CHAPTER 3 PROJECT IMPLEMENTATION PLAN

3.1 Implementation Plan

3.1.1 Implementation Concept

(1) Executive Agency of the Project

Irrigation and Power Department (IPD) of the Government of Punjab is assumed to be the executing agency of the Project that shall be implemented on the grant aid basis. The IPD is responsible for the project implementation and all the affairs concerning the Project, such as the contracting of consulting services and construction agreement, Banking Arrangement, arrangements with other departments, the approval of Tender Documents and issuance of Authorization to Pay.

The IPD is the executing body for the irrigation project in the province, carrying out planning and designing of many irrigation projects and supervising many construction works. The IPD district office at D. G. Khan shall be strengthened in order to manage the project implementation smoothly during the project period.

(2) Dispatch of technical staffs

Main part of the construction work of the Project is the work of steel sheet piles which has a long driving length. However, the local contractors do not get used to deal with this type of steel sheet piles. Therefore, well-skilled manager, operators and workers from Japan shall be needed. Furthermore, taking account of the limited construction schedule, well-trained Japanese technical staffs for the works of precast friction piles shall also have to be dispatched from Japan.

(3) Local contractors in D. G. Khan

There are much gabion works that need intensive labor work in the Project and the local contractors are familiar with gabion work. Therefore, local contractors shall be utilized effectively in the Project. Further, the Project shall be a good opportunity to earn cash income for the local population.

(4) Scope of works

The scope of works of the Project consists of the following items and related temporary works of access roads.

1)	Cross Structure	
	Concrete piles; L = 12 m, ø = 400 mm	1,782 nos.
	Concrete volume	50,782 cu.m
	Upstream (U/S) cut-off (steel sheet piles; L = 24 m)	540 m
	Downstream (D/S) cut-off (steel sheet piles; L = 11 m)	540 m
	Gabion mattress	104,200 cu.m
2)	Guide walls	
	Guide wall between North and South branch	900 m
	steel sheet piles; L = 22 m, with gabion mattress	
	Guide wall between South branch and Escape	900 m
	steel sheet piles; L = 22 m, with gabion mattress	
3)	Rivetment	
	Left (U/S cross structure)	1,100 m
	steel sheet piles; L = 12 m, with gabion mattress	
	Left (U/S cross structure with bed protection)	30 m
	steel sheet piles; L = 12 - 16 m	
	Left (side of cross structure)	40 m
	steel sheet piles; L = 11 - 24 m	
	Left (side of D/S bed protection of cross structure)	80 m
	steel sheet piles; L = 22 - 28.5 m	
	Left (D/S cross structure)	900 m
	steel sheet piles; L = 22, with gabion mattress	
	Right (U/S cross structure)	300 m
	steel sheet piles; L = 12 m, with gabion mattress	
	Right (U/S cross structure with bed protection)	30 m
	steel sheet piles; L = 12 - 16 m	
	Right (side of cross structure)	40 m
	steel sheet piles; L = 11 - 24 m	
	Right (side of D/S bed protection of cross structure)	80 m
	steel sheet piles; L = 22 - 28.5 m	
	Right wall (D/S cross structure)	400 m
	steel sheet piles; L = 22, with gabion mattress	

3.1.2 Implementation Condition

(1) Conditions at proposed site

Social infrastructure

There are two routes from D. G. Khan, capital city of the division, to Choti Bala, construction site. One is the paved southern route by way of Choti Zerin. Its distance from D. G. Khan to the site is about 60 km. Another is the route which diverges from national highway which links Punjab and Balochistan Province at Sakhi Sarwar and leads to Choti Bala. The unpaved 20 km road from Sakhi Sarwar to Choti Bala is in poor condition to pass through. This road must be used for hauling road of boulders for gabions supplied at Sakhi Sarwar. For the construction, unpaved portions of this road have to be improved.

As to medical facilities, there is a dispensary at Choti Bala for a slight medical care. For injuries, some doctors are available at D. G. Khan. Besides, there is a military hospital in Multan, 2.5-hour drive from Choti Bara where most of illness and injury can be taken care of.

Conditions for construction works

The project site is located at inland of semi-arid tropics, where the temperature rises extremely from April to September. Especially in the months from May to August, it is difficult for human beings and heavy equipment to work in the daytime due to the temperature beyond 50 °C in the daytime. Progress of construction work, therefore, slows down in this period. Then working hour must be set only in the morning.

Occasionally heavy rain comes during the monsoon season of June to September. As there is little vegetation in the watershed, flood flow rushes to the construction site soon after the rain. According to the local farmers, they can forecast occurrence of rainfall from the look of the sky above the mountain range, and flood reaches to the site within three hours after the rain storm. To avoid an accident by the flood, therefore, local forecast is helpful to move workers and heavy equipment from the river bed in advance.

(2) Construction materials

Main works are composed of concrete works, gabion works and driving steel sheet piles and precast concrete piles in the foundation. Steel sheet piles and the pile driving equipment shall be imported from Japan because it is difficult to procure them in Pakistan.

For the concrete works, maximum volume of placing concrete amounts to 7,930 cu.ft or 225 cu.m per day which is equivalent to 1,900 bags of 50 kg cement bag, and the works will continue for 19 months. Such huge demand of cement may cause shortage and price escalation of cement in the region. Water concrete mixing is also limited in the site so that it is necessary to get water from D. G. Khan canal. Concrete mixing plant, pump trucks and truck mixers need to be imported from Japan consequently.

As to the gabion works, geotextile membrane which is used as a filter under the gabions is to be imported from Japan, because it is not available in the local market. Although the boulders for the gabions are available in the area to meet the demand of 200,000 cu.m for the project, shortage of boulders in the area and escalation of their price can be predicted.

(3) Construction method

A heavy rainfall occasionally causes flood over the site during the monsoon season from June to September. Steel sheet piles under the cross structure must be completed in the first dry season from October to May. If the sheet piles will not have been completed, serious scouring in the river bed will be developed by flood flows. That may affect adversely the site condition and the construction schedule of the project.

3.1.3 Consultant Supervision

Detailed design and construction supervision shall be rendered by a Japanese consultant firm under the agreement between the IPD of Punjab and the said consultant firm in conformity with the Japan's grant aid system. Contents of the supervisory works are to assist the IPD to conclude a justifiable construction contract with a Japanese contractor, and then to give the contractor the proper guidance from a fair standpoint so that the construction shall be completed in line with the design concept and the condition of contract. The consultant services include the following items:

1) Assistance in the construction contract:

   Detailed design and preparation of tender documents, qualification of the contractor for the tender, witnessing to tender, awarding the contract, etc.

2) Approval of construction drawings ;

   Inspection of construction materials and its specification, approval of construction drawings by the contractor, etc.

3) Supervision of construction:

Examination of the construction schedule, technical advice to the contractor, reporting construction progress to the client, etc.

4) Assistance for arrangement of approval to pay:

Examination of request for payment by the contractor during and after the construction, assistance for arrangement of the payment, etc.

5) Witnessing in the inspection:

Examination of specifications of the construction structures during and after the construction, technical advice to the contractor, etc.

After confirming the complete execution of the construction, and witnessing the transfer of the implemented facilities, the consultant will make its services complete. The consultant also needs to inform the Japanese Government concerned of the construction progress, payment requirements and transfer of the completed facilities.

For the quantity of the work is huge and the dimensions of the facilities are in a large scale, the consultant shall dispatch two supervisory engineers to the site. The senior supervisor shall inspect the construction work for 15 days every two months. It is recommended that supervisors shall have the specialty in the river engineering and erosion control.

Fig. 3.1 Implementation Schedule (Derailed Design)

Mouth	1	2	3	4	5	6	7	8	9	10	11	12
Detailed Design												
Field Work Survey & Foundation Exploration												
Design & Cost Estimate												
Preparation for Tendering Documents												
Tendering / Contract												

Fig. 3.2 Implementation Schedule (Construction - Phase I/Phase II)

Mouth	1	2	3	4	5	6	7	8	9	10	11	12
	1	2	3	4	5	6	7	8	9	10	11	12
Construction Phase I												
Pereparation Works												
Cross Structure												
Bed Protection Works (Downstream)												
Bed Protection Works (Upstream)												
Left Bank Protection Works												
Right Bank Protection Works												
Guide Walls (North Branch / South Branch)												
Guide Walls (South Branch / Escape)												

Mouth	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
Construction Phase II												
Pereparation Works												
Cross Structure												
Bed Protection Works (Downstream)												
Bed Protection Works (Upstream)												
Left Bank Protection Works												
Right Bank Protection Works												
Guide Walls (North Branch / South Branch)												
Guide Walls (South Branch / Escape)												

Fig. 3.3 Implementation Schedule (Construction - Phase III/Phase IV)

Mouth	1	2	3	4	5	6	7	8	9	10	11	12
	25	26	27	28	29	30	31	32	33	34	35	36
Construction Phase III Pereparation Works												
Cross Structure												
Bed Protection Works (Downstream)												
Bed Protection Works (Upstream)												
Left Bank Protection Works												
Right Bank Protection Works												
Guide Walls (North Branch / South Branch)												
Guide Walls (South Branch / Escape)												

Mouth	1	2	3	4	5	6	7	8	9	10	11	12
	37	38	39	40	41	42	43	44	45	46	47	48
Construction Phase IV Pereparation Works												
Cross Structure												
Bed Protection Works (Downstream)												
Bed Protection Works (Upstream)												
Left Bank Protection Works												
Right Bank Protection Works												
Guide Walls (North Branch / South Branch)												
Guide Walls (South Branch / Escape)												

3.1.4 Procurement Plan

(1) Construction materials, machinery and equipment

Main construction works are composed of concrete works, gabion works, driving steel sheet piles and precast concrete piles. As the following construction materials, machinery and equipment are not available or hard to procure the necessary quantity, they shall be procured from Japan.

- steel sheet piles, filter sheets (geotextile membrane), tie rods, concrete mixing plant, concrete pumping trucks, concrete ready-mix trucks, clawler cranes, vibro-hummers, pile drivers, generators, submersible pumps

2) O&M and monitoring office

The O&M and monitoring office with the following equipment and facilities will be necessary to realize the objectives of the project, while the costs are excluded from the cost estimates of the project.

- Observatory ; office building furnished, dormitory, garage, workshop, etc.
- Monitoring equipment ; meteorological equipment, flood gauge, telecommunication equipment, camera, video camera, radio-control helicopter, etc.
- Equipment and materials for O & M ; 4WD vehicles, heavy equipment such as bulldozer, backhoe, tractor, etc., gabion crates and boulders

3.1.5 Implementation Schedule

The Project will be implemented on the following processes.

(a) Consultant contract; The IPD, the Government of Punjab will conclude the consultant service agreement with a Japanese consulting firm. The consultant will proceed upon the verification of the agreement by the Government of Japan.

(b) Detailed design: Detailed design study will be carried out in conformity with the description in the basic design study report, while the additional foundation exploration and detailed topographic survey is needed for the detailed design. A detailed design of the facilities and tender documents will be prepared in 12 months.

(c) Tender and construction contract: After the approval of the tender documents by the IPD, the consultant will hold the tendering among the Japanese contractors. Four months are needed for announcement of tender, pre-qualification, examination of tender documents and construction contract.

(d) Construction: After the verification of the construction contract by the Government of Japan, the construction works will be commenced. The construction works will be completed in 39 months, consisting of 12 months in Phase 1, 12 months in Phase 2, 12 months in Phase 3 and 2.5 months in Phase 4.

3.1.6 Obligation of the Government of Pakistan

To facilitate the smooth implementation of the Project, the Government of Pakistan shall take necessary measures:

1) Support to establishment of operation and maintenance organizations for the fan and facilities.
2) Land acquisition for the construction.
3) Permission on the construction works.
4) Exemption from taxes, duties and other charges on equipment, machinery and other materials to be imported.
5) Costs on operation and maintenance, replacement and so on.

3.2 Operation and Maintenance

3.2.1 Operation and Maintenance Plan

(1) Establishment of Kamara Coordination Committee

It is recommended that a Kamara Coordination Committee (KCC) should be formed on the lines of a similarly existing organization that was headed by the Tumandar until the 1950s. This KCC would simply be an extension of the present Kamara activities, and if provided that necessary support and guidance in the initial stages, it could fill a long overdue and badly felt need of the local farmers. With some help from outside at the outset, the KCC will take over all important matters regarding the overall fan management. The KCC should soon be able to handle monitoring, forecasting, maintenance and financial matters for all major community works.

The KCC can be formed along the following principles:

- The membership of the KCC should be drawn from all existing and viable Kamaras, based on the Kamara size or bund ownership. The total number of members should be among 15 and 25.

- Equal representation should be given to the Shomali (Talha wah) users and Janubi (Siraj wah) users, while a way could be found to give representation to the Ganehar wah (escape) beneficiaries. In this regard, matters regarding the review of water rights should be taken up in consultation with all the Mokadams of the area.

- Once formed, all decisions should be made by the principles of democracy, one man one vote.

- Most of the members would be either Mokadams or Mokadam nominees. Following the analogy of the old Tumandari system, the Mokadams forming a council of elders or Jirga will elect their own Tumandar (chairman) and other office bearers.

- The KCC should register itself with the Social Welfare Department, and get itself recognized as an entity.

- The KCC should be provided some training of cooperative activities concerning fertilizer, seeds, agrochemical, production and marketing besides technical training mentioned above.

(2) Institutional and technical support

Overall, the Mithawan area farmers seem to be capable of managing low to mid-level flood situations; they may not need much help for that. But they have difficulty in managing high floods. They can monitor and detect detrimental changes in the embankment structures, but not in the channel beds and courses. Thus, there is need for technical training in the field of alluvial fan management. Further, training in the areas of social organization, cooperative activities, group harmony, etc. need to be provided. The engineering staff of the irrigation department, particularly those dealing with the Rod Kohis, also need some training of social organization, group action and farmer organizations.

(3) Financial arrangement

Flood irrigation in the Pachad area shall be executed to intake water more steadily for the flood mitigation in the lower area. The additional costs on the construction of the more durable structures and operation and maintenance on them should be

owed by the Government of Pakistan not by the farmers of the site. On the contrary, the costs, such as the monitoring and maintenance cost of the channels should be paid by the beneficial farmers in the same manner as they have done.

As of 1995/96, the budget of the IPD of Punjab including operation and maintenance on the barrages and canals was Rs. 2.27 billion to the irrigated area of 12 million ha or Rs. 200 /ha only. Operation and maintenance cost on the project is estimated as high as Rs. 1,230 /ha. Thus, the IPD might have high hurdle to bear such high O&M cost for less productive flood irrigated area.

(4) Operation and Maintenance Schedule

Until the O&M organization of the fan (the KCC) works, the supporting system for legal, finance, personnel and implementation affairs is needed. Such system should have following three phases.

Phase 1 external supporting period; 5 - 10 years
Phase 2 shifting period of external support to self-reliant operation; 5 - 10 years
Phase 3 self-reliant operation period

(5) Strengthening of Kamara Coordination Committee

The KCC, a responsible body for the fan management through monitoring and maintenance of the facilities shall be strengthened to be the self-governing organization by the local people. The most important thing is that the members of the KCC acquire self-imposed manner for their cooperation through the training.

(6) Technical training

There are two types of monitoring activities that must continuously be undertaken in order to avoid catastrophic situations on flood irrigation. First, the structures, mainly embankments, must be monitored for erosion, cracks, and subsidence. Because those situations lead the structures to malfunction, they need to be taken action immediately after being found to be ameliorated. Second, the channel beds need to be monitored continuously to avoid unfavorable changes and variations. The channels showing signs of degradation, aggradation and change of course must be taken seriously at the first sight and reported, and appropriate action must be taken. The local Kamaras appear to understand and normally take some action with regard to damage detected in the structures, but there is less understanding and realization of the impotance of variations in the channels beds. It is important that technical training in both the above areas, with emphasis on the latter, be imparted

to the local farmers. Such areas should include damage monitoring, damage detection and assessment, forecasting and prompt action techniques, etc.

(7) Repair of the dispersion structure

Structures of a canal irrigation system are deteriorated year by year, but they are usually repaired only at a severe or dangerous damage. The Mithawan dispersion structure should be restored soon after the heavy damage by torrential flow.

(8) Monitoring and data collection

This project is acknowledged as a pilot project of the hill torrent development. For the future of development planning and designing in the similar area, the project should provide basic data such as rainfall, flood discharge and effect of the structures. Then, the operation and maintenance work of the project should be run on the data. The remote sensing techniques, such as use of satellite images and aerial photos are useful for the monitoring of the land transformation caused by flood.

3.2.2 Executive Institution

(1) Action Plan

Objects:

The objects of operation and maintenance are the proposed Mithawan dispersion structure and all the facilities for the flood irrigation, such as wahs, wakras, gandhas, etc.

Monitoring:

The channels, structures and damaged areas should be surveyed after flood.

Preparation of maintenance plan:

The repair and maintenance plan and its financial arrangement should be prepared on the basis of the monitoring results.

Collection of maintenance cost:

In principle, the cost of common maintenance should come from the benefited farmers, while the big amount of the construction and repair works of the large-scale facilities should be provided by the Government as before.

Implementation of maintenance and construction:

The maintenance and construction works shall be carried out in line with the plan on the collected maintenance fee and the governmental subsidies.

Hydrological observation:

The data of rainfall and flood discharge are measured and collected properly.

(2) Operation and Training

Operation and maintenance of the facilities:

The IPD shall operate and maintain the dispersion structures, such as removal of sand bars in upstream of the distributor, the monitoring of the channel condition after flood and repair of the damaged protection works. At the same time, the Kamaras shall observe site conditions, such as siltation, scouring and shift of channels after flood. Based on the report of the flood damage by the Kamaras, the IPD shall provide necessary technical and financial support to the Kamaras. The Kamaras shall make the maintenance works of monitoring of the channels and other minor repair works on the alluvial fan. The KCC shall manage and coordinate the Kamaras and the farmers.

Training:

The following training shall be carried out under support from the outside.

Management, for KCC and Kamaras;

Organization management, legal and financial affairs, etc.

Water management, for KCC, Kamaras and IPD;

Flood protection, water management, etc.

Improvement of local technology, for KCC, Kamaras and IPD;

Technologies of monitoring, forecasting, communication, repair, etc.
Repair and construction by field staffs

Monitoring, for KCC, Kamaras and IPD;

Hydrological observation including measuring items, sites and Organization
Arrangement and use of the data

Monitoring:

Hydrological observation;
Climate, rainfall, flood discharge, sediment concentration, etc.

Discharge of Wah;

Intake volume to farm lands;
Investigation of the facilities;
Structure and intake function of gandha and wakra

(3) Equipment and Facilities

The facilities and equipment shall be provided for the purpose of the smooth implementation of meteorological and hydraulic data collection, observation of flood flow, monitoring of land and river and structure conditions after flood. The necessary facilities and equipment are as mentioned in the Section 4-1-4.

3.2.3 Operation and Maintenance Cost

Annual maintenance and repair cost is estimated upon the results of the hydraulic model test with river bed protection works, and the following assumptions.

- At the design discharge of 2,500 cumecs/88,300 cusecs (unit discharge per width qw = 4.6 cumecs/162 cusecs), 2/3 of bed protection work is assumed to be collapsed by scouring. At the unit discharge per width of over 4.6 cumecs (162 cusecs), the protection will be in destruction thoroughly.
- Unit price of gabion works is Rs. 1,140.87 /cu.m.
- When the bed protection for the cross structure lowered 3.75 m (12.4 feet), the volume of gabion needs to be repaired as much as V = 81,000 cu.m (2,860,000 cu.ft.).
- The bed protection work of two guide walls and the left bank revetment will be damaged by 100 m (330 feet) for each part at the design discharge. In this case, damaged volume of gabion amounts to V = 72,000 * 1/5 = 14,400 cu.m (509,000 feet).

Damage at the flood discharge of Q = 2,500 cumecs/88,300 cusecs is estimated as follows:

Damage to the protection gabions for the cross structure at downstream;

81,000 cu.m * 2/3 * 1,140.87 Rs./cu.m = Rs. 61,607,000

Damage to the protection gabions for the guide walls and revetment;

72,000 cu.m * 1/5 * 1,140.87 Rs./cu.m = Rs. 16,428,000

Assuming that the flood damage is in proportion to discharge, the damage amount can be calculated as follows:

Table 3.1 Flood Damage by Flood Discharge

Year	Discharge (cumecs)	(cusecs)	(cu.m)	Damage Volume (cu.ft.)	Damage Amount (Rs. '000)
1/1.3	400	14,000	10,900	0.38	12,477
1/2	917	32,400	23,600	0.83	28,624
1/2.5	1,100	38,800	28,300	1.00	34,340
1/3.33	1,257	44,400	34,400	1.21	39,235
1/5	1,658	58,500	45,400	1.60	51,795
1/10	1,952	68,900	53,400	1.89	60,922
1/25	2,500	88,300	68,400	2.42	78,035
	> 2,500	>88,300	109,800	3.89	125,267

Table 3.2 Annual Flood Damage

Occurrence	Interval	Damage Amount (Rs. '000)	Annual Damage Amount (Rs. '000)
0.98			
0.96	0.02	101,651	2,033
0.90	0.06	70,049	4,203
0.80	0.10	56,889	5,689
0.70	0.10	45,475	4,548
0.60	0.10	36,787	3,679
0.50	0.10	31,482	3,148
0.23	0.27	20,551	5,549
Average			28,849

As a conclusion, proper maintenance to assure function of the distributor may cost at Rs. 28,849,000 per annum.

The operation and maintenance office requires 20 permanent staffs, i.e., 1 SDO, 3 sub engineers, 1 sociologist, 6 group promoters, 5 drivers and 4 other staffs. The annual office expense including salary is estimated at 250,000 Rs./month * 12 months = Rs. 3,000,000.

Eventually, the total operation and maintenance cost, which consists of the annual maintenance cost and the office expense, becomes 28,849,000 + 3,000,000 = Rs. 31,849,000.

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

4.1 Project Effect

4.1.1 Project Effect

The Project aims at reduction of flood damage in the canal irrigated areas by enhancing flood irrigation in the Pachad. The effect of the Project could be measured by increase in the crop production and decrease of the flood damages.

(1) Increase of crop production

The crops cultivated in the Pachad are jowar and bajra for kharif crops and wheat, gram and oilseeds for rabi crops. The area of flood irrigation varies with extent of floods and it is expected to be expanded by construction of the distributor. Possible irrigated areas by each return period are shown in Table - 4.1 after completion of the distributor.

Table - 4.1 Possible Irrigated Area with the Distributor

Return period	Irrigated Area (ha)							
	Kharif			Rabi				Total
	Jowar	Bajra	Total	Wheat	Gram	Oilseed	Total	
5-year	4,056	2,055	6,111	718	223	851	1,792	7,903
10-year	5,196	2,633	7,828	1,259	390	1,493	3,143	10,971
15-year	6,085	3,083	9,168	1,655	516	1,973	4,154	13,322
20-year	7,698	3,901	11,599	2,238	693	2,654	5,586	17,185

Crop production is calculated as shown Table - 4.2 on the basis of the yield of each crop, 736 kg/ha for jowar, 645 kg/ha for bajra, 554 kg/ha for wheat, 415 kg/ha for gram and 370 kg/ha for oilseed.

Table - 4.2 Crop Production with the Distributor

Return period	Production (million rupees)					
	Jowar	Bajra	Wheat	Gram	Oilseed	Total
5-year	11.88	9.38	1.49	0.40	2.45	25.61
10-year	15.22	12.02	2.62	0.70	4.29	34.85
15-year	17.83	14.08	3.46	0.92	5.67	41.96
20-year	22.55	17.81	4.65	1.24	7.62	53.88

Using the data in Table - 4.1 and - 4.2, average annual crop production is calculated. It is expected 13.81 million rupees with the distributor as shown in Table- 4.3.

Table - 4.3 Average Annual Crop Production

Frequency	Production (mil. Rs)	Average Production (mil. Rs)	Frequency Interval	Annual Production (mil. Rs)
0.9	3.60			
0.8	5.30	4.45	0.1	0.445
0.7	7.20	6.25	0.1	0.625
0.6	9.4	8.30	0.1	0.83
0.5	12.00	10.70	0.1	1.07
0.4	15.10	13.55	0.1	1.36
0.3	19.20	17.15	0.1	1.72
0.2	25.00	22.10	0.1	2.21
0.1	34.90	29.95	0.1	3.00
0.067	41.96	38.43	0.033	1.27
0.04	53.88	47.92	0.027	1.29
TOTAL				13.81

Estimated crop production of 3 years from 1992 to 1994 is shown in Table - 4.4 by the crop area. Since the area received extraordinarily much water in the year of 1994 by 3 times of flooding, average of the remained two years are to be the annual production at present. Then it assumes 9.12 million rupees and increases of production by the distributor estimated as smaller as 4.69 million rupees.

Table - 4.4 Crop Production at Present

Year	Production (million rupees)					
	Jowar	Bajra	Wheat	Gram	Oilseed	Total
1992	3.54	4.19	1.64	0.30	0.18	9.85
1993	3.38	3.65	0.77	0.32	0.27	8.38
1994	10.02	11.67	0.93	0.85	0.39	23.85

(2) Reduced Flood Losses

The canal irrigated area by the D. G. Khan canal extends both D. G. Khan district and Rajanpur district. Damage by the flood was estimated by the feasibility studies for the flood protection of Taunsa-Gudu Reach - Indus river - final report as shown in Table - 4.5. In this study, average of the two districts used for the basis of computing flood damages.

Table - 4.5 Flood Losses in D. G. Khan and Rajanpur Districts (Rs/ha)

Area	Direct				Indirect	Total
	Crop	Houses	Roads Railways	Others		
D. G. Khan	5,998	2,440	190	2,590	2,242	13.460
Rajanpur	4,650	2,010	250	2,073	1,797	10,780

The feasibility study for the Mithawan Pilot Project in 1984 estimated flood area about 32,000 ha as shown in Table - 4.6. The share of Mithawan hill torrent to the total flood losses is estimated 35 % by the area of watershed since the heavy rain causing flood losses tends to pour simultaneously over the D. G. Khan hill torrent belt.

Table - 4.6 Area and Peak Flood of the Hill Torrents

Name	Drainage area (square km)	Share of area (%)	Peak Flood Discharge at 25-year (cumecs)
Sori Lund	520	23	1,500
Vidore	770	35	1,796
Sakhi Sarwar	160	7	739
Mithawan	792	35	2,500

Table - 4.7 shows the total affected area and the area and losses affected by Mithawan hill torrent by probable flood by various return periods. Reduced losses are expected 23.94 million rupees annually as shown in Table - 4.8.

Table - 4.7 Flood Losses by Probable Flood

Return Period	Peak Flood	Area affected	By Mithawan Hill Torrent	
		(ha)	Area affected (ha)	Losses (mil. Rs)
2	917	1,695	593	7.19
2.5	1,100	5,060	1,771	21,46
3.33	1,257	8,770	3,070	37.20
5	1,658	13,895	4,863	58.94
10	1,952	22,260	7,791	94.43
25	2,500	32,380	11,333	137.36

Table - 4.8 Reduced Annual Flood Losses

Frequency	Losses (mil. Rs)	Average Losses (mil. Rs)	Frequency Interval	Annual Losses (mil. Rs)
0.54	0			
0.5	7.19	3.6	0.04	0.14
0.4	21.46	14.33	0.1	1.43
0.3	37.20	29.33	0.1	2.93
0.2	58.94	48.07	0.1	4.81
0.1	94.43	76.69	0.1	7.67
0.04	137.36	115.90	0.06	6.95
TOTAL				23.94

(3) Benefited population

Population in the Pachad is estimated about 14,000 and all of them will be benefited by irrigation. Number of beneficiaries by flood protection is estimated about 40,000 in canal irrigated area assuming affected area of 113 square km at the return period of 25-year and 23 houses per square km with average family number of 15.

4.1.2 Analysis

(1) Technical Aspect

The distributor is to be constructed on a thick sand-layer in the Mithawan hill torrent. It is expected that the durability and stability of the structure will depend on the degree of occurrences of local scouring during flood in the sand layer around the structure. Although the range of scouring depends on the flood discharge, the design flood discharge estimated using less accurate flood discharge record. In addition to this, the behavior of the fine sandy bed material is unknown during flood in spite of a series of the hydraulic model test had been conducted prior to the designing.

In the design, sheet-piles of 10 to 30 m lengths with protection gabions are to be arranged to protect from the local scouring in the sandy channel bed. It is, however, still uncertain about the stability of the main part of the distributor unless the protection gabions are repaired when damaged.

In addition to the construction of the distributor, management of the alluvial fan is inevitable to maintain the channels for the flood irrigation and to avoid the formation of secondary fans which deteriorate the flood irrigation.

(2) Operation and Maintenance

Although the traditional local irrigator's organization Kamaras still exist, there are no leadership control over the whole Pachad area because of the change in social structure. The lack of labor force also results in little maintenance work for flood irrigation.

For sustainable farming on the Mithawan fan, it is necessary to keep the fan flat and to maintain the channels on the fan usable for flood irrigation by effective monitoring and through quick remedy works against any unfavorable change. Therefore, it is necessary to set up a managing organization and to provide it strengthening and training.

The existing independent Kamaras are necessary to be united under a higher coordinating body for the steady operation and maintenance over the fan area. The Kamara Coordinating Committee shall be established for this purpose.

The government must assist on the maintenance works required for severe degradation in the channels and for restoration of the distributor as this would be a heavy burden for the farmers and would severely harm the downstream area.

(3) Benefit and Cost

Addition to the construction cost, the annual expenditure is estimated at Rs. 31.85 million. On the contrary, the benefits of the Project are Rs. 23.94 million generated from flood protection and Rs. 4.69 million from increased crop production. Therefore, the annual maintenance cost of Rs. 31.85 million exceeds the annual benefits of Rs. 28.63 million.

(4) Conclusion

As the distributor is constructed on the thick sand layer, severe local scouring is expected to occur around the structure. To prevent from such degradation, the deep foundation is designed on the structure and gabion protection works are placed. There is, however, no assurance to keep the stability of the main structure unless the protection gabion works are repaired when damaged, since the protection works cannot avoid from settlement and washed-away by every flood. There are also problems in the operation and maintenance on the structures and control of financial and technical capability of the operating organizations. Furthermore, the maintenance cost must be a heavy burden to the local people and the government. Accordingly, construction of the distributor is not feasible.

4.2 Necessary Technical Cooperation

Financially aid from foreign countries, which consists most part of finance for development in Pakistan, has been put into projects that contribute directly to enhance production because the national budget is limited. In this circumstance, the money for O&M of completed facilities lacks, and O&M of agricultural and irrigation system that is as to say the base of the nation's economy is also in insufficient.

Budget for small beneficial projects such as development of hill torrent and non-beneficial projects like disaster prevention has been neglected. Therefore, personnel concerning these projects are limited, engineering for these projects has not been paid

attention, and engineers have not had interest in this engineering. Though interest in development of depressed rainfed area including hill torrent has been increasing because national agricultural productivity is decreasing recently, actual activities have not been materialized yet.

Five years' watershed management project, which is a participating project, has been implemented as a joint project of JICA and FAO since April, 1995 in upstream area of the Project. Farmer's organizations have been established in each village and are working actively to introduce vegetable and fruit growing, improve irrigation facilities and establish saving cooperatives. Furthermore, trial limited pasturage and water and soil prevention on slope of mountainside have been implemented since 1996. In watershed management project, it is needed to enlighten farmers with these activities. However, Organizations of GOP have few experiences of projects which require to contact rural people directly.

Government organizations should play main role in strengthening of cooperation between Kamaras in Mithawan alluvial fan. However, it is vital to strength Government organizations first. Then, staff training for improvement of such as water resources management, flood irrigation engineering and agricultural engineering should be operated.

In conclusion, engineering concerning steep slope rivers and alluvial fan has not been established, and there are few experiences of watershed management with farmers participation in Pakistan. Therefore, cooperation with experienced organizations is essential.

4.3 Recommendation

4.3.1 Problems

Construction of Mithawan distributor is regarded not to be feasible, because the structure will not be durable and need frequent maintenance works because of no economical and practical measures against anticipated degradation and scouring in the riverbed.

Dispersing flood flows over the fan makes its use being sustainable, but, it is necessary to reduce peak flood and to extend flooding period for realizing sure dispersion by the traditional practice instead of construction of the distributor.

Mithawan alluvial fan is still on the process of fan formation by enormous supply of sediment from the watershed. For stable crop production on the fan, it must be conserved keeping the fan balanced avoiding hazardous surface variation. Dispersion of flood flows is most important by eliminating flow concentration into specified channels.

In Pakistan, there is little data available for the basis of the design of the structures. Moreover, states on rainfall and flood are not clear in a depressed area such as hill torrent belt. Engineering is not developed much to the rivers with steep bed slope and to the alluvial fans. In addition, because the structures in ephemeral streams are used rarely and they have enough time to repair the structures if damaged, the structures are built for the moment with minimal cost and without proper design.

The social structure had based on strong tribal system in the hill torrent belt in D. G. Khan and their system has become weakened by penetration of commercialism and information from the outside world. Operation and maintenance for the flood irrigation depend on the traditional association of Kamara. Sustainable crop cultivation on the fan needs farmers participation to the organization differed from its old Sardar dominant system.

4.3.2 Recommendation

The practices for a water harvesting in the hill torrent area must contribute to enhance carrying capacity in a similar dry region not only in Pakistan but also in Western China, Central Asian and Middle East countries.

Watershed management is necessary re-vegetation along with structural method to reduce peak flood and to decrease sediment outflow. Re-vegetation increases livestock farming in the area and assures stable livelihood to the population. For this purpose, participation of the population is most important to promote watershed management. Structural method is recommended to harvest water and soil on the slopes along with controlling development of gullies and construction of small dams.

It is necessary to maintain the flood irrigation on an alluvial fan by preventing from channel beds lowering and secondary fan formation for utilize the fan as a productive area. For this purpose, degraded channels should be reclaimed by building channel crossing embankments for accumulating sediment in its upstream. Construction of contour embankment across the alluvial fan is effective measure to prevent flood concentration in a particular channel and to hinder a secondary fan formation. The contour embankment will be placed on a concentric circle centered the apex, that stops not only water but also sediment. Owing to this sediment deposition, uneven fan

surface will be flattened enabling dispersion of floods and sediment over the fan. Prior to designing the countour embankment, detailed study including topo survey and its effective layout is required.

Addition to those, figures of natural condition, such as rainfall and flood resords, flood condition, flood damage and shift of channels, must be collected for the basis of future engineering. It is recommended that accumulating experience through the monitoring of existing structures in Kaha, Vidore and Choti Nallah and observation on the variation of the channels on the fan.

APPENDICES

APPENDICES

1. Member list of the Study Team

1-1 Member List of the First Survey Team (19, Oct., 1995 to 3, Nov., 1995)

Specialty	Name	Position
Leader	MASAYUKI WATANABE	Development Specialist, JICA
Technical Adviser (Irrigation Planner)	TOSHIRO SHIMOMAI	Deputy Director, Office of Construction Planning and Coordination Design Division, Construction Department Agricultural Structure Bureau, Ministry of Agriculture, Forestry and Fisheries
Technical Adviser (River and Sabo)	KOICHI FUJITA	Senior Research Engineer, River Hydraulic Division, River Department, Public Works Research Institute, Ministry of Construction
Chief Consultant	YOICHI KISHI	Nippon Giken Inc.
Hydraulic Model Test Planner	HIKOSHICHI ABE	Non-Profit Foundation, Civil Engineering Research Laboratory
Construction Planner	HIROEI ISHIHARA	Nippon Giken Inc.

1-2 Member List of the Second Survey Team (24, Jun., 1996 to 22, Feb., 1996)

Specialty	Name	Position
Leader	MASAYUKI WATANABE	Development Specialist, JICA
Technical Adviser (Irrigation Planner)	KATSUO IWATA	Deputy Director, Land Development Division Construction Department Agricultural Structure Improvement Bureau, Ministry of Agriculture, Forestry and Fisheries Government of Japan
Chief Consultant	YOICHI KISHI	Nippon Giken Inc.
Structure Planner	MASAMI KATAYAMA	CTI Engineering Co., Ltd.
Structure Designer	JUNJI KAMATA	CTI Engineering Co., Ltd.
Construction Planner	HIROEI ISHIHARA	Nippon Giken Inc.

1-3 Member List of the Third Survey Team (1, July, 1996 to 11, Nov., 1996)

Specialty	Name	Position
Leader	MASAYUKI WATANABE	Development Specialist, JICA
Coordinator (Irrigation Planner)	SHOKICHI SAKATA	First Project Study Division, Grand Aid Project Study Department, JICA
Chief Consultant	YOICHI KISHI	Nippon Giken Inc.
Hydraulic Model Test Planner	AKIRA ODA	Non-Profit Foundation, Civil Engineering Research Laboratory

1-4 Member List of the Explanation of Draft final Report Team (23, Jun., 1997 to 30, Jun., 1997)

Specialty	Name	Position
Leader	KENJI IWAGUCHI	Managing Director, Grant Aid Project Study Department, JICA
Grand Aid	FUMIO IWAI	Deputy Director, Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs
Coordinator (Irrigation Planner)	SHOKICHI SAKATA	First Project Study Division, Grand Aid Project Study Department, JICA
Chief Consultant	YOICHI KISHI	Nippon Giken Inc.
Hydraulic Model Test Planner	AKIRA ODA	Non-Profit Foundation, Civil Engineering Research Laboratory
Structure Designer	JUNJI KAMATA	CTI Engineering Co., Ltd.

2. Survey Schedule

2 Survey Schedule

2-1 On the First Survey (19, Oct., 1995 to 3, Nov., 1995)

No.	Date	Day	Itinerary	Work Schedule
1	Oct. 19	Thi.	Narita - Bangkok - Islamabad	Arrival at Islamabad
2	20	Fri.	Islamabad - D. G. Khan	Inspection of the Taunsa Barrage and the spar dike in the Indus river
3	21	Sat	D. G. Khan	Survey of the Kaha project
4	22	Sun	D. G. Khan	Survey of the Sakhi Sarwar hill torrent and Mithawan site
5	23	Mon.	D. G. Khan	Field survey of the Mithawan site and the Pachad
6	24	Tue.	D. G. Khan	Inspection of the Vidore hill torrent and the model area of watershed management at Dholi
7	25	Wed.	D. G. Khan - Islamabad	(Watanabe, Shimomai & Fujita) Courtesy call on Deputy Administrator of I&P, Travel
			D. G. Khan	(Abe, Kishi & Ishihara) Survey of the Mithawan Nala
8	26	Thi.	Islamabad	(Watanabe, Shimomai & Fujita) Courtesy call at EOJ, JICA, EAD, W&P & FAO
			D. G. Khan	(Abe, Kishi & Ishihara) Survey of the Mithawan Barrage site
9	27	Fri.	Islamabad	(Watanabe, Shimomai & Fujita) Survey of the Indus river
			D. G. Khan	(Abe, Kishi & Ishihara) Sruvey of the Rakhi Nala
10	28	Sat.	Islamabad - Karachi	(Watanabe, Shimomai & Fujita) Survey of the Mangla dam, Travel
			D. G. Khan	(Abe, Kishi & Ishihara) Sruvey of the Sharti Wah
11	29	Sun	Karachi - Bangkok	(Watanabe, Shimomai & Fujita) Travel
			D. G. Khan	(Abe, Kishi & Ishihara) Sruvey of the Sharti Wah
12	30	Mon.	Bangkok - Narita	(Watanabe, Shimomai & Fujita) Travel
			D. G. Khan - Lahore	(Abe, Kishi & Ishihara) Travel
13	31	Tue.	Lahore - Islamabad	(Abe, Kishi & Ishihara) Investigation of the I&P research institute of hydraulic model test, Travel
14	Nov. 1	Wed.	Islamabad	(Abe, Kishi & Ishihara) Report to EOJ & JICA
15	2	Thi	Islamabad - Bangkok	(Abe, Kishi & Ishihara) Travel
16	3	Fri.	Bangkok - Narita	(Abe, Kishi & Ishihara) Travel

2-2 On the Second Survey (24, Jan., 1996 to 22, Feb., 1996)

No.	Date	Day	Itinerary	Work Schedule
1	Jan. 24	Wed	Narita - Bangkok	Travel
2	25	Thi.	Bangkok -Islamabad	Travel
3	26	Fri.	Islamabad - D. G. Khan	Survey of the Vidore hill torrent Courtesy call at Chief Engineer of D. G. Khan office, Irrigation and Power Department, the Punjab (I&P)
4	27	Sat	D. G. Khan	Interview with Kamara members
5	28	San	D. G. Khan	Survey of the Kaha project
6	29	Mon.	D. G. Khan - Lahore	Travel, Courtesy call at I&P, Planning and Development Department, Gov. of the Punjab (P&D)
			D. G. Khan	(Kamata & Ishihara) Field survey
7	30	Tue.	Lahore - Islamabad	(Watanabe, Iwata, Kishi & Katayama) Courtesy call at W&P, Federal Flood Commission (FFC) & JICA office
			D. G. Khan	(Kamata & Ishihara) Field survey
8	31	Wed	Islamabad	(Watanabe, Iwata, Kishi & Katayama) Discussion with FFC
			D. G. Khan	(Kamata & Ishihara) Field survey of the Barrage predetermined site
9	Feb. 1	Thi.	Islamabad	(Watanabe, Iwata, Kishi & Katayama) Signature of the minutes of discussion with W&P & I&P Report to EAD, EOJ & JICA
			Islamabad - Karachi	(Watanabe) Travel
			Islamabad	(Iwata) Tarbela Dam
			D. G. Khan	(Kamata & Ishihara) Field survey of the Barrage predetermined site
10	2	Fri.	Karachi - Bangkok - Narita	(Watanabe) Travel
			Islamabad	(Iwata) Collecting Data
			Islamabad - D. G. Khan	(Kishi & Katayama) Travel
			D. G. Khan	(Kamata & Ishihara) Collecting Data
11	3	Sat	Islamabad - Karachi	(Iwata) Travel
			D. G. Khan	(Kishi, Kamata, Katayama & Ishihara) Field survey of the Barrage predetermined site
12	4	San	Karachi - Bangkok - Narita	(Iwata) Travel
			D. G. Khan	(Kishi, Kamata, Katayama & Ishihara) Field survey of the Barrage predetermined site

No.	Date	Day	Itinerary	Work Schedule

13	5	Mon.	D. G. Khan	(Kishi, Kamata, Katayama & Ishihara) Collecting Data
14	6	Tue.		Field survey of Sakhi Sarwar Darra
15	7	Wed		Field survey of the Barrage predetermined site
16	8	Thi.		Field survey of the Barrage predetermined site
17	9	Fri.		Survey of the Rakhi Nala
18	10	Sat		Field survey
19	11	Sun		Field survey
20	12	Mon.		Field survey
21	13	Tue.		Field survey
22	14	Wed		Field survey
23	15	Thi.		Field survey
24	16	Fri.		Field survey of Sanga hill torrent & Taunsa Barrage
25	17	Sat		Field survey
26	18	Sun		Field survey
27	19	Mon.		Field survey
28	20	The	D. G. Khan - Islamabad	Travel
29	21	Wed	Islamabad - Karachi	Report to EOJ, Travel
30	22	Thi.	Karachi - Singapore - Narita	Travel

2-3 On the Third Survey (1, July, 1996 to 11, Aug., 1996)

No.		Date	Day	Itinerary	Work Schedule
1	July.	1	Mon.	Narita - Islamabad	Travel
2		2	Tue.	Islamabad	Courtesy call and meeting at (FFC), Courtesy call at JICA.
3		3	Wed	Islamabad - D. G. Khan	Travel
4		4	Thi.	D. G. Khan	Field survey at Kaha project
5		5	Fri.		Field survey
6		6	Sat		(Watanabe, Sakata & Kishi) Explanation of Interim Report and Discussion with Secretary of I&P
					(Oda) Field survey
7		7	Sun		(Watanabe, Sakata & Kishi) Attending workshop of FAO project
					(Oda) Field survey
8		8	Mon.	D. G. Khan - Islamabad	Travel
9		9	Tue.	Islamabad	Discussion with FFC, Report to EAD and JICA
10		10	Wed	Islamabad	Signing for Minutes of Discussion with FFC.
					(Watanabe, Sakata & Oda) Report to Economic Affairs Division, Ministry of Finance and Economic Affairs (EAD)
				Islamabad - D. G. Khan	(Kishi) Travel
11		11	Tue.	Islamabad - Bangkok	(Watanabe, Sakata &Oda) Courtesy call at FAO, Travel
				D. G. Khan	(Kishi) Attending the meeting in Dohri for Social survey
12		12	Fri.	Bangkok - Narita	(Watanabe, Sakata &Oda) Travel
				D. G. Khan	(Kishi) Social survey
13		13	Sat	D. G. Khan	(Kishi) Interview of residence at B. Talpur for Social survey
14	Jul.	14	Sun.		(Kishi) Interview of residence at B. Jogiani and B. Hasnani for Social survey
15		15	Mon.		(Kishi) Interview of residence at B. Alluthul for Social survey
16		16	Tue.	D. G. Khan - Lahore	(Kishi) Meeting with I&P and FAO, Travel
17		17	Wed	Lahore - Bangkok - Narita	(Kishi) Arrival at Japan
18 to 42	Aug.	18 to 11	Thi.	D. G. Khan	Social survey
				D. G. Khan	Social survey continued

2-4 On the Explanation of Draft final Report (23, June, 1997 to 30, Jun., 1997)

No.		Date	Day	Itinerary	Work Schedule
1	June.	23	Mon.	Narita - Islamabad	(Sakata, Kishi, Kamata & Oda) Travel
2		24	Tue.	Narita - Lahore	(Iwaguchi & Iwai) Travel
				Islamabad - Lahore	(Sakata, Kishi,.Kamata & Oda) Travel, Discussion with I&P and P&D
3		25	Wed	Lahore - Islamabad	(Iwaguchi & Iwai) Courtesy call at EOJ and JICA
				Lahore - Islamabad	(Sakata, Kishi, Kamata & Oda) Discussion with I&P, Travel
					(All) Joint meeting at JICA Office (with with Ministry of Water and Power, FFC, EOJ and JICA)
4		26	Thi.	Islamabad	(Iwaguchi & Iwai) Courtesy call at EAD .
					(All) Joint meeting with Ministry of Water and Power, FFC, I&P, EOJ and JICA)
					(Iwaguchi, Iwai & Kishi) Discussion with Planning Division, Ministry of Planning and Development. Discussion with JICA
5		27	Fri.	Islamabad	Discussion with JICA, EOJ and FFC
6		28	Sat	Islamabad	Courtesy call on H. E. President Farooq Ahmad Khan Leghari
					Signing for Minutes of Discussion with FFC
7		29	Sun	Islamabad - Narita	(Iwai, Sakata, Kishi, Kamata & Oda).Travel
				Islamabad - Lahore - Bangkok	(Iwaguchi) Travel
8		30	Mon.	Bangkok - Narita	(Iwaguchi) Travel

3. List of Party Concerned in the Recipient Country

President of the Islamic Republic of Pakistan	H.E. President Farooq Ahmad Khan Leghari
Ministry of Water and Power	
Special Secretary / Chairman, Federal Flood Commission	Mr. Asif H. Kazi
Federal Flood Commission (FFC)	
Secretary and Chief Engineer	Mr. Illahi B. Shaikh
Engineer	Mr. Alamgir Khan
Economic Affairs Division, Ministry of Finance and Economic Affairs (EAD)	
Deputy Secretary	Mr. Shahid Humayun
Deputy Secretary	Mr. S. M. Hasan Zaidi
Joint Secretary	Mr. Rashid Mahmood Ansari
Planning Division, Ministry of Planning and Development	
Member	Dr. Zafar Altaf
Planning and Development Department, Gov. of the Punjab (P&D)	
Chairman	Mr. Tariq Sultan
Member (engineering)	Mr. Riaz Ahmed Khan
Member (ECA)	Mr. C. A. Haheez
Assistant Chief (ECAI)	Mr. Nasim Riaz
Research Officer (ECAI)	Mr. Abdul Latif Khan
Irrigation and Power Department, Gov. of the Punjab (I&P)	
Secretary	Mr. Syed Mansoob Ali Zaidi
Secretary	Mr. Suleman Ghani
Secretary / Chief Engineer, D.G. Khan	Ch. Riaz Hussain Waraich
Additional Secretary	Ch. Muhammad Sagheer
Additional Secretary	Mr. Shafqat Masood
Deputy Secretary	Mr. Abdul Aki Sheikh
Irrigation Research Center, Gov. of the Punjab	
Chief Engineer	Mr. Tahir Ahmad Malik
Hydraulic Modelling	Mr. M. Basir Shaiki

Irrigation, D.G. Khan, I&P, Punjab	
Chief Engineer, D.G. Khan	Ch. Riaz Hussain Waraich
Superintending Engineer, Project Circle	Mr. Iftikhar Ahmad Butta
Superintending Engineer, Derajat Circle	Mr. Bagh Ali Shahid
Superintending Engineer, Muzaffargarh Canal Circle	Mr.Mohammad Ibrahim
Executive Engineer, Construction Division, Project Circle	Ch. Akhtar Hussain
Executive Engineer, Construction Division, Muzaffarghrh Canal Circle	Mr. Muhammad Saleem Malik
Sub Divisional Officer, Mechanical Sub-Division, Rajanpur Div.	Mr. Saifullah Sheikh
National Engineering Service Pakistan (NESPAK)	Mr. Javid Arif

Minutes of Discussions 1 February, 1996

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY

ON

THE MITHAWAN HILL TORRENT PILOT PROJECT IN PUNJAB

IN

THE ISLAMIC REPUBLIC OF PAKISTAN

In response to the request from the Government of the Islamic Republic of Pakistan, the Government of Japan decided to conduct a Basic Design Study on the Mithawan Hill Torrent Pilot Project (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Pakistan a study team headed by Mr. Masayuki Watanabe, Development Specialist, JICA, from January 25 to February 21, 1996.

The Team held a series of discussions with the officials concerned of the Government of Pakistan and conducted field surveys in the study area.

As a result of the discussions and the field surveys, both parties have confirmed the main items described on the attached sheets. The Team proceed to further works and prepare the Basic Design Study Report.

Islamabad, February 1, 1996

Mr. Masayuki Watanabe
Leader
Basic Study Team, JICA

Mr. Riaz Hussain Warriach
Chief Engineer
D.G. Khan
Irrigation and Power Department,
Government of the Punjab

Mr. Asif H. Kazi
Special Secretary
Ministry of Water and Power,
Government of Islamic Republic
of Pakistan

Mr. Shahid Humayun
Deputy Secretary
Economic Affairs Division,
Ministry of Finance and Economic Affairs,
Government of Islamic Republic
of Pakistan

ATTACHMENT

1. Objective of the Project

The objective of the Project is to construct dispersion structures and flood management facilities to control flood water and to optimize it for irrigation purposes in Mithawan area in Punjab.

2. Project Areas

The project areas are in Mithawan Hill Torrent in Punjab. The location map is shown in Annex I.

3. Responsible and Executing Agencies

(1) The responsible authority is the Ministry of Water and Power, Government of the Islamic Republic of Pakistan.
(2) The executing agency is the Irrigation and Power Department, Government of the Punjab.

4. Items requested by the Government of Pakistan

After discussions with the Basic Design Study Team, the following items are finally requested by the Pakistani side.

- Main dispersion structure (Mithawan)
- Second dispersion structure (Bhattiwala Bund)

However, the final components of the Project will be decided after further studies.

5. Japan's Grant Aid System

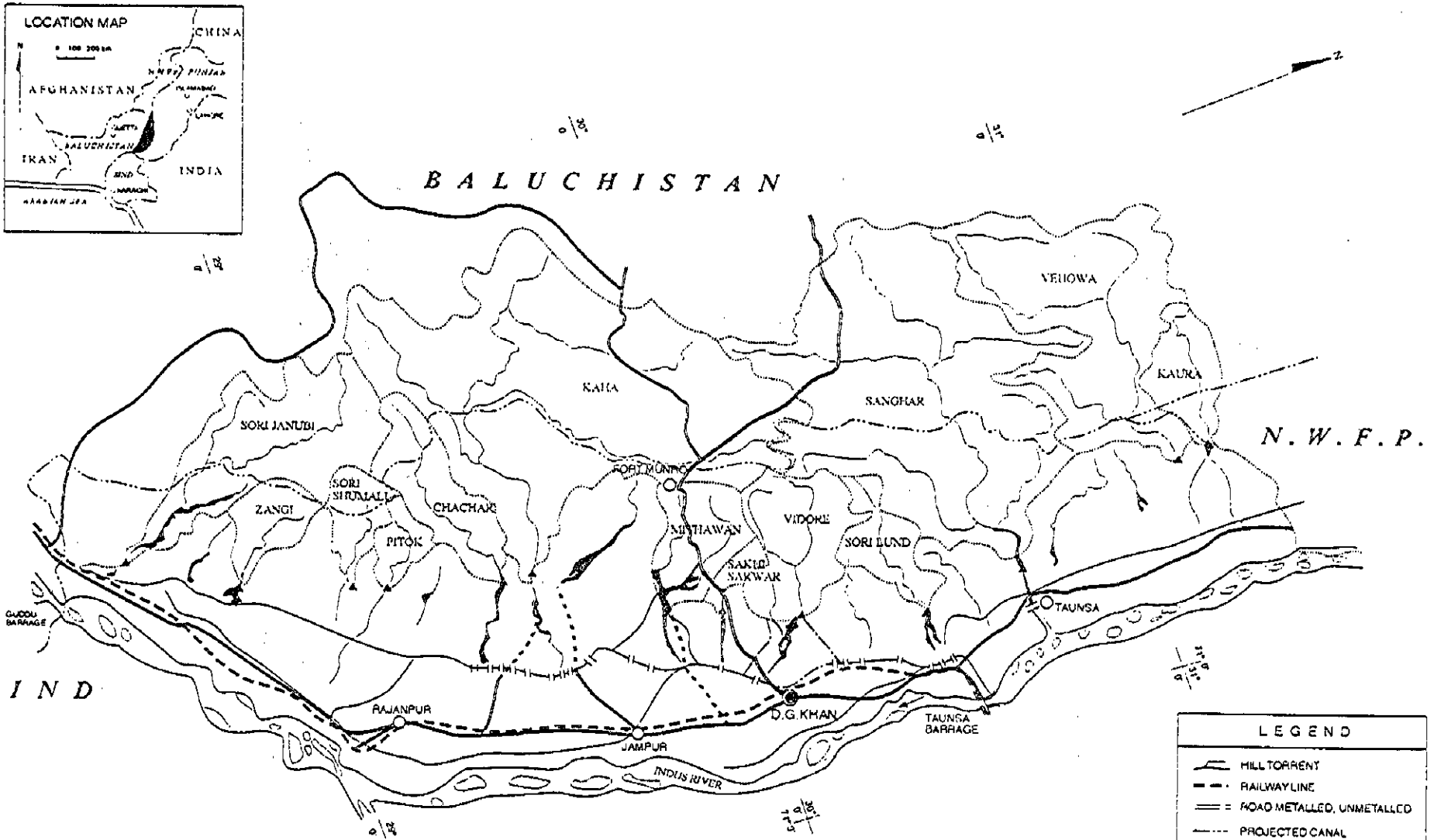
(1) The Pakistani side has understood Japan's Grant Aid system explained by the Team (see Annex II).
(2) The Pakistani side will take necessary measures described in Annex III for smooth implementation of the Project, on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

The consultants will proceed to further studies in Pakistan until February 21, 1996.

7. Other Relevant Issues

(1) The Pakistani side will reply to the letter, as attached in Annex IV, issued by the Study Team Leader to the Additional Secretary of the Irrigation and Power Department, the Government of the Punjab.
(2) The Government of Islamic Republic of Pakistan strongly expressed their hope that they create a new technology center to follow up the Project with a technical and financial cooperation of Japan. The team understood their hope and promised to convey it to the Government of Japan.



Annex I Location for Project Site

Annex II Japan's Grant Aid System

1 Japan's Grant Aid System

1-1. Grant Aid Procedures

1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm (s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

1-2. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereafter referred to as the Study), conducted by JICA on a requested project (hereafter referred to as the Project) is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study area are as follows:

a) Confirmation of the background, objectives, and benefits of the requested Project and institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.

b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.

c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.

d) Preparation of a basic design of the Project

e) Estimation of costs of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA select (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and to avoid any undue delay in implementation should the selection process be repeated.

1-3. Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws' regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting constructing and procurement firms, are limited to "Japanese nationals." (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality).

5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified

by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

6) Undertakings required of the Government of the Recipient Country.

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

(1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.

(2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.

(3) To secure buildings prior to the procurement in case the installation of the equipment.

(4) To ensure all the expenses and prompt execution for unloading, customs clearance at port of disembarkation and internal transportation of the products purchased under the Grant Aid.

(5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.

(6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(8) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

(9) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as 'the Bank'). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

2 Grant Aid Procedures

Grant Aid Procedures is elucidated as "Flow Chart of Japan's Grant Aid Procedures" and "Major Undertaking to be taken by Each Government."

Annex III Necessary measures to be taken by the Government of the Islamic Republic of Pakistan

1. To provide data and information necessary for implementation of the Project.

2. To secure land for the sites of the Project.

3. To ensure prompt unloading. tax exemption. customs clearance at ports of disembarkation in Pakistan and prompt internal transportation of the items purchased under the Grant Aid.

4. To bear the following commissions to the Japanese foreign exchange bank for banking services based upon the Banking Arrangement.

   (1) Advising commission of Authorization to Pay
   (2) Payment Commission

5. To exempt Japanese nationals involved in the Project from custom duties, internal taxes and other fiscal levies which may be imposed in the Islamic Republic of Pakistan with respect to the supply of the products and services under the verified contracts.

6. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Pakistan and stay therein for the performance of their work.

7. To bear all the expenses other than those to be borne by the Grant Aid.

8. To ensure the necessary budget and personnel for the proper and effective implementation of the Project, including operation and maintenance of the equipment provided under the Grant Aid.

9. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant Aid.

Annex IV

INSTITUTE FOR INTERNATIONAL COOPERATION, JICA

10-5, Ichigaya Honmura-cho, Shinjuku-ku, Tokyo
162 Japan

Telephone:03-3269-2911
Facsimile:03-3269-2054

29 January 1996

Mr. Muhammad Sagheer
Additional Secretary
Irrigation and Power Department
Government of the Punjab, Lahore

Dear Sir,

I am writing with regard to the Mithawan Hill Torrent Pilot Project (II).

After our field reconnaissance, we are going to launch a hydraulic simulation using various scale models as well as numeric simulation. In this connection, I should be grateful if you would provide us with the following data and information:

1) Current status of water use and demands assessment in a certain planning term

2) Current status of damage due to floods from the torrent and associated hardships, if any

3) Current status of wah management practices and related problems

   Wah management practices may consist of institutional and/or traditional systems for water use including water right, institutional and/or traditional organizations for water use, funding system to keep the above systems and organizations in operation, and technology employed for water use.

4) Water use and flood prevention plan on which the Project stands

   This includes a possibility of amendment of the water right enacted in 1906 and redelineation of the haqooq and non-haqooq areas.

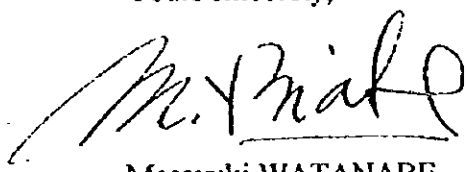
5) Wah management and operation program after the completion of the Project

   In order to achieve the dual purpose, efficient intake of flood water for irrigation purpose and prevention of flood disaster due to excess discharge from wahs, we believe that there must be a coordination mechanism which links beneficiaries in upper reaches and lower reaches. Furthermore, taking into account specific characteristics of the wah channels which accomodate heavy sediment load and vertical and horizontal changes in channel courses during floods, a specific organization is required for monitoring practices. Proper

operation of the structure and maintenance practices based on closer monitoring practices will ensure stable and sustainable water intake.

I believe the data and information mentioned above are indispensable for the study. I should therefore be grateful if you would give me your reply by 18 February 1996.

Yours sincerely,



Masayuki WATANABE
Leader
JICA Study Team

CC: Mr. Riaz Hussain Warriach
Chief Engineer
Irrigation and Power Department
Government of Punjab, D. G. Khan

Minutes of Discussions 10 July, 1996

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY
ON
THE MITHAWAN HILL TORRENT PILOT PROJECT IN PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN

In response to the request from the Government of the Islamic Republic of Pakistan, the Government of Japan decided to conduct a Basic Design Study on the Mithawan Hill Torrent Pilot Project (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Pakistan a study team headed by Mr. Masayuki Watanabe, Development Specialist, JICA, from July 1 to August 11, 1996.

The Team held a series of discussions with the officials concerned of the Government of Pakistan and conducted field surveys in the study area.

As a result of the discussions and the field surveys, both parties have confirmed the main items described on the attached sheets. The Team proceed to further works and prepare the Basic Design Study Report.

Islamabad, July 10, 1996

Mr. Masayuki Watanabe
Leader
Basic Study Team, JICA

Mr. Yousaf Ali
Additional Secretary,
Irrigation and Power Department,
Government of the Punjab

Mr. Asif H. Kazi
Special Secretary
Chairman, Federal Flood Commission
Water and Power
Government of Islamic Republic

Mr. Shahid Humayun
Economic Affairs Division
Ministry of Finance and Economic Ministry of Affairs
Government of Islamic Republic of of Pakistan
Pakistan

ATTACHMENT

1. Objective of the Project

The objective of the Project is to construct dispersion structures and flood management facilities to control flood water and to optimize it for irrigation purposes in Mithawan area in Punjab.

2. Project Area

The project area is in Mithawan Hill Torrent in Punjab. The location map is shown in Annex I.

3. Responsible and Executing Agencies

(1) The responsible authority is the Ministry of Water and Power, Government of the Islamic Republic of Pakistan.

(2) The executing agency is the Irrigation and Power Department, Government of the Punjab.

4. Items requested by the Government of Pakistan

After discussions with the Basic Design Study Team, the following item is finally requested by the Pakistani side.

- Main dispersion structure (Mithawan)

However the final components of the Project will be decided after further studies.

5. Japan's Grant Aid System

(1) The Pakistani side has understood Japan's Grant Aid system explained by the Team. (see Annex II)

(2) The Pakistani side will take necessary measures described in Annex III for smooth implementation of the Project, on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

The consultants will proceed to further studies in Pakistan until August 11, 1996.

7. Other Relevant Issues

It was confirmed that the Government of Islamic Republic of Pakistan should carry out following issues :

(i) to establish the organization for operation and maintenance of the structures and overall fan management,

(ii) to operate and maintain properly and effectively the structures constructed,

(iii) to measure and collect the data on flood discharge,

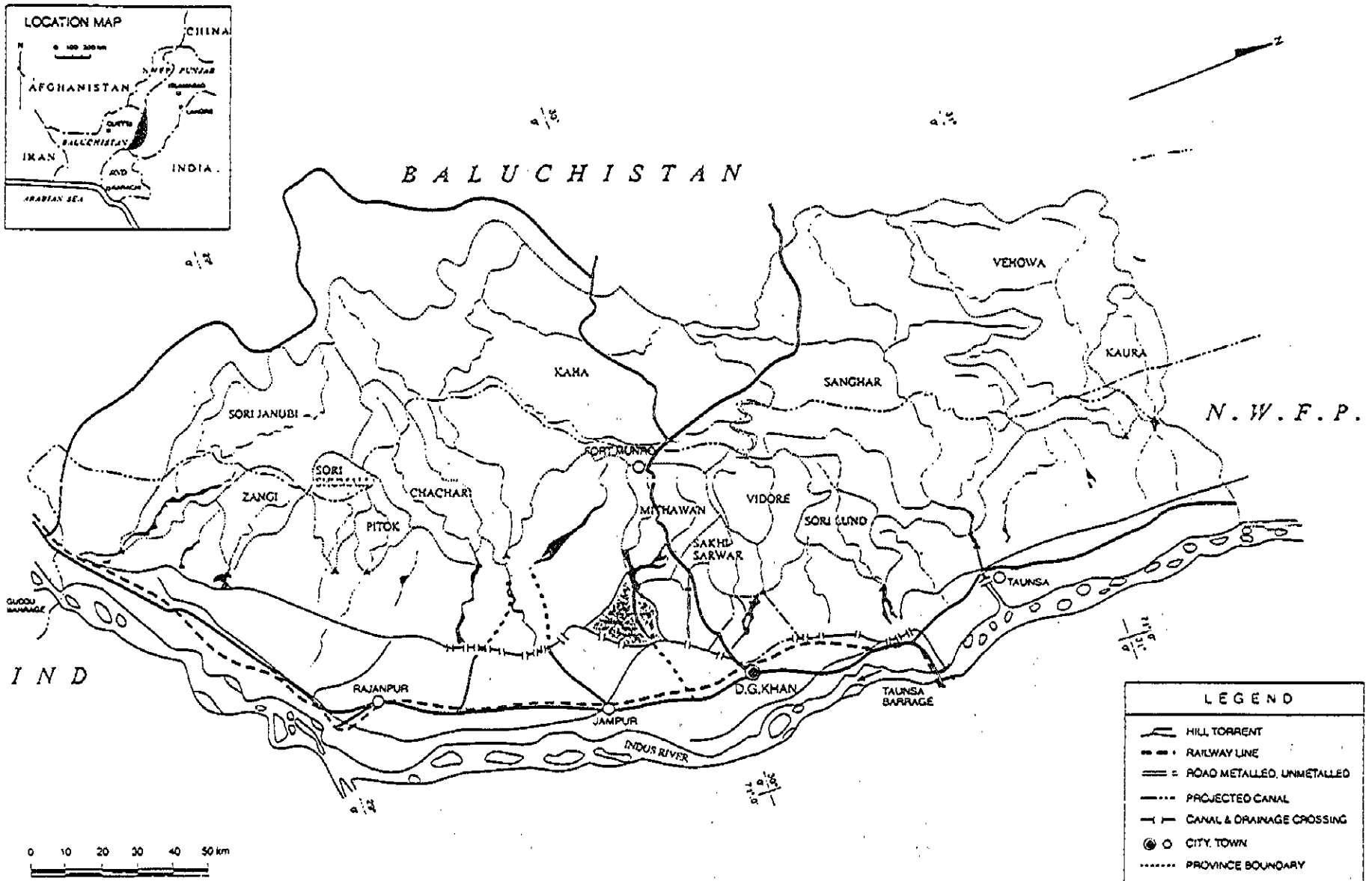
(iv) to secure operation and maintenance expenditure,

(v) to construct, rehabilitate and maintain secondary facilities for efficient distribution of flood flows on the fan, including Bhattiwala Bund,

(vi) to restore and maintain the right bank embankment of D.G.Khan canal and Dajal Branch canal,

(vii) to take appropriate action of possible amendment on water right dispersing flood flows throughout the fan, and

(viii) to strengthen the responsibility of engineers and to enrich their technical experience on hill torrent and fan control engineering by avoiding frequent transferring.



Annex I Location Map of the Project

Annex II Japan's Grant Aid System

1 Japan's Grant Aid System

1-1. Grant Aid Procedures

1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm (s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

1-2. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereafter referred to as the Study), conducted by JICA on a requested project (hereafter referred to as the Project) is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study area are as follows:

a) Confirmation of the background, objectives, and benefits of the requested Project and institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.

b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.

c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.

d) Preparation of a basic design of the Project

e) Estimation of costs of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA select (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and to avoid any undue delay in implementation should the selection process be repeated.

1-3. Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws' regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting constructing and procurement firms, are limited to "Japanese nationals." (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality).

5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

6) Undertakings required of the Government of the Recipient Country.

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

(1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.

(2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.

(3) To secure buildings prior to the procurement in case the installation of the equipment.

(4) To ensure all the expenses and prompt execution for unloading, customs clearance at port of disembarkation and internal transportation of the products purchased under the Grant Aid.

(5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.

(6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(8) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

(9) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as 'the Bank'). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

2 Grant Aid Procedures

Grant Aid Procedures is elucidated as "Flow Chart of Japan's Grant Aid Procedures" and "Major Undertaking to be taken by Each Government."

Annex III Necessary measures to be taken by the Government of the Islamic Republic of Pakistan

1. To provide data and information necessary for implementation of the Project.

2. To secure land for the sites of the Project.

3. To ensure prompt unloading, tax exemption, customs clearance at ports of disembarkation in Pakistan and prompt internal transportation of the items purchased under the Grant Aid.

4. To bear the following commissions to the Japanese foreign exchange bank for banking services based upon the Banking Arrangement.

   (1) Advising commission of Authorization to Pay
   (2) Payment Commission

5. To exempt Japanese nationals involved in the Project from custom duties, internal taxes and other fiscal levies which may be imposed in the Islamic Republic of Pakistan with respect to the supply of the products and services under the verified contracts.

6. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Pakistan and stay therein for the performance of their work.

7. To bear all the expenses other than those to be borne by the Grant Aid.

8. To ensure the necessary budget and personnel for the proper and effective implementation of the Project, including operation and maintenance of the equipment provided under the Grant Aid.

9. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant Aid.

Minutes of Discussions 28 June, 1997

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY
ON
MITHAWAN HILL TORRENT PILOT PROJECT
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
(CONSULTATION ON DRAFT REPORT)

In October 1995, and February and July 1996, the Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team on the Mithawan Hill Torrent Pilot Project (hereinafter referred to as "the Project") to the Islamic Republic of Pakistan, and through discussions, field survey and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult with the Pakistani side on the components of the draft report, JICA sent to Pakistan a study team (hereinafter referred to as "the Team") headed by Mr. Kenji IWAGUCHI, Managing Director, Grant Aid Project Study Department, JICA, which is scheduled to stay in the country from June 23 to 29, 1997.

Both parties confirmed the main points of the discussions as per attached.

The list of participants in series of meetings is attached in the Annex I.

Islamabad June 28, 1997

Mr. Kenji IWAGUCHI
Leader,
Draft Report Explanation Team,
JICA

Mr. Suleman GHANI
Secretary,
Irrigation and Power Department,
Government of Punjab

Mr. Asif H. KAZI
Special Secretary,
Ministry of Water and Power
Chairman,
Federal Flood Commission

Mr. Rashid Mahmood ANSARI
Joint Secretary,
Economic Affairs Division

ATTACHMENT

1. The Team explained the draft report and the Pakistani side has understood it.

2. Both Pakistani and Japanese sides agreed that since the project in question is of "PILOT" nature, the staged development should be the approach to be followed. In this regard, the Pakistani side agreed in principle to the importance of watershed management to reduce the peak flood and sediment for developing Mithawan hill torrent basin.

3. The Pakistani side maintained that flood management structures need not be designed against very rigid standard, since it is always a dynamic situation to which the structures have to respond. The Pakistani side maintained their confidence in the possibility of designing and constructing a flexible structure, with much lesser cost, that would require minor repair/ maintenance every year and some major repair say every 5-10 years.

4. In response to the viewpoint of the Pakistani side, the Japanese team stressed that under geological condition and given flood discharge at 25-year return period, the structures designed in the report are optimum to secure their durability, reliability and stability, though they are not economically feasible.

   The Japanese team also made it clear that Japan's grant aid is accountable for only if it is extended for the construction of durable, reliable and stable as well as economically feasible structures.

5. The Pakistani side, while appreciating Japanese past and on-going cooperation on the development of Mithawan hill torrent basin, requested that the Government of Japan continue to help the Government of the Islamic Republic of Pakistan develop the area.

6. Sharing with the Pakistani side in the recognition of the importance of developing semi-arid areas as Mithawan basin, the Team express their willingness to forward the request by advising the Government of Japan to send a project formation study team to the Islamic Republic of Pakistan not only to further promote watershed management but also to support a project supplementing to the construction of flexible structures if implemented by the Government of Islamic Republic of Pakistan on its own responsibility.

ANNEX I

LIST OF PARTICIPANTS

President, Islamic Republic of Pakistan

H.E. Mr. Farooq Ahmad Khan Leghari

Federal flood Commission

Mr. Asif H. Kazi	Chairmen(Special Secretary)
Mr. Illahi B. Shaikh	Secretary, Chief Engineer
Mr. Alamgir Khan	Senior Engineer

Ministry of Water and Power

Mr. Sarfraz Tariq	Section Officer
Mr. Adnan Jahangir	Section Officer

Ministry of Finance and Economic Affairs, Economic Affairs Division

Mr. S. M. Hasan Zaidi	Deputy Secretary
Mr. Rashid Mahmood Ansari	Joint Secretary

Ministry of Planning and Development, Planning Division

Dr. Zafar Altaf	Member

Irrigation and Power department, Punjab

Mr. Suleman Ghani	Secretary
Mr. Shafqat Masood	Additional Secretary
Mr. Abdul Aki Sheik	Deputy Secretary
Mr. Iftikhar Ahmad Bhutta	Superintending Engineer
Mr. Mubashir Hussain	Chief Engineer

Irrigation and Research Institute, Lahore

Mr. Tahir Ahmad Malik	Chief Engineer
Mr. M. Bashir Shaiki	Hydraulic Modeling

Planing and Develop Department, Punjab

Mr. Tariq Sultan	Chairman
Mr. Riaz Ahmed Khan	Member (Engineering)
Mr. C.A.Haheez	Member(ECA)
Mr. Nasim Riaz	Assistant Chief(ECAI)
Mr. Abdul Latif Khan	Research Officer (ECAI)

M/S NESPAK(Local Consultant)

Mr. Javid Arif	Chief Engineer

Draft Report Explanation Team

Mr. Kenji Iwaguchi	Leader
Mr. Fumio Iwai	Grant Aid Cooperation
Mr. Shokitchi Sakata	Coordinator
Mr. Yoichi Kishi	Chief Consultant
Dr. Akira Oda	Hydraulic Model Test Planner
Mr. Junichi Kamata	Facility Designer

Embassy of Japan

Mr. Takao Kwakami	Ambassador
Mr. Hiroshi Hukada	Minister
Mr. Koji Yamada	First Secretary

JICA Pakistan Office

Mr. Kazuo Nakagawa	Resident Representative
Mr. Noriaki Nagatomo	Deputy Resident Representative

Cost Estimation Borne by the Recipient Country

5. Cost Estimation Borne by the Recipient Country

In the course of the project implementation, some cost shall be borne by Pakistan side on the 5 items, i.e., (1) land acquisition, (2) compensation, (3) office expense, (4) facilities, and (5) utilities. The result of the cost estimation is summarized as follows.

Cost borne by Pakistan

Items	Cost (Rs. '000)
(1) Land acquisition	0
(2) Compensation	50
Compensation for lands and crops at stock yard	
(3) Office expense	1,287
1) Salary & wage	780
2) Vehicle & operation cost	390
3) Others	117
(4) Facilities	0
(5) Utilities	100
Total	1,437

(1) Land Acquisition

The cost on the land acquisition will not be necessary for expense, because the proposed construction site will be located within the river.

(2) Compensation

The compensation will be required for the stock yard of 2.6 ha for 39 months. A half of the land, assumed as a wasted land, will cost Rs. 15,000 on the lease for the construction period. Another half, assumed as a farm land will cost as a crop compensation. Jowar, representative crop in the area, may make a value of Rs. 8,832 /ha/year, based on the average yield rate of 736 kg/ha and the expected present price of Rs. 12 /kg. Thus, the total crop compensation will be about Rs. 35,000 because 4 crop seasons will pass. As a result, the total compensation cost is estimated at Rs. 50,000.

(3) Office Expense

The office expense consists of salary and wages, vehicle and operation cost, and others. For the Project, one SDO will work for the implementation, his salary including related expense is estimated at 780,000, based on the unit cost of Rs. 20,000 per month. The vehicle cost will be nil because the vehicle of IPD will be available for the project. Thus, only fuel and oil will cost at Rs. 390,000 based on the unit cost of Rs. 1,000 per month. Other cost is estimated at Rs.

39,000 based on the unit cost of Rs. 3,000 per month. As a result, the total office expense amounts to Rs. 1,287,000.

(4) Facilities

The cost on the facilities, such as electric supply, water supply, telephone line, etc., will be nil because the Project will use the furnished D. G. Khan office of IPD.

(5) Utilities

The cost of all utilities necessary for the Project implementation is estimated at Rs. 100,000 as lump sum.

REFERENCES

REFERENCES

1. Report on Hydraulic Model Test (Part 1)

2. Report on Hydraulic Model Test (Part 2)

3. Characteristics of the Channels on Mithawan Alluvial Fan

4. Project Area

5. Report on Social Soundness Analysis

Report on Hydraulic Model Test (Part 1)

Table of Contents

1 OBJECTIVES AND PARTICULARS OF THE TEST

1.1 Objectives

A large quantity of eroded materials from the watershed forms the Mithawan alluvial fan which extends about 20 km from east to west and about 20 km from south to north. Though the annual rainfall is less than 300 mm in the area, floods occur mostly in the monsoon season from July to September.

Two third in the northern part of the alluvial fan is given the water rights, and remained one third in the southern part has no water rights. North and South branches supply water to the water rights area and Escape channel goes to the area without water rights, and D.G.Khan canal runs along the base of the alluvial fan.

On the Mithawan alluvial fan, flood irrigation has been traditionally carried out acquiring irrigation water from flood flow, that is the unique water resources. On the other hand, the canal irrigated areas have been suffered from flood damage for a long time located in the lower reaches of the Mithawan fan. Construction of the structure has been proposed to distribute flood flows over the fan to expand flood irrigation and to reduce flood damages.

Construction of the structure, however, must break the equilibrium of the sandy riverbed, so that forecast on a riverbed alteration is important prior to design the structure. Since numerical analysis cannot solve all the phenomena brought about by the structure, a series of hydraulic model test has been done to evaluate the function and effect of the structure experimentally.

1.2 Particulars of the Test

The hydraulic model tests aim to perceive followings.

1) Selection of the suitable location for the distributor,
2) Determination of a type of the distributor to maintain the proposed shares of flood distribution at any flood discharge,
3) Confirmation of the discharge at the beginning to divert into Escape,
4) Evaluation of the function of the distributor and fluctuation of shares of distribution by riverbed alteration, and
5) Evaluation of the function of the existing Hadwari bund.

2 DESIGN FACTORS OF THE MITHAWAN DISTRIBUTOR

2.1 Design Flood Discharge

According to the local residents, the flood occurred on September 4 in 1994 was the highest one since 1986, and its discharge was estimated at 2,070 cumecs (73,000 cusecs) by the flood marks. The drainage area at the outlet of the Mithawan valley was 741 km^2 during the flood.

In the Mithawan hill torrent, the flood discharge at various return periods is estimated by statistical analysis (Iwai's method) using 21 and selected 19 data from 1979 to 1989 (See Table-2.1).

Table-2.1 Relation between return Period and Discharge

A number of data	Discharge Q (m3 / sec)	Q (cusec)
1	65	2,291
2	110	3,877
3	232	8,177
4	299	10,538
5	502	17,693
6	518	18,257
7	518	18,257
8	611	21,535
9	729	25,694
10	730	25,729
11	968	34,117
12	1,270	44,761
13	1,392	49,061
14	1,446	50,965
15	1,631	57,485
16	1,637	57,696
17	1,674	59,000
18	1,695	59,741
19	2,193	77,293
20	2,251	79,337
21	2,264	79,795

For 21 data			For 19 data		
Return Period	Discharge Q		Return Period	Discharge Q	
	(m3 / sec)	(cusec)		(m3 / sec)	(cusec)
2 year	917	32,320	2 year	1,065	37,536
3 year	1,257	44,303	3 year	1,376	48,497
5 year	1,658	58,437	5 year	1,726	60,833
10 year	2,188	77,117	10 year	2,169	76,447
20 year	2,722	95,938	20 year	2,597	91.532
25 year	2,882	101,577	25 year	2,721	95,902
50 year	3,451	121,631	50 year	3,142	110,741

The discharge of 25-year return period is estimated at about 2,800 m^3/sec in Mithawan Nallah with drainage area of 741 km^2. But the drainage area has been reduced to 640 km^2 by constructed Choti Nallah distributor in 1996. Accordingly, the design flood discharge at Mithawan hill torrent has bee reduced to 2,500 cumecs (88,100 cusecs) proportional to the reduction of the drainage area.

2.2 Design Hydrograph

The design hydrograph for the hydraulic model test is shown in Table-2.2 and Fig.-2.1. The design hydrograph at the peak flood discharge of 1,900 m^3/sec shown in the PC-1 application form was extended to the flood discharge of 2,500 m^3/sec. The total run-off of the design flood is estimated about 59 million m^3.

Table-2.2 Hydrograph of 25 years Return Period

Time	Discharge	Unit Discharge Volume		Accumulated Discharge	
(hour)	Q (m3 / sec)	(m3)	(cu ft)	(m3)	(cu ft)
0	0	0	0	0	0
1	224	403,200	14,210,881	403,200	14,210,881
2	373	1,074,600	37,874,536	1,477,800	52,085,417
3	1,567	3,492,000	123,076,381	4,969,800	175,161,798
4	2,238	6,849,000	241,394,654	11,818,800	416,556,452
5	2,500	8,528,400	300,585,512	20,347,200	717,141,963
6	2,388	8,798,400	310,101,727	29,145,600	1,027,243,690
7	1,940	7,790,400	274,574,524	36,936,000	1,301,818,214
8	1,436	6,076,800	214,178,279	43,012,800	1,515,996,493
9	1,045	4,465,800	157,398,196	47,478,600	1,673,394,689
10	765	3,258,000	114,828,995	50,736,600	1,788,223,684
11	560	2,385,000	84,059,899	53,121,600	1,872,283,583
12	410	1,746,000	61,538,190	54,867,600	1,933,821,774
13	298	1,274,400	44,916,535	56,142,000	1,978,738,308
14	216	925,200	32,608,897	57,067,200	2,011,347,205
15	149	657,000	23,156,123	57,724,200	2,034,503,328
16	104	455,400	16,050,683	58,179,600	2,050,554,011
17	75	322,200	11,356,016	58,501,800	2,061,910,028
18	63	248,400	8,754,918	58,750,200	2,070,664,946
19	41	187,200	6,597,909	58,937,400	2,077,262,855
20	34	135,000	4,758,108	59,072,400	2,082,020,962
21	22	100,800	3,552,720	59,173,200	2,085,573,682
22	15	66,600	2,374,333	59,239,800	2,087,921,015
23	11	46,800	1,649,477	59,286,600	2,089,570,493
24	7	21,609	761,614	59,308,209	2,090,332,107
25	4	19,800	697,856	59,328,009	2,091,029,963
26	0	7,200	253,766	59,335,209	2,091,283,729

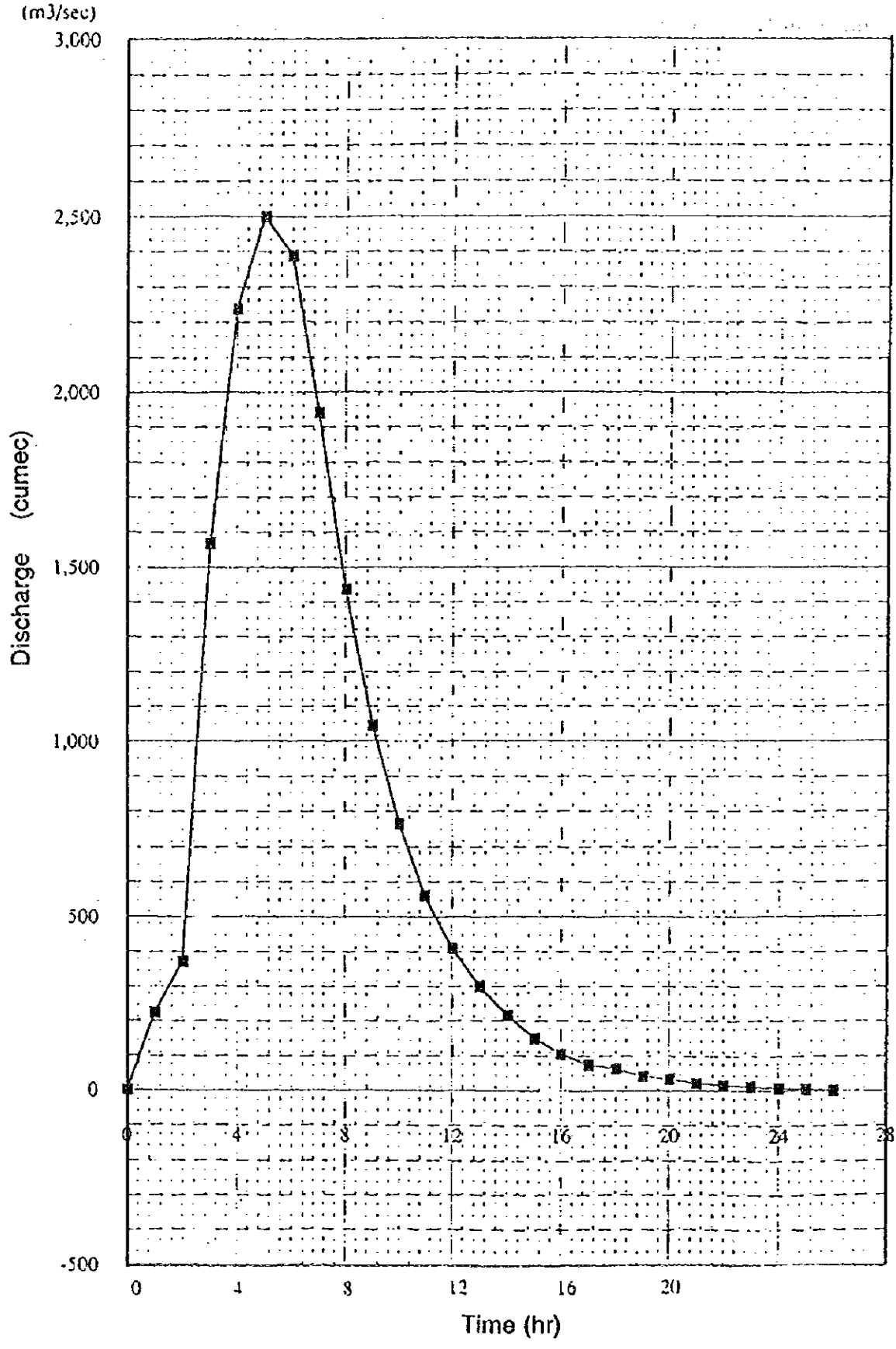


Fig -2.1 Hydrograph at Mithawan Nala

2.3 Distribution Plan and Proposed Shares of Distribution

2.3.1 Distribution Plan

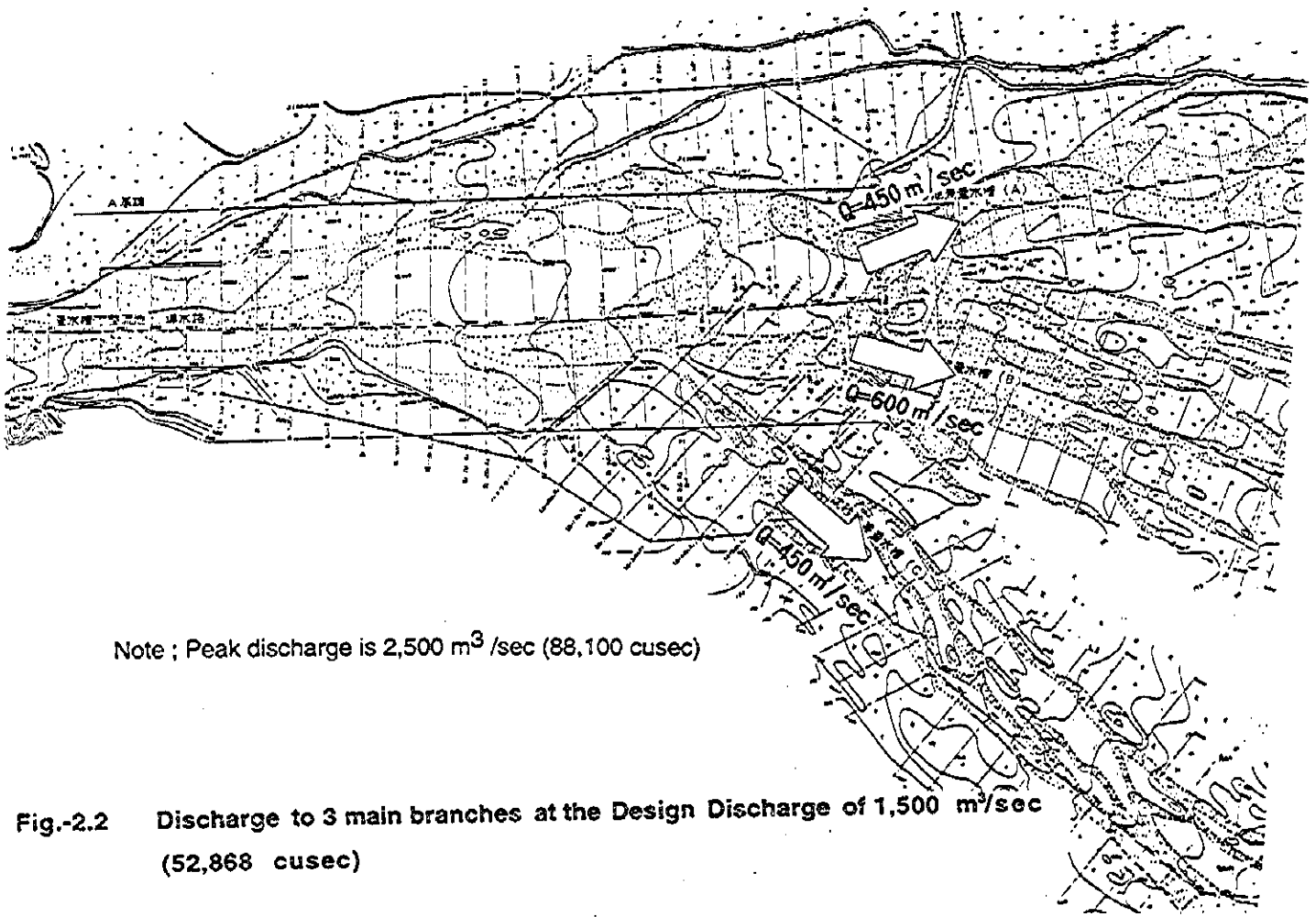
On the Mithawan alluvial fan, flood flows have been the unique water resources for the flood irrigation. Failure of flood irrigation has resulted serious damage in the crop land in the lower reaches of Mithawan alluvial fan. Construction of the distributor assures to distribute flood flows to the North and South branches and the Escape at certain shares. Design discharge and share of flood distribution for each channel are as follows.

(1) Design Discharge for the structure safety	2,500 m^3 /sec (88,113 cusec)	25-year return period
(2) Design Discharge for flood distribution	1,500 m^3 /sec (52,868 cusec)	5-year return period

Shares of flood distribution for the three major branches

North Branch : South Branch : Escape = 450 m^3 /sec : 600 m^3 /sec : 450 m^3 /sec
=15,860 cusec : 21,147 cusec : 15,860 cusec
= 30 % : 40 % : 30 %

Note; Design Peak Discharge is 2,500 m^3 /sec (88,113 cusec)



Note ; Peak discharge is 2,500 m^3 /sec (88,100 cusec)

Fig.-2.2 Discharge to 3 main branches at the Design Discharge of 1,500 m^3/sec (52,868 cusec)

2.3.2 Flow Capacity in Main Branches

The flow capacities in the main branches are shown in Table-2.3 which are examined during the site survey and the branch system on the Mithawan fan is shown in Fig.-2.3. Flow capacities for North branch, South branch and Escape are 500 m3/sec, 550m3/sec, and 480 m3/sec respectively.

Table-2.3 Flow Capacity in Main Channel

Main Branch	Name of Wah	Width of wah. (m) {feet}	Depth (m) {feet}	River bed Gradient	Manning's Roughness Coefficient ($sec/m^{1/3}$) ($sec/ft^{1/3}$)	Velocity (m / sec) {ft / sec}	Discharge (m^3 /sec) {cusec}
North	Talha	15 {49.2}	1.5 {4.92}	1 / 300	0.025 {0.037}	2.68 {8.79}	60 2,115
	Moldi	40 {131.1}	1.5 (4.92)	1 / 300	0.025 {0.037}	2.88 {9.44}	173 {6,097}
	Behu	25 {82.0}	1.5 {4.92}	1 / 300	0.025 {0.037}	1.81 {5.93}	105 3,700
	Sharti	100 {327.9}	0.8 {2.6}	1./ 300	0.025 {0.037}	1.97 {6.46}	158 {5,569}
South	Darel	30 {98.4}	1.0 {3.28}	1 / 300	0.025 {0.037}	2.21 {7.25}	66 {2,326}
	Sirag	300 {983.6}	0.8 {2.62}	1 / 300	0.025 (0.037}	1.98 {3.28}	476 {16,777}
Escape	Bhakker	150 {491.8}	0.8 {2.62}	1 / 300	0.025 (0.037}	1.98 {3.28}	237 {8,353}
Total							1,513 {53,326}

2.3.3 Design Flood Discharge and Shares of Flood Distribution

The shares of flood distribution was determined to be North branch : South branch : Escape = 30 %: 40% : 30% at the discharge of 1,500 m^3/sec (5-year return period) considering the capacity of the branches. The design flood discharge, however, is determined at 2,500 m^3/sec., so that flood flows must be spilled over in the lower reaches of the channels resulting the fan area being inundated. Therefore, the design flood was not applied for the discharge for flood distribution. Instead of the design flood, the total capacity of the branches of 1,500 m3/sec was applied for the experiments to determine the shares of distribution of flood flows.

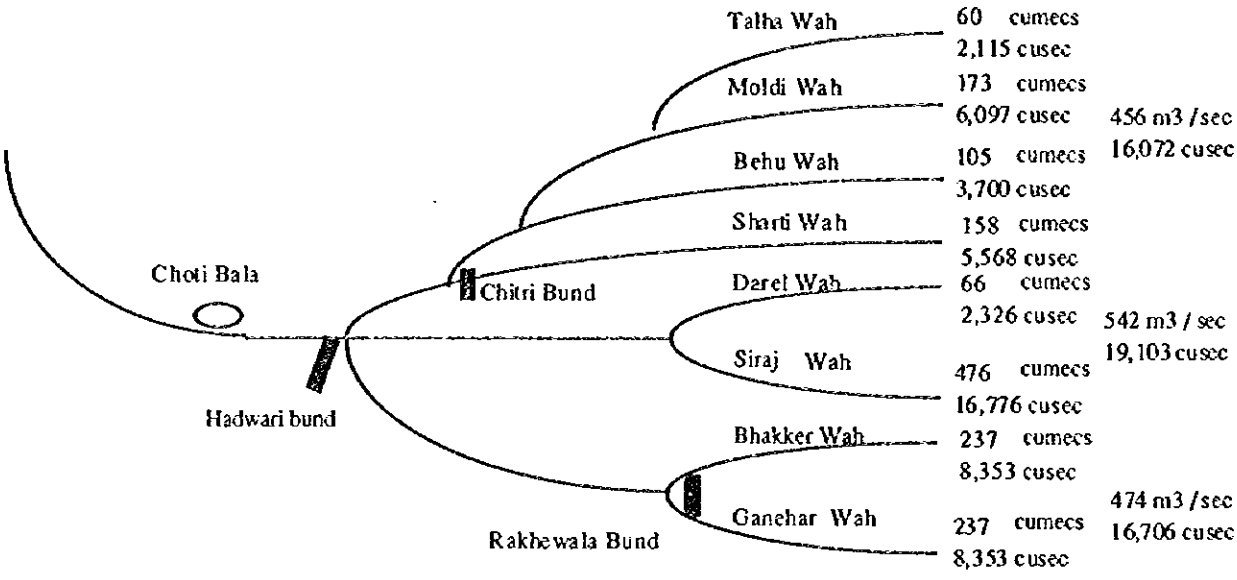


Fig.-2.3 Diagram of Discharge Capacity in Main Branches on Mithawan Fan

Table-2.4 Shares of Distribution

Main Branch	Name of Wah	(a)Existing Cultivated Area Basis		(b)Cultivable Area Basis		(c)Command Area Basis		(d)Channel Capacity Basis		Average Share (a)+(b)+(c)+(d)
		(ha)	%	(ha)	%	(ha)	%	(cumecs)	%	%
North	Talha	2,112	31.0	2,576	20.8	3,462	13.2	340	21.2	
	Sharti			1,314	10.8	2,150	8.8	160	10.4	
	Sub Total	2,112	31.0	3,890	31.6	5,612	22.0	500	31.6	30 %
South	Darel	938	13.2	938	7.6	970	3.0	70	3.6	
	Sirag	2,262	33.2	4,852	99.2	6,783	27.9	480	31.4	
	Sub Total	3,200	48.4	5,790	46.8	7,753	31.8	550	35.8	40%
Escape	Bhakker	1,247	18.9	1,811	13.6	5,458	21.4	240	15.7	
	Ganehal	50	0.8	880	7.1	5,530	21.7	240	15.7	
	Sub Total	1,297	19.8	2,891	21.8	10,988	45.1	480	31.4	30%
Total		6,609	100.0	12,371	100.0	24,953	100.0	1,630	100.0	100%

2.4 Particle Size on River Bed

The river bed material is composed of fine sand, 0.3 mm in average diameter as shown in Fig.-2.4. Photo-1 shows the river bed material at the site.

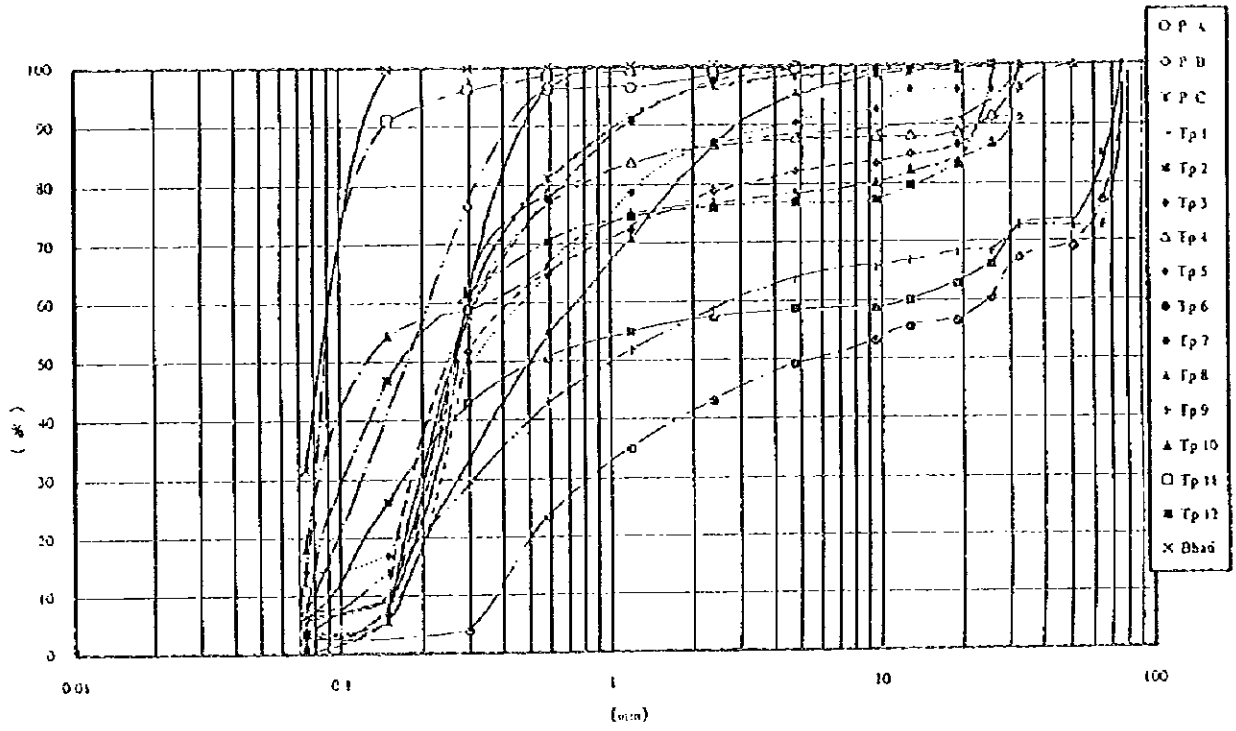
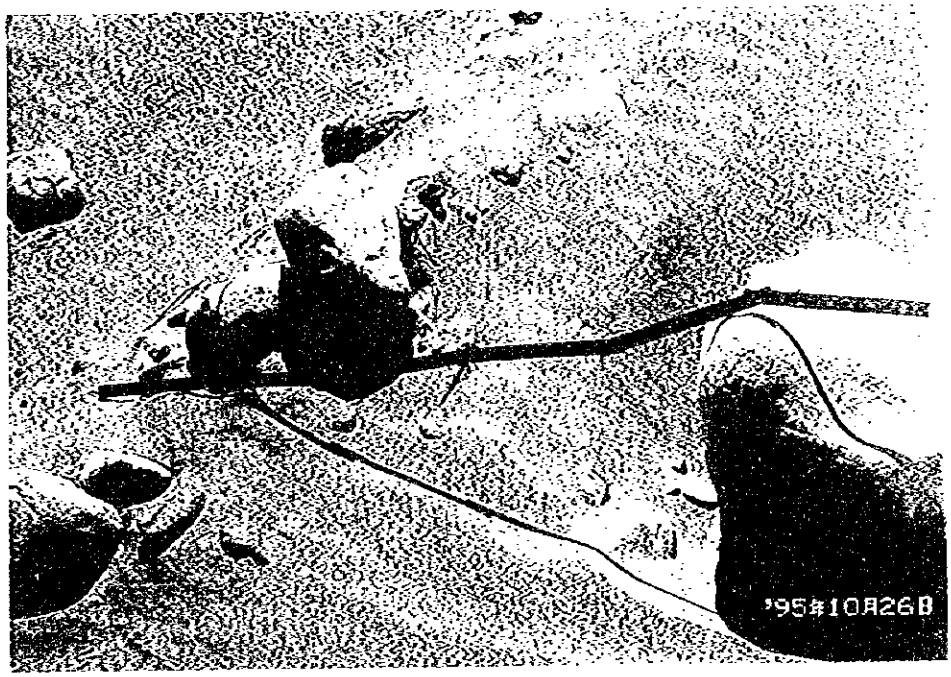


Fig. 2.4 Grain Size Distribution of Mithawan Bed Material

Photo. 1
Bed material composed mostly fine sand with rare boulder. It lacks medium size particles.



3 MORPHOLOGICAL FEATURES OF MITHAWAN FAN

Immense topographical change is expected to happen on the Mithawan alluvial fan, because the bed of the Mithawan hill torrent is composed of fine sand even at its apex. Therefore, it is important to understand the characteristics of sediment transportation and its effect on the fan and river morphology. The features of the Mithawan hill torrent are described below.

3.1 Bed Slope

Topography around the apex of the Mithawan fan is shown in Fig. 3-1. The figure shows that the bed slope is 1/240 in the upper reaches of the apex, 1/570 at the apex, then it is again 1/250 downstream of the distributary point near Hadwari bund. The bed slope in the Escape is steeper than those of the North branch or the South branch.

3.2 Width of the Channel

The channel width upstream of the apex is wider than that of each branch downstream of the Hadwari bund, but the total of each width of the three branches downstream of the Hadwari bund is wider than that of the upper reaches of the apex. Accordingly, it can be said that the channel width on the alluvial fan is wider than that of in the upper reaches of the apex.

3.3 Cross Section of Channel

The riverbed of the channels on the alluvial fan are mostly flat in the cross sections. The height of river banks, however, varies depending on the extent of flood concentration. In the most of the fan, the height of the river banks is about 60 cm at most. Onhe other hand, the river bank reaches to 3 to 4 m high where the channel bed eroded by the concentrated flood flows.

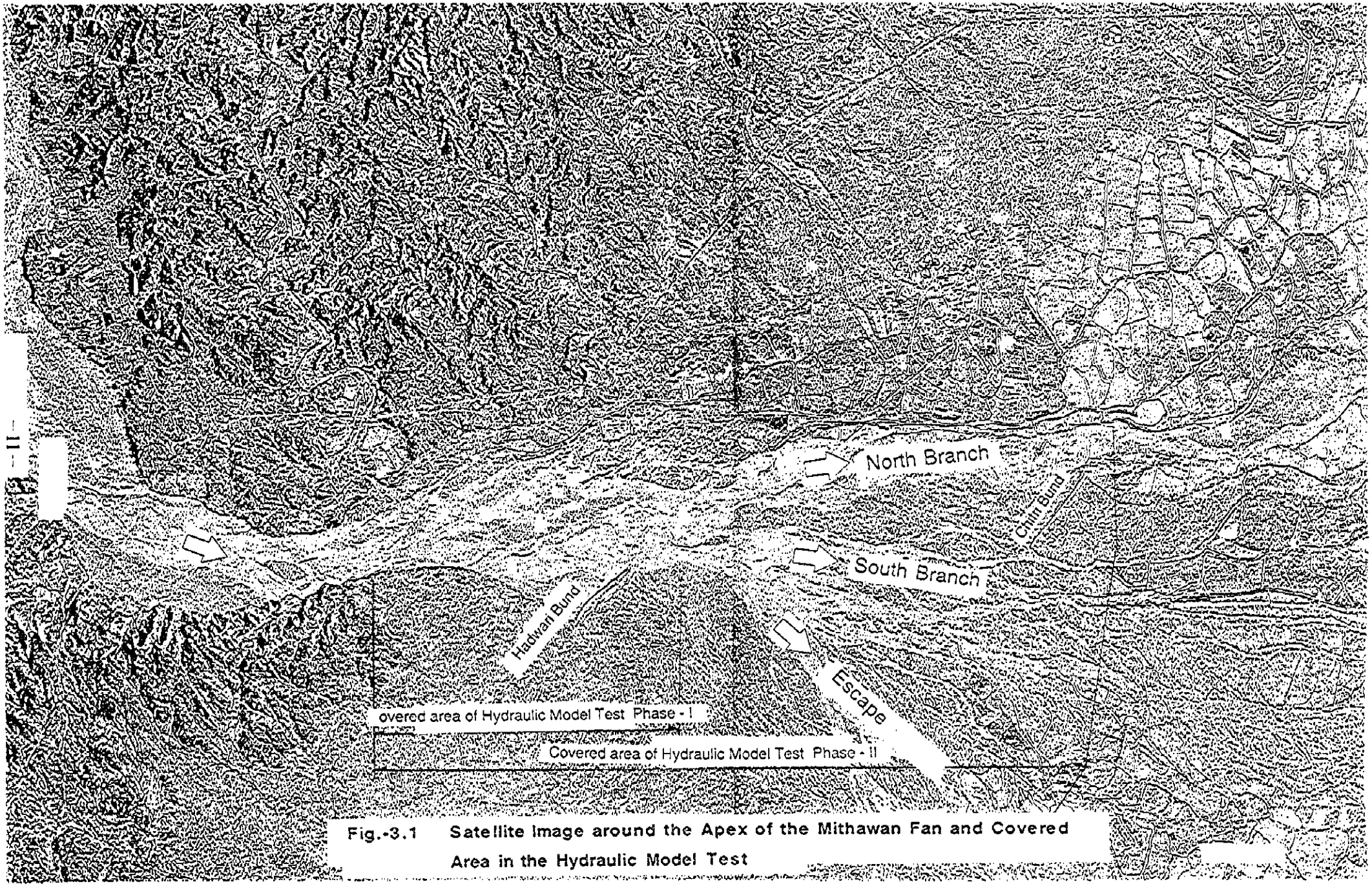


Fig.-3.1 Satellite Image around the Apex of the Mithawan Fan and Covered Area in the Hydraulic Model Test