6.5 Farmer Organization Plan

6.5.1 Basic Strategy for Organization

(1) Organizational Criteria

Organization of farmers is to be according to the following criteria:

- Irrigation supply boundaries (hydrological boundaries) are to applied as opposed to administrative boundaries.
- Organization members are to be landowner and tenant farmers within a given boundary, with one person (household head) from each household to be member of the organization.
- The basic unit for hydrological boundaries is to be the irrigation block. Irrigation blocks are to be divided into sub-blocks according to distributary canal supply boundaries, and these sub-blocks are to be the smallest unit for farmer organization.
- Five representatives from each sub-block will be elected to comprise an Executive Committee.
- Seven irrigation block representatives are to be selected from among the sub-block representatives.
- A Project Management Committee (PMC) will be formed for macro-decision making. The PMC will comprise 12 irrigation block chairmen and 5 district level officials to engage in project operation and management.

6.5.2 Proposed WUA Organization in TIP

The primary unit of the WUAs under TIP will be the sub-block level WUA. The Farmers of each sub-block elect or select five members for the executive committee of the sub-block level WUA. At least one woman representative must be a member of the executive committee of the respective sub-block. Among these five members, a chairman, vice chairman, secretary and treasurer are elected.

(1) Sub-block Level

The chairman and secretary of the sub-block level water users' organizations represent the said group at the block level water users' association. The number of members in each block shall be:

- representatives from each sub-block
- women member
- weaker group representation
- other ex-officio members of economic and social groups

Composition:

- chairman
- vice-chairman
- secretary
- treasurer
- women's representative
- weaker section representation
- exofficio members of economic and social groups

(2) Project Management Committee

The Project Management Committee is composed of 12 chairmen of the respective irrigation blocks as representatives, and 5 district level government officials. Among the block representatives, a chairman, vice chairman, and secretary will be elected/selected. Other members include the District Irrigation Officer, District Representative of NEA, ISC and ADB and DADO.

Marketing Sub-committee:

The Agricultural Marketing Sub-committee will be made up of the DADO Agricultural Development Officer, the AIC Trishuli Main Branch Manager, and WUA members elected from each irrigation block. The committee chairman, vice chairman and secretary will be elected from the 12 WUA members.

Besides the multi-functional water users' associations, groups are to be formed for farmers who engage specifically in vegetable and improved seed production, with careful consideration to the socio-economic status of the socially disadvantaged including marginal and small farmers, and households headed by women. These would be registered as agricultural cooperatives under the Cooperative Act. It would be expected that these cooperatives would be organized without concern for irrigation block boundaries, and that they would engage in a systematic range of activities to include assistance for farm product marketing and managed shipping of group produce, supply of information on market conditions, and extension of crop production credit to member farmers. These cooperatives would be evolved on a stage-wise basis in close liaison with the Agricultural Marketing Sub-committees organized under the Project Management Committee. It is planned that member farmers would participate in the agricultural market training program to be carried out by the Agricultural Marketing Sub-committees.

(3) Proposed Organization Chart

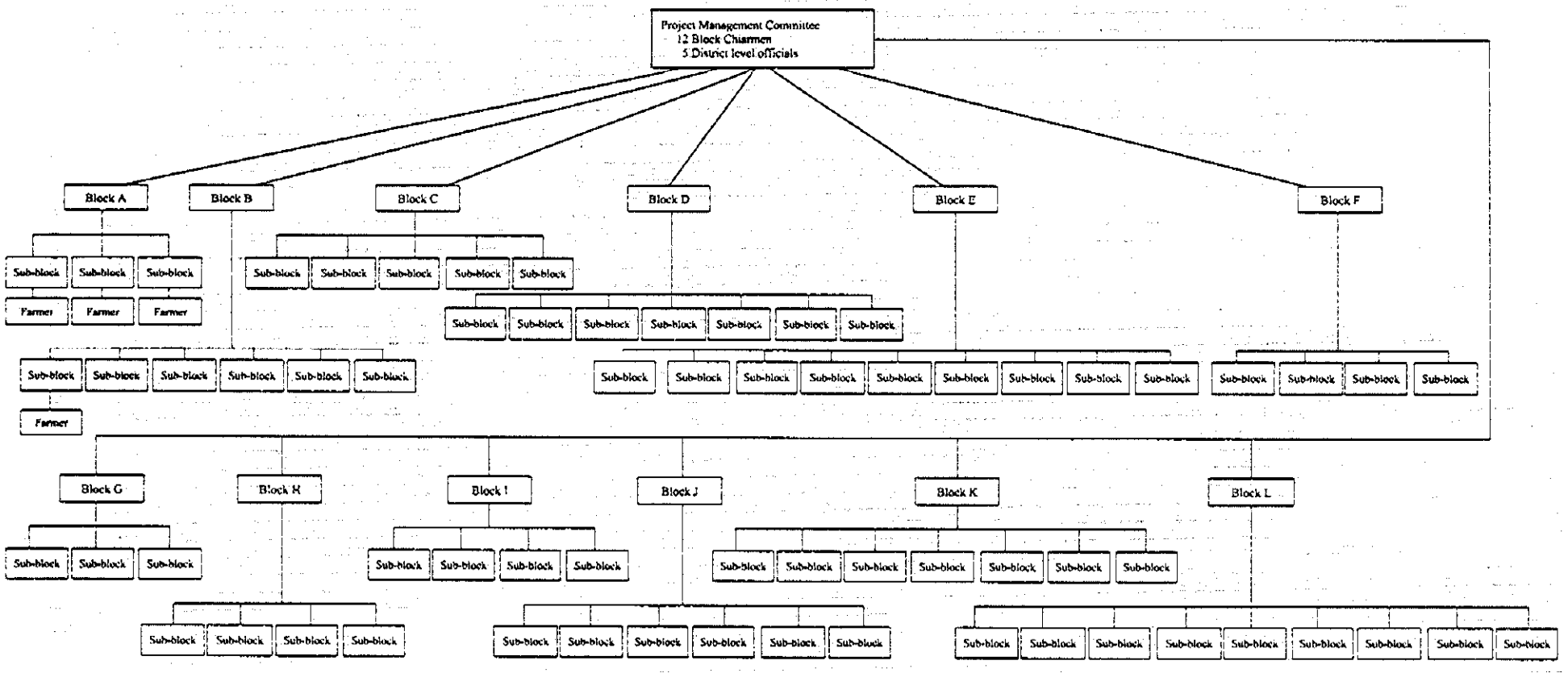

Fig. 6.5.2-1 Proposed Organization of WUA

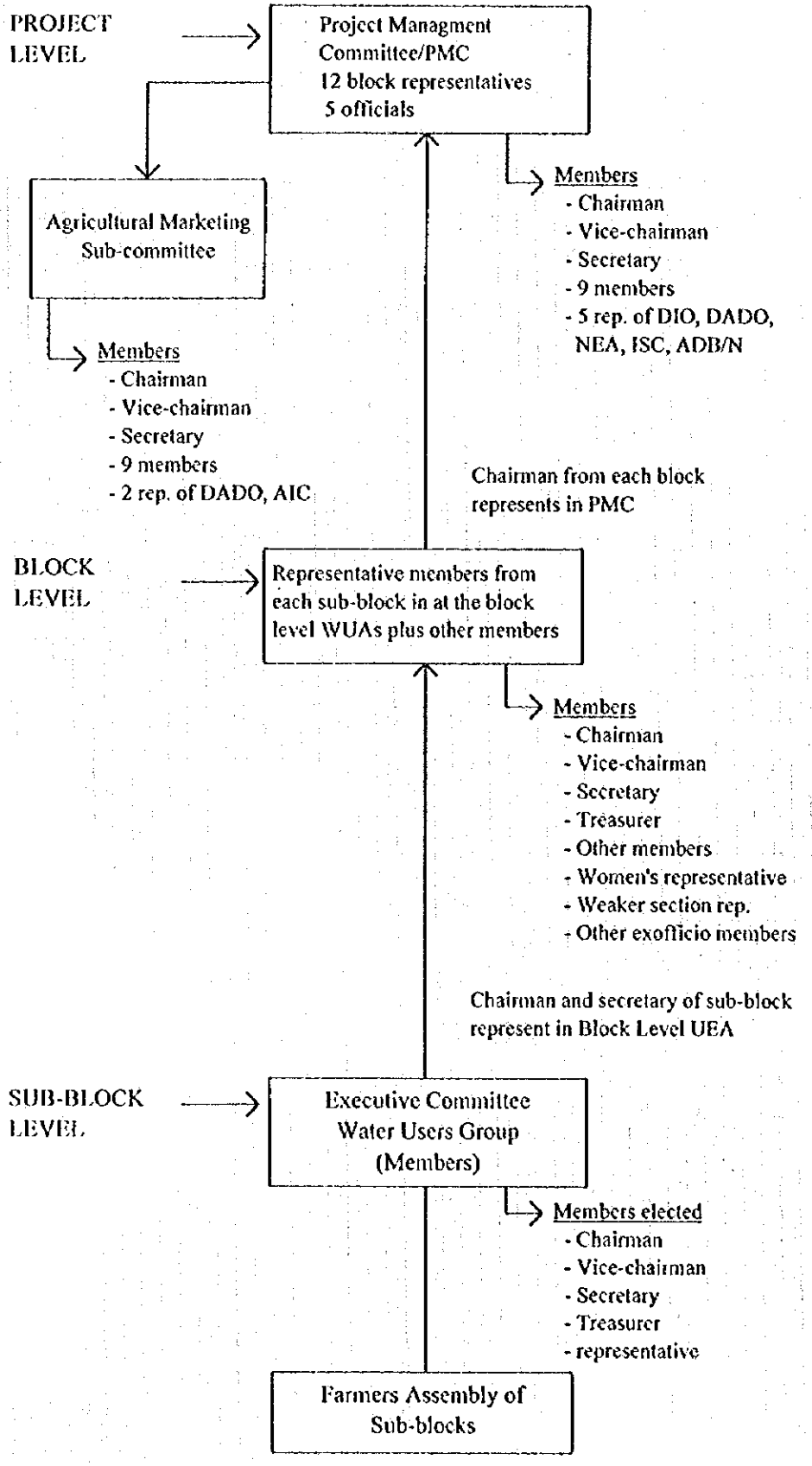

Fig. 6.5.2-2 Proposed WUA Organization for TIP

(4) Irrigation Block L

Irrigation Block L is located on the right bank of the Trishuli river, and comprises area not covered by the gravity system (main canal). Irrigation of this block is to be by direct pump lift from the Trishuli river.

In terms of irrigation system, Irrigation Block L is independent; however, it must be integrated with the rest of TIP particularly from the stand point of cropping plan with emphasis on agricultural product marketing. Accordingly, as with other irrigation blocks under the Project, Irrigation Block L will select representatives to the PMC, to participate in among other activities crop plan formulation, etc. as performed by the Agricultural Marketing Sub-committee.

Table 6.5.2-1 Proposed Number of Representatives in Each Block Level WUA

Blocks / Members	A	B	C	D	E	F	G	H	I	J	K	L
Chairman	1	1	1	1	1	1	1	1	1	1	1	1
Vice chairman	1	1	1	1	1	1	1	1	1	1	1	1
Secretary	1	1	1	1	1	1	1	1	1	1	1	1
Treasurer	1	1	1	1	1	1	1	1	1	1	1	1
Representative of Sub-blocks												
Women's representative	1	2	2	2	2	2	1	2	2	2	2	2
Representation of Weaker Section		1	1	1	1	1	1	1	1	1	1	1
Ex-officio member of Social and Economic groups	1°						1X					3*
Total	6	7	7	7	7	7	7	7	7	7	7	10

° Kiriyasil Krisak Group, Semester
X Sukumikhola Soil Erosion Control Community Group
* Chairman of Dairy Cooperation, Chairman of Community Bank and chairman of community shop.

6.5.3 Proposed Functions of WUA Units

(1) Functions of Sub-Block Water Users Group

- The water users group acts as a link between water users' associations at the block level with that of the sub-block unit.
- To construct the field channels within the distributary level command area on the basis of design recommended under the Project.
- To settle among themselves the right of way for field channels
- To repair and maintain field channels at least two times a year, before monsoon and after monsoon.
- To distribute irrigation water to the farmers of the sub-blocks on the basis of schedule agreed upon.
- In case of water distribution on the basis of rotation, the basis of rotation and schedule will be informed to the farmers and schedule will be enforced.
- Quantity of water for sub-block level is to be ensured.
- Crop calendar is to be discussed and agreed upon.
- In case of conflict at the time of water distribution, such as water stealing, the water users' group at sub-block level will resolve the conflict.
- Minutes of the meetings are to be properly recorded.
- Water users group is accountable to the farmers.
- Transparency will be maintained. The account book and office records are to be made open to the inspection by the farmers of the sub-blocks.
- To ensure that water charges are collected from all farmers who cultivate using the irrigation water.
- Provisions are to be made for the mobilization of labour for ordinary maintenance and emergency maintenance.
- In the hill irrigation systems, emergency maintenance is often necessary during monsoon period such as response to the threat to distributary canals by the formation of new gullies or flood destruction of the field channels.
- The water users' groups impose the fine on members who do not comply with the rules.
- In case of sub-blocks which are subject to pump lift irrigation, the users' group must be active in;
  a) crop calendar preparation
  b) crop choice
  c) scheduling water by rotation system
  d) development of system for on demand water supply
  e) appointment of the pump operators
  f) schedule for the pump operation
  g) measures to take to save cost
  h) supervision of the pump operation
  i) regular maintenance of the pump
  j) training program to pump operators
  k) pump spare parts supply

l) strict adherence to manual for pump operation
m) ensuring that the cost of the pump operation is borne by the members of the sub-block.

(2) Functions of Water Users' Associations at the Block Level.

The functions of WUAs shall be as follows:

- To ensure water rights for the irrigation blocks
- Allocation of water to sub-blocks
- In case of water shortage, stress rotation system for water distribution among the sub-blocks is to be introduced
- In case of conflict on water allocation and distribution among sub-blocks, WUA resolves such conflict
- Crop calendar preparation and get it approved from the general assembly so that all the farmers know the crop calendar and corresponding water distribution schedule
- Distribution canal and pumps are to be maintained by the WUA
- Right of way for the construction of distribution canals is to be settled by the WUA.
- Operation of the system at the block level would be the responsibility of WUA
- Appointment of the pump operators and supervisors for irrigation blocks
- Resources for operation and maintenance are to be mobilized
- Water charges will be collected by WUA through sub block water users group
- According to the Irrigation Policy of Nepal, 1992, TIP falls under a joint management system where the water charge collection is to be shared between TIP -WUA and DOI. If the headwork and main canals are maintained and managed by DOI, a 50% water charge will be shared by DOI and 50% will be given to the WUA. If the DOI takes the responsibility of only headwork, 25% water charge will be taken by DOI and 75% will be given to the WUAs. In case of TIP, it would be appropriate for WUAs to take responsibility for main and distribution canals and share 75% of water charge collection
- WUA has to prepare a program for regular maintenance and emergency maintenance
- In hill irrigation systems, breaking down of the part of the system is frequent so WUA has to be prepared for such occasion. In many hill irrigation systems, there are systems of emergency labour mobilization
- TIP has to make provision for labour mobilization from within the respective blocks for emergency repairs of facilities
- In case of a major emergency in any part of the command area, contribution of labour and resources are to be made on request
- The WUA can impose fines to individual farmers or to the sub-block for noncompliance with the rules which have been agreed to in the general assembly meetings.

Irrigation blocks served by pumps, i.e. blocks I, J, K and L:

The process of formation of sub-block water users groups, role and functions of the general assembly and overall functions of the WUA at the block level would be the same. However, these blocks utilize pumps as the main means to make water available to the command area, and accordingly some of WUA functions are specific to these blocks.

- The management and maintenance of the pump would be the main function of the WUA.
- Crop calendar is to be properly worked out so that water delivery can be made economically and effectively.
- Water delivery is to be made on demand
- Schedule is to be worked in such a way so that the cost of operation of the pump is reduced.
- Water distribution will be on a rotation basis
- Water supply will be available only for 12 hours in a day so the water distribution schedule is to be worked out on that basis
- Water management plan is to be prepared and acceptance of the same garnered from the general assembly
- Operators of the pumps are to be appointed and are to be given proper training
- Since the water distribution system will be on a rotation basis, the Dhalpas are to be appointed by the WUA and made to distribute water on the basis of the agreed schedule.
- The detailed water distribution plan will be prepared by the engineering group. The said plan is subsequently to be enforced by the WUA.

The WUA of these blocks take the responsibility of pump ownership:

- Enough funding for operation and maintenance is to be mobilized
- These blocks have to introduce a system of water charge collection in advance so that there will be cash flow regularly for maintenance and for electricity bill paying
- The accounting system is to be strengthened as the volume of transaction in these systems would be substantially high compared to gravity irrigation system
- Other functions of WUA regarding operation and maintenance, conflict resolution and resource mobilization are the same.

(3) The functions of the Project Management Committee

The functions of the Project Management Committee shall be:

a) The Project Management Committee consisting of representatives of WUAs would be the party to effect agreement among farmers groups, DOI and NEA.

b) To enter into agreement with DOI for delineation of O&M responsibility and O&M cost sharing
c) To discuss with concerned officials on crop calendar, and coordinate activities with officials for irrigation water supply, electricity supply, input supply and credit availability
d) The Project Management Committee acts as a means for strengthening communication among different agencies so that possible conflict and misunderstanding can be minimized
e) To communicate the decisions made in committee for execution by the block level WUAs

6.5.4 Methodology on Organizing WUA

(1) Mobilizing Catalysts

For the organization of WUAs at different levels, catalysts from outside the DIO office are to be mobilized. At present, the District Irrigation office has only one person who is responsible for users' organizations. He has several other projects to look after besides TIP so external catalysts would be employed.

The basis to definite the required number of catalyst for organizing work is estimated on the basis of area to be covered. Typically, a catalyst would be given responsibility for 200 ha. TIP has close to 757.74 ha so it is proposed to employ 4 catalysts. Each catalyst would cover 3 irrigation blocks.

The catalysts would either be employed from the NGO sector or by direct hire. In this regard, it would be useful to obtain input from those NGOs which have similar experience to that anticipated in TIP project area.

In the case of some social groups like in Pokhariphant, external agencies such as C-CODER, an NGO, has helped such groups to organize and carry on different income generating activities. NGOs like C-CODER could be engaged for the formation of WUAs under TIP.

(2) Current Social Groups and WUA Formation

It was found during the TIP field study that in the case of areas where social groups are functioning, the mobilization of the farmers for farmer consultation and farmers meetings was facilitated, and thus these groups can be considered as an important resource for WUA formation.

Those social groups which fall within a given hydrological boundary can help to facilitate the formation of WUAs at the block level. Potential social groups are identified in Table 6.5.4.

6.5.4-1 Current Social Groups and WUA Formation

Irrigation Blocks	Existence of Social Groups in number	Effectiveness of Social Group	Assistance to WUA formation	Remarks
A	10	A	WUA can be formed	can play complementary role
B	4	B+	with assistance, they can help form WUA	need supports from outside
C	6	C	need external catalyst	special care for WUA formation required
D	4	C	need external catalyst	Village like Gharigoan does not have any social groups
E	5	C	need external support	need supportor WUA formation
F	no social groups	-	-	No villages within command area
G	2	A	WUA can be formed	can play very effective complementary role
H	1	A	Could form WUA	can play complementary role
I	3	C	need external support	some villages like Dhansar and Beltar do not have any social groups at all
J & K	3	B	need support for WUA formation	
L	10	A	they can help form WUA	They can play effective complementary role

Ranking
A Active
B less active
C Inactive

(3) Training Program for Catalysts

The catalysts are to be given training on group dynamos, group psychology, rapid information collection, public relation etc.

The orientation program to the farmers should be carried out simultaneously. This orientation program will act as an awareness creation vehicle regarding WUAs.

The exercise to form WUAs at the sub-block level and block level is expected to take 6 months. After formation, regular supervision is required.

The service of catalysts will be required for at least a year. After one year, catalyst intervention would be phased out, giving way to independent and active WUA function..

The WUA formation monitoring committee at the district level is to be formed with the membership of the TIP project manager, AO of DIO, local development officer and TA of farmer organization.

A TA responsible for farmer organization is to be assigned to the Project before actual implementation. This person would be in charge of WUA formation and implementation of the related training program under the Project.

The program to form WUAs should commence at least 6 months before Project start.

6.5.5 Logistics Support Required to WUA

The following table summarizes the logistics support required for the WUAs. It is proposed to have only one multi-purpose community building with one meeting hall and 2 office rooms to be located at Irrigation Distribution at Inarpati, Battar. The other equipment is related to the training program to help development of human resources for better management of TIP by the users themselves. In the case of the blocks which are subject to pumped irrigation, a good supply of spare parts for the pumps is necessary.

Table 6.5.5 - 1 Logistics Support Required to WUA

Items / Block	Building	Furniture	Training equipment	Transport	Spare parts (pump)
PMC	- multipurpose community hall with 2 offices rooms (12 m × 10 m = 120 m²)	chair, tables for meeting hall, furnitures for office	TV, VCR, screen, white boards, overhead, projector, slide projector	motor bike	
Block					
A					
B					spare parts
C					spare parts
D					spare parts
E					
F					
G					
H					
I					spare parts
J					spare parts
K					spare parts
L					spare parts

Cost Estimate for WUA Activities

(unit: Rs)

No.	Particulars	Units	Cost
1	WUA organizers 15,000/month	4 ×12	
2	Motor bikes	4	
3	Computer	2	
4	Office 12 m × 10 m = 120 m²	1	1,000,000
5*	Cost of training program	-	
6	Portable microphone	4	
7	Wireless	2	

* : Cost of training programs is included in the social preparation

6.5.6 WUA Registration

In order to get legal recognition for WUAs, there is provision for registration of WUAs under the Water Resources Act, 1992. WUAs of each irrigation block are to be registered at the Local Development Officers' Office at the District Headquarters.

In the application for WUA registration, it is required to include a) constitution of the WUA, b) minutes of the meetings, c) bank voucher of Rs. 100 as registration fee, d) citizenship certificate of the chairman of the committee, and e) recommendation of the District Irrigation Office.

Within a month of the application for registration, registration is effected by the District Water Resources Committee formed under the Water Resources Act, 1992.

The members of the committee are:

CDO	Chairman
LDO	Secretary
District Irrigation Engineer	Member
District Drinking Water Officer	Member
District Forest Officer	Member
District Soil Conservation Office	Member
DADO	Member
Member, Representative of DDC	Member
Representative of NEA	Member

6.6 Operation and Maintenance Plan

6.6.1 Basic Strategy

The benefit area under the Project comprises 620.66 ha on the Trishuli river left bank, and 128.5 ha on the right bank. The LB area comprises a single integrated zone under a piped irrigation system with diversion of discharge from the balancing reservoir. The RB area on the other hand comprises a separate system to be irrigated by direct pumping of discharge from the Trishuli river.

At the outset, given the level of O&M difficulty for the said systems in light of irrigated area, system function, system operation, etc., it is concluded that management of the LB system would overly challenge the capabilities of the WUAs acting alone. Accordingly, system operation will begin under joint management by the government and the WUAs. The scope of government involvement would then be gradually reduced with eventual full turn over to the WUAs. However, to accomplish this O&M capability building directed at the said WUAs is necessary.

In the case of the RB system, given the fact that the area is 1/5 that of the LB system, a number of active community groups already exist, and some farmers have experience acting on their own in purchasing and operating pumps for irrigation, it is planned that the WUAs will assume full responsibility for system operation from the outset.

6.6.2 Irrigation Systems

(1) Left Bank Irrigation System (LBIS)

1) Canal System

The LBIS is laid out in detail in the schematic proposed irrigation distribution system figure in Section 6.4 (Irrigation and Drainage Plan). In terms of system management, the LBIS would be organized as follows:

Main canal:	From the intake point (balancing reservoir) to the central control tank (CCT)
Branch canal:	From the CCT to the block control tanks (BCT) and pump stations
D canal:	Directly from the main and branch canals to the sub-blocks (multiple or single)
F canal:	From the D canals to the individual fields

Branch canals are as follows (in sequence moving downstream):

Branch canal no. 1:	from CCT to I-BCT
Branch canal no. 2:	from CCT to pump station no. 6
Branch canal no. 3:	from CCT via J-BCT to K-BCT

Branch canal no. 3-1: from branch canal no. 3 to G-BCT
Branch canal no. 3-2: from branch canal no. 3-1 to H-BCT

(2) Right Bank Irrigation System

The benefit area of 128.52 ha is planned for irrigation by two pump units. Water conveyance would be by the existing irrigation system.

6.6.3 Joint Management

(1) Management Scope

The LBIS is to be jointly operated and maintained by the DIO and WUAs. Sharing of responsibilities would be as follows:

- Scope of DIO responsibility would cover main canal and branch canals. However, diversion from these to the D canals would be done by the WUAs under guidance by the DIO and PMC.

- Scope of WUA responsibility would cover D and F canals

(2) Proposed Management Strategy

Each system would be divided into sectors, with the DIO and respective WUAs therein forming a team for joint management of each sector. Team composition would be as follows:

Team Composition and Area of Responsibility

Team composition		Canals of responsibility	Number of D canals	Number of sub-blocks	Area covered (ha)
DIO	WUA				
1	13	Main canal	8	13	137.04
1	12	No. 1 branch canal No. 2 branch canal	6	12	127.56
2	32	No. 3 branch canal No. 3-1 No. 3-2 No. 4 branch canal	17	32	356.06
Total: 4	57		41	57	620.66

Personnel from the District Irrigation Office comprising 4 officials (Irrigation Officer and Assistant Officers) would be responsible for respective sectors, with the IO in charge of

the main canal assuming overall team leadership. WUAs in each sector would select an O&M persons-in-charge (operators) from each sub-block to team up with the DIO personnel for system management. The operators would carry out D canal diversion for their respective sub-blocks under the direction of the DIO staff.

The IO in charge of the main canal would effect diversion from the power station canal in collaboration with the PMC.

The right bank area would be managed by the L Block Executive Committee.

6.6.4 O&M Training Program

(1) O&M Manual

In accordance with the overall area cropping plan formulated by the PMC, an O&M manual focusing on water distribution procedures is to be prepared as a basis for system management. Manual would be prepared by DOI in collaboration with MOA during the 2 year project construction period.

(2) O&M Training Program

Basic system management know-how would be conveyed as set out in the social preparation plan. The training program in actual system O&M based on the O&M manual is discussed below.

1) Manual Use Training Program

(i) District Officials' Training

Once the O&M manual has been prepared, an manual use training program will be initiated aimed at 10 persons included the 4 concerned DIO personnel. This training would involve actual system operation, and would extend for a 30 day period. Instructors would include project experts and senior DIO engineering staff.

(ii) WUA Representatives Training

Block level

An O&M training program would be carried out directed at a total of 50 persons comprising 6 representatives for L block, and 4 representatives from each of the other irrigation blocks. Training program would comprise a 5 day course, with 4 coursed to be carried out over a 20 day period.

Sub-block level

O&M training at the sub-block level would be directed at a total of 140 persons comprising 2 representatives from each sub-block. Trainees would be divided into 4

groups (at 3 locations for the LBIS and 1 location for RBIS) for instruction to consist of a 5 day course conducted simultaneously for the 4 groups.

DIO officers would act as instructors for the block and sub-block level training.

6.6.5 Proposed Water Charges

The Project area is divided into gravity irrigation and lift irrigation zones. Power costs for pumping are incurred in the course of lift irrigation, and the water charges to cover these will be considerably higher than those for the gravity irrigation area. Water charges will be set by the WUAs on their own after system turnover, and applied to system O&M. Water charges are thus considered from the view point of the future system turn-over, and with a consideration of the possible 2 approaches, (i) establishment of a uniform per-area charge for the entire Project area regardless of zone, or (ii) two separate water charge systems depending on whether irrigation is by gravity or pump.

However, the fact that pump operational costs incur a greater amount of expense, and coupled with consultation with concerned officials in the related agencies as well as the outcome of farmer meetings indicate that a uniform water charge system would not be practical. Accordingly, with consideration to Project sustainability, a dual water charge levying system is to be adopted with water tariffs to be scaled to the type of irrigation method.

Pump operation cost

Salient features of pump stations and operational costs are indicated in Table 6.6.5-1 and 6.6.5-2. Average pump operational cost (electrical power only) is Rs 6,186/ha.

(1) Proposed Water Charges

1) Lift Irrigation Area

In addition to electrical power costs, in the future there will also be equipment repair costs. With inclusion of system management costs, a water charge of Rs 6,500/ha/year is envisioned.

2) Gravity Irrigation Area

In the case of the area to be gravity irrigated comprising the main canal and branch canal network, a water charge of Rs 1,000/ha/year is proposed with consideration to criteria set out in the Irrigation Policy, 1992.

Table 6.6.5-1 Tentative Design of Proposed Pump Station

Pump Station			Command Area			Pump Head (m)		Discharge	Pump Specification				
No.	Location	GL(m)	Tar	Irrigated Area (ha)	No. of Household	Actual	Total	(m3/min)	Water Power (KW)	total	Suction (mm)	Delivery (mm)	Pump Type
P1	Jhadigaon	559	Majhitar	46	115	32	39	2.4	15.0 x 2 nos.	30.0	80	65	Single Volute
P2	Chwadi	557	Pipartar	136	120	39	45	6.2	55.0 x 2 nos.	110.0	200	150	Double Volute
P3a	Pokarephant	460	Pokharephant	95	165	30	33	7.2	37.0 x 2 nos.	74.0	200	150	Double Volute
P3b	Pokarephant	460	Pokharephant	34	65	50	55	2.6	30.0 x 2 nos.	60.0	100	80	Single Volute
P4	Battar	570	Battar(upper)	17	50	24	30	1.8	7.5 x 2 nos.	15.0	80	65	Single Volute
P5	Bidur	570	Bidur(upper)	8	10	7	9	0.8	1.5 x 2 nos.	3.0	65	65	Single Volute
P6	Dhansar	546	Dhansar	12	35	24	27	1.0	5.5 x 2 nos.	11.0	65	50	Single Volute
Total				348	560					303			

Table 6.6.5-2 Tentative Operation Cost

	Water Power		Rate of Tariff (Rs.)			Demand Tariff Yearly (Rs.)	Energy Tariff (1) Yealy (Rs.)	Yearly Total (Rs.)			
			Monthly Demand	Energy Tariff	Catagory			Total	Per Area		Per Household
No.	(KW)	(KVA)	(Rs/KVA)	(Rs/KW/h)				(Rs.)	(Rs/ha)	(Rs/ropa)	
P1	30.0	37.5	16.00	3.05	Lower Voltage	7,200	205,875	213,075	4,632	232	1,853
P2	110.0	137.5	20.00	3.05	Medium Voltage	33,000	754,875	787,875	5,793	290	6,566
P3a	74.0	92.5	20.00	3.05	Medium Voltage	22,200	507,825	530,025	5,579	279	3,212
P3b	60.0	75.0	16.00	3.05	Lower Voltage	14,400	411,750	426,150	12,534	627	6,556
Sub-total (P3)	**134.0**	**167.5**				**36,600**	**919,575**	**956,175**	**7,412**	**371**	**4,157**
P4	15.0	18.8	16.00	3.05	Lower Voltage	3,600	102,938	106,538	6,267	313	2,131
P5	3.0	3.8	12.00	2.75	Lower Voltage	540	18,563	19,103	2,388	119	1,910
P6	11.0	13.8	12.00	2.75	Lower Voltage	1,980	68,063	70,043	5,837	292	2,001
Total(Avarage)	**303.0**	**378.8**				**82,920**	**2,069,888**	**2,152,808**	**(6,186)**	**(309)**	**(3,844)**

(1): 12hrx25dayx6month

6.7 Environmental Conservation Plan

6.7.1 Basic Criteria in Planning

(1) Environmental Standards

In Nepal, environmental standards are set by the Environment Standards, Monitoring and Evaluation Section of the Ministry of Population and Environment in line with the Environment Act. However, the efforts of this agency are still in progress, and for the time being standards utilized by international agencies are applied. For the subject Study, FAO standards have been adopted for evaluation of irrigation water quality.

(2) Environmental Clearance

In order to judge the application of the legal provisions of IEE (Initial Environmental Examination) for the Project, interviews and data collection were performed through line agencies such as DOI, Ministry of Water Resources and Ministry of Population and Environment.

At present, there are three legal documents addressing the legal procedures of IEE in Nepal, as described below.

1) Environment Act (gazetted 30 January 1997 in Nepali);
2) National Environmental Impact Assessment Guidelines 1993 (gazetted on 19 July, 1993); and
3) Irrigation Policy 2053 (1996/97, in Nepali).

Regarding the executing agency (DOI, Executive Section, Environmental Section), it has to submit the IEE/EIA documents to the upper agency (Ministry of Water Resource, Executive Section, Planning Section) for approval. The subsequent formalities are completed with approval of the upper agency in case of IEE.

In case of EIA, on the other hand, the upper agency takes the responsibility of submitting the EIA to the Ministry of Population and Environment for further approval after its approval by the upper agency. In response to the specific requirements, a committee whose members are represented from various line agencies, is organized by the Ministry of Population and Environment to assess the contents of the corresponding EIA. Moreover, information on projects and EIAs are issued for public consumption.

No detailed environmental provisions are mentioned in the Environmental Act; accordingly detailed matters must be addressed after ultimate enactment of the related regulations.

The National Environmental Impact Assessment Guidelines 1993, provide more details than the Environment Act. According to the Guideline, the corresponding article on need of EIA for the Project stipulates that EIA is required for a project meeting the following criteria:

- more than 760 ha irrigable area
- large scale irrigation (more than 500 ha irrigable areas) in hill area

Therefor, TIP is required to pass EIA.

The EIA guidelines for the power and irrigation sector are under preparation.

(3) IEE

Under the IEE, preliminary evaluation of potential negative impacts to the environment are identified and mitigating measures for the same proposed. The said proposed measures are reflected in Project formulation, construction plan and implementation period.

The following table summarizes the environmental issues identified with regard to the Project.

Items	Existing Status	Main Affected Area	Carefulness in the TIP
(1) Soil Erosion	Sheet and gully erosion	Irrigation Block G, I, J, K	Construction and implementation period
(2) Forest	Management by FUGs which have rule for conservation forest	-	Construction period
(3) Grazing	Restraint of natural vegetation	Along the Irrigation Block A, J, K	-
(4) Agro-chemicals	Using unsuitable item	(reported by beneficiaries)	On planning

6.7.2 Environmental Evaluation for Proposed Irrigation System Alternative Plan

Environmental evaluation was carried out for comparison of the three main canal alignments, i.e., open type, closed type from the original intake point and Alternative-1, to check impacts on the surrounding environment. In the course of the said evaluation, focus was given to existing forests and landslide areas. The results of survey are summarized as per below:

Comparison between 3 Main Canal Alignments

Items:	Topography		Forest			
	Slope	Landslide	Main species	Density	Owner	No. of cutting trees
Open type alignment	Generally, excessively steep to strongly sloping	6 places	Sal (Shorea robusta) (seedling to tree)	10 to 80%	4 FUGs*	2,515
Closed type alignment	Generally, strongly sloping to gently sloping	--	Sal (Shorea robusta) (sapling to tree)	30 to 60%	2 FUGs* and Government	60
Alternative 1 alignment	Strongly sloping right bank of Trishuli river	2 places	--	--	--	--

Remarks: * Forest Users Group
Note: 1) Consideration of the width; open canal 5m, pipeline 5m.
2) Area; each intake site to Army Camp of jointing point.

(1) Original Intake Point

The environmental impacts resulting from the open canal from the originally proposed intake point (aqueduct no. 2) and the pipeline alignment option are compared below.

1) Open Canal Type Alignment of Main Canal

This alignment crosses existing forest at 7 portions and total crossing lengths in the forests is 2,005 m. At the time of construction, it would be necessary to cut 2,515 trees. Additionally, on the alignment, 6 small landslide places exist posing the possibility of higher incidence of landslide and soil erosion during and after implementation.

In addition, tunnel construction at 4 locations is necessary (total 1,010 m). In the case of the said tunnel construction, much of this would be on sloped terrain with a perceived high probability of slope collapse and soil erosion due to weak ground composition. In addition, numerous other problems including forest cutting would be entailed as a result of excavation and access road construction works.

2) Pipeline Type Alignment of Main Canal

This alignment cross the existing forest at 3 portions and total crossing length of forest is 352 m. At the time of construction, it would be necessary to cut 60 trees. Also, tunnel construction at one location (140 m) is necessary.

The forest type in the area is primarily Sal (Shorea robusta) which although having a longer growth cycle is of high economic value due to its suitability as fodder and as construction material. The species is protected as well under the Forest Act, 1993. It is well suited to growth on rugged terrain, and functions to prevent slope landslide and soil erosion. The Sal forest in the Project environs is almost all

second growth due to past cutting, and area residents are well conscious of the need for this forest conservation due to past experience with scarcity of home fuel wood and animal fodder.

On the basis of the above, it is concluded that the negative impacts from open canal type alignment are far more than that of the pipeline type alignment, and the former is therefore deemed inappropriate.

(2) Original and Alternative Intake Points

The environmental impacts resulting from adoption of the pipeline type main canal from both the original intake point (aqueduct no. 2) and the Alternative-1 intake point (at the downstream of the balancing reservoir) are compared below.

1) Pipeline Type Alignment from the Original Intake Point

As described in (1) above, tree cutting and tunnel construction are necessary and comprise the major impacts to the environment. Also, the original intake point is located upstream of the Trishuli power station desilting reservoir and balancing reservoir. As a result, there is the concern of sediment inflow to farmland from direct river discharge diversion.

2) Pipeline Type Alignment from the Alternative Intake Point

This alignment does not cross the existing forest. There are 2 places of landslide on the right bank of Trishuli river along alignment line. Accordingly, construction plan must take this possibility into consideration.

Pipeline type alignment from the originally proposed intake point presents the need for forest cutting, the problems generated by tunnel construction as discussed in (1) above, and inflow of sediment to farmland. On the other hand, the pipeline type alignment from the alternative intake point poses the concern for landslide; however, this can be addressed through appropriate measures during construction. Accordingly, the latter is deemed to pose little negative impact and to be appropriate for adoption under the Project.

6.7.3 Environmental Conservation Plan

(1) Problematic Issues

1) Soil Erosion

At the planning and design stages, sites where soil erosion is of particular concern are as follows:

a. From the proposed intake site (alternative I intake point) to Trishuli bazaar.

b. The valley from the army camp to irrigation blocks B and C.

c. Slope from pump house 1 to Majhitar (Irrigation Block D).

d. Slope from pump house 2 to Pipaltar (Irrigation Block J)

e. The canal alignment between Pipaltar (Irrigation Block K) and Chandiphokari (Irrigation Block E)

f. Canal alignment inside Pipaltar from the upper terrace to the lower terrace.

Points requiring attention during the Project implementation period are soil surface and surface flow, with particular emphasis on irrigation blocks I, J, K and G.

a. Soil surface: Fifty percent of annual rainfall is concentrated in the rainy season in July and August. Accordingly, attention must be given to top soil erosion during the said rainy season. This includes the dispersion of soil particles due to raindrop impact during the monsoon. Irrigation blocks I, J, K and G show progressive soil weathering, and in relation to the surface flow discussed below soil particle dispersion is envisioned to readily occur.

b. Surface flow: Irrigation blocks I, J and K are surrounded by gently sloping terrain, with sheet erosion commonly seen. As these blocks are located in more upland hill area, surface runoff has a tendency to carve gullies. Accordingly, this surface flow must be given careful attention.

2) Inflow of Eroded Sediment to Farmland

The water source for the Project, the Trishuli river, exhibits heavy sediment load carried down form its upper reaches. The hydropower facilities using the same river incorporate a settling basin (regulation pond) to prevent direct inflow of sediment. The earlier Battar Pump Irrigation Project was forced to shut down as a result of the aforementioned heavy sediment load.

Eroded sediment inflow to farmland is envisioned as well under the subject Project. Depending on water source, the following 2 cases are considered.

Zone A: This area is located downstream of the regulation pond for the Trishuli hydropower station. Due to the fact that discharge for power generation transits a desilting basin and regulation pond, it is assumed that almost all sediment load would be eliminated from discharge prior to diversion for the subject irrigation scheme.

Zone B: This area is to be irrigated by direct pump lift from the Trishuli river.

3) Agro-chemicals

Under the Project, although a per area unit use of agro-chemicals and chemical fertilizers will not differ significantly from the present condition, introduction of new crops, particularly vegetables, will result in increased frequency and volume of use.

Direct and indirect impacts envisioned as a result are as follows:

a. Direct impact: These would include spray content adhering to the body, inhalation of spray residue, and spray adherence to the surface of agricultural products.

b. Indirect impact: This would include soil pollution by agro-chemical residue, as well as groundwater and river discharge contamination. This type of impact has the danger of widespread influence without being noticed.

In the course of field survey, area residents, officials of agricultural related agencies and medical personnel were interviewed, however this did not enable a clear identification of potential direct and indirect impacts from the use of agro-chemicals. It is nevertheless concluded that these impacts must be carefully considered under the Project.

In addition to the general environmental impacts as a result of agro-chemical use as described above, there is the issue of BHC and Metacid (methyl parathion) use, which has been banned in many countries.

BHC is an agro-chemical with significant indirect impact to the environment. Although toxicity is relatively low, it is highly residual and biologically subject to increased concentration as it moves up the food chain. Its toxicity has potential manifestation in terms of circulatory disorders, and is considered to be carcinogenic. On the other hand, methyl parathion is highly toxic with significant direct environmental impact.

4) Malaria

At present, outbreak of malaria in the Project area has been largely eliminated as a result of the Malaria Eradication Program. In addition, irrigation discharge to be generated under the Project, including regulation ponds, will be moving water. This makes difficult the proliferation of anopheles, a carrier of the malaria inducing organism. Also, since the Project envisions 9 month irrigation, the 3 month period from January to March will be dry. In light of the foregoing, the potential for malaria occurrence as a result of the Project is considered extremely small.

With regards to diarrhea and parasites, the possibility of such in the human population as a result of the Project is considered nil as the vector for these is drinking water which is not an issue under the Project.

5) Friction between Ethnic Groups

The possibility of problems occurring within or between ethnic groups is concluded to be low for the reasons set out below. This pertains to the Kumal, Majhi, Sarki, Kami, Damai and Muslim groups. However, it is essential that careful attention be given to full enjoyment of Project benefit on the part of these groups in the future establishment and operation of WUAs, and the introduction of new farm management technology under the Project.

As a result of household survey, individuals of the so called less socially advantaged castes comprise around 25% of the total beneficiary population, and reside in blocks D, E, G, H, I, J, and K. In the case of the Kumar group, despite being land holders, ethnic group members are economically disadvantaged due to relatively weaker agricultural base and lower levels of farm management technology.

It was learned as a result of field survey that some residents of the Battar area moved away from their land and subsequently were unable to enjoy the benefits of the irrigation project due to inadequate prior access to information. Under this Study, Project objectives and content were explained to the farmers of the area on three separate occasions, at which time it was confirmed that members of all ethnic groups attended the briefing sessions. In addition to the foregoing, individual Study Team members conveyed information to target beneficiaries in the course of their respective survey works.

Also, in the course of field survey including that of forest cooperatives, it was concluded that beneficiaries have experience in organizing which is inclusive of the various ethnic groups, and that the custom of resolving conflicts through dialogue is established.

6) Others

a. Forest

As discussed in Section 6.7.2 above, if Alternative-1 is adopted whereby the intake for the Project located at the downstream of the balancing reservoir, forest cutting will not be necessary. Accordingly, it is concluded that the implementation of the Project will not impact on wooded area.

b. Impact on Farmland by Buried Pipe

In irrigation blocks B, C and D, a portion of pipeline (ø 450~1000; L = 3.0 km) is to be buried beneath farmland. This would be considered to pose the possibility of soil horizon disturbance. However, backfilling works are planned to take into account replacement of agricultural top soil and as a result the impact of pipeline construction on farm land is concluded to be virtually nil under the Project.

Also, pipeline will be imbedded more than 90 cm below the ground surface in the case of farmland, which will not impact on crop rhizosphere and growth.

(2) Conservation Plan

1) Soil Erosion

In collaboration with the Project executing agency, DOI, it is proposed that the Nuwakot District Soil Conservation Office provided monitoring and technical support as required. Soil erosion control measures would include the following.

(Construction stage)

a. To avoid works in the July~August rainy season.

b. For the canal segment from the alternative I intake point to Trishuli Bazar:

To landslide locations occur along this segment. Design here will include concrete and gabion reinforcing works for pipeline, pipeline embedding and landslide prevention works.

c. For along slopes, etc.:

Here, small scale check dams (simple masonry type) and bio-engineering works (slope planting) are proposed. Gabion reinforcing works would likewise be considered.

Simple check dams already exist in the area, and these works can readily be effected with beneficiary participation under appropriate guidance. Likewise, slope planting is currently done on a small scale in the area and can be easily performed by beneficiaries. Technical guidance with regard to the foregoing would be provided by Nuwakot District Soil Conservation Office as discussed above. This support would be channeled via the PMC and District Technical Group.

(Project operation period)

In order to preserve farmland soil surface, the following are proposed.

a. Cover cropping:

The cropping pattern must take into consideration maximum avoidance of prolonged periods of bare land. This is particularly important in the rainy season. Cropping in the area in the past was in many cases rain-fed, with seeding being done at the start of the rainy season. With introduction of the Project, micro-control of the cropping pattern will be possible.

b. Mulching:

In the case of irrigation blocks I, J, K, and G, availability of crop refuse for mulching is considered low due to use of the same for animal feed and

home fuel. Instead, it is proposed that manure be used for mulching. Use of manure for agricultural purposes is already being done in the area.

c. Stubbles:

Crop stubble is to be left at harvest time. The well developed root system in the case of maize and upland rice will promote soil protection.

d. Manuring Practice:

Promotion of conglomerate soil structure creates a soil membrane which is water resistant and less susceptible to disintegration due to the kinetic force of rainfall. To foster this, use of organic materials is proposed.

(Control of surface water flow)

In order to mitigate impacts of surface flow erosion, the following measures are proposed. Although paddy is not a design crop for irrigation blocks I, J and K, 50% of the area of Irrigation Block G is planned to be cropped with paddy during the rainy season. Accordingly in the case of the latter, underground percoloation from inundated paddy field must be taken into consideration in addition to the impacts from surface flow.

a. Tillage of area immediately adjacent to the Tadi river, where erosion is heavy, is to be avoided in principle.

b. In order to preserve farm plots adjacent to the Tadi river where erosion is heavy, mixed planting is to be done with grasses such as bamboo, etc. which have extensive root network.

c. In order to prevent erosion by irrigation water at the terminal field level, simple drainage facilities surrounding farm plots are to be established to carry excess runoff back to the river. In such case, careful attention is to be given to prevent such runoff from inducing rill and gully erosion. In this regard, reference is to be made to the effective functioning of drainage facilities under the DOSC's Soil Conservation and Watershed Management Project and DPTC.

d. In combination with the above drainage facilities, furrowing appropriate to land slope (contour ploughing) is to be carried out to control surface runoff.

e. In order to prevent soil erosion on the side of the bluff facing the Tadi river as a result of underground percolation of water from paddy field in Irrigation Block G, paddy cultivation in adjacent area is to be avoided. Also, to realize effective utilization of irrigation water, paddy cultivation is to be avoided in locations where A and B layer are shallow in order to promote formation of a well defined plowsole.

f. In the case of bluff side fronting the Tadi river where erosion as a result of irrigation is a concern, simple check dams of masonry or latticed bamboo fencing combined with vegetal cover are to be constructed.

As the above measures include content outside the scope of the Department of Irrigation, support is to be obtained from the Department of Soil Conservation (DOSC) and DPTC which have know-how and experience in this area.

2) Inflow of Eroded Sediment to Farmland

Countermeasures for eroded sediment inflow to farmland in Zone A and Zone B are proposed as follows:

Zone A: For Zone A, the proposed intake site will be at the downstream of the Trishuli hydropower station regulation pond which will serve to eliminate a large part of sediment before reaching the irrigation schemes. Also, a regulating pond (1,200 m^3) will be constructed in Zone A at the point where open canal changes to pipeline (at the terminus of Irrigation Block C), and this will provide an additional sediment removal effect. Sediment inflow to farmland is accordingly concluded to pose almost no problem in Zone A.

Zone B: The following measures are to be incorporated into facility design to prevent eroded sediment inflow into farmland in Zone B.

- Intake site is to be selected at a location with ample river depth and minimized effect from river sediment load.
- A suction sump is to be installed at the intake site to prevent sediment inflow to pump.
- A discharge chamber is to be constructed at a point prior to water distribution to farm plots, to effect desilting prior to irrigation water allocation to cultivated fields.

3) Agro-chemicals

Measures regarding agro-chemical use are proposed as follows. DADO would be the prime agency in formulating these, and they would be implemented via the PMC.

a. Provision of information on correct agro-chemical use:

At present, extension of agro-chemical use centers on appropriate substance for each type of pest. With regard to quantity of agro-chemical use and resultant impacts, it is also necessary that agricultural extension officers make available instruction and information to the farmers. DADO would be the prime agency involved in these efforts. Accordingly, it is proposed

that DADO expand the scope of its present campaign regarding agro-chemical extension.

b. Farm management:

In order to control crop pest and disease outbreak while at the same time achieving a minimal use of agro-chemicals requires attention to cropping periods and crop rotation. Simultaneous large area planting of the same crop should be avoided. It is proposed that the PMC take the foregoing into consideration when determining the block-wise cropping.

c. Selection of agro-chemicals:

Use of highly residual and potentially carcinogenic BHC should be avoided.

d. Water contamination:

Almost all sources of potable water for the Project area are located at some distance in nearby hill. Accordingly, it is concluded that there is no potential for contamination of drinking water by the use of agro-chemicals inside the Project area. However, such use does have the potential of affecting surface water runoff and ground water extended to downstream areas. In this light, use of agro-chemical is to be minimized in line with items a, b and c above. In the event that it should be deemed necessary to carry out water quality check, it is proposed that this be done at the spring sites scattered in the Pipaltar vicinity of the Project area, where a large amount of vegetable cultivation is planned. As Nuwakot district is not equipped to perform such water quality analysis, it will be necessary to request this of the central agency, NARC (Nepal Agricultural Research Council).

With regard to appropriate use of agro-chemicals, it is desirable that an integrated program in line with national policy throughout the country be adopted to include identification of types of crop pest and seasons when such outbreak occurs, cultivation of hardy varieties resistant to pest, establishment of IPM, extreme minimizing and/or prohibition of the use of BHC and other highly residual chemicals, and health and sanitation related measures.

4) Malaria Countermeasures

It is anticipated that outbreak of malaria in the area would be extremely rare. However, it is recommended that regular inspection of the Project area be carried out by WUA members to identify any stagnant pools as a result of water leakage from facilities.

5) With Consideration to More Socially Disadvantaged Caste Members

The following are proposed:

a. Equitable access to information: All information relevant to the Project is to be made available to all beneficiaries comprising the WUAs.

b. Creation of an environment conducive to the active participation of all: Equitable opportunity is to be given to all, embracing socially disadvantaged groups including women as well, to have their say in Project affairs.

With regard to b. above, inclusion of socially disadvantaged caste members and women in the PMC is to be promoted.

c. Introduction of new farm management technology: Socially disadvantaged caste members generally have access to fewer educational opportunities. Accordingly, it is recommended that extra time be according to this group in the introduction and demonstration of new agricultural technology under the Project. Understanding on this part by agricultural extension personnel is a prerequisite.

6.7.4 Conclusion of IEE Study

The Project content pays careful attention to environmental considerations, i.e.:

1) Adoption of pipeline alignment from the intake point which minimizes tree cutting and the possibility of soil erosion;

2) Facility design and construction schedule timing which takes into full account the possibility of soil erosion, the largest environmental issue under the Project;

3) Farm management plan which gives full attention to the impacts of agro-chemicals and fertilizers on the environment; and

4) Clear indication of entities / personnel to be responsible for the relevant countermeasures.

On the basis of the above, it is concluded by the Study Team that no negative impacts from the Project will be indicated by EIA.

6.8 Project Monitoring Plan

The project monitoring plan is to be carried out on an irrigation block unit basis. Under the cooperation of the IB Executive Committee, district officials will commence irrigation observations and data record collection. Upon elapse of 3 years from the completion of construction, the results of monitoring will be analyzed as a basis for identifying Project effect and impact, and as criteria for determining any long-term strategy correction measures which might be necessary. During the initial minimum of 3 years necessary to get the completed system fully on track, guidance from concerned personal of the relevant agencies will be necessary. This would be provided in the following areas:

- Irrigation system efficiency
- Agricultural production and marketing
- Environment

(1) Monitoring of Irrigation System Efficiency

1) Rainfall Observation

At present, there are no rainfall observation facilities in the Project area. Accordingly, a new gauging station would be established near the control tank in Block C to begin rainfall record collection.

2) Recording of intake discharge from the intake point would be commenced.

3) Executing Agency

The District Irrigation Officer (DIO) and the PMC would formulate the monitoring plan, which would then be carried out by the Executive Committee of each irrigation block with the cooperation of DIO. In particular, careful check would be made of the status of water distribution to each block.

4) Analysis of System Efficiency, and Feedback to the Project

At the end of the irrigation season (April~December), irrigation efficiency of the system would be analyzed based on rainfall and discharge records, and the agricultural production monitoring described below. The results of this analysis would be submitted to the PMC, which would on this basis make any necessary modifications in the cropping and water distribution plan for the coming season in order to further upgrade system efficiency. Analysis of system efficiency would be done under the guidance of the Department of Irrigation.

(2) Monitoring of Agricultural Production and Marketing

Irrigated agricultural development will begin with the start up of irrigation upon completion of system facilities. Degree of achievement of agricultural production and market reaction would be evaluated as base criteria for the next-season cropping plan.

In particular, emphasis would be placed on tracking the status of marginal and small farmers.

1) Executing Agency

Monitoring would be carried out by the District Agricultural Development Office in collaboration with the PMC and AMSC.

2) Target Farmers

In principle, 1 farm household from each sub-block will be selected for monitoring survey. However, in the case of Block C given its large area and number of farmers, 2 households from each sub-block would be monitored. Selected farmers to be monitored would be fixed, in order to track any annual / seasonal changes in conditions. Selection of these would be done by DADO in collaboration with the PMC and AMSC.

Table 6.8-1 Target Farmers for Block-wise Monitoring

Irrigation Block	No. of HH	HH monitored	No. of HH < 0.5 ha
A	35	3	17
B	62	6	29
C	297	10	154
D	108	7	68
E	125	9	69
F	65	4	30
G	113	3	52
H	155	4	58
I	133	4	50
J	51	6	25
K	72	7	32
L	229	9	88
Total	1,445	67	672

As indicated by the above table, the total number of households to be monitored is 67.

3) Items for Monitoring

Monitoring will be carried out crop-wise according to the following indices.

- Cropped area
- Status of irrigation water supply
- Fertilizer use
- Quantity and cost of agro-chemical use
- Yield
- Marketed quantity and price

(3) Environmental Monitoring

Environmental monitoring will continue from the construction through the post project stages. In the case of the subject Project area, soil erosion, slope collapse are the negative environmental impacts of greatest potential concern. These will be carefully monitored particularly during the construction stage of the Project; nevertheless they will also be closely tracked after construction completion as well. Impacts from agro-chemical use will be monitored based on the agro-chemical use data obtained from monitoring of agricultural production. Monitoring items, sites of particular concern, implementation period and relevant agencies are indicated in the table below.

Monitoring item	Locations of particular concern	Implementation period	Relevant agency
Soil erosion	Irrigation blocks G,I,J,K; other locations indicated in section 6.7.3 (1) 1)	Construction stage; operation stage (1 time per year)	DSCO (PMC, executive committee of each irrigation block
Slope collapse	Intake point - Trishuli Bazar (along pipeline); irrigation blocks G,I,J,K	Construction stage; operation stage (1 time per year)	"
Sediment inflow	Irrigation Block L	Operation stage (1 time per year)	DSCO (PMC, executive committee of each irrigation block
Agro-chemicals	(to be carried out as one part of agricultural related monitoring)		

1) Soil Erosion

Monitoring in this regard would focus on the area adjacent to the Tadi river in irrigation blocks G, I, J, and K, and the other locations indicated in Section 6.7.3 Environmental Conservation Plan, (1) Problematic Issues, 1) Soil Erosion. This monitoring is particularly important during the construction stage with regard to pipeline laying. During the project operation stage, the said monitoring would be one time per year in principle.

2) Slope Collapse

This monitoring would focus on the pipeline route from the intake point to Trishuli Bazar, and the area adjacent to the Tadi river in irrigation blocks G, I, J, and K. Monitoring of the pipeline route from the intake point to Trishuli Bazar is particularly important during the construction stage, and the latter area adjacent to the Tadi river requires monitoring during the project operation stage. The said monitoring during the project operation stage would be in principle one time per year.

3) Eroded Sediment Inflow to Farmland

Monitoring in this regard would focus on the area of Zone B which obtains irrigation water directly from the Trishuli river. Monitoring would be carried out one time per year during the project operation stage.

4) Executing Agency

In the case of monitoring of soil erosion and slope collapse, the District Soil Conservation Office (DSCO) will carry out the subject monitoring in collaboration with the PMC and each irrigation block executive committee. Monitoring of sediment inflow to farmland would be done by the District Irrigation Office (DIO) in collaboration with the PMC and the executive committees of each irrigation block.

5) Analysis of Monitoring Results, and Evaluation of Monitoring

Analysis of monitoring results, evaluation of monitoring as well as overall assessment of environmental conditions pertaining to the Project would be performed by the Environment Section of DOI in collaboration with PMC.

6.9 Training Program

As discussed earlier with regard to the social preparation plan, and operation and maintenance plan, program implementation is to be in 3 phases, i.e. phase I, phase II and phase III.

Phase I:	8 months leading up to start of construction (following 2 months of preparatory work, 6 months of setting up WUAs
Phase II:	24 months from start to completion of construction works
Phase III:	12 months from completion of construction works

Phase I: Training programs on preparation for organizing WUA

Training course	No. of Trainees	Duration of course (days)	Total man-days
District officials orientation	30	2	60
Catalyst training	10	5	50

Phase II: Training programs on WUA capacity development

Training course	No. of Trainees	Duration of course (days)	Total man-days
Orientation to farmers	1000	2	2000
Training to WUA representatives at sub-block level	100	3	300
Training to WUA representatives at block level	60	5	300
Farmer to farmer training	200	10	2000
Training program in pump irrigation	30	2	60

Phase III would commence upon completion of construction works and would comprise instruction in system operation. It would extend for 24 months including the 9 months in the first year of irrigation under the Project. The training would be directed at district officials, WUA block level representatives, sub-block representatives, and pump operators (WUA). Experts and related government personnel would carry out the training.

Phase III: System management programs for district officials and WUA

Training course	No. of Trainees	Duration of course (days)	Total man-days
District Officials	10	30[1)]	300
WUA representatives at the block level (system operators)	50	20[2)]	100
WUA representatives at the sub-block level (system operators)	140	20[3)]	2800

System operators: includes pump operators
1): 5 days × 6 times
2), 3): 5 days × 4 times

Also, training in environmental conservation practices will comprise a part of the above program. Content would include mitigatory measures, particularly bio-engineering works, and training would comprise a preliminary monitoring survey. Timing for this training would be Phase II.

6.10 Technical Assistance

The Project aims for a high project effect through agricultural diversification and increased agricultural production. In order to achieve this, a long term and continuous guidance structure is necessary. In particular, as both concerned agency officials and the farmers themselves are inexperienced in pipe irrigation systems, it will be essential that guidance be provided in pipeline management. With regards to the pumped irrigation component of the Project, pump maintenance will likewise be an important issue (part replacement, minor repairs). Lack of adequate maintenance was a factor in the failure of the previous Battar project.

Accordingly, technical assistance is judged to be necessary to comprise dispatch of the following experts:

- 1 irrigation expert: water management under pipeline system
- 1 agricultural expert: agricultural diversification
- 1 mechanical expert: pump maintenance