,750 ha of the recovering area where cultivation has been made before. In this ANNEX, overall project evaluation is discussed in detail for this selected particular case.

The project evaluation involves making an assessment of project feasibility in view of economic, financial and socio-economic aspects. The economic feasibility is firstly evaluated by calculating the internal rate of return (IRR), and benefit-cost ratio (B/C) and the net present value (NPV) at a discount rate of 8 %.

Financial evaluation is carried out by analysing the effect of the project on a typical farm budget.

The socio-economic impacts from the implementation of the Project is also briefly studied.

J.2 ECONOMIC EVALUATION

J.2.1 Basic Assumptions

The economic evaluation was made on the following basic assumptions:

(1) The construction period of the Mol dam would be four (4) years including one (1) years of for detailed design and preparatory works.

(2) The economic useful life of the project would be 50 years.

(3) All prices are expressed in constant 1989 prices.

(4) The exchange rate of US$1.00 = Rs. 21.5 = ¥ 150.0 as of 1989 would be used throughout.

J.2.2 Evaluation of Economic Factors

J.2.2.1 Standard Conversion Factor

Tariff and trade restrictions introduce a distortion in the price relationship between trade goods and non-traded goods. In order to evaluate the project costs and benefits with respect to world market prices, a standard conversion factor (SCF) is applied to the price of non-trade goods and services. The SCF is calculated on the basis of the following formulas:

$$SCF = \frac{X + M}{(X + Sx - Tx) + (M - Sm + Tm)}$$

where,
- X : export value
- M : import value
- Sx : export subsidy
- Sn : Import subsidy
- Tx : export taxes
- Tm : import taxes

The SCF in the years of 1982/83 to 1986/87 is calculated at 0.84 or 0.85 as shown in Table J.2.1, indicating constant. In this project, the SCF of 0.85 is applied.

J.2.2.2 Transfer Payment

From the viewpoint of the international economy, the transfer payment such as contract tax, duty, subsidy and interest are considered as a domestic monetary movement without direct productivity. These transfer payment are, therefore, excluded from the project cost as far as economic analysis is concerned.

J.2.2.3 Economic Prices of Agricultural Outputs and Inputs and Opportunity Cost of Farm Labor

Economic prices of farm inputs (urea, triple super phosphate and muriate potash) is estimated on the basis of IBRD projections of world market prices for 1989 in constant 1985 terms. The IBRD forecasted prices are adjusted to constant 1989 price level using the factor of 1.376 based on manufacturing unit value (MUV) index computed by IBRD. The domestic cost elements such as transport, handling and processing down to the farm gate level are multiplied by the SCF of 0.85. Economic prices of tradable agricultural inputs are shown in Tables J.2.2.

The economic prices of farm inputs and outputs are summarized in Table J.2.3. Farm labor is priced at Rs. 35/man-day by a labor shadow price factor of 0.7. Electricity for electric pump is priced at Rs. 0.14/m^3 of water referring to a report on SCARP project prepared by USAID in 1989.

J.2.2.4 Economic Cost of Construction

The individual financial cost for major project components are spilt into four categories of transfer payment, unskilled labour, non-traded cost and traded foreign costs, for each of which an economic/financial conversion factor is applied. The construction conversion factor (CCF) that is the weighted average of the above component, is calculated as shown in Table J.2.4.

J.2.3 Economic Benefit

Economic benefit will be expected from two benefit components: (1) benefit from crop production and (2) benefit from cost saving of well deepening and increased electricity.

J.2.3.1 Agricultural Benefit

Agriculture benefit to be expected is defined as the difference in primary profit from crops between future with project and without project conditions. On the basis of the estimated production cost and gross income, primary profit for crop per hectare is calculated both on future with and without project conditions as follows; details are shown on Tables J.2.5 to J.2.7.

Unit: Rs./ha

	Without Project			With Project		
	Gross Income	Prod. Cost	Prim. Profit	Gross Income	Prod. Cost	Prim. Profit
A. Vegetable						
- Tomato	11,418	7,444	3,974	24,220	9,140	15,080
- Eggplant	12,005	5,927	6,078	22,050	8,702	13,348
- Chilli	7,660	5,433	2,227	19,150	8,229	10,921
- Sponge Gourd	10,261	5,539	4,722	36,410	7,080	29,330
- Bottle Gourd	13,536	6,078	7,458	23,040	7,500	15,540
- Cauliflower	40,698	7,048	33,650	48,960	8,592	40,368
- Spinach	4,498	4,214	284	10,380	6,403	3,977
- Carrot	8,424	5,458	2,966	17,160	8,563	8,597
- Radish	7,800	5,836	1,964	25,350	8,626	16,724
- Turnip	14,652	6,061	8,591	33,300	8,814	24,486
- Peas	9,568	5,444	4,124	18,400	7,538	10,862
B. Fruits						
- Guava	13,452	6,810	6,642	24,780	8,137	16,643
- Mango	24,461	7,158	17,303	36,090	7,985	28,105
- Chicoo	8,050	5,748	2,302	10,500	7,185	3,315
- Coconut	14,850	5,750	9,100	22,000	6,724	15,276
- Papaya	15,257	11,086	4,171	17,765	12,561	5,204
C. Fodder						
- Maize	3,392	2,874	518	5,760	3,855	1,905
- Lucern	5,838	4,526	1,312	10,920	5,975	4,945

Applying the primary profit per crop estimated to crop area, total primary profits accrued from agricultural production for the project are estimated both on without and with project conditions. Based on this result, agricultural benefit is calculated.

The production of annual crops will be expected to increase year by year and reach the full benefit at five (5) years after the completion of the dam. The expected agricultural benefit from annual crops during built-up period is assumed as follows:

1st year	50% of the full benefit
2nd year	65% of the full benefit
3rd year	80% of the full benefit
4th year	90% of the full benefit
5th year	100% of the full benefit

For the orchards, weighted average benefit for the whole useful life period in each species is adopted evenly throughout the project life since replanting of orchards will be taken place at any time as required.

As a result, agriculture benefit will be born from the end of the year, 1996. It will gradually increase and attain its maximum in 2000. The agriculture benefit at full development stage is estimated at Rs. 93.7 x 10^6 as shown in Table J.2.8.

J.2.3.2 Benefit from Cost Saving of Well Deepening and Electricity

In without project condition, further cost for digging wells to ensure irrigation water so as to maintain irrigation area will be born. As described in ANNEX H, some 0.6 m of well deepening will be taken place annually for the period from 1996 to 2000, and some 0.8 m during 2001 to 2005. It will take some ten (10) years for groundwater level to reach near the baserock where no more water extraction is expected. Annual digging cost of about Rs. 2.6 x 10^6 during 1996 to 2000 and Rs. 3.8 x 10^6 during 2001 to 2005 will be saved by the implementation of the Project.

With the increase of well depth, electricity consumption for pump operation will also be increased. The pump operation cost to be increased will be Rs. 0.38 x 10^6 annually during the years from 1996 to 2000, and Rs. 1.2 x 10^6 for the period from 2001 to 2005.

J.2.4 Economic Cost

J.2.4.1 Capital Cost

The economic construction cost is estimated by applying construction conversion factor (CCF) to the financial construction cost as follows:

Cost Component	Financial Cost (Rs.x10^6)	CCF	Economic Cost (Rs.x10^6)
1. Preparatory Works	32.9	0.97	31.9
2. Mol Dam	439.4	0.97	424.8
3. Causeway	6.2	0.89	5.5
4. Pilot Demonstration Farm	13.3	0.96	12.7
5. Project Office	1.2	0.87	1.0
6. O&M Equipment	10.3	1.00	10.3
7. Physical Contingency	71.0	0.97	68.2
8. Administration Cost	6.7	0.81	5.5
9. Engineering Services	76.0	0.96	73.0
Total	657.0		632.8

The economic cost is estimated at Rs. 632.8x10^6. Annual disbursement of economic cost is shown in Table J.2.9.

J.2.4.2 Annual Operation and Maintenance Cost

Economic annual operation and maintenance cost is estimated at Rs. 4.3×10^6 as shown below:

Unit: $Rs.10^3$

	Description	Financial O&M Cost	CCF	Economic O&M Cost
A.	Malir Project Office	3,600	0.85	3,060
B.	Pilot Demonstrate Farm	1,500	0.85	1,240
	Total	5,100		4,300

J.2.4.3 Replacement Cost

O&M equipment and gates are assumed to be replaced in every 10 years and 25 years after implementation of the project. Economic replacement cost is estimated as follows:

Unit: $Rs.10^6$

	Useful Life	Economic Replacement Cost
O&M Equipment with spare parts	10 years	10.3
Gate	25 years	25.5

J.2.4.4 Annual Cost Flow

The economic cost flow is prepared on the basis of the construction schedule as shown in Table J.2.10.

J.2.5 Economic Internal Rate of Return (EIRR), Benefit-cost Ratio (B/C) and Net Present Value (NPV)

The EIRR, B/C and NPV are calculated on the basis of cost and benefit flow as shown in Table J.2.10.

The calculated result is:

EIRR	=	10.60%	
B/C	=	1.36	(at a discount rate of 8%)
NPV	=	Rs. 196.4 x 10^6	(at a discount rate of 8%)

J.3 FINANCIAL ANALYSIS

J.3.1 General

Financial evaluation of the project is made by the analysis of the typical farm budgets and the assessment for repayment of the project construction cost.

Farm budget analysis is conducted to assess whether the project will have sufficient incentive to the farmers in the project area and will bring enough income increase in the farmer's economy.

J.3.2 Farm Budget Analysis

In order to evaluate the Project from the financial aspect of the farmers, the farm budget analysis on different sizes of farmers are made under both future with and without project conditions. The results are shown in Tables J.3.1 and J.3.2.

Project implementation will surely contribute to the increase in farm income. The cropped area will be more than doubled. Incremental benefit per hectare between with and without project conditions is some Rs. 16,600 for owner operator, and Rs. 4,920 for tenant farmer. In with-project condition, owner operator will get about Rs. 20,300 when cultivate one (1) hectare. Tenant farmer, however, will receive only Rs. 5,400 if landlord takes a half of gross income, which is common contract form in the area as described in ANNEX-F.

In without-project condition, owner operator will get only less than Rs. 5,000/ha/yr, while tenant farmer will receive only Rs. 1,000, far less than owner operator receives. With the implementation of the project, the income of beneficiaries will increase about four times as before.

Private consumption expenditure in Pakistan in 1988-89 is reported at Rs. 556 billion. Dividing the expenditure by total national population of 105.4 million, average per capita expenditure is calculated at about Rs. 5,300 per year. Assuming this expenditure is average per capita income in Pakistan, some Rs. 30,000 of income per year may be a target to be got by beneficiaries, considering the average family size of 5.6 in the Malir area (see Table F.2.1 in ANNEX-F).

In without-project condition, owner operator with the holding size of 6 hectares will reach to the target income, while tenant owner seems not be able to earn the target even cultivating as wide as 20 hectares of land. On the other hand, two (2) hectares may be enough for owner operator to get the target income in with-project condition, while owner operator will reach to the target with the cultivating land of six (6) hectares, although this evaluation may be underestimated since family labour is included in the production cost in the crop budget analysis.

It is estimated that more than 70 % of the farmers in Malir area is less than the average income level in without-project condition. With the implementation of the project, about a half of such farmers will be expected to reach to the income level more than Rs. 30,000 as shown below.

Expected Income of over Rs. 30,000/year

	Owner	Owner/Tenant	Tenant
Land holding size (ha)1/			
Without project condition:	6	11	30
With project condition:	2	3	6
Number of Family2/			
Without project condition:	about 100	about 60	about 5
With project condition	about 150	about 120	about 150

Remarks: 1/; estimated from Tables J.3.1.and J.3.2
2/; estimated from Table F.2.2 in ANNEX-F. Land holding pattern of owner/tenant is assumed be fifty-fifty.

Judging from the results of the above analysis, the project will bring about a great improvement in farm budget and give an incentive to farmers. The project could be justified from the beneficiaries' viewpoint.

J.4 IMPACT OF THE PROJECT

In addition to the direct benefits counted in economic evaluation, various secondary and intangible benefit and/or favorable socio-economic impacts are expected through the implementation of the project. The major socio-economic impacts are described hereunder.

J.4.1 Stable Supply of Water

The dam construction will ensure the reliable water supply by augmenting the groundwater recharge volume. Irrigation water will be supplied steadily and it will make it possible to cultivate crops two times a year as well as fruit trees. Drinking water will also be supplied more than at present.

J.4.2 Increase of Employment Opportunity

Construction of the Mol dam will produce about 270 x 10^3 man-days of employment opportunity for unskilled labour, which is equivalent to Rs. 24.3 x 10^6. Those workers will be employed near the construction site, maybe from the project area, and this will contribute to improve economic situation in the area. In addition the project will creates a demand for farm labour requirement accrued from increased farming activities due to increasing irrigation area as well as intensive use of the land. The incremental farm requirement is estimated at 315 x 10^3 man-days annually as shown in Table F.4.9 in ANNEX F.

J.4.3 Increase of Crop Production and Stable Supply of the Products to the Karachi City

The project will increase agricultural production of vegetables (42,000 tons), fruits (7,000 tons) and fodder crops (1,850 tons), which will bring about considerable profit to the beneficiaries in the project area. These products except fodder crops for domestic will be marketed in the Karachi city. People in the Karachi city will enjoy those fresh and stable supply of the products from the project area due to the locational advantage.

J.4.4 Increase of Farmers' Income

The farmers' income will be expected to improve considerably due to the increase of crop production, as described in the previous chapter. The income will become about 3 to 4 times of that at present, which will provide farmers with motivation of improving living standard.

J.4.5 Improvement of Water Quality

The quality of groundwater is getting worse in the downstream of the project area, and this suggests sea water intrusion resulted from overdrifting of groundwater from below the sea level. In some place in the project area, electric conductivity of groundwater is reported at as high as 3,000 uS/cm. This deterioration of groundwater quality will make it impossible for

people to utilize this water as drinking purpose. With the implementation of the project, increased groundwater recharge will be expected to improve the water quality in such an area in long term by pushing sea water back.

J.4.6 Flood Mitigation Effects

The dam will decrease peak flood occasionally occurred in Kharif season, due to its storage effect of the reservoir. Peak-cut effects by construction of the Mol dam would be estimated at 3 to 6 per cent depending on the initial water level of the reservoir. Though the flood protection dike in the downstream of the project area has been constructed to protect the urban and industrial complex areas, peak-cut by the Mol dam would be a favorable effect for flood protection in the project area and the downstream area.

J.4.7 The Use of Fertilizer and Agro-chemicals

The project will increase crop production with the introduction of somewhat intensive farming technology. The dosage of fertilizer and agro-cheminals will considerably increased. The trade of fertilizer and agro-chemicals will be stimulated in this regards. Since the use of fertilizer and agro-chemicals is not common practice in the area, this practice will be extended through the guidance of extension worker. As for the use of agro-chemicals, such toxic commodities as Methyl Parathion, Benzene Hexa Chloride (BHC), DTT, Dieldrin, etc. are still in commonly use in Pakistan. Such chemicals should be replaced with low toxic ones, especially in the project area, and the frequency of the use of fertilizer should be kept minimum, since people depend their drinking water on groundwater which tends to be easily contaminated with those chemicals.

J.4.8 Demonstration Effect of Pilot Farm

A pilot demonstration farm proposed as a part of the project will play an important role on extension of modern or intensive farming technology to the farmers. The farmers will be encouraged to follow a new technology when they prove to see crop production increase with the use of such technology. New species or cultivar may also be introduced to the project area

TABLES

Table J.2.1 ESTIMATION OF STANDARD CONVERSION FACTOR (SCF) FOR PAKISTAN

Unit: Rs.10^6

ITEM	1982-83	1983-84	1984-85	1985-86	1986-87	5 YEARS AVERAGE
(1) Total Import Value (CIF)	68,151	76,707	89,778	90,946	92,431	83,603
(2) Total Import Duties	18,110	21,074	22,882	24,334	28,519	22,984
(3) Total Export Value (FOB)	34,442	37,339	37,978	49,592	63,355	44,541
(4) Total Export Duties	400	458	489	990	275	522
(5) Export Subsidy	1,380	1,694	nil.	1,834	nil.	1,636
(6) = (1)+(3)	102,593	114,046	127,756	140,538	155,786	128,144
(7) = (1)+(2)+(3)-(4)+(5)	121,683	136,356	150,149	165,716	184,030	151,587
(8) SCF = (6)/(7)	0.84	0.84	0.85	0.85	0.85	0.85

Source: "Economic Survey, 1988-89" Economic Advisor's Wing, Finance Division, Government of Pakistan, Islamabad.

Table J.2.2 ECONOMIC PRICES FOR FERTILIZERS

	Urea	TSP	DAP	KCl
1. Projected 2000 world market price (US$/ton, 1985 constant)	125	141	186	73
2. Convert to 1989 constant dollars (US$/ton)	191	215	284	111
3. International shipping and handling charge (US$/ton)	34	34	36	32
4. CIF price at Karachi port (US$/ton)	224	249	319	144
5. Equivalent in Rs./ton	4,936	5,483	7,023	3,157
6. Domestic transport and handling to wholesale point (Rs./ton x SCF)	-	209	326	203
7. Transport/handling to farmgate (Rs./tons x SCF)	27	27	27	27
8. Farmgate economic price (Rs./ton)	4,963	5,719	7,376	3,387
9. Price per ton of nutrient content	10,789 N (46%)	11,914 P2O5 (48%)		5,645 K2O (60%)

Table J.2.3 ECONOMIC PRICES OF FARM INPUTS

Items	Economic Prices (Price at 1989)		Economic Prices (Price at 1989)
FARM INPUT		FARM PRODUCTS	
A. Seeds			
Maize	3 Rs/kg	Maize	0.32 Rs/kg
Lucern	3 Rs/kg	Lucern	0.42 Rs/kg
Tomato	625 Rs/kg	Tomato	3.46 Rs/kg
Eggplant	100 Rs/kg	Eggplant	2.45 Rs/kg
Chilli	200 Rs/kg	Chilli	7.66 Rs/kg
Sponge Gourd	200 Rs/kg	Sponge Gourd	3.31 Rs/kg
Bottle Gourd	200 Rs/kg	Bottle Gourd	2.88 Rs/kg
Cauliflower	300 Rs/kg	Cauliflower	3.06 Rs/kg
Spinach	70 Rs/kg	Spinach	1.73 Rs/kg
Carrot	120 Rs/kg	Carrot	1.56 Rs/kg
Radish	120 Rs/kg	Radish	1.95 Rs/kg
Turnip	400 Rs/kg	Turnip	2.22 Rs/kg
Peas	25 Rs/kg	Peas	3.68 Rs/kg
Guava	12 Rs/seedling	Guava	3.54 Rs/kg
Mango	20 Rs/seedling	Mango	4.01 Rs/kg
Chikoo	20 Rs/seedling	Chikoo	3.5 Rs/kg
Coconut	40 Rs/seedling	Coconut	5.5 Rs/kg
Papaya	3 Rs/seedling	Papaya	2.09 Rs/kg
B. Fertilizer			
Urea	5.0 Rs/kg		
D.A.P.	7.4 Rs/kg		
FYM	60 Rs/ton		
C. Agro-chemicals			
Insecticides	170 Rs/litre		
Fungucides	213 Rs/litre		
D. MAchinery Cost (Tractor)			
Plowing/ harrowing	60 Rs/hour		
Levelling/ ridging	60 Rs/hour		
E. Well O/M Cost			
Electric cost	0.14 Rs/m3		
F. Labour Cost	35 Rs/man-day		

Table J.2.4 STRUCTURE OF FINANCIAL AND ECONOMIC COST

Unit: %

Cost Component	Financial Cost				Economic Cost				Weighted Conversion Factor
	Local Cost			Foreign Cost	Local Cost			Foreign Cost	
	Transfer Payment	Un-skilled labour	Others		Transfer Payment	Un-skilled labour	Others		
A. *Capital Cost*									
1. Preparatory Works	0	4	14	82	0	3	12	82	97
2. Mol Dam	0	4	13	83	0	3	11	83	97
3. Causeway	0	14	47	39	0	10	40	39	89
4. Pilot Demonstration Farm	0	5	17	78	0	4	14	78	96
5. Project Office	0	17	54	30	0	12	45	30	87
6. O&M Equipment	0	0	0	100	0	0	0	100	100
7. Physical Contingency	0	4	14	82	0	3	12	82	97
8. Administration Cost	0	24	76	0	0	16	65	0	81
9. Engineering Servoces	0	5	17	78	0	4	14	78	96
B. O&M Cost									
1. Administration Staff	0	0	100	0	0	0	85	0	85
2. Operation Cost of O&M Equipment	0	0	100	0	0	0	85	0	85
3. Office Operation Cost	0	0	100	0	0	0	85	0	85

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (1/11)

- Tomato -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	3,300	3.46	11,418 (c)	kg	7,000	3.46	24,220 (c)
Farm Inputs								
1) Seeds	kg	1.5	625	938	kg	1.5	625	938
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg	125	7.4	925	kg	125	7.4	925
- Farmyard Manure	ton	5	60	300	ton	10	60	600
3) Insecticides	lit	1	170	170	lit	2	170	340
4) Fungicides	lit		213		lit	1	213	213
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	5	60	300	hour	5	60	300
- Levelling/ ridging		5	60	300		5	60	300
2) Well operation	month	4		1,262	month	4		1,262
Labour Requirement								
1) Land preparation	man-day	10.0	35	350	man-day	10.0	35	350
2) Nursery work		3.5	35	123		5.5	35	193
3) Transplanting		10.0	35	350		10.0	35	350
4) Fertilizer application		2.0	35	70		5.0	35	175
5) Insecticide application		1.5	35	53		4.0	35	140
6) Fungicide application						2.0	35	70
7) Weeding		15.0	35	525		15.0	35	525
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		15.0	35	525		20.0	35	700
10) Packing, others		10.0	35	350		15.0	35	525
	(sub-total)	(72.0)			(sub-total)	(91.5)		
Miscellaneous								
(5 % of above production cost)		5%		354		5%		435
Total Production Cost				7,444 (d)				9,140 (d)
Net Return per Ha (c - d)				3,974				15,080

- Eggplant -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	4,900	2.45	12,005 (c)	kg	9,000	2.45	22,050 (c)
Farm Inputs								
1) Seeds	kg	1.5	100	150	kg	1.5	100	150
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg				kg	125	7.4	925
- Farmyard Manure	ton	7.5	60	450	ton	15	60	900
3) Insecticides	lit	1	170	170	lit	2	170	340
4) Fungicides	lit		213		lit	1	213	213
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	5	60	298	hour	5	60	300
- Levelling/ ridging		5	60	298		5	60	300
2) Well operation	month	4		1,262	month	4		1,262
Labour Requirement								
1) Land preparation	man-day	10.0	35	350	man-day	10.0	35	350
2) Nursery work		5.5	35	193		5.5	35	193
3) Transplanting		10.0	35	350		10.0	35	350
4) Fertilizer application		3.5	35	123		7.0	35	245
5) Insecticide application		1.5	35	53		4.0	35	140
6) Fungicide application						2.0	35	70
7) Weeding		15.0	35	525		15.0	35	525
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		15.0	35	525		20.0	35	700
10) Packing, others		10.0	35	350		15.0	35	525
	(sub-total)	(75.5)			(sub-total)	(93.5)		
Miscellaneous								
(5 % of above production cost)		5%		282		5%		414
Total Production Cost				5,927 (d)				8,702 (d)
Net Return per Ha (c - d)				6,078				13,348

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (2/11)

- Chilli -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	1,000	7.66	7,660 (c)	kg	2,500	7.66	19,150 (c)
Farm Inputs								
1) Seeds	kg	2.5	200	500	kg	2.5	200	500
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	75	5.0	375
- D.A.P.	kg		7.4		kg	125	7.4	925
- Farmyard Manure	ton	5	60	300	ton	10	60	600
3) Insecticides	lit		170		lit	2	170	340
4) Fungicides	lit		213		lit	1	213	213
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	4	60	238	hour	5	60	298
- Levelling/ ridging		2	60	119		5	60	298
2) Well operation	month	4		1,262	month	4		1,262
Labour Requirement								
1) Land preparation	man-day	10.0	35	350	man-day	10.0	35	350
2) Nursery work		5.5	35	193		5.5	35	193
3) Transplanting		10.0	35	350		10.0	35	350
4) Fertilizer application		2.5	35	88		5.0	35	175
5) Insecticide application						4.0	35	140
6) Fungicide application						2.0	35	70
7) Weeding		10.0	35	350		10.0	35	350
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		20.0	35	700		25.0	35	875
10) Packing, others		5.0	35	175		10.0	35	350
	(sub-total)	(68.0)			(sub-total)	(86.5)		
Miscellaneous								
(5 % of above production cost)		5%		259		5%		392
Total Production Cost				5,433 (d)				8,229 (d)
Net Return per Ha (c - d)				2,227				10,921

- Turnip -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	6,600	2.22	14,652 (c)	kg	15,000	2.22	33,300 (c)
Farm Inputs								
1) Seeds	kg	2.5	400	1,000	kg	2.5	400	1,000
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg		7.4		kg	125	7.4	925
- Farmyard Manure	ton	3	60	180	ton	10	60	600
3) Insecticides	lit	0.5	170	85	lit	2	170	340
4) Fungicides	lit		213		lit	1	213	213
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	5	60	298	hour	5	60	298
- Levelling/ ridging		5	60	298		5	60	298
2) Well operation	month	3		1,262	month	3		1,262
Labour Requirement								
1) Land preparation	man-day	15.0	35	525	man-day	15.0	35	525
2) Nursery work			35				35	
3) Sowing		5.0	35	175		5.0	35	175
4) Fertilizer application		3.5	35	123		5.0	35	175
5) Insecticide application		1.5	35	53		4.0	35	140
6) Fungicide application						2.0	35	70
7) Weeding		10.0	35	350		10.0	35	350
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		15.0	35	525		20.0	35	700
10) Packing, others		10.0	35	350		15.0	35	525
	(sub-total)	(65.0)			(sub-total)	(81.0)		
Miscellaneous								
(5 % of above production cost)		5%		289		5%		420
Total Production Cost				6,061 (d)				8,814 (d)
Net Return per Ha (c - d)				8,591				24,486

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (3/11)

- Sponge Gourd -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	3,100	3.31	10,261 (c)	kg	11,000	3.31	36,410 (c)
Farm Inputs								
1) Seeds	kg	5.0	200	1,000	kg	5.0	200	1,000
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg	75	7.4	555	kg	125	7.4	925
- Farmyard Manure	ton	3	60	180	ton	5	60	300
3) Insecticides	lit	1	170	170	lit	2	170	340
4) Fungicides	lit		213		lit		213	
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	4	60	240	hour	4	60	240
- Levelling/ ridging		2	60	120		4	60	240
2) Well operation	month	3		1,183	month	3		1,183
Labour Requirement								
1) Land preparation	man-day	10.0	35	350	man-day	10.0	35	350
2) Nursery work			35				35	
3) Sowing		2.5	35	88		2.5	35	88
4) Fertilizer application		2.0	35	70		5.0	35	175
5) Insecticide application		2.0	35	70		4.0	35	140
6) Fungicide application								
7) Weeding		5.0	35	175		5.0	35	175
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		10.0	35	350		15.0	35	525
10) Packing, others		5.0	35	175		7.5	35	263
	(sub-total)	(41.5)			(sub-total)	(54.0)		
Miscellaneous								
(5 % of above production cost)		5%		264		5%		337
Total Production Cost				5,539 (d)				7,080 (d)
Net Return per Ha (c - d)				4,722				29,330

- Bottle Gourd -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	4,700	2.88	13,536 (c)	kg	8,000	2.88	23,040 (c)
Farm Inputs								
1) Seeds	kg	7.0	200	1,400	kg	7.0	200	1,400
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg	75	7.4	555	kg	125	7.4	925
- Farmyard Manure	ton	2	60	120	ton	5	60	300
3) Insecticides	lit	1.0	170	170	lit	2	170	340
4) Fungicides	lit		213		lit		213	
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	4	60	240	hour	4	60	240
- Levelling/ ridging		4	60	240		4	60	240
2) Well operation	month	3		1,183	month	3		1,183
Labour Requirement								
1) Land preparation	man-day	10.0	35	350	man-day	10.0	35	350
2) Nursery work			35				35	
3) Sowing		2.5	35	88		2.5	35	88
4) Fertilizer application		3.5	35	123		5.0	35	175
5) Insecticide application		2.0	35	70		4.0	35	140
6) Fungicide application								
7) Weeding		5.0	35	175		5.0	35	175
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		10.0	35	350		15.0	35	525
10) Packing, others		5.0	35	175		7.5	35	263
	(sub-total)	(43.0)			(sub-total)	(54.0)		
Miscellaneous								
(5 % of above production cost)		5%		289		5%		357
Total Production Cost				6,078 (d)				7,500 (d)
Net Return per Ha (c - d)				7,458				15,540

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (4/11)

- Cauliflower -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	13,300	3.06	40,698 (c)	kg	16,000	3.06	48,960 (c)
Farm Inputs								
1) Seeds	kg	1.5	300	450	kg	1.5	300	450
2) Fertilizers								
- Urea	kg	125	5.0	625	kg	150	5.0	750
- D.A.P.	kg	125	7.4	925	kg	125	7.4	925
- Farmyard Manure	ton	7.5	60	450	ton	15	60	900
3) Insecticides	lit	2	170	340	lit	2	170	340
4) Fungicides	lit		213		lit	1	213	213
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	5	60	300	hour	5	60	300
- Levelling/ ridging		2	60	120		2	60	120
2) Well operation	month	3		1,262	month	3		1,262
Labour Requirement								
1) Land preparation	man-day	10.0	35	350	man-day	10.0	35	350
2) Nursery work		5.5	35	193		5.5	35	193
3) Transplanting		10.0	35	350		10.0	35	350
4) Fertilizer application		3.5	35	123		7.0	35	245
5) Insecticide application		2.0	35	70		4.0	35	140
6) Fungicide application						2.0	35	70
7) Weeding		15.0	35	525		15.0	35	525
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		8.0	35	280		15.0	35	525
10) Packing, others		5.0	35	175		10.0	35	350
	(sub-total)	(64.0)			(sub-total)	(83.5)		
Miscellaneous								
(5 % of above production cost)		5%		336		5%		409
Total Production Cost				7,048 (d)				8,592 (d)
Net Return per Ha (c - d)				33,650				40,368

- Spinach -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	2,600	1.73	4,498 (c)	kg	6,000	1.73	10,380 (c)
Farm Inputs								
1) Seeds	kg	12.5	70	875	kg	12.5	70	875
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg		7.4		kg	125	7.4	925
- Farmyard Manure	ton	3	60	180	ton	10	60	600
3) Insecticides	lit	1	170	170	lit	1	170	170
4) Fungicides	lit		213		lit		213	
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	4	60	240	hour	4	60	240
- Levelling/ ridging		2	60	120		2	60	120
2) Well operation	month	3		828	month	3		828
Labour Requirement								
1) Land preparation	man-day	4.0	35	140	man-day	5.0	35	175
2) Nursery work			35				35	
3) Sowing		2.0	35	70		2.0	35	70
4) Fertilizer application		3.0	35	105		5.0	35	175
5) Insecticide application		1.5	35	53		2.0	35	70
6) Fungicide application							35	
7) Weeding		7.5	35	263		10.0	35	350
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		8.0	35	280		12.5	35	438
10) Packing, others		4.0	35	140		7.5	35	263
	(sub-total)	(35.0)			(sub-total)	(49.0)		
Miscellaneous								
(5 % of above production cost)		5%		201		5%		305
Total Production Cost				4,214 (d)				6,403 (d)
Net Return per Ha (c - d)				284				3,977

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (5/11)

- Carrot -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	5,400	1.56	8,424 (c)	kg	11,000	1.56	17,160 (c)
Farm Inputs								
1) Seeds	kg	4.5	120	540	kg	4.5	120	540
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg		7.4		kg	125	7.4	925
- Farmyard Manure	ton	3	60	180	ton	15	60	900
3) Insecticides	lit	0.5	170	85	lit	2	170	340
4) Fungicides	lit		213		lit	1	213	213
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	5	60	298	hour	5	60	298
- Levelling/ ridging		5	60	298		5	60	298
2) Well operation	month	3		1,183	month	3		1,183
Labour Requirement								
1) Land preparation	man-day	15.0	35	525	man-day	15.0	35	525
2) Nursery work			35				35	
3) Sowing		5.0	35	175		5.0	35	175
4) Fertilizer application		2.5	35	88		5.0	35	175
5) Insecticide application		1.5	35	53		4.0	35	140
6) Fungicide application			35			2.0	35	70
7) Weeding		10.0	35	350		10.0	35	350
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		15.0	35	525		20.0	35	700
10) Packing, others		10.0	35	350		15.0	35	525
	(sub-total)	(64.0)			(sub-total)	(81.0)		
Miscellaneous								
(5 % of above production cost)		5%		260		5%		408
Total Production Cost				5,458 (d)				8,563 (d)
Net Return per Ha (c - d)				2,966				8,597

- Radish -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	4,000	1.95	7,800 (c)	kg	13,000	1.95	25,350 (c)
Farm Inputs								
1) Seeds	kg	7.5	120	900	kg	7.5	120	900
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg		7.4		kg	125	7.4	925
- Farmyard Manure	ton	3	60	180	ton	10	60	600
3) Insecticides	lit	0.5	170	85	lit	2	170	340
4) Fungicides	lit		213		lit	1	213	213
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	5	60	298	hour	5	60	298
- Levelling/ ridging		5	60	298		5	60	298
2) Well operation	month	3		1,183	month	3		1,183
Labour Requirement								
1) Land preparation	man-day	15.0	35	525	man-day	15.0	35	525
2) Nursery work			35				35	
3) Sowing		5.0	35	175		5.0	35	175
4) Fertilizer application		2.5	35	88		5.0	35	175
5) Insecticide application		1.5	35	53		4.0	35	140
6) Fungicide application			35			2.0	35	70
7) Weeding		10.0	35	350		10.0	35	350
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		15.0	35	525		20.0	35	700
10) Packing, others		10.0	35	350		15.0	35	525
	(sub-total)	(64.0)			(sub-total)	(81.0)		
Miscellaneous								
(5 % of above production cost)		5%		278		5%		411
Total Production Cost				5,836 (d)				8,626 (d)
Net Return per Ha (c - d)				1,964				16,724

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (6/11)

- Peas -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)		Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	
Unit Yield	kg	2,600	3.68	9,568	(c)	kg	5,000	3.68	18,400	(c)
Farm Inputs										
1) Seeds	kg	30	25	750		kg	30	25	750	
2) Fertilizers										
- Urea	kg		5.0			kg	75	5.0	375	
- D.A.P.	kg		7.4			kg	125	7.4	925	
- Farmyard Manure	ton	5	60	300		ton	5	60	300	
3) Insecticides	lit		170			lit	1	170	170	
4) Fungicides	lit		213			lit		213		
Machinery Requirement										
1) Tractor										
- Plowing/ harrowing	hour	5	60	298		hour	5	60	298	
- Levelling/ ridging		5	60	298			5	60	298	
2) Well operation	month	3		1,439		month	3		1,439	
Labour Requirement										
1) Land preparation	man-day	10.0	35	350		man-day	10.0	35	350	
2) Nursery work			35					35		
3) Sowing		3.0	35	105			3.0	35	105	
4) Fertilizer application		2.0	35	70			5.0	35	175	
5) Insecticide application			35				2.0	35	70	
6) Fungicide application			35					35		
7) Weeding		10.0	35	350			10.0	35	350	
8) Water management		5.0	35	175			5.0	35	175	
9) Harvesting		20.0	35	700			25.0	35	875	
10) Packing, others		10.0	35	350			15.0	35	525	
	(sub-total)	(60.0)				(sub-total)	(75.0)			
Miscellaneous										
(5 % of above production cost)		5%		259			5%		359	
Total Production Cost				5,444	(d)				7,538	(d)
Net Return per Ha (c - d)				4,124					10,862	

- Papaya -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)		6 years	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)		6 years
Unit Yield	kg	7,300	2.09	15,257	(c)	64,842	kg	8,500	2.09	17,765	(c)	75,501
Farm Inputs												
1) Seeds	Seedling	1,100	3	3,300		3,300	Seedling	1,100	3	3,300		3,300
2) Fertilizers												
- Urea	kg	75	5.0	375		2,250	kg	125	5.0	625		3,750
- D.A.P.	kg		7.4				kg		7.4			
- Farmyard Manure	ton	5	60	300		300	ton	10	60	600		600
3) Insecticides	lit	1	170	170		1,020	lit	2	170	340		2,040
4) Fungicides	lit		213				lit	1	213	213		
Machinery Requirement												
1) Tractor												
- Plowing/ harrowing	hour	5	60	298		298	hour	5	60	298		298
- Levelling/ ridging		5	60	298		298		5	60	298		298
2) Well operation	month	12		3,648		21,887	month	12		3,648		21,887
Labour Requirement												
1) Land preparation	man-day	2.0	35	70		70	man-day	2.0	35	70		70
2) Digging (1,100 pits)		10.0	35	350		350		10.0	35	350		350
3) Planting		10.0	35	350		350		10.0	35	350		350
4) Fertilizer application		4.0	35	140		490		5.0	35	175		525
5) Insecticide application		2.0	35	70		420		4.0	35	140		840
6) Fungicide application			35					2.0	35	70		420
7) Weeding		10.0	35	350		2,100		10.0	35	350		2,100
8) Water management		10.0	35	350		2,100		10.0	35	350		2,100
9) Harvesting		10.0	35	350		1,488		15.0	35	525		2,231
10) Packing, others		5.0	35	175		744		7.5	35	263		1,116
	(sub-total)	(63.0)				(193)	(sub-total)	(75.5)				(193)
Miscellaneous												
(5 % of above production cost)		5%		530		1,873		5%		598		2,114
Total Production Cost				11,123	(d)	39,337				12,561	(d)	44,388
Net Return per Ha (c - d)				4,134		25,505				5,204		31,113
						(4,251)						(5,186)

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (7/11)

- Lucerne -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	13,900	0.42	5,838 (c)	kg	26,000	0.42	10,920 (c)
Farm Inputs								
1) Seeds	kg	25.0	3	75	kg	25.0	3	75
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg		7.4		kg		7.4	
- Farmyard Manure	ton	3	60	180	ton	5	60	300
3) Insecticides	lit		170		lit	1	170	170
4) Fungicides	lit		213		lit		213	
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	4	60	238	hour	4	60	238
- Levelling/ ridging		2.5	60	149		2.5	60	149
2) Well operation	month	10		2,208	month	10		2,208
Labour Requirement								
1) Land preparation	man-day	2.5	35	88	man-day	2.5	35	88
2) Nursery work			35				35	
3) Sowing		2.5	35	88		2.5	35	88
4) Fertilizer application		1.0	35	35		5.0	35	175
5) Insecticide application			35			2.0	35	70
6) Fungicide application			35				35	
7) Weeding			35			3.0	35	105
8) Water management		5.0	35	175		5.0	35	175
9) Harvesting		15.0	35	525		25.0	35	875
10) Packing, others		5.0	35	175		10.0	35	350
	(sub-total)	(31.0)			(sub-total)	(55.0)		
Miscellaneous								
(5 % of above production cost)		5%		216		5%		285
Total Production Cost				4,526 (d)				5,975 (d)
Net Return per Ha (c - d)				1,312				4,945

- Maize -

Items	Unit	Without Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)	Unit	With Project Quantity (a)	Unit Price (b) (Rs)	Amount (a x b) (Rs)
Unit Yield	kg	10,600	0.32	3,392 (c)	kg	18,000	0.32	5,760 (c)
Farm Inputs								
1) Seeds	kg	80.0	3	240	kg	80.0	3	240
2) Fertilizers								
- Urea	kg	75	5.0	375	kg	125	5.0	625
- D.A.P.	kg		7.4		kg		7.4	
- Farmyard Manure	ton		60		ton	5	60	300
3) Insecticides	lit		170		lit		170	
4) Fungicides	lit		213		lit		213	
Machinery Requirement								
1) Tractor								
- Plowing/ harrowing	hour	4	60	238	hour	4	60	238
- Levelling/ ridging		2	60	119		2	60	119
2) Well operation	month	2		1,065	month	2		1,065
Labour Requirement								
1) Land preparation	man-day		35		man-day	2.5	35	88
2) Nursery work			35				35	
3) Sowing		2.5	35	88		2.5	35	88
4) Fertilizer application		1.0	35	35		3.0	35	105
5) Insecticide application			35				35	
6) Fungicide application			35				35	
7) Weeding			35			3.0	35	105
8) Water management		2.5	35	88		2.5	35	88
9) Harvesting		10.0	35	350		12.5	35	438
10) Packing, others		4.0	35	140		5.0	35	175
	(sub-total)	(20.0)			(sub-total)	(31.0)		
Miscellaneous								
(5 % of above production cost)		5%		137		5%		184
Total Production Cost				2,874 (d)				3,855 (d)
Net Return per Ha (c - d)				518				1,905

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (8/11)

- Mango - Without Project

Items	Unit	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total (a)	Unit Prices (b)	Amount (a x b) (Rs)	20 years
Unit Yield	kg	0	0	0	0	1,020	2,040	3,060	4,080	6,100	6,100	22,400	4.01	89,824 (c)	334,434
Farm Inputs															
1) Seeds	seedling	85										85	20	1,700	1,700
2) Fertilizers															
- Urea	kg			50	50	125	125	125	250	250	250	1,225	5	6,125	18,625
- Farmyard Manure	ton	6				6					6	18	60	1,080	1,440
3) Agro-chemicals	lit	1	1	1	1	2	2	2	3	3	3	19	170	3,230	8,330
Machinery Requirement															
1) Tractor															
- Plowing	hour	5										5	60	298	298
- Levelling	hour	4										4	60	238	238
2) Well operation	month	12	12	12	12	12	12	12	12	12	12	120	3,648	36,479	72,958
Labour Requirement															
1) Land preparation	man-day	10										10	35	350	350
2) Digging (85 pits)	man-day	20										20	35	700	700
3) Planting	man-day	10										10	35	350	350
4) Fertilizer application	man-day	5		1	1	5	2	2	4	4	5	29	35	1,015	2,485
5) Spraying	man-day	1	1	1	1	2	2	2	3	3	3	19	35	665	1,715
6) Weeding	man-day	6	6	6	6	6	6	6	6	6	6	60	35	2,100	4,200
7) Water management	man-day	5	5	5	5	10	10	10	10	10	10	80	35	2,800	6,300
8) Harvesting	man-day					5	5	8	8	10	10	46	35	1,610	5,110
9) Packing/ loading	man-day					3	3	4	4	5	5	24	35	840	2,590
(sub-total)		(57)	(12)	(13)	(13)	(31)	(28)	(32)	(35)	(38)	(39)	(298)			(680)
Miscellaneous															
(5 % of above production cost)		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%			2,979	6,369
Total Production Cost		8,829	4,450	4,749	4,749	6,361	5,873	6,020	6,965	7,075	7,490			62,558 (d)	133,758
Net Return per Ha (c - d)		-8,829	-4,450	-4,749	-4,749	-2,271	2,308	6,251	9,396	17,386	16,971			27,266	200,676 (10,034)

- Mango - With Project

Items	Unit	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total (a)	Unit Prices (b)	Amount (a x b) (Rs)	20 years
Unit Yield	kg	0	0	0	0	1,800	3,600	5,400	7,200	9,000	9,000	36,000	4.01	144,360 (c)	505,260
Farm Inputs															
1) Seeds	seedling	85										85	20	1,700	1,700
2) Fertilizers															
- Urea	kg	125		125	125	250	250	250	250	250	250	1,875	5	9,375	21,875
- Farmyard Manure	ton	10				10					10	30	60	1,800	1,440
3) Agro-chemicals	lit	2	2	2	2	4	4	4	5	5	5	35	170	5,950	14,450
Machinery Requirement															
1) Tractor															
- Plowing	hour	5										5	60	298	298
- Levelling	hour	4										4	60	238	238
2) Well operation	month	12	12	12	12	12	12	12	12	12	12	120	3,648	36,479	72,958
Labour Requirement															
1) Land preparation	man-day	10										10	35	350	350
2) Digging (85 pits)	man-day	20										20	35	700	700
3) Planting	man-day	10										10	35	350	350
4) Fertilizer application	man-day	7.5		1	1	7.5	2	2	2	2	10	35	35	1,225	2,695
5) Spraying	man-day	2	2	2	2	4	4	4	5	5	5	35	35	1,225	2,975
6) Weeding	man-day	6	6	6	6	6	6	6	6	6	6	60	35	2,100	4,200
7) Water management	man-day	5	5	5	5	10	10	10	10	10	10	80	35	2,800	6,300
8) Harvesting	man-day					7.5	7.5	10	10	15	15	65	35	2,275	7,525
9) Packing/ loading	man-day					5	5	7.5	7.5	10	10	45	35	1,575	5,075
(sub-total)		(61)	(13)	(14)	(14)	(40)	(35)	(40)	(41)	(48)	(56)	(360)			(856)
Miscellaneous															
(5 % of above production cost)		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%			3,422	7,156
Total Production Cost		10,044	4,665	5,358	5,358	7,957	7,125	7,308	7,524	7,799	8,723			71,861 (d)	150,285
Net Return per Ha (c - d)		-10,044	-4,665	-5,358	-5,358	-739	7,311	14,346	21,348	28,291	27,367			72,499	354,975 (17,749)

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (9/11)

- Guava - Without Project

Items	Unit	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total (a)	Unit Prices (b)	Amount (a x b) (Rs)	20 years
Unit Yield	kg	0	0	760	1,520	2,280	3,040	3,800	3,800	3,800	3,800	22,800	3.54	80,712 (c)	215,232
Farm Inputs															
1) Seeds	seedling	85										85	12	1,020	1,020
2) Fertilizers															
- Urea	kg			50	50	125	125	125	125	125	125	850	5	4,250	10,500
- Farmyard Manure	ton	6				6					6	18	60	1,080	1,440
3) Agro-chemicals	lit	2	2	2	2	3	3	3	3	3	3	26	170	4,420	9,520
Machinery Requirement															
1) Tractor															
- Plowing	hour	5										5	60	298	298
- Levelling	hour	4										4	60	238	238
2) Well operation	month	12	12	12	12	12	12	12	12	12	12	120	3,648	36,479	72,958
Labour Requirement															
1) Land preparation	man-day	10										10	35	350	350
2) Digging (85 pits)	man-day	20										20	35	700	700
3) Planting	man-day	10										10	35	350	350
4) Fertilizer application	man-day	5		1	1	5	2	2	2	2	5	25	35	875	1,785
5) Spraying	man-day	2	2	2	2	3	3	3	3	3	3	26	35	910	1,960
6) Weeding	man-day	6	6	6	6	6	6	6	6	6	6	60	35	2,100	4,200
7) Water management	man-day	5	5	5	5	10	10	10	10	10	10	80	35	2,800	6,300
8) Harvesting	man-day			5	5	10	10	15	20	20	20	105	35	3,675	10,675
9) *Packing/ loading*	*man-day*			2	2	3	3	4	4	5	5	*28*	35	*980*	*2,730*
(sub-total)		(58)	(13)	(21)	(21)	(37)	(34)	(40)	(45)	(46)	(49)	(364)			(830)
Miscellaneous															
(5 % of above production cost)		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%			3,026	6,251
Total Production Cost		8,330	4,665	5,222	5,222	6,760	6,272	6,492	6,676	6,713	7,201			63,551 (d)	131,274
Net Return per Ha (c - d)		-8,330	-4,665	-2,531	159	1,311	4,490	6,960	6,776	6,739	6,251			17,161	83,958 (4,198)

- Guava - With Project

Items	Unit	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total (a)	Unit Prices (b)	Amount (a x b) (Rs)	20 years
Unit Yield	kg	0	0	1,400	2,800	4,200	5,600	7,000	7,000	7,000	7,000	42,000	3.54	148,680 (c)	396,480
Farm Inputs															
1) Seeds	seedling	85										85	12	1,020	1,020
2) Fertilizers															
- Urea	kg	125		125	125	250	250	250	250	250	250	1,875	5	9,375	21,875
- Farmyard Manure	ton	10				10					10	30	60	1,800	1,440
3) Agro-chemicals	lit	2	2	2	2	4	4	4	4	4	4	32	170	5,440	12,240
Machinery Requirement															
1) Tractor															
- Plowing	hour	5										5	60	298	298
- Levelling	hour	4										4	60	238	238
2) Well operation	month	12	12	12	12	12	12	12	12	12	12	120	3,648	36,479	72,958
Labour Requirement															
1) Land preparation	man-day	10										10	35	350	350
2) Digging (85 pits)	man-day	20										20	35	700	700
3) Planting	man-day	10										10	35	350	350
4) Fertilizer application	man-day	7.5		1	1	7.5	2	2	2	2	10	35	35	1,225	2,135
5) Spraying	man-day	2	2	2	2	4	4	4	4	4	4	32	35	1,120	2,520
6) Weeding	man-day	6	6	6	6	6	6	6	6	6	6	60	35	2,100	4,200
7) Water management	man-day	5	5	5	5	10	10	10	10	10	10	80	35	2,800	6,300
8) Harvesting	man-day			5	10	20	20	20	25	25	25	150	35	5,250	14,000
9) Packing/ loading	man-day			2	4	5	5	7.5	7.5	10	10	51	35	1,785	5,285
(sub-total)		(61)	(13)	(21)	(28)	(53)	(47)	(50)	(55)	(57)	(65)	(448)			(1,034)
Miscellaneous															
(5 % of above production cost)		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%			3,516	7,295
Total Production Cost		9,330	4,665	5,615	5,873	8,416	7,584	7,676	7,860	7,952	8,876			73,846 (d)	153,204
Net Return per Ha (c - d)		-9,330	-4,665	-659	4,039	6,452	12,240	17,104	16,920	16,828	15,904			74,834	243,276 (12,164)

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (10/11)

- Chikoo - Without Project

Items	Unit	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total (a)	Unit Prices (b)	Amount (a x b) (Rs)	30 years
Unit Yield	kg	0	0	460	920	1,380	1,840	2,300	2,300	2,300	2,300	13,800	3.50	48,300 (c)	209,300
Farm Inputs															
1) Seeds	seedling	85										85	20	1,700	1,700
2) Fertilizers															
- Urea	kg			50	50	50	50	125	125	125	125	700	5	3,500	16,000
- Farmyard Manure	ton	5				5					5	15	60	900	1,800
3) Agro-chemicals	lit														0
Machinery Requirement															
1) Tractor															
- Plowing	hour	5										5	60	298	298
- Levelling	hour	4										4	60	238	238
2) Well operation	month	12	12	12	12	12	12	12	12	12	12	120	3,648	36,479	109,437
Labour Requirement															
1) Land preparation	man-day	10										10	35	350	350
2) Digging (85 pits)	man-day	20										20	35	700	700
3) Planting	man-day	10										10	35	350	350
4) Fertilizer application	man-day	5		1	1	5	1	2	2	2	5	24	35	840	2,660
5) Spraying	man-day												35		0
6) Weeding	man-day	6	6	6	6	6	6	6	6	6	6	60	35	2,100	6,300
7) Water management	man-day	5	5	5	5	10	10	10	10	10	10	80	35	2,800	9,800
8) Harvesting	man-day			2	2	3	3	5	5	10	10	40	35	1,400	8,400
9) Packing/ loading	man-day			1	1	2	2	2	2	4	4	18	35	630	3,430
(sub-total)		(56)	(11)	(15)	(15)	(26)	(22)	(25)	(25)	(32)	(35)	(262)			(914)
Miscellaneous															
(5 % of above production cost)		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%			2,614	8,073
Total Production Cost		8,551	4,235	4,644	4,644	5,363	4,901	5,405	5,405	5,663	6,088			54,899 (d)	169,535
Net Return per Ha (c - d)		-8,551	-4,235	-3,034	-1,424	-533	1,539	2,645	2,645	2,387	1,962			-6,599	39,765 (1,325)

- Chikoo - With Project

Items	Unit	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total (a)	Unit Prices (b)	Amount (a x b) (Rs)	30 years
Unit Yield	kg	0	0	600	1,200	1,800	2,400	3,000	3,000	3,000	3,000	18,000	3.50	63,000 (c)	273,000
Farm Inputs															
1) Seeds	seedling	85										85	20	1,700	1,700
2) Fertilizers															
- Urea	kg	50		125	125	250	250	250	250	250	250	1,800	5	9,000	34,000
- Farmyard Manure	ton	10				10					10	30	60	1,800	1,800
3) Agro-chemicals	lit	1	1	2	2	3	3	3	3	3	3	24	170	4,080	14,280
Machinery Requirement															
1) Tractor															
- Plowing	hour	5										5	60	298	298
- Levelling	hour	4										4	60	238	238
2) Well operation	month	12	12	12	12	12	12	12	12	12	12	120	3,648	36,479	109,437
Labour Requirement															
1) Land preparation	man-day	10										10	35	350	350
2) Digging (85 pits)	man-day	20										20	35	700	700
3) Planting	man-day	10										10	35	350	350
4) Fertilizer application	man-day	7.5		1	1	7.5	2	2	2	2	10	35	35	1,225	3,045
5) Spraying	man-day	1	1	2	2	3	3	3	3	3	3	24	35	840	2,940
6) Weeding	man-day	6	6	6	6	6	6	6	6	6	6	60	35	2,100	6,300
7) Water management	man-day	5	5	5	5	10	10	10	10	10	10	80	35	2,800	9,800
8) Harvesting	man-day			4	4	6	6	10	10	10	10	60	35	2,100	9,100
9) Packing/ loading	man-day			2	2	4	4	5	5	5	5	32	35	1,120	4,620
(sub-total)		(60)	(12)	(20)	(20)	(37)	(31)	(36)	(36)	(36)	(44)	(331)			(1,083)
Miscellaneous															
(5 % of above production cost)		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%			3,259	9,948
Total Production Cost		9,435	4,450	5,579	5,579	7,650	6,818	7,001	7,001	7,001	7,925			68,438 (d)	208,905
Net Return per Ha (c - d)		-9,435	-4,450	-3,479	-1,379	-1,350	1,582	3,499	3,499	3,499	2,575			-5,438	64,095 (2,137)

Table J.2.5 CROP BUDGETS PER HA WITHOUT AND WITH PROJECT CONDITION (11/11)

- Coconut - Without Project

Items	Unit	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total (a)	Unit Prices (b)	Amount (a x b) (Rs)	50 years
Unit Yield	kg	0	0	0	0	540	1,080	1,620	2,160	2,700	2,700	10,800	5.50	59,400 (c)	653,400
Farm Inputs															
1) Seeds	seedling	170										170	40	6,800	6,800
2) Fertilizers															
- Urea	kg			50	50	125	125	125	125	125	125	850	5	4,250	29,250
- Farmyard Manure	ton	4				4					4	12	60	720	2,400
3) Agro-chemicals	lit														0
Machinery Requirement															
1) Tractor															
- Plowing	hour	5										5	60	298	298
- Levelling	hour	4										4	60	238	238
2) Well operation	month	12	12	12	12	12	12	12	12	12	12	120	3,648	36,479	182,394
Labour Requirement															
1) Land preparation	man-day	20										20	35	700	700
2) Digging (170 pits)	man-day	30										30	35	1,050	1,050
3) Planting	man-day	10										10	35	350	350
4) Fertilizer application	man-day	5		1	1	5	2	2	2	2	5	25	35	875	4,515
5) Spraying	man-day												35		0
6) Weeding	man-day	6	6	6	6	6	6	6	6	6	6	60	35	2,100	10,500
7) Water management	man-day	5	5	5	5	10	10	10	10	10	10	80	35	2,800	16,800
8) Harvesting	man-day					5	5	5	5	10	10	40	35	1,400	15,400
9) Packing/ loading	man-day					1	1	2	2	4	4	14	35	490	6,090
(sub-total)		(76)	(11)	(12)	(12)	(27)	(24)	(25)	(25)	(32)	(35)	(279)			(1,583)
Miscellaneous															
(5 % of above production cost)		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%			2,927	13,839
Total Production Cost		14,578	4,235	4,534	4,534	5,731	5,369	5,405	5,405	5,663	6,025			61,477 (d)	290,624
Net Return per Ha (c - d)		-14,578	-4,235	-4,534	-4,534	-2,761	571	3,505	6,475	9,187	8,825			-2,077	362,776 (7,256)

- Coconut - With Project

Items	Unit	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total (a)	Unit Prices (b)	Amount (a x b) (Rs)	50 years
Unit Yield	kg	0	0	0	0	800	1,600	2,400	3,000	4,000	4,000	15,800	5.50	86,900 (c)	966,900
Farm Inputs															
1) Seeds	seedling	170										170	40	6,800	6,800
2) Fertilizers															
- Urea	kg	50		125	125	250	250	250	250	250	250	1,800	5	9,000	59,000
- Farmyard Manure	ton	10				10					10	30	60	1,800	2,400
3) Agro-chemicals	lit														0
Machinery Requirement															
1) Tractor															
- Plowing	hour	5										5	60	298	298
- Levelling	hour	4										4	60	238	238
2) Well operation	month	12	12	12	12	12	12	12	12	12	12	120	3,648	36,479	182,394
Labour Requirement															
1) Land preparation	man-day	20										20	35	700	700
2) Digging (85 pits)	man-day	30										30	35	1,050	1,050
3) Planting	man-day	10										10	35	350	350
4) Fertilizer application	man-day	7.5		1	1	7.5	2	2	2	2	10	35	35	1,225	4,865
5) Spraying	man-day												35		0
6) Weeding	man-day	6	6	6	6	6	6	6	6	6	6	60	35	2,100	10,500
7) Water management	man-day	5	5	5	5	10	10	10	10	10	10	80	35	2,800	16,800
8) Harvesting	man-day					10	10	10	15	15	15	75	35	2,625	23,625
9) Packing/ loading	man-day					2.5	2.5	5	5	5	5	25	35	875	7,875
(sub-total)		(79)	(11)	(12)	(12)	(36)	(31)	(33)	(38)	(38)	(46)	(335)			(1,639)
Miscellaneous															
(5 % of above production cost)		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%			3,317	15,845
Total Production Cost		15,310	4,235	4,928	4,928	7,096	6,264	6,356	6,539	6,539	7,463			69,656 (d)	332,740
Net Return per Ha (c - d)		-15,310	-4,235	-4,928	-4,928	-2,696	2,536	6,844	9,961	15,461	14,537			17,244	634,160 (12,683)
		-65.914	0	-35.44	-35.44	5.85	176.8	300.6	313.7	564.6	514				

Table J.2.6 GROSS AND NET CROP INCOME WITHOUT PROJECT

Crops	Cropped Area	Gross Crop Income: Unit Yield	Pro-duction	Unit Price	Gross Income	Production Cost: Unit Cost	Total Cost	Net Crop Income: Total Income	per Ha
	(ha)	(t/ha)	(tons)	(Rs/kg)	(Rs 000)	(Rs/ha)	(Rs 000)	(Rs 000)	(Rs/ha)
A. Fodder Crops									
Lucerne	100	13.9	1,390	0.42	583.8	4,526	452.6	131.2	1,312
Maize, others	90	10.6	954	0.32	305.3	2,874	258.7	46.6	518
All Fodder	190	(12.3)	2,344	(0.38)	889.1	(3,743)	711.3	177.8	(936)
B. Vegetables									
Tomato	400	3.3	1,320	3.46	4,567.2	7,444	2,977.6	1,589.6	3,974
Eggplant	140	4.9	686	2.45	1,680.7	5,927	829.8	850.9	6,078
Chilli	20	1.0	20	7.66	153.2	5,433	108.7	44.5	2,227
Sponge Gourd	160	3.1	496	3.31	1,641.8	5,539	886.2	755.5	4,722
Bottle Gourd	120	4.7	564	2.88	1,624.3	6,078	729.4	895.0	7,458
Cauliflower	100	13.3	1,330	3.06	4,069.8	7,048	704.8	3,365.0	33,650
Spinach	110	2.6	286	1.73	494.8	4,214	463.5	31.2	284
Carrot	120	5.4	648	1.56	1,010.9	5,458	655.0	355.9	2,966
Raddish	70	4.0	280	1.95	546.0	5,836	408.5	137.5	1,964
Tunip	50	6.6	330	2.22	732.6	6,061	303.1	429.6	8,591
Peas	80	2.6	208	3.68	765.4	5,444	435.5	329.9	4,124
Others	170	4.5 *	788	2.80 *	2,208.5	6,206 *	1,055.0	1,153.5	6,785
All Vegetables	1,540		6,956		19,495.2		9,557.0	9,938.1	
C. Fruit				Rs./ha					
Mango (2)	390	6.1	2,379	16,722	6,521.5	6,688	2,608.3	3,913.2	10,034
Guava (2)	280	3.8	1,064	10,762	3,013.2	6,564	1,837.8	1,175.4	4,198
Chikoo (2)	80	2.3	184	6,977	558.1	5,651	452.1	106.0	1,325
Coconut (2)	90	2.7	243	13,068	1,176.1	5,812	523.1	653.0	7,256
Papaya	50	7.3	365	10,807	540.4	6,556	327.8	212.5	4,251
Others	110	4.8 *	523	13,269 *	1,459.6	6,460 *	710.6	749.0	6,809
All Fruit	1,000		4,758		13,268.9		6,459.7	6,809.2	
Total	2,730		14,058		33,653		16,728	16,925	6,200

Remarks : (1) ; Detail crop budgets, see Table J.2.5 (1/11 - 11/11).
(2) ; Gross income and unit cost for mango, guava, chikoo and coconut are shown with the weighted average.
(3) ; All fodder, vegetable, fruit crops and others(*) are weighted average of unit yield, unit prices and unit costs.

Table J.2.7 GROSS AND NET CROP INCOME WITH PROJECT

Crops	Cropped Area	Gross Crop Income: Unit Yield	Pro-duction	Unit Price	Gross Income	Production Cost: Unit Cost	Total Cost	Net Crop Income: Total Income	per Ha
	(ha)	(t/ha)	(tons)	(Rs/kg)	(Rs 000)	(Rs/ha)	(Rs 000)	(Rs 000)	(Rs/ha)
A. Fodder Crops									
Lucerne	100	26.0	2,600	0.42	1,092.0	5,975	597.5	494.5	4,945
Maize, others	100	18.0	1,800	0.32	576.0	3,855	385.5	190.5	1,905
All Fodder	200		4,400		1,668.0		983.0	685.0	
B. Vegetables									
Tomato	1,000	7.0	7,000	3.46	24,220.0	9,140	9,140.0	15,080.0	15,080
Eggplant	500	9.0	4,500	2.45	11,025.0	8,702	4,351.0	6,674.0	13,348
Chilli	350	2.5	875	7.66	6,702.5	8,229	2,880.2	3,822.4	10,921
Sponge Gourd	1,000	11.0	11,000	3.31	36,410.0	7,080	7,080.0	29,330.0	29,330
Bottle Gourd	400	8.0	3,200	2.88	9,216.0	7,500	3,000.0	6,216.0	15,540
Cauliflower	300	16.0	4,800	3.06	14,688.0	8,592	2,577.6	12,110.4	40,368
Spinach	300	6.0	1,800	1.73	3,114.0	6,403	1,920.9	1,193.1	3,977
Carrot	200	11.0	2,200	1.56	3,432.0	8,563	1,712.6	1,719.4	8,597
Raddish	150	13.0	1,950	1.95	3,802.5	8,626	1,293.9	2,508.6	16,724
Tunip	150	15.0	2,250	2.22	4,995.0	8,814	1,322.1	3,672.9	24,486
Peas	200	5.0	1,000	3.68	3,680.0	7,538	1,507.6	2,172.4	10,862
Others	750	8.9 *	6,071	2.99 *	18,147.2	8,085 *	6,063.6	12,083.6	16,111
All Vegetables	5,300		46,646		139,432.2		42,849.5	96,582.7	
C. Fruit				(Rs/ha)					
Mango	390	9.0	3,510	25,263	9,852.6	7,514	2,930.6	6,922.0	17,749
Guava	280	7.0	1,960	19,824	5,550.7	7,660	2,144.9	3,405.9	12,164
Chikoo	80	3.0	240	9,100	728.0	6,964	557.1	170.9	2,137
Coconut	90	4.0	360	19,338	1,740.4	6,655	598.9	1,141.5	12,683
Papaya	50	8.5	425	12,584	629.2	7,398	369.9	259.3	5,186
Others	110	7.3 *	761	20,788 *	2,286.6	7,417 *	815.9	1,470.7	13,370
All Fruit	1,000		7,256		20,787.5		7,417.2	13,370.3	
Total	6,500		58,302		161,888		51,250	110,638	17,021

Remarks : (1) ; Detail crop budgets, see Table J.2.5 (1/11 - 11/11).
(2) ; Gross income and unit cost for mango, guava, chikoo and coconut are shown with the weighted average.
(3) ; All fodder, vegetable, fruit crops and others(*) are weighted average of unit yield, unit prices and unit costs.

Table J.2.8 INCREMENTAL NET INCOME WITHOUT AND WITH PROJECT

Unit : Rs ,000

Crops	Without Project			With Project			Incremental Value
	Gross Income	Total Cost	Net Income	Gross Income	Total Cost	Net Income	
A. Fodder Crops							
Lucerne	583.8	452.6	131.2	1,092.0	597.5	494.5	363.3
Maize, others	305.3	258.7	46.6	576.0	385.5	190.5	143.9
Sub-total	889.1	711.3	177.8	1,668.0	983.0	685.0	507.2
B. Vegetables							
Tomato	4,567.2	2,977.6	1,589.6	24,220.0	9,140.0	15,080.0	13,490.4
Eggplant	1,680.7	829.8	850.9	11,025.0	4,351.0	6,674.0	5,823.1
Chilli	153.2	108.7	44.5	6,702.5	2,880.2	3,822.4	3,777.8
Sponge Gourd	1,641.8	886.2	755.5	36,410.0	7,080.0	29,330.0	28,574.5
Bottle Gourd	1,624.3	729.4	895.0	9,216.0	3,000.0	6,216.0	5,321.0
Cauliflower	4,069.8	704.8	3,365.0	14,688.0	2,577.6	12,110.4	8,745.4
Spinach	494.8	463.5	31.2	3,114.0	1,920.9	1,193.1	1,161.9
Carrot	1,010.9	655.0	355.9	3,432.0	1,712.6	1,719.4	1,363.5
Radish	546.0	408.5	137.5	3,802.5	1,293.9	2,508.6	2,371.1
Turnip	732.6	303.1	429.6	4,995.0	1,322.1	3,672.9	3,243.4
Peas	765.4	435.5	329.9	3,680.0	1,507.6	2,172.4	1,842.5
Others	2,208.5	1,055.0	1,153.5	18,147.2	6,063.6	12,083.6	10,930.1
Sub-total	19,495.2	9,557.0	9,938.1	139,432.2	42,849.5	96,582.7	86,644.6
C. Fruit							
Mango	6,521.5	2,608.3	3,913.2	9,852.6	2,930.6	6,922.0	3,008.9
Guava	3,013.2	1,837.8	1,175.4	5,550.7	2,144.9	3,405.8	2,230.4
Chikoo	558.1	452.1	106.0	728.0	557.1	170.9	64.9
Coconut	1,176.1	523.1	653.0	1,740.4	598.9	1,141.5	488.5
Papaya	540.4	327.8	212.5	629.2	369.9	259.3	46.7
Others	1,459.6	710.6	749.0	2,286.6	815.9	1,470.7	721.7
Sub-total	13,268.9	6,459.7	6,809.2	20,787.5	7,417.2	13,370.3	6,561.1
Total	33,653	16,728	16,925	161,888	51,250	110,638	93,713

Remarks : Without project, see Table J.2.6
With project, see Table J.2.7

Table J.2.9 DISBURSEMENT OF ECONOMIC COST

Unit: Rs.1,000

Description	1st 1991	2nd 1992	3rd 1993	4th 1994	5th 1995	Total
1. Preparatory Works	0	31,863	0	0	0	31,863
2. Mol Dam	46	92,918	186,956	119,222	25,637	424,779
3. Causeway	0	0	0	5,506	0	5,506
4. Pilot Demonstration Farm	0	0	12,730	0	0	12,730
5. Project Office	0	1,044	0	0	0	1,044
6. O&M Equipment	0	0	0	10,300	0	10,300
7. Physical Contingency	7	14,098	29,953	20,254	3,846	68,158
8. Administration Cost	0	1,365	1,819	1,819	455	5,459
9. Engineering Services	13,608	18,240	18,272	18,272	4,568	72,961
Total	13,661	159,528	249,731	175,373	34,507	632,800

Table J.2.10 ECONOMIC COST AND BENEFIT FLOW

IRR= 10.60%
NPV(8%)= 196.4 million Rs.
B/C(8%)= 1.36

Unit: Rs.1,000

		Cost				Benefit			
	Year	Investment	Annual O&M	Replacement	Total	Irrigation	Well Ope.	Total	Balance
1	1991	13,662			13,662	0		0	-13,662
2	1992	159,528			159,528	0		0	-159,528
3	1993	249,731			249,731	0		0	-249,731
4	1994	175,373			175,373	0		0	-175,373
5	1995	34,507			34,507	0		0	-34,507
6	1996		4,335		4,335	50,137	2,551	52,688	48,353
7	1997		4,335		4,335	63,210	2,551	65,761	61,426
8	1998		4,335		4,335	76,283	2,551	78,833	74,498
9	1999		4,335		4,335	84,998	2,551	87,548	83,213
10	2000		4,335		4,335	93,713	2,551	96,264	91,929
11	2001		4,335		4,335	93,713	4,450	98,163	93,828
12	2002		4,335		4,335	93,713	4,450	98,163	93,828
13	2003		4,335		4,335	93,713	4,450	98,163	93,828
14	2004		4,335		4,335	93,713	4,450	98,163	93,828
15	2005		4,335	10,300	14,635	93,713	4,450	98,163	83,528
16	2006		4,335		4,335	93,713	1,203	94,916	90,581
17	2007		4,335		4,335	93,713	1,203	94,916	90,581
18	2008		4,335		4,335	93,713	1,203	94,916	90,581
19	2009		4,335		4,335	93,713	1,203	94,916	90,581
20	2010		4,335		4,335	93,713	1,203	94,916	90,581
21	2011		4,335		4,335	93,713	1,203	94,916	90,581
22	2012		4,335		4,335	93,713	1,203	94,916	90,581
23	2013		4,335		4,335	93,713	1,203	94,916	90,581
24	2014		4,335		4,335	93,713	1,203	94,916	90,581
25	2015		4,335	10,300	14,635	93,713	1,203	94,916	80,281
26	2016		4,335		4,335	93,713	1,203	94,916	90,581
27	2017		4,335		4,335	93,713	1,203	94,916	90,581
28	2018		4,335		4,335	93,713	1,203	94,916	90,581
29	2019		4,335		4,335	93,713	1,203	94,916	90,581
30	2020		4,335	25,500	29,835	93,713	1,203	94,916	65,081
31	2021		4,335		4,335	93,713	1,203	94,916	90,581
32	2022		4,335		4,335	93,713	1,203	94,916	90,581
33	2023		4,335		4,335	93,713	1,203	94,916	90,581
34	2024		4,335		4,335	93,713	1,203	94,916	90,581
35	2025		4,335	10,300	14,635	93,713	1,203	94,916	80,281
36	2026		4,335		4,335	93,713	1,203	94,916	90,581
37	2027		4,335		4,335	93,713	1,203	94,916	90,581
38	2028		4,335		4,335	93,713	1,203	94,916	90,581
39	2029		4,335		4,335	93,713	1,203	94,916	90,581
40	2030		4,335		4,335	93,713	1,203	94,916	90,581
41	2031		4,335		4,335	93,713	1,203	94,916	90,581
42	2032		4,335		4,335	93,713	1,203	94,916	90,581
43	2033		4,335		4,335	93,713	1,203	94,916	90,581
44	2034		4,335		4,335	93,713	1,203	94,916	90,581
45	2035		4,335	10,300	14,635	93,713	1,203	94,916	80,281
46	2036		4,335		4,335	93,713	1,203	94,916	90,581
47	2037		4,335		4,335	93,713	1,203	94,916	90,581
48	2038		4,335		4,335	93,713	1,203	94,916	90,581
49	2039		4,335		4,335	93,713	1,203	94,916	90,581
50	2040		4,335		4,335	93,713	1,203	94,916	90,581
51	2041		4,335		4,335	93,713	1,203	94,916	90,581
52	2042		4,335		4,335	93,713	1,203	94,916	90,581
53	2043		4,335		4,335	93,713	1,203	94,916	90,581
54	2044		4,335		4,335	93,713	1,203	94,916	90,581
55	2045		4,335		4,335	93,713	1,203	94,916	90,581

Table J.3.1 INCREMENTAL GROSS MARGIN OF OWNER OPERATED FARMER IN VARIOUS SCALE

			Owner Operated Farm														
			Without project					With project					Increment				
Holding Size (ha) (1)			1.0	3.0	5.0	10.0	20.0	1.0	3.0	5.0	10.0	20.0	1.0	3.0	5.0	10.0	20.0
B. Cropped Area (ha) (2)																	
Summer season			0.48	1.44	2.40	4.80	9.60	0.87	2.61	4.36	8.71	17.42	0.39	1.17	1.95	3.91	7.82
Winter season			0.08	0.23	0.38	0.75	1.50	0.49	1.48	2.47	4.93	9.87	0.42	1.25	2.09	4.18	8.36
			0.56	1.67	2.78	5.55	11.11	1.36	4.09	6.82	13.64	27.29	0.81	2.43	4.05	8.09	16.18
C. Cropped Pattern (ha) (2)																	
Fodder	7.0%	3.0%	0.04	0.12	0.19	0.39	0.78	0.04	0.12	0.20	0.41	0.82	0.00	0.01	0.01	0.02	0.04
Vegetables	56.4%	82.0%	0.31	0.94	1.57	3.13	6.26	1.12	3.36	5.59	11.19	22.38	0.81	2.42	4.03	8.06	16.11
Fruit	36.6%	15.0%	0.20	0.61	1.02	2.03	4.07	0.20	0.61	1.02	2.05	4.09	0.00	0.00	0.01	0.01	0.03
Total	(without)	(with)	0.56	1.67	2.78	5.55	11.11	1.36	4.09	6.82	13.64	27.29	0.81	2.43	4.05	8.09	16.18
D. Crop Production (tons) (3)																	
Fodder	12.3	21.0	0.5	1.4	2.4	4.8	9.6	0.9	2.6	4.3	8.6	17.2	0.4	1.1	1.9	3.8	7.6
Vegetables	4.5	7.9	1.4	4.2	7.0	14.1	28.2	8.8	26.5	44.2	88.4	176.8	7.4	22.3	37.1	74.3	148.6
Fruit	4.8	6.9	1.0	2.9	4.9	9.8	19.5	1.4	4.2	7.1	14.1	28.2	0.4	1.3	2.2	4.4	8.7
Total	(t/ha)	(t/ha)	2.9	8.6	14.3	28.6	57.3	11.1	33.3	55.6	111.1	222.2	8.2	24.7	41.2	82.5	164.9
	(without)	(with)															
E. Gross Income (Rs) (3)																	
Fodder	0.38	0.38	182	545	909	1,817	3,634	327	980	1,633	3,267	6,533	145	435	725	1,449	2,899
Vegetables	2.80	2.99	3,947	11,840	19,733	39,467	78,934	26,429	79,286	132,143	264,286	528,572	22,482	67,446	112,409	224,819	449,638
Fruit	2.79	2.86	2,722	8,166	13,611	27,221	54,443	4,039	12,117	20,195	40,389	80,779	1,317	3,950	6,584	13,168	26,336
Total			6,851	20,552	34,253	68,505	137,011	30,794	92,383	153,971	307,942	615,884	23,944	71,831	119,718	239,436	478,873
F. Production Cost (Rs) (4)																	
Labour cost	(50 Rs/man-day)																
Fodder	25.8	43.0	50	150	251	502	1,003	88	264	440	880	1,760	38	114	189	379	757
Vegetables	60.6	74.6	949	2,847	4,745	9,491	18,982	4,173	12,520	20,867	41,733	83,467	3,224	9,673	16,121	32,243	64,485
Fruit	37.4	46.4	380	1,140	1,901	3,801	7,602	475	1,424	2,374	4,748	9,497	95	284	474	947	1,895
Total	(without)	(with)	1,379	4,138	6,897	13,793	27,587	4,736	14,209	23,681	47,362	94,724	3,357	10,071	16,784	33,568	67,137
Other cost	(Rs/ha)																
Fodder	3,198	4,568	74	223	371	742	1,484	99	297	495	990	1,980	25	74	124	248	496
Vegetables	6,289	8,124	1,021	3,062	5,104	10,208	20,416	4,916	14,749	24,581	49,163	98,325	3,895	11,686	19,477	38,955	77,909
Fruit	4,918	5,893	620	1,859	3,098	6,196	12,391	731	2,194	3,656	7,313	14,626	112	335	559	1,117	2,235
Total	(without)	(with)	1,715	5,144	8,573	17,145	34,291	5,747	17,240	28,733	57,465	114,931	4,032	12,096	20,160	40,320	80,640
G. Net Crop Income																	
Gross income			6,851	20,552	34,253	68,505	137,011	30,794	92,383	153,971	307,942	615,884	23,944	71,831	119,718	239,436	478,873
Production cost			3,094	9,282	15,469	30,939	61,878	10,483	31,448	52,414	104,827	209,654	7,389	22,166	36,944	73,888	147,777
Gross margin			3,757	11,270	18,783	37,567	75,133	20,311	60,934	101,557	203,115	406,229	16,555	49,664	82,774	165,548	331,096

Table J.3.2 INCREMENTAL GROSS MARGIN OF TENANT FARMER IN VARIOUS SCALE

			Tenant Operated Farm													
			Without project					With project				Increment				
Holding Size (ha) (1)			1.0	3.0	5.0	10.0	20.0	1.0	3.0	5.0	10.0	20.0	1.0	3.0	5.0	10.0	20.0
B. Cropped Area (ha) (2)																	
Summer season			0.48	1.44	2.40	4.80	9.60	0.87	2.61	4.36	8.71	17.42	0.39	1.17	1.95	3.91	7.82
Winter season			0.08	0.23	0.38	0.75	1.50	0.49	1.48	2.47	4.93	9.87	0.42	1.25	2.09	4.18	8.36
			0.56	1.67	2.78	5.55	11.11	1.36	4.09	6.82	13.64	27.29	0.81	2.43	4.05	8.09	16.18
C. Cropped Pattern (ha) (2)																	
Fodder	7.0%	3.0%	0.04	0.12	0.19	0.39	0.78	0.04	0.12	0.20	0.41	0.82	0.00	0.01	0.01	0.02	0.04
Vegetables	56.4%	82.0%	0.31	0.94	1.57	3.13	6.26	1.12	3.36	5.59	11.19	22.38	0.81	2.42	4.03	8.06	16.11
Fruit	36.6%	15.0%	0.20	0.61	1.02	2.03	4.07	0.20	0.61	1.02	2.05	4.09	0.00	0.00	0.01	0.01	0.03
Total	(without)	(with)	0.56	1.67	2.78	5.55	11.11	1.36	4.09	6.82	13.64	27.29	0.81	2.43	4.05	8.09	16.18
D. Crop Production (tons) (3)																	
Fodder	12.3	21.0	0.5	1.4	2.4	4.8	9.6	0.9	2.6	4.3	8.6	17.2	0.38	1.14	1.91	3.81	7.63
Vegetables	4.5	7.9	1.4	4.2	7.0	14.1	28.2	8.8	26.5	44.2	88.4	176.8	7.43	22.29	37.15	74.29	148.59
Fruit	4.8	6.9	1.0	2.9	4.9	9.8	19.5	1.4	4.2	7.1	14.1	28.2	0.44	1.31	2.18	4.37	8.73
Total	(t/ha)	(t/ha)	2.9	8.6	14.3	28.6	57.3	11.1	33.3	55.6	111.1	222.2	8.2	24.7	41.2	82.5	164.9
	(without)	(with)															
E. Gross Income (Rs) (3)																	
Fodder	0.38	0.38	182	545	909	1,817	3,634	327	980	1,633	3,267	6,533	145	435	725	1,449	2,899
Vegetables	2.80	2.99	3,947	11,840	19,733	39,467	78,934	26,429	79,286	132,143	264,286	528,572	22,482	67,446	112,409	224,819	449,638
Fruit	2.79	2.86	2,722	8,166	13,611	27,221	54,443	4,039	12,117	20,195	40,389	80,779	1,317	3,950	6,584	13,168	26,336
Total			6,851	20,552	34,253	68,505	137,011	30,794	92,383	153,971	307,942	615,884	23,944	71,831	119,718	239,436	478,873
F. Production Cost (Rs) (4)																	
Labour cost (50 Rs/man-day)																	
Fodder	25.8	43.0	50	150	251	502	1,003	88	264	440	880	1,760	38	114	189	379	757
Vegetables	60.6	74.6	949	2,847	4,745	9,491	18,982	4,173	12,520	20,867	41,733	83,467	3,224	9,673	16,121	32,243	64,485
Fruit	37.4	46.4	380	1,140	1,901	3,801	7,602	475	1,424	2,374	4,748	9,497	95	284	474	947	1,895
Total	(without)	(with)	1,379	4,138	6,897	13,793	27,587	4,736	14,209	23,681	47,362	94,724	3,357	10,071	16,784	33,568	67,137
Other cost	(Rs/ha)		(50%)	(50%)	(50%)	(50%)	(50%)	(50%)	(50%)	(50%)	(50%)	(50%)					
Fodder	3,198	4,568	62	186	311	622	1,243	93	280	467	935	1,870	31	94	157	313	627
Vegetables	6,289	8,124	985	2,955	4,925	9,850	19,699	4,545	13,634	22,724	45,448	90,896	3,560	10,680	17,799	35,599	71,197
Fruit	4,918	5,893	500	1,499	2,499	4,998	9,997	603	1,809	3,015	6,031	12,061	103	310	516	1,032	2,065
Total	(without)	(with)	1,547	4,641	7,735	15,469	30,939	5,241	15,724	26,207	52,414	104,827	3,694	11,083	18,472	36,944	73,888
G. Net Crop Income			(50%)	(50%)	(50%)	(50%)	(50%)	(50%)	(50%)	(50%)	(50%)	(50%)					
Gross income			3,425	10,276	17,126	34,253	68,505	15,397	46,191	76,985	153,971	307,942	11,972	35,915	59,859	119,718	239,436
Production cost			2,926	8,779	14,631	29,263	58,526	9,978	29,933	49,888	99,775	199,551	7,051	21,154	35,256	70,513	141,025
Gross margin			499	1,497	2,495	4,990	9,980	5,420	16,259	27,098	54,195	108,391	4,921	14,762	24,603	49,206	98,411

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