

will be applied for the construction of large scale structures, such as mini-dams and check dams, which contribute to improve environmental circumstances of the area and are not familiar to the villagers. The small structures, which are popular in the area, will be constructed by the community organization with technical assistance of FAO. The community organization will operate and maintain the facilities built by the project in future.

The request to Japan's Grant Aid Program is construction of small dams and various other structures, and land conservation works. Facilities and equipment listed below are also requested to facilitate and supply by the Government of Japan for supporting FAO's program.

1. Office buildings with appurtenant facilities
2. Vehicles and equipment for FAO's activities
3. Demonstration farm and appurtenant facilities
4. Construction for small pond, silt-trap dam, check dams and water resource development
5. Vegetation works
6. Equipment for water resource development and construction works

The details of the FAO's project are mentioned in the Mithawan Watershed Management Project in the appendix.

#### **4.2.3 Evaluation for Components Requested by the Government of Pakistan**

Present condition at the proposed site for structures in Choti nallah and Nangar nallah, pilot project site in Dholl, and proposed alignment of road were investigated in this field survey. Based on the results of the investigation, the project components have been evaluated.

##### **(1) Results of the Investigation**

The proposed site of Choti nallah distributor is located at 250 m above sea level on the alluvial fan, which is still active, at 250 meter height. The site is composed of cobbles and boulders larger than man head size, which have been transported as debris flows, and sandy deposits dominate on the river-bed more than 300 meters below the site. The site is cobble and boulders suitable in views of elevation of the bed of canals, providing that large stones mixed in flood-flows are eliminated for the purpose of diverting water properly at the site. Construction of sediment pocket is required for this purpose at Choti nallah

darrah, 800 meters upstream of the site. As to a type of the structure, sediment pocket formed by low dike of boulders is recommended.

The proposed site of Nangar nallah is located on the alluvial fan at 290 m above sea level. Fan of Nangar nallah is larger than that of Choti nallah and man head size cobbles extend to about 4 kilometers downstream from the fan cone. Nangar nallah is raised bed river at the proposed distributor site and the water course changes with every high flood. Because of this, proper maintenance of the water course including construction of Sabo structure, a measure reducing sediment supply, is a must for keeping function of the proposed distributor. However, by reason of a vast quantity of sediment supply, Sabo structure will be not only huge and costly but also uncertain in its effect. Moreover, water quantity might be short for irrigation except high flood even raised bed water course maintained, because much leakage is estimated through pervious river-bed composed of cobbles. And as the distributor itself seems to be small and simple structure, it can be temporarily constructed by the farmers through ordinary maintenance works. Consequently, the construction of Nangar nallah distributor is canceled from the Project.

Proposed road work includes improvement of existing roads network and construction of temporary road for construction works. Road from Choti Zerim to Choti Bala is recommended to improve mainly at cross drainages and cause ways damaged during floods in 1992 and 1993. Road from Choti Bala to Sakhi Sarwar must be improved mostly the portion passing in hilly area in consideration with the importance for farmers' transportation. The road to the watershed conservation project site is also recommended to be improved so as to eliminate frequent stoppages during rainfall. Temporary road for construction works is proposed from Choti Bala to the Project sites in Choti nallah which will be available for farmers' transportation also.

Pilot model project for watershed management is planned at Dholi in which villagers have made effort to develop more than 50 ha farm land over the last several decades. It was recognized during the field survey that farmers in Dholi have been eager to improve their living conditions, to enlarge their own farm land and to increase production of fodder.

Judging from the results of interview carried out by FAO, farmers must be able to conduct watershed management by themselves with understanding of the importance to recover the vegetation in watershed. Considering these

situation, the pilot model project for watershed management at Dholi is expected significant.

Described above are results of the field survey regarding requested components by the Pakistan government excluding Mithawan distributor and Bhattwala band.

(2) Evaluation of the Request

Flood water diverting in Choti nallah will be realized to irrigate about 6,000 ha by means of construction of flood distributor in Choti nallah. No difficulties is found in operation and maintenance for the facilities in comparison with similar other facilities. The construction work of Choti nallah distributor is therefore concluded to be suitable as a component of Grant Aid Program in view of its scale, construction period and necessity.

Though the Nangar nallah distributor may benefit the area through irrigation, this work should be canceled in the Grant Aid Project because of its scale and difficulty in physical conditions.

Two road improvement works of Choti Zerim to Choti Bala and Choti Bala to Sakhi Sarwar are selected as a component of the Project, which can be utilized for distributor construction work. Construction of roads from Choti Bala to the Project sites in Choti nallah and from Rakhi Munh to Dholi in watershed management works are included in the component. These road works are selected in view of necessity and urgency as a grant aid program.

Implementation of watershed management will cooperate with FAO. FAO's concept to the watershed management is people's participation to the project for promoting it by them-selves. Following this concept, construction of small structures, which are popular in the area, is recommended to be executed by the community organizations with technical assistance of FAO.

The study team recommend that Japan's Grant Aid would be applied for construction of large scale structures, which contribute to improve environmental circumstances of the area and are not familiar to the people, in three (3) square kilometers wide demonstration area around Dholi village and also for construction of office buildings for the base of FAO's activity and equipment supporting usual activity such as tractors and facilities for training.

During the field survey of Basic Design study, the Study team had opportunities to observe agricultural practice in Mithawan hill-torrent toward the end of rainy season. Though construction works for main distribution structure in Mithawan hill torrent and Bhattiwala bund have once been eliminated from the Project, necessity of the two structures has strongly recognized considering farmer's enthusiasm for realization and remarkable benefits of their construction. Study team watched that farmers were controlling flood flows by building temporary dikes immediately when floods arrive. Construction of Mithawan distributor and Bhattiwala bund must be distribute excess flood water properly to farm land automatically. Considering importance of the facilities, Mithawan main dispersion structure and Bhattiwala bund are recommended to be included in the Project.

#### **4.3 Outline of the Plan**

##### **4.3.1 Executive Agency and Organization for Operation and Maintenance**

An agency for implementation of the Project is Janpur construction department of Irrigation office of the D. G. Khan circle. After completion of the Project, operation and maintenance of the completed facilities will be conducted by the same agency. The organization for implementation, operation and maintenance of the Project is shown in Fig. 4.3.1-1.

##### **4.3.2 Location and Present Condition of the Site**

Proposed site of Choti nallah distributor is located at about 800 meters downstream of the sediment pocket which will be constructed at Choti nallah of 6 kilometers distance from village of Choti Bala. River bed of the site is composed of sand and gravel, which has high bearing capacity but weak against. Cobbles and boulders flown from a ravine comprise river bed at around the sediment pocket site. Command area for irrigation by the Choti nallah distributor is about 1,500 ha and it will extend additionally 5,000 ha when big flood occurs.

Dholi village, where watershed management project will be implemented, is national located in a valley of 8 kilometers northwest from the road from D. G. Khan to Baluchistan. Approximate population of the village is 700. There is a small irrigation from Siri nallah supplying to about 50 ha farm land in the village. Wheat is normally cultivated in winter, millet and sorghum is cultivated in summer.

Location of these sites are shown in Fig. 4.3.2-1.

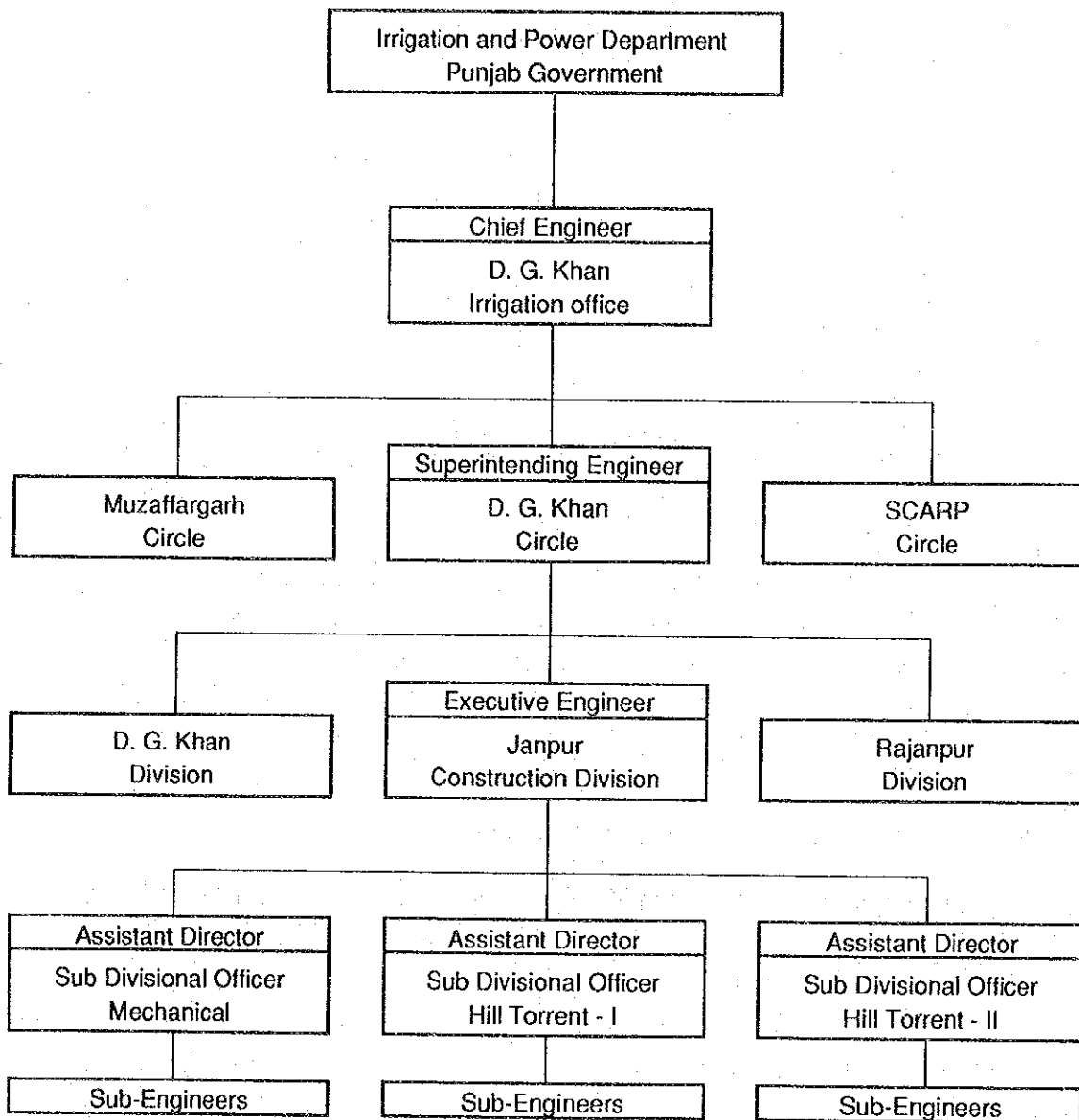


FIG. 4.3.1-1 ORGANIZATION FOR PROJECT MANAGEMENT AND OPERATION/MAINTENANCE

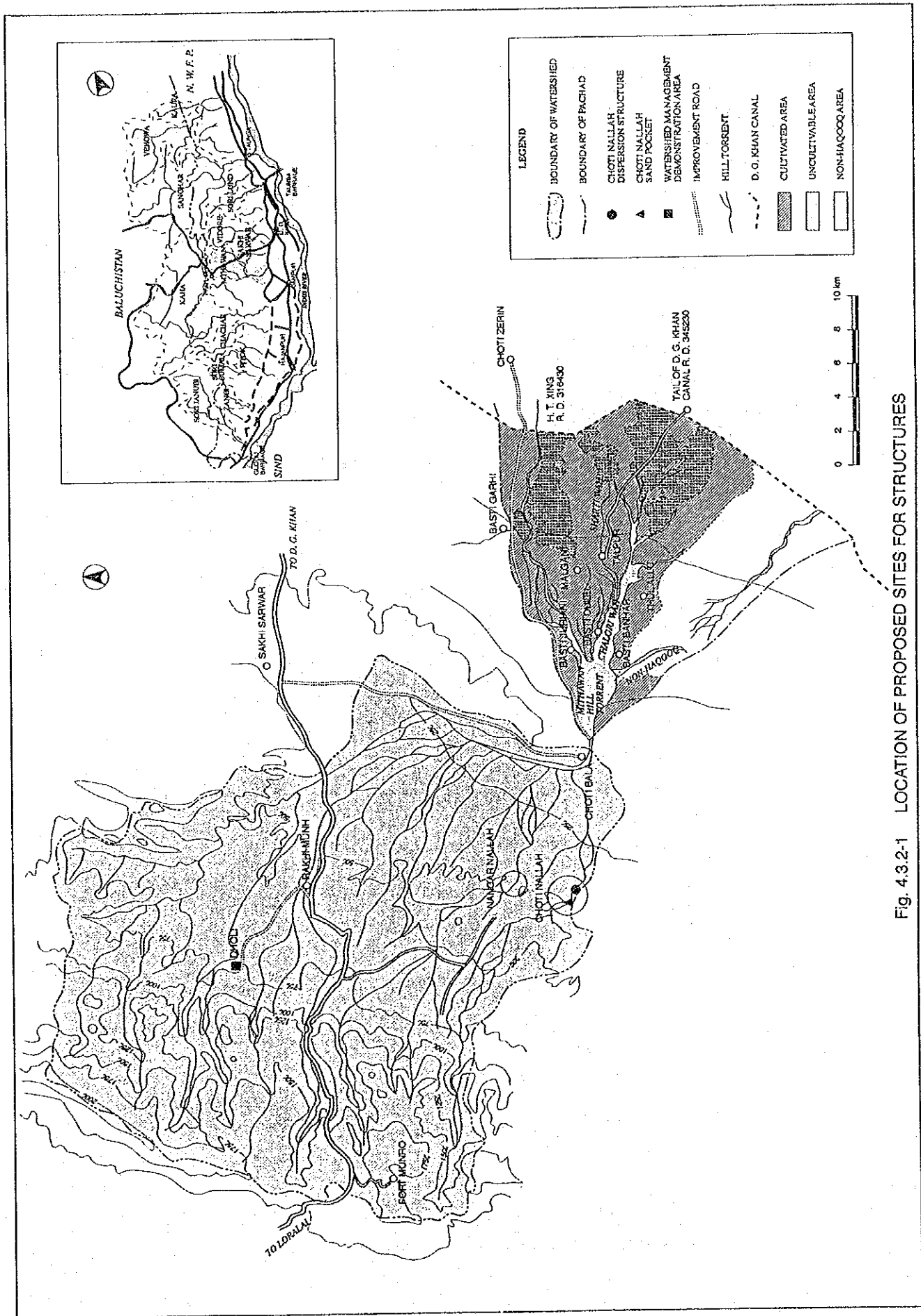


Fig. 4.3.2-1 LOCATION OF PROPOSED SITES FOR STRUCTURES

### 4.3.3 Summary of Proposed Facilities and Equipment

#### (1) Facilities

##### (a) Sediment Pocket

Capacity for sediment is 150,000 cu.m.

##### (b) Choti Nallah Distributor

Distributor provides irrigation water to Deviani, Al-Hadad, Malakh, Kandewala, Tajjarwala canals.

##### (c) Office Buildings

Office buildings, such as project office, site office and training center are provided for the base of FAO activities. Two types of training center building will be built for staff.

Table 4.3.3-1 Area of Office Buildings

Project office	Building	627 m <sup>2</sup>
Site office	Building	226 m <sup>2</sup>
Training center		
No. 1 Two-storied	Building	377 m <sup>2</sup>
No. 2 One-storied	Building	200 m <sup>2</sup>

##### (d) Facilities for Watershed Management

1. Small impounding pond will be located over farm land and use for small irrigation, livestock, human use and fish farming.
2. Check dams will be built up-stream of the small impounding pond to take sediment load away from flood flows and keep the capacity of impounding pond.
3. Earthen bund will be placed on contour for silt-trapping and water-harvesting.
4. Horizontal wells in appropriate location will be used for livestock water development as well as for human use.

5. The weir will be constructed in Siri nallah to dam up flowing water for livestock and human use.
6. Nursery will cater for provision of seedlings for afforestation and vegetation.

(2) **Equipment/Facilities**

Field office and related structures:	for project activities
Vehicles:	for site management and educating activities
Meteorological equipment:	for meteorological observations
Materials for nursery:	for afforestation and vegetation
Tractor:	for agricultural and construction works and maintenance of facilities
Drilling rig:	for constructing of water-harvesting facilities
Computers:	for office job
Copy machine:	for office job
Fax machine and telephone:	for office job
Typewriter:	for office job
Video system:	for educating activities
Cameras:	for educating activities
Slide projector system:	for educating activities
Overhead projector:	for educating activities
Back-up generator system:	for electricity supply in case of emergency
Air conditioners:	for effective execution of office job

**4.3.4 Operation and Maintenance**

(1) **Operation and Maintenance Plan**

(a) **Choti Nallah Distributor**

Operation and maintenance plan for the Choti nallah distributor is described below.

- **Sediment Pocket:**

The sediment pocket has a function of separating gravels and cobbles from sediment load. Since the function of separation depend on the



gradient of sediment pocket bed, specific work for operation and maintenance is not necessary except routine inspection for top of the dike when big flood occurs.

**Training Dike:**

Concrete distributor may be inspected after big flood passing. Training dikes of stone masonry at downstream of the distributor shall be inspected periodically. Responsible body of operation and maintenance for the facilities is Janpur Construction Division of D. G. Khan Circle. Actual maintenance work will be carried out by the farmer's organization, so-called Kamara system, under technical instruction by the hill-torrent section of the Janpur Construction Division.

**(b) Facilities for Watershed Conservation**

FAO has scheduled to complete the watershed conservation program in 15 years and 6 months. Study and preparation for implementation will be conducted in the beginning 6 months. Phase-1 will be continued for the purpose of technology transfer for 5 years, then Phase-2 is a transition duration for initiative of the program from FAO to farmers. The farmers will be expected to manage the program fully by themselves in Phase-3 without support by other agencies.

**(2) Cost for Operation and Maintenance**

**(a) Choti Nallah Distributor**

A sub-engineer belonging to the hill-torrent section of Janpur Construction Division will execute operation and maintenance for Choti nallah distributor. As no expenditure for repairing will be required for materials, cost will be only for the salary of supervising engineer. Annual cost for operation and maintenance is estimated at 1 % of construction cost as follows:

**Expense for Supervising Engineer:**

Sub-engineer                      Rs. 50,000 /year

**Expense for repairing:**

Sediment pocket                  Rs. 30,000 /year

Distributor                         Rs. 40,000 /year

(b) Facilities for Watershed Management

Operation and maintenance for the facilities in the watershed management will be carried out by the villagers who are beneficiary of the Project. All expense for the operation and maintenance shall be born by the farmers themselves, under the supervision by FAO.

#### 4.4 Technical Cooperation

Since proposed dispersion structures in the project are same type of facilities constructed popularly in Pakistan, no technical support for operation and maintenance will be expected to be necessary.

Nevertheless, certain technical cooperation on the watershed management is required, which would be jointly conducted by Japanese government and FAO. FAO has carried out watershed management projects in Azad Jammu and Kashmir, vicinity of boundary of Punjab province by farmers' participation. According to these instances, FAO had conducted technical training such as planning of land use, education and extension work for promotion of watershed conservation, afforestation, water course improvement, farm land management, water resources development and promoting woman's participation.

This cooperation program is expected to reflect the FAO's experiences for technical cooperation in this field in Pakistan. However, both plans of this Japan's Grant Aid and FAO should be adjusted regarding components and implementing schedule because Japan's Grant Aid Program must be completed within a limited short period in comparison with long duration for execution of FAO's project. As to adjusted plan of this component with both agencies, FAO will initially establish a promotion program for recovering vegetation and soil conservation, grazier' organization in half of the villages in the watershed area, community organization for effective use of facilities to be constructed in the Grant Aid Project. Continuing these performance, FAO will be train community organization for construction of small structures in the pilot area, and enlightenment of watershed management to whole watershed area. On the contrary, Japanese side will cooperate to construct major structures which will be a model for recipients to construct by themselves in future.

As mentioned above, Japanese side and FAO will shear their obligation on the component. It should be emphasized that exchanging opinion, adjusting schedule and supporting each other are much important and necessary for success of the Project.

Table 4.3.4-1 Annual O&M Cost Disbursement (1993-1998) for Watershed Management

	Total Cost	Total M/M	1993		1994		1995		1996		1997		1998	
			M/M	Cost	M/M	Cost	M/M	Cost	M/M	Cost	M/M	Cost	M/M	Cost
CTA	\$722,500	63	3	\$32,500	12	\$130,000	12	\$140,000	12	\$140,000	12	\$140,000	12	\$140,000
APO Watershad	no cost to project	60	0		12		12		12		12		12	
APO Extension	no cost to project	60	0		12		12		12		12		12	
Consultants	\$270,000	18	2	\$30,000	4	\$60,000	3	\$45,000	3	\$45,000	3	\$45,000	3	\$45,000
National Adviser	\$92,250	63	3	\$4,050	12	\$16,200	12	\$18,000	12	\$18,000	12	\$18,000	12	\$18,000
National Socio-Economist	\$11,000		3	\$5,500	3	\$5,500								
National Consult	\$18,900		0		4	\$5,400	4	\$5,400	2	\$2,700	2	\$2,700	2	\$2,700
Group Program (6)	\$108,000	63	0		72	\$21,600	72	\$21,600	72	\$21,600	72	\$21,600	72	\$21,600
Administration Assiant	\$44,100		3	\$2,100	12	\$8,400	12	\$8,400	12	\$8,400	12	\$8,400	12	\$8,400
Clerk	\$31,500	63	3	\$1,500	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000
Driver 1	\$31,500	63	3	\$1,500	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000
Driver 2	\$31,500	63	3	\$1,500	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000
Duty Travel	\$32,000			\$2,000		\$6,000		\$6,000		\$6,000		\$6,000		\$6,000
Training	\$35,000	0		\$10,000		\$5,000		\$8,000		\$2,000		\$5,000		\$5,000
Equipment	\$98,000	0		\$33,000		\$8,000		\$10,000		\$4,000		\$15,000		\$15,000
O&M Cost	\$38,500	0		\$3,000		\$5,500		\$7,000		\$10,000		\$8,000		\$8,000
Sundry	\$59,000	0		\$3,000		\$10,000		\$12,000		\$17,000		\$12,000		\$12,000
Mission Costs	\$17,000	0												
Reporting	\$7,000	0												
<b>TOTAL</b>	<b>\$1,647,750</b>	<b>\$516</b>	<b>23</b>	<b>\$149,650</b>	<b>179</b>	<b>\$299,600</b>	<b>175</b>	<b>\$299,400</b>	<b>173</b>	<b>\$299,700</b>	<b>173</b>	<b>\$299,700</b>	<b>173</b>	<b>\$299,700</b>

(Source : FAO Concept Paper)

## **Chapter 5 Basic Design**

### **5.1 Design Concept**

Mithawan Hill Torrent Pilot Project aims to control flood-flows of hill torrent through technically sound and economically viable measures to raise agricultural production and to reduce flood damage. The project is anticipated to function as a preceding model for flood-flows irrigation of hill torrent and for protection from flood damage.

The basic concept for the project is the following.

- to make maximum use of flood-flows in the area;
- to reduce losses and suffering due to flood in an economically sound manner such that benefits of flood damage abatement measures exceed their costs as far as possible;
- to provide, as far as possible, adequate protection from flood damages to cities, irrigation works, communication facilities, and other vital infrastructure;
- to make maximum use of existing flood control/protection facilities by improvement where it is necessary;
- to promote appropriate land use by avoiding the growth of flood vulnerable development in flood hazard areas and adjusting land use, where possible, to be compatible with the frequency and duration of flooding; and
- to minimize adverse effects on natural ecosystem and environment.

Hill torrent flood-flows with heavy sediment load, that flow out from totally denuded watershed, effect adversely in the lower reaches. Watershed management, which directs recovery of vegetation in the area with flattening peak flood discharge and conserving soil, will be introduced to reduce damage and sufferings. In the Pachad area of the lower reaches of Mithawan main stream, flood irrigation is applied with high bunds surrounding the farming lands. Dispersion structures are constructed across the hill torrent channels to divert flood-flows into the farming lands.

(a) Choti Nallah Dispersion Structure

This structure distributes flood-flows into canals by due shares and extend irrigation in the area.

Irrigation systems including distributor and canals in hill torrent areas are commonly constructed by soil and stones. These systems, which divert flood-flows by due shares under the water-rights, are constructed and maintained by Kamara system under the Hill Torrent Officer. Construction of stable distribution structure is proposed since these structures are apt to be washed out by flush floods and cause unequal distribution of flood-flows and flood damage.

It is pointed out that heavy floods containing a significant amount of sediment load including cobbles and boulders might destroy the dispersion structure because of their different behavior from water and would be impossible to distribute water by due shares. It is recommended to construct debris accumulating facility like a sediment pocket at upstream of distribution structure. The facility will separate cobbles/boulders from flood-flows with high sediment concentration.

Dispersion structure has spillway/escape weir diverting excess flood-flows to the area without water-right (non-haqooq area) as there is a limitation to the capacity of irrigation canals in the benefited rightful area (Haqooq area).

River-bed at the proposed Choti nallah dispersion structure consists of embedded cobbles and boulders having adequate bearing capacity for the dispersion structure. Training dikes will be furnished against erosion of banks on both side upstream and downstream of the diversion structure.

Construction period for the project will be divided into two stages. The sediment pocket will be constructed in the first stage. In the second stage distributor will be built.

(b) Watershed Management

Implementation of watershed management will be in cooperation with FAO. FAO's concept to the watershed management is people's participation to the project for promoting it by them-selves with their self-reliance and understanding. The program of watershed management includes not only

construction works but also education and organization of the local population.

In the project, Dholi village is selected for a demonstration area owing to people's continuing effort towards development of their village. The Japan's Grant Aid will be applied for the construction of large scale structures, such as small impounding pond and check dams, which contribute to improve environmental circumstances of the area and are not familiar to the people. The small structures, which are popular in the area, will be constructed by the community organization with technical assistance of FAO. The community organization will operate and maintain the facilities built by the project in future. The Japan's Grant Aid Program also includes construction of office buildings for the base of FAO's activity and equipment supporting usual activity such as tractors and facilities for training.

The first stage of the Project consists office buildings, access roads, some structures, such as small pond, weir, horizontal well and check dams. The second stage consists earthen bund and nursery.

## **5.2 Study and Examination of the Design Criteria**

### **5.2.1 Irrigation Facilities**

Irrigation facilities are composed of sediment pocket and distributor to be constructed in Choti nallah as mentioned below.

#### **(1) Sediment Pocket**

Sediment pocket is a facility to separate cobbles and boulders from flood-flows. Since a part of up-stream of Choti nallah darrah has been eroded, characteristics of sediment load should be taken into account for design of the sediment pocket.

According to the satellite image, it is suggested that Choti nallah has been newly composed due to piracy, erosion developing from down-stream to up-stream. Water course of Choti nallah is categorized into three zones in view point of geology. Zone 1 is a part of eroded terrace gravel deposit in the upstream basin, Zone 3 forms narrow valley composed of eroded Pliocene layer and Zone 2 is a transition part between Zone 1 and Zone 3.

Dimensions of nallah including flood discharge at a 25-year return period in each zone are shown below.

Table 5.2.1-1 Condition of Choti Nallah at each Zone

	Zone 1	Zone 2	Zone 3
Elevation	370 to 750	340 to 370	275 to 340
Gradient of river bed	1/10 to /30	1/70	1/60
Catchment (sq.km)	59	73	76
River length (km)	22	24	28
Concentration time (hr)	4.02	4.18	4.56
Rainfall intensity (mm/hr)	14.0	13.2	2.7
Flood discharge (25 year)	217	269	280
Return Period (cumec)			
Width of river (m)	150	100	50
Velocity (m/sec)	1.9 to 2.4	1.9 to 2.3	2.5 to 3.4
Water depth (m)	0.5 to 0.6	1.0 to 1.2	1.4 to 1.7

For the above estimation, the following figures are assumed.

Runoff coefficient : 0.8  
 Coefficient of roughness : 0.05 to 0.07

Design probable rain at a 25-year return period is calculated with Gumbel method. Applying Rational method with the design probable rain, peak flood discharge are estimated at 184 cumsec in Zone 1, 214 cumsec in Zone 2 and 214 cumsec in Zone 3, respectively.

Taking into account the situations mentioned above, movable diameter of boulders is estimated as follows:

Table 5.2.1-2 Movable Diameter of Boulders (cm)

Coefficient of roughness	0.05	0.06	0.07
Zone 1	20.9	23.3	25.6
Zone 2	16.1	17.8	19.5
Zone 3	26.5	29.4	32.2

According to the results above, it assumed that boulders more than 20 cm diameter move in Zone 1 when 25-year return flood occurs, boulders more than 16 cm diameter in Zone 2, and boulders more than 26 cm diameter in Zone 3 can

be assumed to move. The fact that movable diameter of boulders in Zone 2 is smaller than the same in Zone 1 can explain the deposition of large boulders in Zone 2. Because of these, water course of 200 meters to 300 meters width with deposit of boulders of man head size has been developed in Zone 2. On the contrary, large boulders have been rolled down in Zone 3. The proposed sediment pocket will arrest boulders rolling down mostly from the Zone 3.

Sediment pocket will make traction force decrease by lowering the bed gradient with accumulation of gravel. Velocity and movable diameter of boulders at the center of the sediment pocket are estimated as shown below.

Table 5.2.1-3 Velocity and Movable Diameter of Boulders

Items	Zone 1	Zone 2	Zone 3
Coefficient of roughness	0.05	0.06	0.07
Water depth (m)	0.67	0.75	0.82
Velocity (m/sec)	1.52	1.36	1.24
Movable diameter (cm)	8.1	9.0	9.9

On the above estimation, bed gradient and width of water surface are assumed at 1/100 and 210 meter, respectively.

After completion of the sediment pocket, hill torrent bed gradient will be expected to reduce to 1/100, ie the same as the present gradient of hill torrent bed created by deposition of sand and gravel. In this case, movable diameter of boulders will be altered from less than 30 cm to less than 8 or 10 cm.

Sediment pocket is proposed to be constructed in close vicinity of the darrah of Choti nallah. Width of the present nallah is about 30 meters and elevation of the bed is 265 meters above sea level. Top elevation of the dike is decided at 272 meters above sea level because of structural constraint by stone masonry and topographical conditions. Reservoir capacity for deposition is estimated at 150,000 cubic meters.

(2) Choti Nallah Distributor

Choti nallah distributor is proposed to be constructed 800 meters downstream from proposed site of the sediment pocket. At present, flood water is diverted at the site through temporary weir. Share of distribution shown below shall be applied in line with each water rights.



Table 5.2.1-4 Share of each Canal by Water-Rights

Name of canal	Share as per Water-Right
Deviani	1/6 of total supply
Al-Hadad	1/6 times 5/12 of total supply
Malakh	5/6 times 5/12 of total supply
Tajjar and Kandewala	516 times 1/6 of total supply

According to the water-rights, the first distributing site is located at the off-take of Deviant canal, while the second site is located at about 170 meters downstream of this point where Al-Hadad, Malakh, Kandewala and Tajjar canals used to off-take.

Elevation of proposed site of Choti nallah distributor is 253 meters above sea level (ASL), and flood discharge of 25-year return period is estimated 281 cumsec at 255 meters ASL during flood. As the flow capacity of the canals at the proposed site is 202 cumsec, excess 79 cumsec shall be spilled to other area. The excess flood is proposed to be diverted to the non-haqooq area which has no water-right so far. Proposed discharge of flood-flows at distributor are shown below.

Table 5.2.1-5 Proposed Discharge at Choti Nallah Site

Water elevation ASL (m)	Discharge (cumec)	Excess discharge (cumec)	Available discharge (cumec)
254.2	133.5	0	133.5
254.5	180.3	23.6	156.7
254.8	229.6	51.0	178.6
255.1	285.6	82.1	203.5

Torrent bed at proposed site of Choti nallah distributor consists of embedded boulders. Sound foundation is enough for distributor and local boulders are available as the construction material. The stone masonry is recommended in consideration of topographic condition and saving construction cost. Only revetment by stone masonry is required at bifurcation point of Tajjarwala and Kandewala canals.

Flood flows are distributed by the width of each section of weir which will be fixed depending as per the water-rights.

Table 5.2.1-6 Distributed Discharge at Choti Nallah Distributor

Name of Canal	Distributed discharge (cumec)
Deviani	34.0
Al-Hadad	70.8
Malakh	70.8
Tajjar and Kandewala	24.0
Escape weir	79.3

## 5.2.2 Watershed Conservation Facilities

### (1) Facilities

It is a basic concept for the Project that materials which is available at the proposed site must be utilized for the construction work as much as possible. Whole watershed of Mithawan hill-torrent including the pilot area are covered with gravel and boulders and little soil which is definitely necessary for vegetation. Though boulders will be proposed to be utilized for construction, soil is preferably not to use as the construction material so as to keep quality of land for vegetation.

#### a. Small Impounding Pond

The capacity of reservoir is decided to meet with effective volume of rainfall which can be expected to occur within the catchment of 162 ha from June to September. Due to hard bedrock for foundation, concrete dam could be built.

#### b. Check Dam

Check dam is proposed to be built in order to prevent sediment load from flows into the small impounding and to keep river bed stable through reduced transportation of sediment.

#### c. Earthen Bund

Earthen bund is a dike to harvest soil and water on the slope, which will be built by gravel stuffing with soil so as to stop water effectively.

#### d. Weir

River water of Siri nallah locating near Dholi village flows

underground when shortage of water. In order to make water level raise up so as to use water for domestic and livestock easily.

e. Nursery

Nursery is necessary to supply seedlings of grasses and trees to be planted for watershed conservation. Irrigation system for seedlings will be facilitated.

f. Horizontal Well

Impermeable layer inclines at an acute angle, and these forms certain aquifer. Horizontal well is expected to draw water for livestock and human use without operation cost.

### **5.2.3 Buildings**

a. Project Office and Site Office

The buildings will be used for the center of watershed management. The watershed management activities will be expanded to all the D. G. Khan hill torrent belt in future.

b. Training Center

The building will be used for the base of watershed management activities.

### **5.2.4 Roads**

Existing roads network from Choti Zerim to Sakhi Sarwar through Choti Bala will be rehabilitated.

## **5.3 Structural Design**

### **5.3.1 Sediment Pocket**

(1) Location

Sediment pocket is located at the darrah/outlet of Choti Nallah, about 8 kilometers west of Choti Bala village. The proposed site for the structure is narrow. The sediment pocket is a facility to separate cobbles and boulders from flood-flows, and stabilize the water flow near the dispersion structure.

(2) Salient Features

The salient features of proposed sediment pocket are given below:

Height of embankment:	5 meters
Length of Embankment:	460 meters
Width of top of Embankment:	5 meters
	covered with 50 centimeters thick boulder concrete
Water way:	width 160 meters depth 1 meter
Elevation of the top of embankment:	272 meters above sea level
Storage Capacity:	150,000 cubic meters
Upstream slope protection:	sand and gravel as shock absorber
Downstream slope:	slope is 1 : 0.2 with 1 meter thick boulder concrete
Structure:	stone masonry

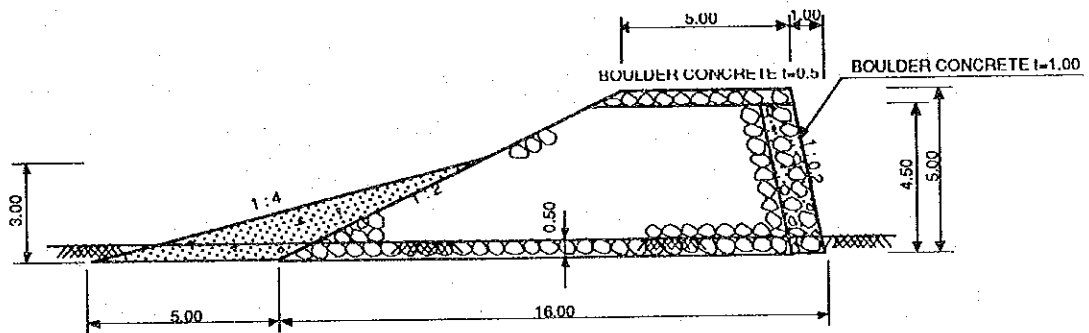


Fig. 5.3.1 Typical Profile of Sediment Pocket

(3) Construction Materials

Bank of the sediment pocket is stone masonry. Stone and sand will be collected around the proposed site.

5.3.2 Dispersion Structure

(1) Location

Dispersion structure will be located at about 800 meters downstream of the proposed sediment pocket. Flood water is diverted into the existing canals by the due shares at this point.

(2) Salient Features

a. Proportional Distributor

Width of water way depends on due shares for Deviani, Al-Hadad, Malakh, Tajjar and Kandewala canals.

Name of canal	Share as per Water-right
Deviani canal	12/72th of total flow
Al-Hadad canal	25/72th of total flow
Malakh canal	25/72th of total flow
Tajjar canal and Kandewala canal	10/72th of total flow

It will be constructed in concrete with river-bed protection of one meter thick boulder concrete.

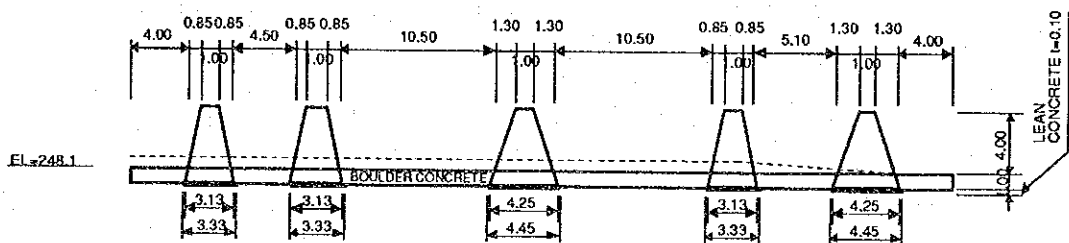


Fig. 5.3.2-1 Typical Profile of Distributor

Table 5.3.2-1 Distributors' Profile

Name of canal	Height	Width (m)	Type (m)
Deviani	5.0	5.1	concrete
Al-Hadad	5.0	10.5	concrete
Malakh	5.0	10.5	concrete
Tajjar and Kandewala	5.0	4.5	concrete

b. Training Dikes

They will be placed to draw water to the farm land by their water-rights. They are constructed by stone considering convenience for maintenance by local people in the future.

Table 5.3.2-2 Salient Features of Training Dikes

	Height (m)	Top Width (m)	Length (m)	Type
Upstream right	3.0 to 5.0	2.0	300.6	Stone with gabion
Upstream left	3.0 to 4.0	2.0	331.2	Stone with gabion
Downstream right	3.6 to 5.0	2.0	151.2	Stone with gabion
Downstream left	4.0 to 4.5	2.0	900.0	Stone with gabion
Devlani- Al-Hadad	4.3	2.0	151.2	Stone with gabion
Malakh- Al-Hadad	4.0 to 4.6	2.0	450.0	Stone with gabion
Tajjar-Kandewala	3.0 to 4.3	2.0	601.2	Stone with gabion
Malakh-Kandewala	3.3 to 4.0	2.0	255.6	Stone with gabion

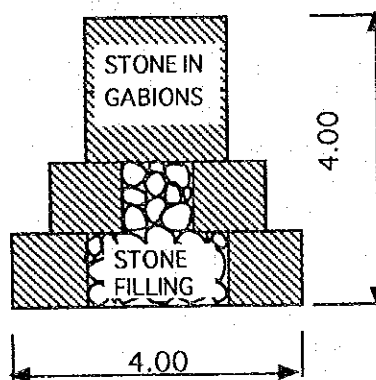


Fig. 5.3.2-2 Typical Profile of Training Dike

c. Escape Weir

Estimated flood discharge is 280 cumsec, of which 202 cumsec will be distributed to haqooq-area/with water-right and 78 cumsec to non-haqooq area/without water-right.

Overflow crest:	Gabion
	Height 2 meters
Downstream slope:	Boulder concrete
	Thickness 1 meter
	Width 30 meters
	Length 22.8 meters

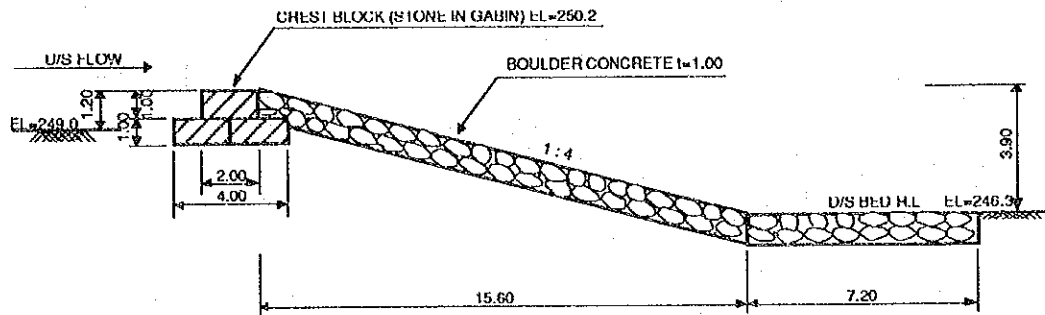


Fig. 5.3.2-3 Profile of Escape Weir

d. Structure Across Canal Bed

In order to protect from the canal bed from scouring, the structures will be placed in the canal bed at 18-meter interval from distributor to 900 meters downstream. Average length is 100 meters and composed of massive boulder concrete of 1.6 meters high and 0.5 meter wide.

e. Protection of Training Dike

This structure will protect training dikes from erosion. It is composed of 2 meters times 1 meter gabions placed along the training dike.

(3) Construction Materials

Stone around the site will be collected. Concrete plant will be built at Choti Bala. Concrete will bring to the site by agitator truck.

**5.3.3 Watershed Conservation Works**

(1) Location

Demonstration area is located in Dholi village at about 8 kilometers north-west of Rakhi Munh. Elevation of the area is around 750 meters above sea level.

(2) Kind of Structures

The structures will be constructed as a pilot project. In a model area, the structures which are large and un-familiar for the villagers will be constructed.

a. Small Impounding Pond No. 1:

Height 6 m, Length 40.2 m

Concrete gravity type

For irrigation, livestock and human use, and fish farming

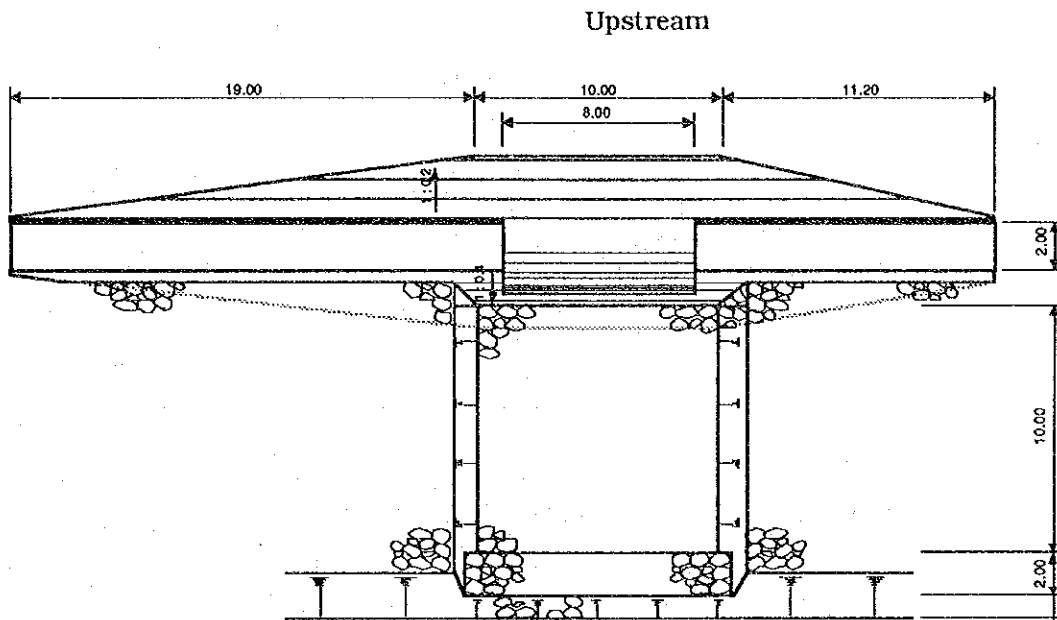


Fig. 5.3.3-1 Plan of Small impounding pond

b. Small Impounding Pond No. 2:

Supplemental to small impounding pond No. 1

Height 3.5 m, Top width 2.0 m, Length 25.1 m

For irrigation and silt trap

Stone masonry

c. Check Dam :

Height 2.5 m in average

For erosion control and channel stabilizatton

Gabion structure



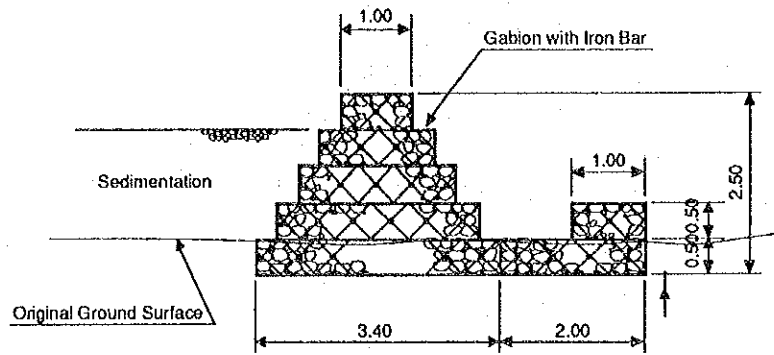


Fig. 5.3.3-2 Typical Profile of Check Dam

d. Earthen Bund:

- Placed along the contour on the slopes
- Height 1.5 m, Top width 1.0 m in average
- Total length 3,200 m
- Stone masonry
- For harvesting soil and water

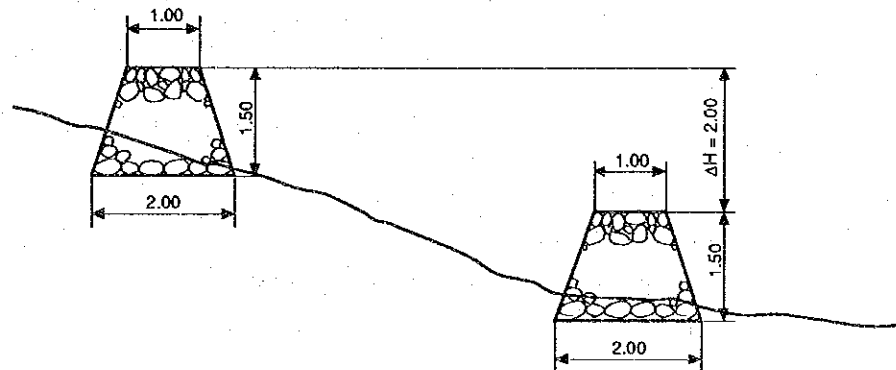


Fig. 5.3.3-3 Typical Profile of Earthen Bund

e. Weir:

- Height 2.5 m, length 60.0 m
- Concrete structure
- For raising water level for livestock and human use

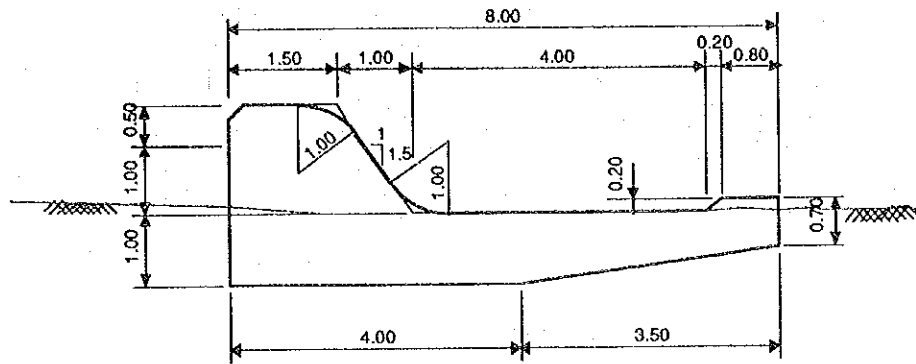


Fig. 5.3.3-4 Typical Profile of Weir

f. Nursery:

Area of 0.5 hectares

With water tank for irrigation

(3) Material

Material for stone structure will be collected in the area. Small concrete plant will be provided for concrete structures.

**5.3.4 Office Buildings**

(1) Location

Main office and training center will be built in the D. G. Khan Irrigation office site which is owned by the Punjab Government. Site office will be built in Dholi village.

(2) Salient Features

Detailed features of the office buildings are shown in Table 5.3.4-1.

Table5.3.4-1 SUMMARY OF BUILDING

EQUIPMENT	BUILDING	STRUCTURE	NOS
Project office (50m * 40m)	Project office (One -Storied)	Pillar, Beam: Reinforced Concrete Wall : Brick	360.0 m2
	Project manager	: 8.0m * 6.0m	48.0 m2
	Meeting room	: 10.0m * 15.0m	150.0 m2
	Office	: 4.2m * 3.8m	16.0 m2
	Toilet No.1	: 4.2m * 2.2m	9.2 m2
	Toilet No.2	: 6.0m * 4.6m	27.6 m2
	Kitchen	: 6.2m * 6.0m	37.2 m2
	Others		72.0 m2
	Garage (5 Vehicles)	: 6.2m * 21.4m	132.7 m2
	Ware house	: 6.5m * 17.0m	110.5 m2
Guard room	: 6.0m * 4.0m	24.0 m2	
Fence	: 180.0m	180.0 m	
Site office (33m * 20m)	Site office (One -Storied)	Pillar, Beam: Reinforced Concrete Wall : Brick	128.2 m2
	Project manager	: 6.7m * 4.3m	28.8 m2
	Meeting room	: 5.5m * 7.9m	43.5 m2
	Office	: 3.1m * 2.4m	7.4 m2
	Toilet No.1	: 4.6m * 3.1m	14.3 m2
	Toilet No.2	: 1.2m * 2.4m	2.9 m2
	Kitchen	: 4.6m * 3.1m	14.3 m2
	Others		17.0 m2
	Garage (3 Vehicles)	: 6.0m * 9.0m	263.5 m2
	Ware house	: 4.0m * 7.9m	215.3 m2
Guard room	: 4.0m * 3.1m	24.0 m2	
Fence	: 106m	310.0 m	
Training center No.1	Training center (Two -Storied) Ground floor :13m * 17m First floor :13m * 12m	Pillar, Beam: Reinforced Concrete Wall : Brick	377.0 m2
Training center No.2	Training center (One -Storied)	Pillar, Beam: Reinforced Concrete Wall : Brick	190.4 m2

### **5.3.5 Roads**

a. Choti Zerim - Choti Bala

- 1) Improvement 21 km
- 2) Cause way 5 nos. or 400 meters length
- 3) Box culvert 2 nos.

b. Choti Bala - Sakhi Sarwar

- 1) Improvement 20 km
- 2) Cause way 4 nos.
- 3) Box culvert 1 no.

### **5.3.6 Equipment Plan**

a. Tractor: 2 units

Used for hauling materials and equipment for watershed conservation works.

b. Drilling equipment: one unit

Used for water resource development.

c. Pick-up: one unit

Used for travel of extension workers and transportation of equipment, and hauling of inputs and operation and maintenance works.

d. Four wheel drive car: one unit

Used for transportation of personnel of extension, training, education and inspection of structures.

e. Copy machine: one unit

Used for extension and training.

f. Facsimile machine: one unit

Used for communication with other offices.

g. Typewriter: one unit

Used for preparation of materials for extension and training.

h. Computer: two units/Printer: one unit

Used for preparation of materials for extension and training.

i. Complete portable video system/Slide projector system/Overhead projector

Used for preparation of materials for extension and training.

j. Camera: two units

Used for making training and education materials.

k. Other office equipment

Supplemental office works

l. Meteorological equipment

Used for collecting meteorological data for agricultural activities and planning of water development.

m. Air conditioners

Used in the office building.

## **5.4 Project Implementation**

### **5.4.1 Implementation Plan**

#### **(1) Executive Agency of the Project**

Irrigation and Power Department (IPD) of the Government of Punjab will be the executive agency for the project implemented under Japan's Grant Aid Program. The IPD is responsible for the project implementation and all of the affairs concerning the Project, such as the conclusion of the Consultant Services and Construction Agreement, Banking Arrangement, the approval of Tender Documents and issue of Authorization to Pay, as well.

The IPD is the executing body for the irrigation project, carrying out

irrigation project planning and supervisory works. During the construction period, Janpur Construction Division, which is one of the district office of the IPD, is substantially responsible for project implementation and supervisory works.

(2) Scope of Works

The scope of works of the Project includes the following facilities and related temporary works of access roads and others necessary for the Project implementation.

a. Flood irrigation facilities

- |  |        |
|--|--------|
| 1) Dispersion structure on Choti nallah: | 1 L.S. |
| 2) Sediment pocket on Choti darrah :     | 1 L.S. |

b. Watershed management facilities/equipment

- |   |            |
|---|------------|
| 1) Small impounding pond                            | : 1 site   |
| 2) Check dam  | : 33 nos.  |
| 3) Contour bund                                     | : 3,200 m  |
| 4) Horizontal drilling work                         | : 2 sites  |
| 5) Weir   | : 1 site   |
| 6) Nursery site                                     | : 0.5 ha   |
| 7) Road improvement                                 | : L = 8 km |
| 8) Project main office                              | : 360 sq.m |
| 9) Site office                                      | : 128 sq.m |
| 10) Training center                                 | : 577 sq.m |
| 11) Procurement of training machinery and equipment |            |
| - Tractor (W/Lorry)                                 | : 2 nos    |
| - Vehicles  | : 2 cars   |
| - Drilling rig                                      | : 1 no     |
| - Computer (W/Printer)                              | : 2 nos    |
| - Copy machine                                      | : 1 no     |
| - Facsimile   | : 1 L.S.   |
| - Typewriter  | : 1 no     |
| - Audio visual equipment                            |            |
| Video system  | : 1 L.S.   |
| Slide system  | : 1 L.S.   |
| O.H.P. system                                       | : 1 L.S.   |
| Camera  | : 2 nos    |

- Office furniture (desk, chair, cabinet,  
generator, air-conditioners, etc.) : 1 L.S.

c. Road improvement

- 1) Choti-Choti Bala : 1 L.S.
- 2) Sakhi Sarwar-Choti Bala : 1 L.S.

#### 5.4.2 Construction Condition

The construction site is located in D. G. Khan District in the south-west of the Punjab Province. D. G. Khan District is well known as a aggregate supply base. In this connection, lots of enterprises have extended their business in this district. It has already been predicted that the material prices and labor wage would rise in the vicinity area of D. G. Khan District because of the Indus Highway construction works.

Both of the construction sites, distribution structure site and watershed management site, are far from the populated areas. Accordingly, the social infrastructures, such as tele-communication, electricity and water supply systems are not facilitated in the construction sites. The road improvement, which is included in the proposed construction works is indispensable for smooth construction material and labor transportation for the effective construction works.

As the flood irrigation facilities are to be constructed in the nallah, it is impracticable to make a construction schedule taking account of the occurrence of flood caused by unpredictable rainfall during rainy season from April to September. In addition, it is impossible to carry out the construction in day time because of the intense sunshine and high temperature of more than 35°C. The stone masonry works by man-power should be scheduled except day time during four summer months of June to September.

The following are the salient features of each construction work:

a. Flood Irrigation Facilities

Construction site is proposed on the developing fan deposition. Construction material is mostly comprised of the cobbles and boulders which have rolled down from upstream of the site by floods for several thousands years. Quarry site is secured against stone requirement of 68,000 cu.m at around 8 km distance from the site.

Eight (8) km long access road on sandy river bed is used for material and labor force transportation. Improvement of the access road is inevitable for smooth construction works at the site. Labor force is estimated about 200 to 250 persons a day.

b. Watershed Management Facilities

Eight(8) km long access road from National road to Dholi should be improved prior to the commencement of the proposed construction for watershed management. Heavy equipment can not be used at the sites because of poor road condition. Around 12,000 cu.m of stone material is required for the proposed watershed management facilities, e.g., small impounding pond, contour bund, check dams. Required labor force is estimated around 100-150 persons a day. To secure the labor force, temporary labors' accommodation and labor transportation is necessary for smooth construction works.

c. Road Improvement

Two construction sites are far from populated area. Road improvement should be completed early in the construction period so as to secure the material and labor transportation routes.

### 5.4.3 Supervisory Plan

Detailed design and construction supervision shall be rendered by a Japanese consultant firm under the agreement between the IPD, Government of Punjab and the consultant firm in conformity with the Japan's Grant Aid Program. Contents of the supervisory work by the consultant include the following:

a) Assistance in the Conclusion of Construction Contract

Preparation of detailed design and tender document, qualification of the contractor for the tender, witnessing to tendering, awarding the contract, etc.

b) Approval of Construction Drawings

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



c) Supervision of Construction

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

d) 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.

e) Witnessing in the Inspection

Examination of the constructed facilities on the specification during construction and at the completion, advice to the contractor about technical matters, and etc.

The consultant is responsible for informing Japanese Government about the progress on the construction works and payments and transfer of the completed facilities to Pakistani Government. The consultant will complete his services by the approval of the client after final inspection of the structures and witnessing the transfer of the facilities.

#### **5.4.4 Procurement Plan**

The proposed facilities are composed of (1) earth works; (2) concrete works; (3) stone masonry works; and (4) building works. The principal construction material and equipment are listed below:

Table 5.4.4-1 Construction Materials and Equipment

Item	Materials	Equipment
(1) Earth works	-	Bulldozers, Tractor shovels, Dump trucks, Vibrator compactors, etc.
(2) Concrete works	Cement, Aggregates Reinforcing bar, Forms, Scaffolding	Concrete mixing plants, Portable mixers, Mixer trucks, Generators, Submersible pumps, etc.
(3) Stone masonry works	Cobbles, Gabion	Tractor shovels, Dump trucks, Agitator trucks, Truck, etc.
(4) Building works	Cement, Aggregates, Lumber, Wooden fittings, Paint, Glass, Plumbing, Electric materials and steel materials	
(5) Equipment to be granted	-	Tractors, Drilling rig, Computers, Copy machine, Tele-communication equipment, Typewriter, Audio visual equipment, Office furniture, Generator, Air-conditioners

For implementation of the Project, construction equipment and material are basically procured in local. However, specified equipment provided from Japan is shown below in consideration to the particular conditions of the construction sites.

(a) Equipment

1) Concrete Mixing plant

Concrete mixing plant is introduced to secure concrete quality and supply for concrete required by the construction schedule. Total concrete volume is estimated at around 10,500 cu.m.

2) Generator

Generator of 125 KVA out-put is required to supply electricity to the aforesaid concrete mixing plant.

**5.4.5 Implementation Schedule**

The Project will be completed after undertaking the processes described below:

(1) Consultant Contract

The Irrigation and Power Department of Punjab Government (IPD) will conclude the consultancy services agreement with a Japanese consulting firm. The consultant will follow the procedure on the verification of the agreement by the Government of Japan.

(2) Detailed Design

Detailed design will be carried out in conformity with the description in the basic design study report. A detailed design report and tender documents will be prepared in three (3) months.

(3) Tender and Construction Contract

After the approval of the tender documents by the IPD, the consultant will explain the contract documents and the bidding to the Japanese contractor. Tendering is composed of public notice, pre-qualification of the contractors, assessment of tenders, and awarding the contract. This takes approximately one and half (1.5) months.

(4) Construction

After the construction contract, the construction work will commence with the verification of the Government of Japan. The construction work will be completed in eight (8) and eleven (11) months in Phase 1-1 and Phase 1-2, respectively .

Detailed design and construction works are scheduled as shown in Fig. 5.4.5-1 and Fig. 5.4.5-2.

Fig 5.4.5 -1 Implementation Schedule (Phase 1-1)

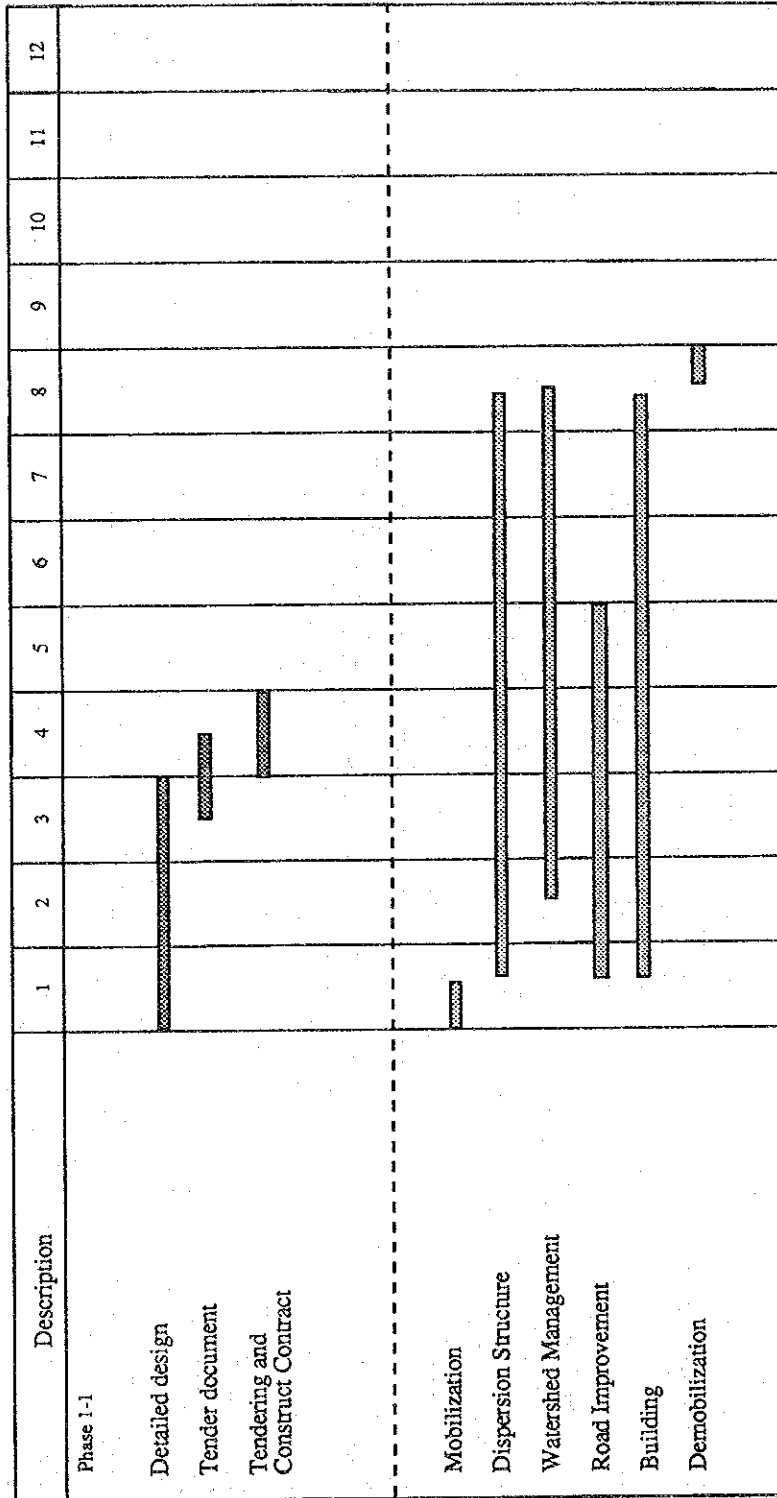
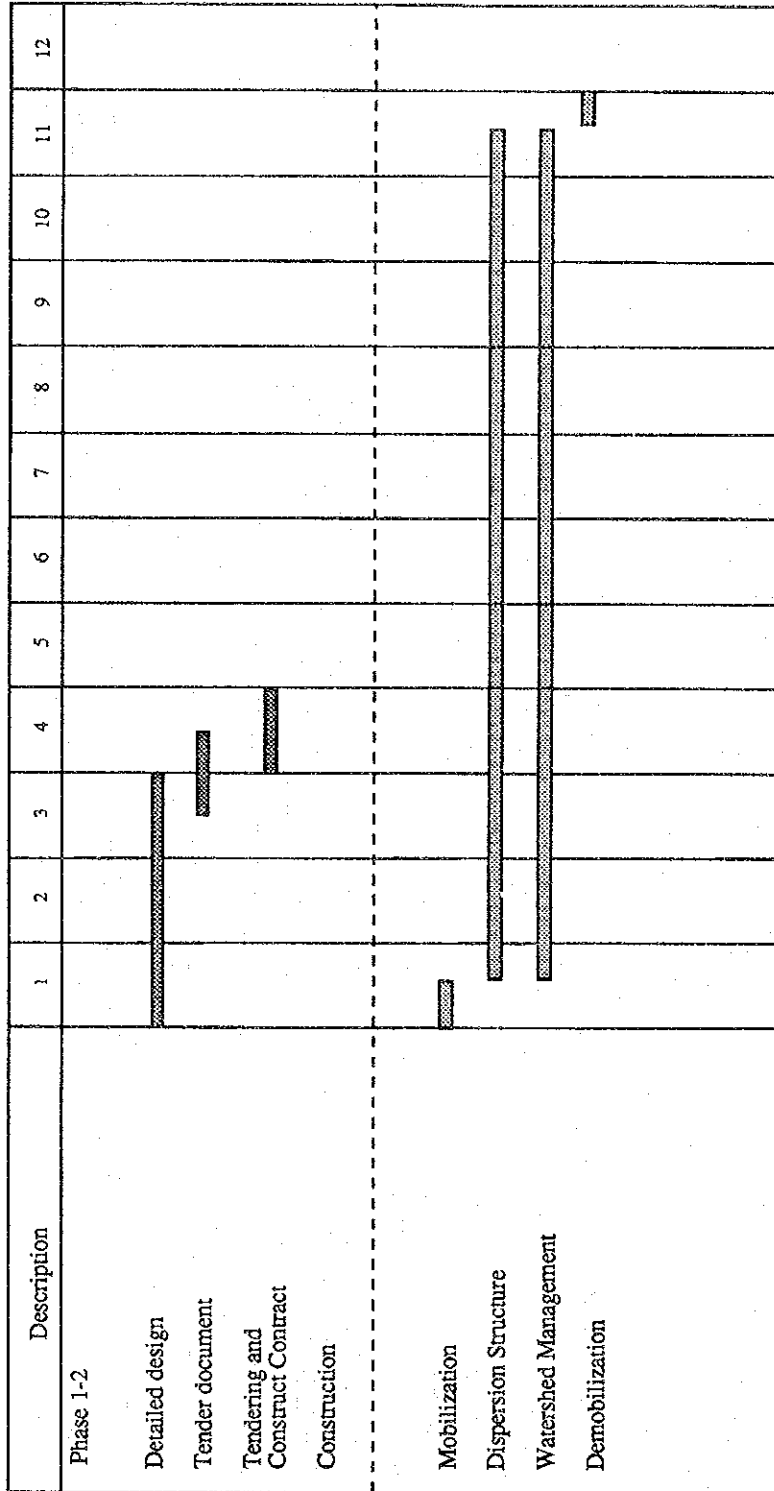


Fig 5.4.5 -2 Implementation Schedule (Phase 1-2)



#### 5.4.6 Undertaking by the Government of Pakistan for the Project Implementation

Funds for the construction of the Project will be offered through Japan's Grant Aid Program. No additional funds for the construction works will be necessary to be provided from the GOP, except compensation for crop damage, temporary stock yard and temporary road construction. The GOP also is responsible to secure the budget for personnel and office requirements during project implementation. Rough amount required is following.

		(unit : Rs '000)
1. Land acquisition	:	0
2. Land compensation	:	50
3. Personnel and office requirement	:	200
4. Provision for utilities	:	400
5. Office furniture	:	100
<b>Total</b>		<b>750</b>



## Chapter 6 Project Evaluation and Conclusion

### 6.1 Project Evaluation

Rise of yield and increase of cropping intensity will be provided by construction of Chotti nallah dispersion structure which irrigates about 6,000 hectares of farming land.

Crop yield will be expected to increase through more effective irrigation by means of new dispersion structure. Estimated yield after completion of the project is compared to yield at present by each return period in following table.

Table 6.1-1 Increase of Yield by the Project

(unit: kg/ha)

Kind of crops	Yield				
	Present	With project Return period			
		5-year	10-year	15-year	25-year
Jowar	736	783	830	921	1,012
Bajra	644	691	736	783	830
Wheat	553	644	736	783	830
Gram	415	462	506	553	644
Oil seed	370	415	462	506	553

Cropping intensity at present and after completion of the project are shown in the following table. Present cropping intensity is cited in the financial report of D. G. Khan district treasury office. Cropping intensity after completion of the project is estimated on the basis of flood discharge and watered surface during flood taking topographical features into account.

Table 6.1-2 Cropping Intensity W/ Project and W/O Project

	Present	With project Return period			
		5-year	10-year	15-year	25-year
	Increase	17.7%	32.2%	44.7%	54.3%

Watershed management aims to flatten peak flood and to minimize soil erosion. As eroded soil deposits around the structures and flush hill torrent flows scour canal floor, the farmers in the area spend time in taking care the structures and canals. Moreover, the farmers need to bear expenses on restoration/rehabilitation to the



deteriorated structures and damaged canals. Occasionally flush flood causes damage to the irrigation canals, roads and houses and reduction of the harvest in the canal irrigated area. Watershed management works will reduce these damage. FAO, managing agency of the watershed conservation works, applies its scheme of participation of local people in the project developing their self-reliant manner. In future, people will be able to raise more livestock, to grow more grains and to plant fruit and multi-purpose trees in the area.

D. G. Khan hill torrent development emerges to expand agricultural activity in the Pachad area converting flush hill torrent flows from damaging flood to useful moisture for crops. Destruction of vegetation in the watershed by un-restricted grazing has caused soil erosion and decrease of moisture-retaining capacity of the soil. Destructive flush flows of the hill torrents have brought sediment and flood damage to the Pachad area in the lower reaches. Development of hill torrent area under severe climate with minimal rainfall will be attained not only by improvement of facilities but also by a people's conviction of the benefits of the project such as improvement of living conditions and increase of agricultural productivity. Implementation of the Mithawan Hill Torrent Pilot Project will be anticipated to produce a good effect on the whole D. G. Khan hill torrent areas.

## **6.2 Conclusion**

The Government of Pakistan aims to achieve the self-sufficiency for food, increase agricultural production and promotion of export. For its attainment, the government has planned development of hill torrent areas in D. G. Khan district through effective use of flood flows.

Mithawan watershed management and irrigation development project aims to promote agricultural production by controlling flush flood. This project is selected as a pilot project for improving use of flood flows and reducing flood damage in the D. G. Khan district.

The project consists of two components which are irrigation project by using flood flows and watershed management program in cooperation with FAO.

In the Basic Design study, flood dispersion structures in Choti nallah and Nangar nallah for irrigation and a model watershed conservation program in Dholi were investigated.

The study concludes the followings.

Choti nallah dispersion structure will utilize the whole quantity of the flood discharge for irrigation reducing flood damage in the lower reaches in Mithawan main stream. Maintenance works are expected to be done without any difficulty because of its similarity to the existing structures built by the Irrigation and Power Department. The project matches with the policy of the Japan's Grant Aid Program by its urgency, scale of the structures and scheduled construction period.

Nangar nallah dispersion structure is planned for the irrigation purpose also. However, temporary structures will be available at the proposed site because of its physical condition, such as raised-bed of the water course and extreme seepage into the gravely river-bed. Proposed structure is small and it will be able to be constructed in their usual maintenance work. Nangar nallah dispersion structure has been excluded from the Grant Aid Program due to these reasons.

Road network will be helpful for convenience of the population in the villages and also used for construction works. For this reason, road improvement will be also included in the project.

Watershed management program will be promoted in cooperation with FAO. The FAO's principle for the project is developing the area with improvement of good environmental circumstances by their understanding and self-help by the local people.

Scope of cooperation of the Japan's Grant Aid Program includes construction works for major structures, which contribute to improve environmental conditions of the area by their function as a pilot model, in the proposed area of Dholi, and construction of office buildings for a base to the FAO's activity and several equipment supporting education and training.

The Project is anticipated to contribute much as mentioned above. Besides, it effects on the improvement of environmental conditions in the area and raise living condition of local people. Implementation of the Project is expected to be of significant and there are no difficulties in the recipient of operation and maintenance with proper numbers of personnel and budget.

**Benefit generated by the Project**

1. Economical effects	a) By irrigation	a) Increase of crop productivity and cultivable area	a) Benefited area  Number of beneficiaries Farm households Population	6,000 ha  2,400 13,200	i) Increase of crop yield (kg/ha)	
					Present	Return-period (year)
					5	10
b) By flood control	b) Decrease of farmers' expenses for maintenance of facilities	b) Number of beneficiaries Farm households Population	2,400 13,200	ii) Increase crop intensity (%)	Present	
					Return-period (year)	
					5	10
c) By watershed management	c) - Increase of crop productivity - Introduction for range land management	c) Number of beneficiaries Farm households Population	140 700	c) - Promotion of livestock farming through limited grazing - Increase of income by irrigation	Present	
					Return-period (year)	
					17.7	32.2
2. Social effects	Improvement of living conditions	- Improving people's livelihood through income generating activities  - Community development and improvement	Number of beneficiaries No. of household Population	2,540 13,900	- Introduction of grazing systems - Restoration of vegetation  - Development of water resources - Promotion of livestock farming - Promotion of wildlife management - Increase of forage and fuelwood production - Improvement of transportation	

## **APPENDICES**

## LIST OF APPENDICES

	Page
I. Preliminary Study	
I-1. Members of the Team.....	A - 1
I-2. Schedule.....	A - 2
I-3. Minutes of Discussions.....	A - 5
II. Basic Design Study	
II-1. Members of the Team.....	A - 15
II-2. Survey Schedule.....	A - 16
II-3. Minutes of Discussions.....	A - 19
III. Explanation for Draft Report	
III-1. Member of the Team.....	A - 27
III-2. Schedule.....	A - 28
III-3. Minutes of Discussions.....	A - 29
	Page
IV. Explanation for Draft report (Revised Version)	
IV-1. Members of the Team.....	A - 37
IV-2. Schedule.....	A - 38
IV-3. Minutes of Discussions.....	A - 39
V. Member List of Concerned Organization.....	A - 47
VI. Draft Documents Technical Assistance by FAO.....	A - 49
VI-1. Project Concept Paper.....	A - 49
VI-2. project Programme.....	A - 65

## I. Preliminary Study

### I-1. Members of the Team

Name	Specialty/Position
Shin Tamura	Leader Agricultural Development Planner Director, Tohoku Agricultural Administration Office, Land Improvement Engineering Service
Kiyoto Kurokawa	Project Coordinator First Basic Design Study Division Grant Aid Study & Design Department Japan International Cooperation Agency
Kyouji Sakakiyama	Irrigation Facilities Planner Japan International Cooperation System
Harunobu Yoshino	Rural Development Planner Japan International Cooperation System

**I-2. Schedule**

No.	Date	Day	Itinerary	Work Schedule
1	May.17	Mon.	Narita-Islamabad	Arrival at Islamabad
2	18	Tue.	Islamabad	Courtesy call and meeting at Embassy of Japan (EOJ), JICA Pakistan Office, Economic Affairs Division (EAD), Ministry of Water and Power (MWP), and FAO
3	19	Wed.	Islamabad	Courtesy call and meeting at FAO, Federal Flood Commission (FFC) and Irrigation and Power Department, Government of the Punjab (IPD)
4	20	Thu.	Islamabad-D.G.Khan	Discussion with IPD
5	21	Fri.	D.G.Khan-Multan	Field survey
6	22	Sat.	Multan-Islamabad	Travel
7	23	Sun.	Islamabad	Discussion with FFC, IPD
8	24	Mon.	Islamabad	Report to EOJ
9	25	Tue.	Islamabad	Discussion and signing for Minutes of Discussions with MWP, FFC, IPD. Report to JICA Pakistan Office,
10	26	Wed.	Islamabad	Report to EAD. Discussion and signing for Memorandum with FAO.  Leave for Japan (Leader and Project coordinator)

No.	Date	Day	Itinerary	Work Schedule
11	May.27	Thu.	Islamabad-D.G.Khain	Field survey
12	28	Fri.	D.G.Khan	Field survey. Discussion with IPD
13	29	Sat.	D.G.Khan-Lahore	Meeting with IPD (D.G.Khan)
14	30	Sun.	Lahore	Meeting with IPD
15	31	Mon	Lahore	Courtesy Call and meeting with Planning and Development Department of Punjab.
16	Jun 1	Tue	Lahore-Islamabad	Travel
17	2	Wed	Suketar	Visit to "Suketar Watershed Management Project" of FAO
18	3	Thu	Islamabad	Collecting Data
19	4	Fri	Islamabad	Collecting Data
20	5	Sat	Islamabad	Report to JICA Pakistan Office
21	6	Sun	Islamabad-Narita	Leave for Tokyo





**I-3. Minutes of Discussions/ Memorandum**



Minutes of Discussions  
Preliminary Study on  
Mithawan Hill Torrent Pilot Project  
in Punjab  
in The Islamic Republic of Pakistan.

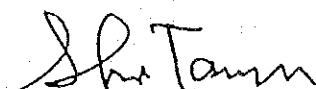
In response to the request from the Government of the Islamic Republic of Pakistan, the Government of Japan decided to conduct a Preliminary Study on Mithawan Hill Torrent Pilot Project (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Islamic Republic of Pakistan a study team, which is headed by Mr. Shin TAMURA, Director, Land Improvement Engineering Service Center, Tohoku Agricultural Administration Office, Ministry of Agriculture, Forestry and Fisheries, Government of Japan from May 17 to June 6, 1993.

The team held discussions with the officials concerned of the Government of the Islamic Republic of Pakistan and conducted a field survey.

As a result of the discussions and field survey, both parties have confirmed the main items described on the attached sheets. On the condition that the Government of Japan approves the implementation of Basic Design Study on the Project, JICA will prepare the study, including dispatchment of a survey team.

Islamabad, May 25, 1993



Mr. Shin TAMURA  
Leader,  
Preliminary Study Team,  
JICA



Mr. Khalid Mahmood  
Secretary  
Irrigation and Power Department,  
Government of the Punjab

Mr. Farhat Hussain  
Joint Secretary,  
Economic Affairs Division,  
Ministry of Finance and Economic Affairs,  
Government of the Islamic Republic of Pakistan

### 1. Objective

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

### 2. Project site

The sites of the Project are located at Mithawan Hill Torrent in Punjab. The location map of the sites is shown in ANNEX-I.

### 3. Executing agency

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

### 4. Items requested by the Pakistan side

After discussions with Preliminary Study Team, the following items were requested by the Pakistan side:

- (1) Engineering Works.
  - 1) Main Dispersion structure (Mithawan)
  - 2) Second Dispersion structure (Bhattiwala Bund).
  - 3) Dispersion structure (Choti Nullah).
  - 4) Improving Distribution system (Nangar Nullah).
- (2) Watershed Management.
- (3) Rehabilitation Works.
  - 1) Rehabilitation of Road (Choti Bala - Sakhi Sawar, 40 Km long)
  - 2) Temporary Road to site. (12 Km long)

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

### 5. Major Points of Discussions.

- (1) The Pakistan side will prepare an official request for technical cooperation concerning watershed management and submit it to FAO not later than June 1993.
- (2) The Pakistan side will prepare and submit a detailed plan of watershed management, necessary for further studies, to JICA in cooperation with FAO by the end of July 1993.
- (3) Major undertakings and necessary measures to be taken by the Pakistan side are described in ANNEX-II.

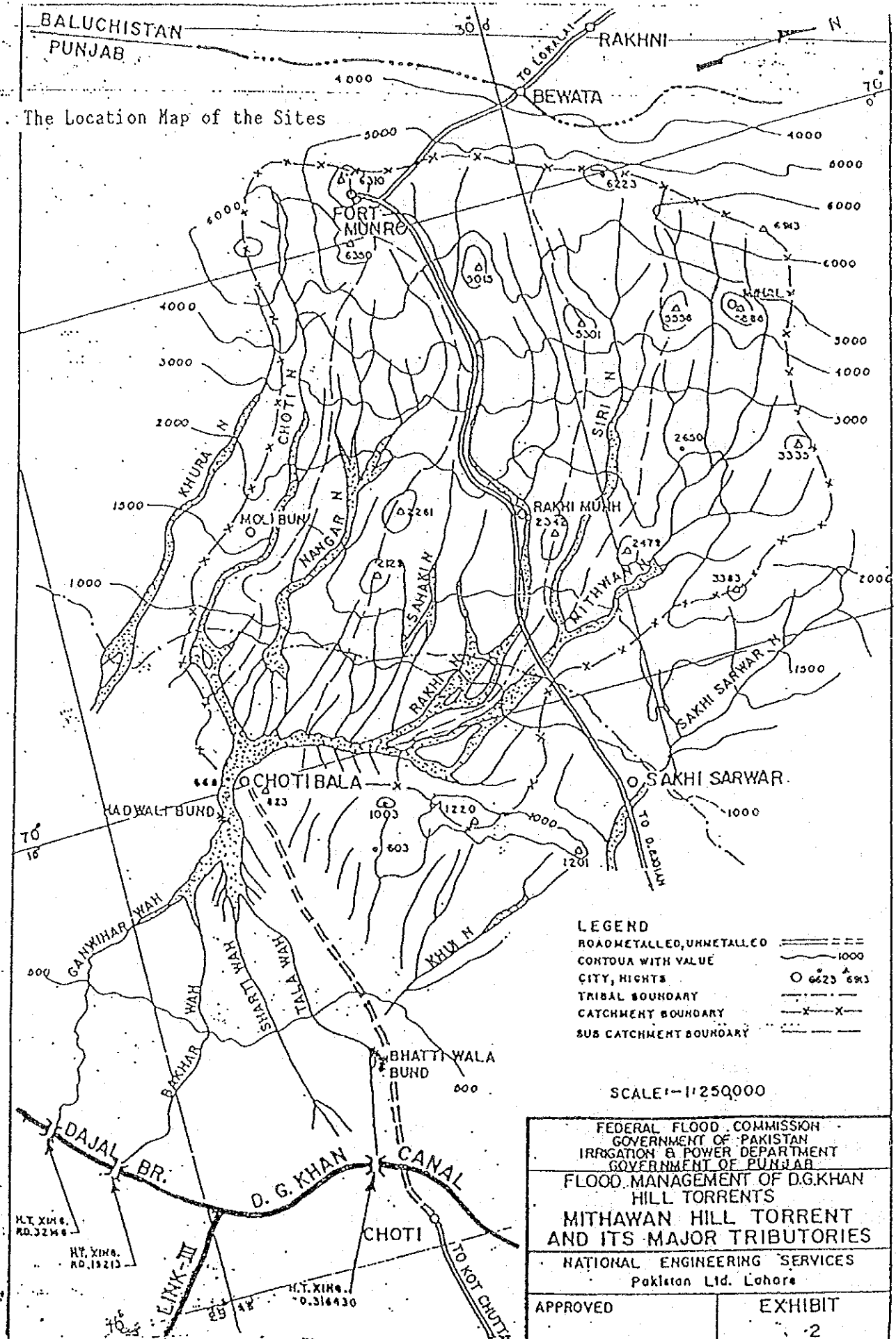
## 6. Japan's Grant Aid System

- (1) Pakistan side has understood the system of Japan's Grant Aid explained by the team.
- (2) Pakistan side will take the necessary measures described in ANNEX-II for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

## 7. Schedule of the Study

If the Project is found feasible as a result of the Preliminary Study, JICA will send Basic Design Study Team around August 1993.

ANNEX-I. The Location Map of the Sites



ANNEX-II.

Major undertakings and necessary measures to be taken by the Pakistan side.

Items to be taken by the Pakistan side,

- (1) To provide data and information necessary for the Project.
- (2) To secure land for the sites of the Project.
- (3) To clear the sites free from all obstructions prior to commencement of the construction.
- (4) To bear the commissions to the Japanese foreign exchange bank for the banking services based upon the banking arrangement.
- (5) To exempt taxes and take necessary measures for customs clearance of the material and equipment brought for the Project at the port of disembarkation in Pakistan.
- (6) To accord Japanese nationals whose services may be required in connection with supply of the products and services under the verified contracts, such facilities as may be necessary for their entry into Pakistan and stay therein for the performance of their work.
- (7) To assign the necessary staff for operation and maintenance of the facilities constructed and equipment purchased under the Grant Aid.
- (8) To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant Aid.
- (9) To bear all the expenses other than those to be borne by the Grant Aid in connection with the Project.



## MEMORANDUM

A meeting was held between Dr. Niels L. MARTIN, FAO Pakistan, and Mr. Shin TAMURA, JICA Preliminary Study Team for the Mithawan Hill Torrent Pilot Project on the 19th and 26th May 1993 in Islamabad.

The purpose of this memorandum is to record the results of discussions on the tentative areas and procedures of cooperation between JICA and FAO in this project.

Main points of the discussion are as follows:


1. Dr. Niels L. MARTIN will revise the concept paper on *Mithawan Hill Torrent Pilot Project* reflecting the realistic budget for FAO/Japan Trust Fund agreed in principle to be provided to FAO Headquarters for Technical Assistance in this project. The Technical Assistance of FAO, therefore, will be implemented on condition that the budget would be allocated from FAO/Japan Trust Fund.
2. Dr. Niels L. MARTIN has requested the Punjab Government Representative to facilitate submission of a formal letter of request to FAO from the Government of Punjab. He will follow up on this matter to see that it is carried out and a copy of the letter will be provided to JICA.
3. Dr. Niels L. MARTIN requested the JICA preliminary study team to convey to the Government of Japan the following requests for Japanese Grant Aid for supporting FAO Technical Assistance to the watershed management program in *Mithawan Hill Torrent Pilot Project*:
  - (1) Construction of a Project Office and Rest House with necessary garages, workshops, laboratories, meteorological station etc. with requisite electrical supply facilities, telephone communications, etc.
  - (2) Vehicles for use of FAO and government staff working on watershed management activities.
  - (3) Establishment of an experimental farm and demonstration watershed, including necessary earthwork, labor, equipment, buildings and/or other facilities to be determined in the Basic Design phase of project preparation.
  - (4) Construction of conservation structures as deemed necessary including check dams, silt trap dams, torrent control structures, etc.
  - (5) Provision of labor for the establishment of conservation plantings of grasses and shrubs such as the proposed planting of *Saccharum munja* hedges along contours of erosive slopes, planting of shrubs and trees for conservation and fodder/fuelwood as appropriate, and other vegetative soil erosion control measures.
  - (6) Provision of equipment, labor and other tangible inputs in water development and conservation structures and facilities such as the construction of ponds for water harvesting for small-scale irrigation, livestock water supplies, fish production, etc.; and the drilling of horizontal wells or other appropriate development of seeps and springs within the pilot project area.



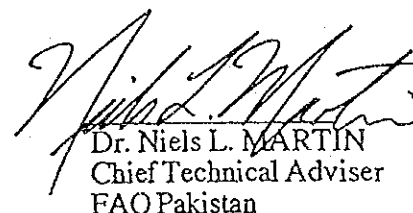
4. The Preliminary Study Team stated:

- (1) Japanese Grant Aid will be extended in the form of financial assistance which makes available the funds for facilities construction, establishment of demonstration farm and watershed area, and procuring equipment necessary for implementing the Project. Other costs necessary for implementation of the watershed management program such as operation and maintenance, office operation and supplies, etc. will not be covered by Japanese Grant Aid.
- (2) Facilities and equipment including vehicles necessary for the Project will be decided at the Basic design Stage. FAO Technical Assistance staff will carry out the watershed management program by use of these facilities and equipment under the consent of Government of the Punjab.
- (3) For smooth execution for the Basic Design Study, the team requested Government of the Punjab to prepare and submit a detailed plan for a watershed management program by the end of July 1993. The team requested Dr. Niels L. MARTIN to cooperate with the Government of the Punjab for compiling the detailed program.

After further studies, the final components of the project will be decided at the Basic Design stage. *This memorandum is not intended to be and must not be taken as the basis for any obligation on the part of either JICA or FAO.*



Mr. Shin TAMURA  
Leader,  
Preliminary Study Team, JICA



Dr. Niels L. MARTIN  
Chief Technical Adviser  
FAO Pakistan

CC: Mr. H.A. Ismet-Hakim, FAOR, FAO/Islamabad  
Mr. A. Chikhaoui, FODO, FAO/Rome  
Mr. M. Tanoi, First Secretary, Embassy of Japan, Islamabad  
Mr. A. Mitarai, Resident Representative, JICA, Islamabad



## II. Basic Design Study

### II-1. Members of the Team

Name	Specialty/Position
Masayuki Watanabe	Leader Development Specialist Japan International Cooperation Agency
Noriaki Nagatomo	Grant Aid Planner First Project Management Division Grant Aid Management Department Japan International Cooperation Agency
Hirofumi Taniguchi	Agricultural Development Planner Okinawa General Bureau Okinawa Development Agency Prime Minister's office
Yoichi Kishi	Chief Consultant Nippon Giken Inc.
Akira Honda	Watershed Management Planner Nippon Giken Inc.
Takahiro Kato	Irrigation Facilities Planner Nippon Giken Inc.
Hiroei Ishihara	Facilities Planner Nippon Giken Inc.

## II-2. Schedule

No.	Date	Day	Itinerary	Work Schedule
1	Aug. 23	Mon.	Narita-Islamabad	Arrival at Islamabad
2	24	Tue.	Islamabad	Courtesy call and meeting at Embassy of Japan (EOJ), JICA Pakistan Office, Economic Affairs Division (EAD), Ministry of Water and Power (MWP), Federal Flood Commission (FFC) and FAG
3	25	Wed.	Islamabad-D.G.Khan	Meeting for field survey
4	26	Thu.	D.G.Khan	Field survey (Watershed area, etc.)
5	27	Fri.	D.G.Khan	Field survey (Irrigation area)
6	28	Sat.	D.G.Khan-Lahore	Travel
7	29	Sun.	Lahore	Discussion with Irrigation and Power Department (IPD) (4 Consultants arrived at Islamabad)
8	30	Mon.	Lahore	Discussion and signing of Minutes of Discussions with IPD (Grant Aid Planner leave for Japan)
9	31	Tue.	Lahore-Islamabad	Travel
10	Sep. 1	Wed.	Islamabad	Discussion with EAD, MWP, FFC Discussion with FAO about Watershed Management project
11	2	Thu.	Islamabad	Report to EAD, MWP, FFC Discussion and signing with FAO
12	3	Fri.	Islamabad-Bangkok Islamabad-Lahore	Leave for Japan (Leader and Agricultural Development Planner) Travel (4 Consultants)
13	4	Sat.	Lahore-D.G. Khan	Meeting with IPD (Lahore)

No.	Date	Day	Itinerary	Work Schedule
14	5	Sun.	D.G.Khan D.G.Khan	Meeting with IPD (D. G. Khan) regarding field survey schedule Field survey
15	6	Mon.	D.G.Khan	Field survey (Irrigation area, Choti Nallah)
16	7	Tue.	D.G.Khan	Field survey (Irrigation area, Nangar Nallah)
17	8	Wed.	D.G.Khan	Field survey (Irrigation area, Choti Nallah), Topo-survey supervision (Road)
18	9	Thu.	D.G.Khan	Field survey (Irrigation area, Nangar Nallah), Topo-survey supervision (Road)
19	10	Fri.	D.G.Khan	Field survey (Irrigation area, Choti Nallah, Sakhi Sarwar), Topo-survey supervision (Choti Nallah, Road)
20	11	Sat.	D.G.Khan	Field survey (Irrigation area, Choti Nallah, Sakhi Sarwar), Topo-survey supervision (Choti Nallah, Nangar Nallah)
21	12	Sun.	D.G.Khan	Field survey (Irrigation area, Nangar Nallah, Sakhi Sarwar), Topo-survey supervision (Choti Nallah, Nangar Nallah, road )
22	13	Mon.	D.G.Khan	Field survey of watershed area (Dholi), Topo-survey supervision (Nangar Nallah)
23	14	Tue.	D.G.Khan	Field survey of watershed area (Dholi), construction planning, Topo-survey supervision (Dholi)
24	15	Wed.	D.G.Khan	Field survey of watershed area (Dholi), Meeting with IPD, Topo-survey supervision (Dholi)
25	16	Thu.	D.G.Khan	Field survey of watershed area (Dholi), Topo-survey supervision (Dholi)

No.	Date	Day	Itinerary	Work Schedule
26	17	Fri.	D.G.Khan	Survey Nangar Nallah, topo-survey supervision (Dholi)
27	18	Sat.	D.G.Khan	Survey Choti Nallah, topo-survey supervision (Dholi)
28	19	Sun.	D.G.Khan-Lahore D.G.Khan	Travel (Chief Consultant, Watershed Management Planner) Data collection
29	20	Mon.	Lahore-Mirpur D.G.Khan	Visit to FAO project (Suketar) Data collection
30	21	Tue.	Mirpur-Islamabad D.G.Khan-Islamabad	Travel
31	22	Wed.	Islamabad	Meeting with JICA and FAO
32	23	Thu.	Islamabad	Data collection
33	24	Fri.	Islamabad-Bangkok	Leave for Japan
34	25	Sat.	Bangkok-Narita	Arrival at Narita

## **II-3 Minutes of Discussions/ Memorandum**





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

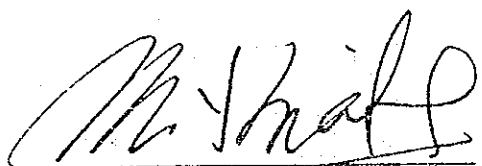
Based on the results of the Preliminary Study. The Japan International Cooperation Agency (JICA) decided to conduct a Basic Design Study on Mithawan Hill Torrent Pilot Project (hereinafter referred to as "the Project").

JICA sent to Pakistan a study team headed by Mr. Masayuki Watanabe, Development Specialist, Institute for International Cooperation. JICA from 23rd August to 24th September, 1993.

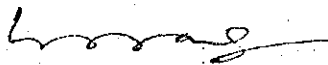
The Team held a series of discussions with the officials concerned of the Government of Pakistan and conducted a field survey in the study area.

In the course of discussions and the field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further work and prepare the Basic Design Study Report.

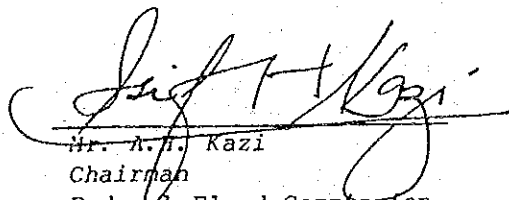
Lahore 30th August, 1993



Mr. Masayuki Watanabe  
Leader  
Basic Design Study Team JICA



Mr. Mohammad Akhtar Rana  
Secretary  
Irrigation and Power Department,  
Government of the Punjab



Mr. A. I. Kazi  
Chairman  
Federal Flood Commission  
Ministry of Water and Power  
Government of Pakistan

Mr. Farhat Hussain  
Joint Secretary  
Economic Affairs Division  
Ministry of Finance and  
Economic Affairs  
Government of Pakistan

ATTACHMENT

1. Objective of the Project

The objective of the Project is to construct dispersion structures and watershed management facilities to make effective use of flood water and to optimize it for irrigation purposes.

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

The responsible authority is the Ministry of Water and Power, Government of Pakistan. The executing agency is the Irrigation and Power Department, Government of Punjab.

4. Items to be surveyed by the consultants

The consultants team will conduct Basic Design Study for the following items out of these requested by the Government of Pakistan.

(1) Engineering Works

- Choti Nallah dispersion structure
- Nangar Nallah distribution system

(2) Road Construction

- Rehabilitation of Choti Bala - Sakhi Sawar Road (40 Km. long)
- Temporary Road to site (12 Km. long)

(3) Watershed Management Project-related facilities

- Project Office including accommodation
- Project vehicles
- Demonstration farm and facilities
- Construction machinery
- Erosion control works (low check dams)
- Vetiver contour hedge.

However, the final items of the Project will be decided after further studies in Japan.

5. Major Points of Discussion

- (1) The Pakistani side has understood the points suggested by the



A-22

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Japanese side and will take them into consideration.

- (2) Choti Nallah dispersion structure and Nangar Nallah distribution system must be designed taking fully into account segment concentration.
- (3) Pakistan side insisted that construction of Mithawan dispersion structure and Bhatti Wala Bund was indispensable for irrigation in Mithawan area.

#### 6. Japan's Grant Aid Programme System

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

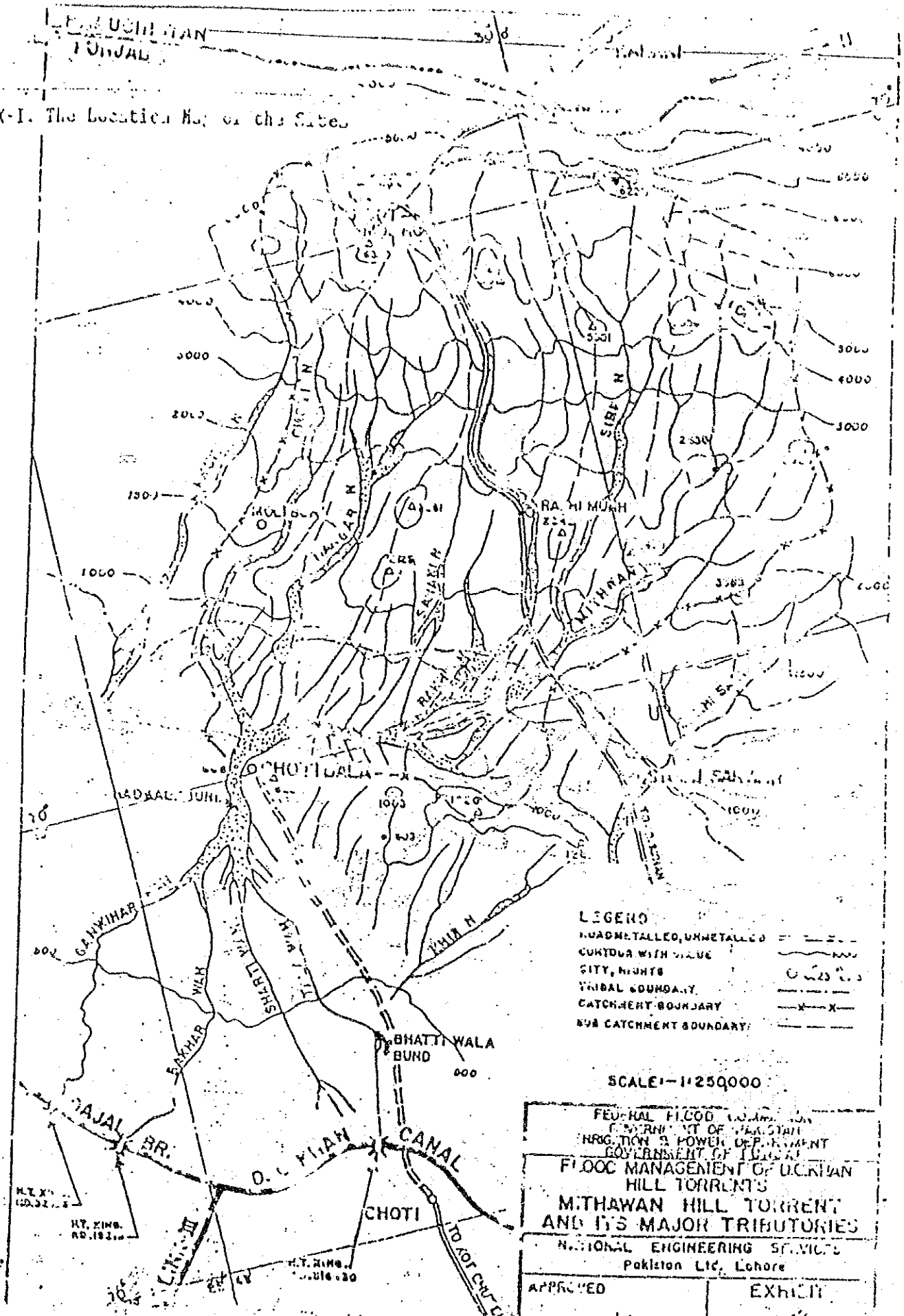
#### 7. Schedule of the Study

- (1) The consultants will proceed to further studies in Pakistan until 24th September.
- (2) JICA will prepare a draft report in English and dispatch a mission in order to explain its contents around November.

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20/8  
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ANNEX-I. The Location Map of the Sites



**LEGEND**  
 ROAD METALLED, UNMETALLED  
 CURTDAR WITH WALL  
 CITY, TOWN  
 TRIBAL BOUNDARY  
 CATCHMENT BOUNDARY  
 RIVER CATCHMENT BOUNDARY

SCALE = 1:250,000

FEDERAL FLOOD COMMISSION  
 GOVERNMENT OF PAKISTAN  
 IRRIGATION & POWER DEPARTMENT  
 GOVERNMENT OF PUNJAB  
**FLOOD MANAGEMENT OF UCHIAN  
 HILL TORRENTS  
 MITHAWAN HILL TORRENT  
 AND ITS MAJOR TRIBUTORIES**  
 NATIONAL ENGINEERING SERVICES  
 Pakistan Ltd., Lahore

APPROVED \_\_\_\_\_ EXHIBIT \_\_\_\_\_

*M*  
 30/8

Annex II Necessary measures to be taken by the Government of Pakistan <sup>and Government of Punjab</sup>

1. To provide data and information necessary for implementation of the Project.
2. 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.
3. 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.
4. To exempt Japanese nationals involved in the Project from custom duties, 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.
5. 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.
6. To bear all the expenses other than those to be borne by the Grant Aid.
7. To assign the necessary staff for operation and maintenance of the facilities constructed and equipment purchased under the Grant Aid. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant Aid.

*Handwritten notes:*  
20/8/53  
Y.M.  
d

## MEMORANDUM

A meeting was held between JICA Basic Design Team for Mithawan Hill Torrent Pilot Project and FAO Pakistan Office on 1 September 1993 in Islamabad

The purpose of this memorandum is to record the results of discussions on the procedures of cooperation between JICA and FAO Pakistan Office for this project.

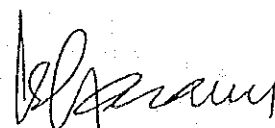
### Main points of the discussions are as follows:

1. JICA team confirmed that the official request for the FAO assistance for the project was made by the Punjab Provincial Government to the Pakistan Government. The official request from the Government of Pakistan to FAO was received on September 1, 1993.
2. JICA team informed FAO that the Government of Japan would allot funds for FAO project provided that FAO would submit to Government of Japan the Project Document for Mithawan watershed project prepared in response to the official request of the Pakistan Government.
3. FAO informed JICA team that in response to the above information FAO Pakistan would request FAO HQs to assign an expert for 6 weeks in order to finalize the Project Document, for which the funds would be made available from the signed Trust Fund Project.
4. JICA team requested FAO Pakistan that the Project Document should be prepared taking into full account the survey results of the JICA Basic Design Team, which will be available by end September 1993, and the Project Document should reach JICA soon after the completion of the assignment of the FAO expert.
5. The skeleton, survey report prepared by JICA Basic Design Team will be provided to FAO by 30 September 1993 to facilitate the work of FAO's Consultant fielded for preparation of the Project Document.
6. JICA informed FAO that funds for construction and equipment will be provided by the JICA's grant and the funds for personnel services etc. needed for the implementation of the project will be provided out of the funds entrusted by the Government of Japan to FAO HQs. The funds meant for construction and equipment should be used within one year or maximum two consecutive years.



Mr M. Watanabe  
Leader  
Basic Design Team, JICA

2/9/93



Mr H.A. Ismet-Hakim  
FAO Representative

2/9/93

### III. Explanation for Draft Report

#### III-1. Members of the Team

Name	Specialty/Position
Hirofumi Taniguchi	Leader Agricultural Development Planner Okinawa General Bureau Okinawa development Agency Prime Minister's office
Noriaki Nagatomo	Grant Aid Planner First Project Management Division Grant Aid Management Department Japan International Cooperation Agency
Yoichi Kishi	Chief Consultant Nippon Giken Inc.
Akira Honda	Watershed Management Planner Nippon Giken Inc.



**III-2. Schedule**

No.	Date	Day	Itinerary	Work Schedule
1	Nov. 22	Mon.	Narita-Islamabad	Arrival at Islamabad
2	23	Tue.	Islamabad	Courtesy call and Explanation on Draft Report to Embassy of Japan (EOJ), JICA Pakistan Office, Economic Affairs Division (EAD), Ministry of Water and Power (MWP), Federal Flood Commission (FFC) and FAO
3	24	Wed.	Islamabad-Lahore	Courtesy call and Explanation on Draft Report to Irrigation and Power Dept., Govt. of the Punjab (IPD)
4	25	Thu.	Lahore	Explanation on Draft Report to IPD,
5	26	Fri.	Lahore	Team meeting
6	27	Sat.	Lahore-Islamabad	Signing of the Minutes of Meeting on Draft Report with IPD
7	28	Sun.	Islamabad	Report to EOJ, JICA, EAD, MWP, and FFC Meeting with FAO and signing for Memorandum
8	29	Mon.	Islamabad-Bangkok	Travel
9	30	Tue.	Bangkok-Narita	Arrival at Narita (Leader and Grant Aid Planner)
10	Dec. 1	Wed.	Bangkok-Narita	Arrival at Narita (2 Consultants)

**III-3. Minutes of Discussions/ Memorandum**



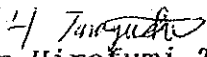
**MINUTES OF DISCUSSIONS**  
**BASIC DESIGN STUDY**  
**ON**  
**MITHAWAN HILL TORRENT PILOT PROJECT**  
**IN PUNJAB**  
**IN THE ISLAMIC REPUBLIC OF PAKISTAN**  
**(CONSULTATION ON DRAFT REPORT)**

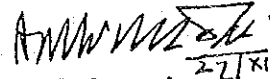
In August 1993, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study team on Mithawan Hill Torrent Pilot Project (hereinafter referred to as "the Project") to the Islamic Republic of Pakistan, and through discussions, field survey and technical examination of the result in Japan, has prepared the draft report of the study.

In order to explain and to consult the Pakistan side on the component of the draft report, JICA sent to Pakistan a study team, which is headed by Mr. Hirofumi Taniguchi, Agricultural Development Planner of Okinawa General Bureau, Okinawa Development Agency, Prime Minister's Office, and is scheduled to stay in the country from November 22 to 29, 1993.

As a result of discussion, both parties confirmed the main items described on the attached sheets.

Lahore 27th November, 1993

  
Mr. Hirofumi Taniguchi  
Leader,  
Draft Report Explanation Team,  
JICA.

  
27/11/93  
Mr. Abdul Aziz Chaudhry  
Secretary,  
Irrigation & Power Deptt.  
Government of the Punjab.

Mr. Faiz Ahmad Zaidi  
Joint Secretary,  
Ministry of Water and Power,  
Government of Pakistan.

Mr. Farhat Hussain  
Joint Secretary,  
Economic Affairs Division,  
Ministry of Finance and  
Economic Affairs,  
Government of Pakistan.

## ATTACHMENT

1- Component of Draft Report.

The Government of Pakistan has agreed and accepted in principle the components of the Draft Report proposed by the team.

2- Japan's Grant Aid system.

(1) The Government of Pakistan has understood the system of Japanese Grant Aid explained by the team.

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

3- Further Schedule.

The team will make the Final report in accordance with the confirmed items, and send it to the Government of Pakistan by the end of January, 1994.

4- Other Issues.

(1) The Team confirmed that Irrigation and Power Department of Punjab Government being executing agency will coordinate cooperation with FAO appropriately for the watershed management program.

(2) The team requested that Irrigation and Power Department of Punjab Government will send copies of document on the discussions with FAO to the Embassy of Japan and JICA Islamabad Office.

(3) Pakistan side insisted that construction of Mithawan dispersion structure and Batiwala Bund would be studied as soon as possible.

12

AWA  
27/11/9

Annex: Necessary measures to be taken by the Government of Pakistan for Japan's Grant Aid Execution.

- 1- To secure the site for the Project.
- 2- To clear, level and reclaim the site prior to commencement of the construction of buildings.
- 3- To undertake incidental outdoor works such as gardening, fencing, gates and exterior lightning in and around the site.
- 4- To arrange to provide utilities connection , as below
  - (1) Electricity distribution line to the site of main office and training institute.
  - (2) City water distribution main to the site of main office and training institute.
  - (3) Drainage city main to the site of main office and training institute.
  - (4) Telephone trunk line and the main distribution panel of main office and training institute.
- 5- To provide furniture for Training Institute.
- 6- To bear commissions to the Japanese foreign exchange bank for the banking services based upon Banking Arrangement.
- 7- To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the project at the port of disembarkation.
- 8- To accord Japanese Nationals whose services may be required in connection with the supply of products and the 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.
- 9- To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant.
- 10- To bear all the expenses other than those to be borne by the Grant.

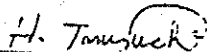
## MEMORANDUM

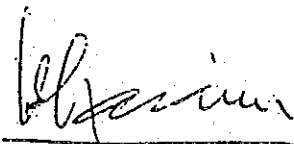
A meeting was held between JICA Draft Report Explanation Team for Mithawan Hill Torrent Pilot Project and FAO Pakistan Office on 23 and 28 November 1993 in Islamabad.

The purpose of this memorandum is to record the result of discussions on the procedures of cooperation between JICA and FAO Pakistan Office for this project.

### Main Points of the discussions are following:

1. Japan's Grant Aid:
  - (1) FAO Pakistan Office has heard the explanation by the team on Japan's Grant Aid system.
  - (2) JICA team explained the details and implementation schedule of the Japan's Grant Aid programme on Mithawan Hill Torrent Pilot Project, and FAO Pakistan Office took note of the matter explained.
  - (3) FAO Pakistan Office was informed that US\$ 150,000 was earmarked for the first year of the Trust Fund project and US\$ 300,000 for the consecutive years for a total of US\$ 1,350,000, and the Team took note of this information.
  
2. Implementation Schedule on the Watershed Management Programme:
  - (1) JICA team requested FAO to recruit the personnel assigned to the watershed management programme as soon as the government of Japan transfer a grant through Trust Fund to FAO Headquarters Rome.
  - (2) JICA team emphasized that the FAO's Watershed Management programme will have to keep pace with the construction works under the Japan's Grant Aid programme that has tight implementation schedule.
  - (3) Both parties confirmed the tentative implementation schedule on the attached sheet.
  
3. Others:
  - (1) JICA team confirmed that FAO's consultant would formulate the project Document and cleared by FAO Headquarters by the end of February 1994, taking the details and schedule of Japan's Grant Aid programme into account.
  - (2) JICA team requested FAO to send copies of the documents concerning the implementation of FAO's technical assistance to the Embassy of Japan and JICA Pakistan Office.

  
\_\_\_\_\_  
Mr H. Taniguchi  
Leader  
Draft Report Explanation Team

  
\_\_\_\_\_  
Mr H.A. Tsmet-Hakim  
FAO Representative

Tentative Implementation Schedule for  
Mithawan Hill Torrent Pilot Project (shown until May '95)

	'93		'94												'95				
	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
FAO																			
P/F		=====	=====	=====															
E/N					=====														
P-1									=====	=====	=====	=====	=====	=====					
P-2																=====	=====	=====	=====
JICA																			
I-pl				=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====					
E/N				=====															
D/D				=====	=====	=====													
T/D					=====	=====													
T/B/C																			
Works																			
MB									=====										
SP									=====	=====	=====	=====	=====	=====					
RD/I									=====	=====	=====	=====	=====	=====					
WSM									=====	=====	=====	=====	=====	=====					
BLG									=====	=====	=====	=====	=====	=====					
RD/A									=====	=====	=====	=====	=====	=====					

FAO

- P/F : Project Formulation
- E/N : Exchange of Note
- P-1 : Phase 1, Mobilization
- P-2 : Phase 2, Project Development (continue 5 years)

JICA

- D/D : Detailed Design
- T/D : Tender Document Preparation
- T/B/C : Tendering, Bidding & Contract with Contractor
- MB : Mobilization
- SP : Sediment Pocket
- RD/I : Road Improvement
- WSM : Watershed Management
- BLG : Office Building
- RD/A : Access Road

*lsh*

*(Signature)*





#### **IV. Explanation of Draft Report (Revised Version)**

##### **IV-1. Member of the Teams**

Name	Specialty/Position
Shinya Suzuki	Leader Grant Aid Cooperation Division Economic Cooperation Bureau Ministry of Foreign Affairs
Yoichi Kishi	Chief Consultant Nippon Giken Inc.
Hiroei Ishihara	Facilities Planner Nippon Giken Inc.

#### IV-2. Schedule

No.	Date	Day	Itinerary	Work Schedule
1	Jan. 11	Tue	Narita-Karachi	Travel
2	12	Wed.	Karachi-Islamabad	Arrival at Islamabad Courtesy call and Explanation to Embassy of Japan (EOJ), JICA Pakistan Office, Economic Affairs Division (EAD), Ministry of Water and Power (MWP), Federal Flood Commission (FFC) Discussion and signing of the memorandum with FAO
3	13	Tue.	Islamabad-Lahore	Travel
4	14	Fri.	Lahore	Team meeting
5	15	Sat.	Lahore	Explanation and discussion with Irrigation and Power Department of Punjab (IPD)
6	16	Sun.	Lahore-D.G.Khan	Signing on the memorandum with IPD Travel to D.G.khan
7	17	Mon.	D.G.khan-Islamabad	Field Survey Travel to Islamabad (Leader)
8	18	Tue.	Islamabad-Karachi D.G.Khan-Karachi	Report to EOJ, JICA, EAD, MWP and FFC, Travel to Karachi (Leader) Field Survey, Travel to Karachi
9	19	Wed	Karachi-Narita	Travel
10	20	Wed.	Bangkok-Narita	Arrival at Narita

**IV-3. Minutes of Discussions / Memorandum**



Memorandum

The Japan International Cooperation Agency (JICA) dispatched a study team on Mithawan Hill Torrent Pilot Project (hereinafter referred to as "the Project") to the Islamic Republic of Pakistan from 12th to 19th January, 1994. The team, headed by Mr. Shinya Suzuki, Official, Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs, had discussions with the Pakistani side and both parties confirmed the main items described hereafter.

1. Component of Draft Report (revised version)

The Pakistani side has agreed and accepted in principle the components of the Draft Report (revised version) proposed by the team.

2. FAO watershed Management Program

The Japanese side has stressed that prompt and smooth implementation of the Watershed Management Program assisted by FAO is essential for the success of the Project.

In this regard, the Pakistani side will take necessary measures to facilitate cooperation with FAO and will furnish the Japanese side with copies of all communications related to the Watershed Management Program with FAO.

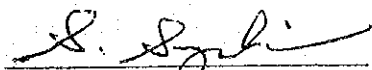
3. Other Issues

1) The both sides have reconfirmed all the points appearing in the Minutes of Discussions signed on 27th November, 1993.

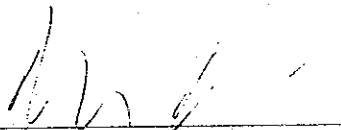
2) The Pakistani side has stressed that the need for implementation of Mithawan dispersion structure and Bhattiwala Bund is urgent and sincere as these are essential part of the overall package and that a B/D mission is to be dispatched as soon as possible. The Japanese team has confirmed that it will convey the message to the Japanese Government.

3) The Pakistani side has assured the proposed sites for construction of offices and training center, and they will be cleared and ready prior to commencement of the construction work.

Lahore 15th January, 1994



Mr. Shinya Suzuki  
Leader  
Revised Draft Report  
Explanation Team  
JICA



Mr. Riaz Ahmad Khan  
Secretary  
Irrigation and Power Department  
Government of the Punjab

c/c: Ministry of Water and Power, Islamabad  
Economic Affairs Div., Ministry of finance and Economic Affairs, Islamabad  
Embassy of Japan, Islamabad  
JICA office, Islamabad

## MEMORANDUM

The Japan International Cooperation Agency (JICA) dispatched a study team on Mithawan Hill Torrent Pilot Project to the Islamic Republic of Pakistan from 12th to 19th January, 1994. The team, headed by Mr. Shinya Suzuki, Official, Grant aid Division, Economic Cooperation Bureau, MOFA, also had discussions with FAO Pakistan office and both parties confirmed the main items described hereafter.

1. Japan's Grant Aid Project

The Japanese side has explained that the implementation plan of Grant Aid project (Mithawan Hill Torrent Pilot Project) has been changed slightly. The new schedule is attached herein.

2. FAO Watershed Management Project

The recruitment of the FAO project staff will be initiated in accordance with the attached work plan.

3. Other Issues

Both sides have agreed to the prompt and smooth implementation of FAO project and JICA project.

With regard to the Watershed Management Project the FAO office will take necessary measures to facilitate cooperation with Pakistani side and will furnish the Japanese side with copies of all communications related to this project.

January 12, 1994

Mr Shinya Suzuki  
Leader  
Study Team  
JICA

Mr H A Ismet-Hakim  
FAO Representative  
Pakistan

ANNEX 1

Mithawan Watershed Management Project

Tentative Work Plan

ACTIVITY	1994		1995		1996		1997		1998		PARTY RESPONSIBLE		
	1	2	3	4	1	2	3	4	1	2		3	4

1.1.1 Conduct a participatory rural appraisal	**	**	**	**	*	*	*	*	*	*	*	Consultant
1.2.1 Conduct a bio-physical survey	**	**	**	**	*	*	*	*	*	*	*	CTA, DFO Consultant
1.3.1 Establish Community Organization	**	**	**	**	*	*	*	*	*	*	*	CTA, JICA DFO
1.4.1 Establish multi-purpose nursery	**	**	**	**	*	*	*	*	*	*	*	CTA, APO Consultant
1.5.1 Establish bio-technical erosion control trials	**	**	**	**	*	*	*	*	*	*	*	CTA Consultant
1.6.1 Establish Grazing Association	**	**	**	**	*	*	*	*	*	*	*	CTA, APO Consultant
1.7.1 Implement simple rotation grazing system	**	**	**	**	*	*	*	*	*	*	*	CTA Consultant
1.8.1 Afforestation with micro-niche planting method	**	**	**	**	*	*	*	*	*	*	*	CTA, DFO
1.9.1 Install hydro-seed monitoring station in Dholi Chur	**	**	**	**	*	*	*	*	*	*	*	CTA, APO
2.1.1 Implement on-farm conservation & income generating measures	**	**	**	**	*	*	*	*	*	*	*	CTA Consultants
2.2.1 Conduct livestock survey	**	**	**	**	*	*	*	*	*	*	*	Consultant



ANNEX 1 (Continued)

Mithawan Watershed Management Project

Tentative Work Plan

ACTIVITY	1994				1995				1996				1997				1998				PARTY RESPONSIBLE
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
2.3.1 Establish water supplies																					CTA, JICA
2.4.1 Conduct cottage industry feasibility study																					Consultant, SDFO Ext.
2.4.2 Implement one or more of the industries identified in Activity 2.4.2																					SDFO Ext. Group Prom.
3.1.1 Conduct practical field training of Community Organization members																					CTA, APO, DFO
3.1.2 Conduct study tours																					CTA, DFO
3.2.1 Develop and implement Conservation Education programme																					Consultant APO, SDFO Ext
3.2.2 Train the local teachers in conservation principles																					Consultant, DFO

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Implementation Schedule (Phase 1-1)

Description	1994												1995				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Phase 1-1			C/M ▲	E/N ▲													
Detailed design																	
Tender document																	
Tendering and Construction Contract																	
Construction																	
Mobilization																	
Choti Nalla Sediment Pocket																	
Watershed Management Building																	
Small Impounding Pond																	
Weir																	
Check Dam																	
Access Road																	
Road Improvement Choti - Choti Bala																	
Sakhi Sarwar - Choti Bala																	



**V. Member List of Organization Concerned**

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Name	Position
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**Japan International Cooperation Agency (JICA)**

Mr. Akihiro Mitarai	Resident Representative
Mr. Kazushige Aragaki	Deputy Resident Representative
Mr. Ryoji Yaginuma	Assistant Resident Representative

**Embassy of Japan**

Mr. Masahiko Tanoi	First Secretary
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**Economic Affairs Division**

Mr. Shahid Humayun	Deputy Secretary
Mr. Farhat Hussain	Joint Secretary
Mr. Faizur Rehman	Section officer

**Ministry of water and Power**

Mr. Syed Shahid Hussain	Additional Secretary
Mr. Inayat Ali	Deputy Secretary
Mr. S. Faiz Ahmad Zaidh	Joint Secretary

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Name	Position
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**Federal Flood Commission**

Mr. Asif H. Kazi	Chairman
Mr. I. B. Shaikh	Chief Engineer
Mr. Taring Masud	Senior Engineer
Mr. Fazlur Rahman Siddiqui	Senior Engineer
Mr. Alamagir Khan	Assistant Engineer

**Government of Punjab, Irrigation and Power Department**

Mr. Riaz Ahmad Khan	Secretary
Mr. Mian Yousaf Ali	Additional Secretary
Mr. Mohammad Waqar Khan	Deputy Secretary (Operation)
Mr. Chaudry Fateh Mohammad	Chief Engineer (D. G. Khan)
Mr. S. Mansoob Ali Zaidi	Superintending Engineer (D. G. Khan)
Mr. Muhammad Ramzan Bhatti	Executive Engineer (Janpur Construction Division)
Mr. Saifullah Sheikh	Sub Divisional Officer (Janpur Construction Division)

**Planning & Development Dept., Punjab**

Mr. Malik Ahmad Khan	Chief (Water and Power)
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**Food and Agricultural Organization of United Nations (FAO)**

Mr. H. A. Ismet-Hakim	Representative
Dr. Reinhard Breitbart	Program Officer
Mr. Bashir Ahmad	Program Advisor
Dr. Niels L. Martin	Chief Technical Advisor
Mr. Ahmad Saeed	Sr. National Advisor
Larry C. Tennyson	FAO Consultant

**VI. Draft Documents for Technical Assistance by FAO**

**VI-1 Project Concept Paper**



CONCEPT PAPER  
MITHAWAN WATERSHED MANAGEMENT PROJECT

NIELS L. MARTIN  
FAO  
PAKISTAN



## MITHAWAN WATERSHED MANAGEMENT PROJECT

### THE AREA

The watershed of the Mithawan Torrent is part of the complex of the Sulaiman Range that drains into the Pachad Plains, adjacent to the Indus River in western Punjab (see maps, Appendix 1.). The watershed covers approximately 68,000 hectares. Elevation ranges from 250 meters above sea level to over 2,000 meters. Parent material is of sedimentary and alluvial origins with geological strata reaching the near-vertical in the hilly parts of the area.

Some of the limestone and indurate layers of sandstone are of limited permeability, resulting in the retention of groundwater in natural subterranean reservoirs behind these vertical layers. Seeps and springs emerge where the water over-tops the impermeable strata or emerges through weak points.

The area is semi-arid with about 300-350 millimeters annual average precipitation. About 60% of the precipitation falls during the monsoon period of July to September. Many rainfall occurrences are high intensity-short duration, resulting in high percentages of runoff with the consequence of common flash floods. The area is highly eroded as a result of overuse by livestock, the aridity and the nature of the rainfall.

Natural vegetation includes trees and shrubs of *Ziziphus numularia*, *Z. jujuba*, *Prosopis spicigens*, *P. juliflora*, *Acacia* spp., *Salvadora oleoides*, and *Tamarix articulata*. Grasses include *Cynodon dactylon*, *Cenchrus ciliaris*, *Lasiurus indicus*, and *Saccharum munja*. Grasses are generally very heavily grazed and shrubs are extremely heavily browsed, resulting in compact hedging. Small drainage ways are more heavily vegetated than are areas without extra water accumulation. The vegetation is present in enough density to allow good increase in plant size and vigor and for reproduction with good management of livestock.

The population of the area occurs in small villages or family units where water is available for human and livestock use. There are a few areas where perennial surface flow of water allows the development of limited agriculture. In other areas earthen and stone structures have been erected

## *Mithawan*

to capture surface flows of runoff from precipitation to grow crops. Crops grown in the area include wheat in the winter season and sorghum or millet in the summer. Fruit trees including dates, pomegranates, and guava are grown on a limited scale as are a few vegetables.

Land ownership is vested in the tribal leaders with verbal and traditional ownership rights given to individuals for cultivated land. Village units have rights for grazing in areas adjacent to the villages. Water rights to perennial water and flood waters from the torrents are clearly established.

### NEED FOR PROJECT INPUTS

The nature of the area results not only in heavy erosion losses on site but also extensive down-stream damage to irrigated croplands by sedimentation and physical damage to irrigation structures by the flood waters. The watershed management project will complement the downstream works to be constructed by the Irrigation Department/JICA to enhance the use of flash-floodwater for irrigation and to eliminate the damage caused to the irrigation works by the floods.

According to estimates in preliminary studies, flood volume per unit time will be reduced by 20% by the implementation of watershed management alone. This will greatly reduce pressures on the downstream structures to be built by the JICA funded project and will make maintenance less expensive.

Upstream benefits will include improved soil stability and increasing productivity of the area by reversing the trend of accelerated soil loss. Vegetation cover will be enhanced with the resulting improvement in livestock forage production and increased amounts of fuelwood for local use and for sale. water resources will be developed for better distribution of livestock; more reliable sources of water for the human population and for increased production of agricultural crops. This, and other peripheral benefits will result in a higher and sustainable standard of living for the inhabitants of the watershed area.

## Mithawan

### PILOT AREA

It is recommended that the project activities begin in a concentrated area for initial testing of activities and to demonstrate the effectiveness of interventions. In a field visit and in collaboration with the study team, it was determined that the Dholi area would be the most suitable site from which to begin project implementation for the following reasons:

- Central location
- Reasonable accessibility
- Concentrated population
- Water available for:
  - Nursery
  - Office and rest house/residence
  - Construction
- Many landscape types occurring in the watershed are present

### PROJECT CONCEPT

Time span. Watershed management requires not only a long period of time for the biological and physical improvements required but also for changes in attitudes for the local people. Total development must be approached over a period of many years. For this reason a long-term view should be taken with development phased as explained below. The proposed project should include two phases with follow-up being considered for the subsequent phases.

#### *Currently planned project*

Phase 1. Six months--Mobilization period.

Phase 2. Five years--Major implementation period.

#### *Future follow-on project*

Phase 3. Five years--Phase-in of local community organization (CO) to operate project and to maintain project works.

Phase 4. Five years--Phase out of donor funding and increase in independent funding by CO.

*Mithawan*

Phase 1.      Mobilization

The mobilization phase should include the following activities:

Placement of project staff

Socio-economic study of project area to include:

Demography

Tribal structure

Land tenure

Economic base

Traditional organization of communities

Feasibility of CO development

Planning of demonstration area:

Resource mapping

Conservation plan

Range management in demonstration area:

Farmers' meetings

Study tour for farmers

Develop concept of grazing association

Grazing management plan

During this period the JICA Contractor would establish with Japan Grant Aid the following:

Field Office

Rest House/Residence

Meteorological station

The primary objective of the mobilization phase would be to obtain an understanding of the social structure and the economics of the project area for the involvement of the local people in the implementation of the project and eventual organization of a viable Community Organization, and to get the project set up and operable. The conservation and range planning and developments would only be preparatory activities with most actual work being done during the second phase.

## *Mithawan*

### Phase 2. Project Development

Objectives of this phase would be to:

- Establish a viable resource development program to begin the rehabilitation of the vegetation, soil and water resources of the Mithawan Watershed.
- Establish viable grazing associations in at least half of the villages of the project area for the organized, managed grazing of half of the area within the watershed.
- Establish a Community Organization (CO) within the Mithawan Watershed (this may be exclusively within the watershed or may extend outside its boundaries, depending upon the social structure of the area) that will be trained to maintain systems and structures developed by the project.

Project Activities:

Conservation. The major cause of the flash-flood problems down-stream in the torrents of the sulaiman Range is the deterioration of the soil and vegetation in the uplands. Unrestricted grazing and other uses have contributed to the drastic decrease of the ground cover and the erosion of the soil. Measures must be taken to reverse the trend.

Traditionally, soil conservation in Pakistan has meant the establishment of checkdams and gully plugs. These measures can be effective in arresting the development of gully erosion but do nothing in stopping sheet erosion. When checkdams fill with sediment, the eroded soil continues to pass over these structures and contributes to the sediment load in the streams. Vegetation cover in the drainage channels and on the land is essential to reversal of erosion, resulting in soil building instead of degradation.

To provide the necessary vegetation cover, grazing management must be implemented on the area (see Range Management section, below). In

## Mithawan

In addition, contour hedges of *Saccharum munja*, a native grass of the area, will be planted initially in minor drainage channels, and then on the contour across the slopes. This will provide a vegetative barrier against sediment loss and will trap the sediment on the land, developing mini-terraces. *Vetiver* spp., a grass being used for this in many parts of the world, will also be tested in this function. *Vetiver* will also be tested as a conservation tool on terraces and field boundaries on farm land where it has the advantage of minimal spread into adjacent areas from where it is planted.

Small earthen dams will be constructed as silt traps in the drainage channels of the tributaries to trap water and sediment before it reaches the major torrents of the watershed. Project bulldozers will construct the dams with the people using the land contributing to the work by planting vegetation on the structures and doing necessary stone masonry for spillways, etc.

Other dams will be constructed to harvest runoff water for use for livestock, human use, fish farming, and small scale irrigation. In many cases these will be constructed in conjunction with silt trap dams, with the silt trap built up-stream to relieve the water of most of its sediment load and then collecting the water in the pond.

Where the water supply in a pond is reliable enough to provide a year-round supply, small-scale irrigation can be set up for orchard production using drip irrigation or other efficient irrigation methods. Hand watering or trickle irrigation can also be used for vegetable gardening. Fish-farming can be done where water supply is adequate.

Silt trap ponds can also be used for agriculture when the water soaks into the soil, leaving enough residual moisture after surface water is gone, to support a crop of grain or vegetables as is the traditional practice in the area.

Range Management. The key to range management is the active and willing participation of the livestock owners and herders. A grazing association must be organized under the auspices of the community organization that will help the graziers in working together to manage the rangelands.

## *Mithawan*

Members of the association will be taught concepts of range management and will participate in the decision making process regarding how it will be implemented on their grazing lands. They must gain the understanding that it is forage they are producing on the land and that the livestock are the means of making the forage useable by man.

Grazing management will first be implemented on the lands of the pilot area at Dholi and then will extend to other areas. Likely management will include a simple rotation system that will allow each area to be rested in alternate years during the monsoon growing season. For example, half of a given area will be rested during July, August and September of the first year and then the other half will be rested during the monsoon season of the second year. Details of the grazing systems will be developed as project personnel gain familiarity with the resources and have a chance to test it.

The core principle of range management, however, will be the natural recovery of existing vegetation. Very little artificial revegetation should be needed except for the conservation planting outlined above.

Water spreading on rangelands will also be developed in areas where this practice is feasible and where it will not take away water from flood irrigated croplands.

Other feed resources will be developed by assisting the local people to enhance their irrigated forages. Now most irrigated fodder is food grains cut before maturity and fed to livestock. Legumes and fodder grasses will be introduced to the landowners to test their acceptability for irrigated forage production. Fodder trees will also be considered for use in irrigated areas as well as in areas of water accumulation such as in silt trap dams or water spreading areas.

Livestock water resources will be developed in cooperation with the grazing associations as part of overall range management development. Some of the ponds will be developed specifically for livestock so the animals will have easily accessible water in their grazing areas. Horizontal well drilling in appropriate locations (see Appendix 2.) will be used for livestock water development as well as for human use.

## *Mithawan*

As a supplement to the range management program, assistance will also be given to the grazing associations in breed improvement. Selection and marketing procedures will be taught and improved herd sires may be purchased by the associations to upgrade the quality of their livestock.

Extension and training. As population involvement is the key to the success of the proposed project, extension activities will be a vital component of it. Extension staff must be closely involved with all project activities and all other project staff must be aware of and intimately involved with the extension program. The group promoters will work especially closely with the grazing associations to ensure that all members understand the concepts behind range management and understand how to work together for the common good through the association.

Field trips will be taken to areas where range management has been effectively implemented by village and grazier groups and training courses will be developed in range management. Other courses will be organized in group organization and management for the officers of the associations.

Other Activities. Other activities will be considered that will enhance the living standards of the people within the watershed. These may include cottage industries, fish farming, bee keeping, orchard production, etc.

Wildlife will also benefit from the activities of the project as vegetation improves and water is developed. The Community Organization may also want to consider how to best control exploitation of the wildlife to benefit their communities. This may include controlling hunting to build populations to the point where hunting becomes a good management tool and then sell hunting rights and hire out guide service to hunters. There may also be grants the community could get through the CO for wildlife preservation.



## Mithawan

### Project Organization

The project should have the Forestry Wing of the Punjab Irrigation and Power Department as the counterpart agency. Local department involvement should, inasmuch as possible, be limited to advisory services, allowing the development of the local population to the fullest extent possible to provide their own support.

The JICA contractors will provide all equipment, buildings and conservation structures as well as establishing the demonstration farm and demonstration sub-watershed.

FAO Forestry Department will provide technical adviser(s) and support staff to the project. The following personnel are suggested for the project:

#### FAO Staff

##### International Staff

- CTA/Watershed Management Adviser
- APO, Range Management
- APO, Extension-community Development
- International consultants

##### National Staff

- National Senior Adviser/Extension Specialist
- National Socio-economist (.5 yr.)
- 3 Male Village Group Promoters
- 3 Female Village Group Promoters
- National consultants

##### Support Staff

- Administrative Assistant
- Clerk/Messenger
- 2 Drivers

*Mithawan*

Forestry Wing Counterpart Staff

Professional Staff

DFO Extension

Male Sub-DFO Extension

Female Sub-DFO Extension

Sub-DFO Range Management

Support Staff as required

Equipment (Provided under FAO/Japan Trust Fund)

2 4x4 double cab pickups

1 10 passenger 4x4 Utility vehicle

Nursery equipment

Field equipment for participation of local people

Misc. equipment not covered by JICA grant

Equipment (Provided to the project for watershed work Under JICA Grant)

Heavy equipment as needed for construction, seconded from  
downstream JICA project

Horizontal well drilling rig

4 4x4 double cab pickups

4 Station office computer system

2 Notebook computers

Copy machine

Fax machine

Typewriter

Complete portable video system (camera, TV/VCR, portable  
generator, etc.)

4 35mm cameras

Slide projector system

Overhead projector

Misc. office equipment

Meteorological equipment

Air conditioners

Back-up generator system

*Mithawan*

### Subsequent Phases.

Staffing, equipment needs, operation and maintenance costs, funding sources etc. for Phases 3 and 4 will be determined near the completion of Phase 2. A Mid-Term Evaluation should be conducted at the end of year three of Phase 2 to determine what absorptive rate can be expected by the Community Organization and thereby determine how much international staffing is required, financial inputs necessary, etc. for the next phases.

MITHAWAN BUDGET

	Total M/M	M/M	Costs 1993	M/M	Costs 1994	M/M	Costs 1995	M/M	Costs 1996	M/M	Costs 1997	M/M	Costs 1998
CTA	63	3	\$32,500	12	\$130,000	12	\$140,000	12	\$140,000	12	\$140,000	12	\$140,000
APO Wtrshd	60	0		12		12		12		12		12	
APO Extension	60	0		12		12		12		12		12	
Consultants	18	2	\$30,000	4	\$60,000	3	\$45,000	3	\$45,000	3	\$45,000	3	\$45,000
Ntl. Adviser	63	3	\$4,050	12	\$16,200	12	\$18,000	12	\$18,000	12	\$18,000	12	\$18,000
Ntl. Soc/Econ		3	\$5,500	3	\$5,500								
Ntl. Consult		0		4	\$5,400	4	\$5,400	2	\$2,700	2	\$2,700	2	\$2,700
Grp.Prom. (6)		0		72	\$21,600	72	\$21,600	72	\$21,600	72	\$21,600	72	\$21,600
Admn Asst		3	\$2,100	12	\$8,400	12	\$8,400	12	\$8,400	12	\$8,400	12	\$8,400
Msgr/Clerk		3	\$1,500	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000
Driver 1		3	\$1,500	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000
Driver 2		3	\$1,500	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000	12	\$6,000
Duty Travel		0			\$6,000		\$6,000		\$6,000		\$6,000		\$6,000
Training		0			\$5,000		\$5,000		\$2,000		\$2,000		\$5,000
Equipment		0			\$8,000		\$8,000		\$4,000		\$4,000		\$8,000
Op. & Maint.		0			\$5,500		\$5,500		\$7,000		\$7,000		\$8,000
Sundry		0			\$10,000		\$12,000		\$10,000		\$12,000		\$12,000
Mission Costs		0											
Reporting		0											
TOTAL	516	23	\$149,650	179	\$299,600	173	\$299,400	173	\$299,700	173	\$299,700	173	\$299,700

The two Associate Professional Officers (APOs) will be requested through FAO headquarters but their actual posting depends upon establishment of APO positions by participating governments.

