CHAPTER 7

SYSTEM MANAGEMENT

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7.1 Irrigation System Management (Joint Management)

What form of irrigation management have we devised? One lists up three types of irrigation system management. These are: 1) user management (in Nepal called farmer managed irrigation system; FMIS); 2) government management (in Nepal called agency managed irrigation system; AMIS); and 3) joint management (sometimes referred to as participatory irrigation management; PIM).

Easily distinguished are between the systems that are managed by local user organizations and systems that are managed by the government agencies. The general tendency in countries having both types of irrigation systems is: for user-managed systems to be relatively small and for government-managed systems to be relatively large. In this country of Nepal, user management usually applies to small scale irrigation systems developed under ADB assisted ISP and SISP while government management applies to big national irrigation systems usually more than 2,000 ha command area.

The third management style that is Joint Management is a form wherein the water users association and the government share the management responsibilities. In most cases, the government manages principal facilities such as dams, reservoirs, diversion weirs, and large canals while the water users association manages downstream part of a system such as secondary canals, sub-secondary canals, tertiary canals, on-farm facilities and in all the cases the water users association is responsible for irrigation service fee (ISF) collection.

Having seen the trend in irrigation management all over the world, many governments are reducing their roles in irrigation management while farmers associations are taking them over. The governments are now transferring a part of irrigation management to the water users associations. This is referred to as Irrigation Management Transfer; so called IMT[1], resulting in a Joint Management that has become a widespread practice over the world.

Especially for the last two decades, many countries around the world have been turning over the management authority from the government to the farmers organization. Nepal is not an exception but is pursuing management transfer either under IMTP or with its own internal fund. The logic why

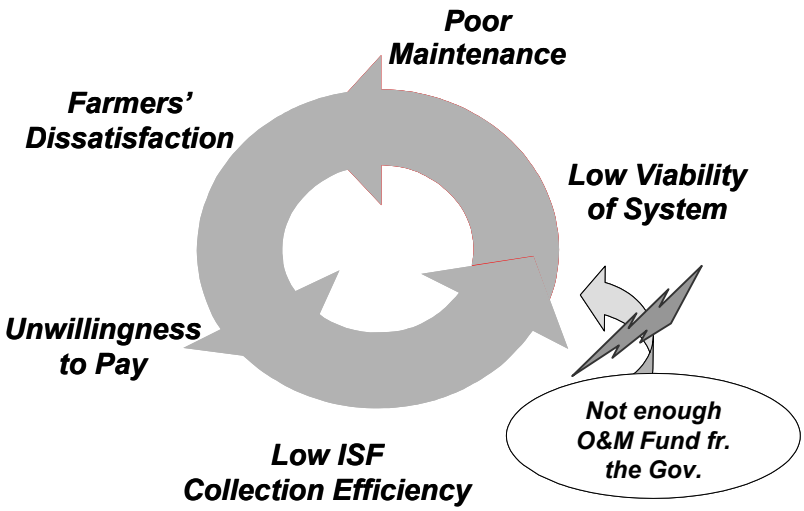


Figure 7.1.1 An Irrigation System in a Vicious Circle

[1] Irrigation Management Transfer early occurred from the 1950s through 1970s in the USA, France, Colombia, and Taiwan. Then, in the 1980s and 1990s, Latin American Countries, African Countries, Middle Eastern Countries, Asian Countries such as Pakistan, India, Sri Lanka, Bangladesh, Lao PDR, Vietnam, China, Indonesia, the Philippines have introduced IMT, and so is the Nepal.

the management transfer, resulting in a joint management, is needed is shown in Figure 7.1.1.

ISF collection efficiency and also the fee itself are very low, an example of which is SMIP; namely, less than 20% efficiency with 200 Rs/ha (half goes to the government). Supplementing O&M by the government budget is not easy task taking into account the budgetary constraint as well as from the viewpoint of equity aspect (capital is subsidized and any rationale to further subsidize O&M ?). System viability becomes low because the system does not have enough funds, leading to poor operation and maintenance.

Thus, the government becomes no longer able to operate and maintain the irrigation system at a level with which the farmers are satisfied. Farmers' dissatisfaction creates unwillingness to pay irrigation service fee. Then, return again to the low ISF collection efficiency, which is the vicious circle wherein most government managed irrigation systems are now struggling.

What mentioned above leads us to concluding rationale why we should promote Joint Management. Government bureaucracies in one way may lack the incentives and responsiveness to optimize the irrigation management performance. Specially given the situation HMGN is now facing under staff curtailment, DOI alone can no longer increase the performance level of the irrigation system. On the other hand, farmers must have a direct interest in enhancing and sustaining the quality and cost-efficiency of irrigation management because agriculture is their primary occupation.

From the viewpoint of government side, joint management will reduce the government expenditures for O&M and allow reallocation of the fund to new construction within the sector. In many countries, the governments are running shortage of fund while many projects are lining up, waiting for the implementation, and Nepal is not an exception in this way. Joint management would contribute to rectifying the situation to certain extent.

The joint management is already legalized in Nepal as Provision 13 of Irrigation Regulation (2056) says that "big projects, which cannot be fully transferred to the WUA, may be operated jointly by concluding as agreement between the two parties including collection of service charge, share percentage of users' association, and arrangement for maintenance." The issue now is how and in what way the joint management be introduced in the Sunsari River Irrigation Project.

There are variations in how far upstream the role of WUAs is extended and the extent to which the Government, DOI, should be still in place. There are also variations in what tasks and responsibilities should be transferred to WUAs. The most frequent pattern in Asia is that the government retains overall ownership of the irrigation system and control over the water resource, and main and other big canals. Then, WUAs take the responsibility of operation & maintenance of lower-level canals and ISF collection.

In Nepal, the responsibility of ISF collection is in no doubt on the farmers' side under the joint management. However, to what level of canal network the WUAs should undertake the responsibility of operating and maintaining is not yet standardized and is still under try & error as one can see in the transfer program of IMTP. Demarcating the responsible line between the government and WUAs should take into account hydraulic decentralization,

farmers' manageability of operating and maintaining the system, solidarity of the member farmers of a WUA, system hardware design, government limited and would-be curtailed workforce, etc.

7.1.1 Hydraulic Decentralization

There will be 13 WUAs, named Water Users Committee (WUC[2]) same as SMIP, along Suksena canal and 9 WUCs along Shankarpur canal, totaling to 22 WUCs under the Sunsari River Irrigation Project. The WUCs are the organ dealing with the irrigation water, which is an economic good. To deal with an economic good, perceived right for the use in exchange of paying the service fee should well be established. In this sense, WUCs should be hydraulically decentralized by being established in conformity with any head gate that regulates the flow going into their irrigation area. The WUCs may be stratified as the organization becomes big, starting in all the cases with on-farm irrigation groups. At every level of the organization, hydraulic decentralization should always be pursued in conformity with turn-out, head gate, check regulator, etc.

7.1.2 Farmers Manageability

The example of West Gandak, where the main canal commanding 10,300 ha was transferred, tells clearly us farmers would face very difficulty in managing such big canals covering several thousand hector. A canal commanding thousands hector usually entails almost same number of member farmers or more in the WUA (say, 10,000 ha means about 10,000 member farmers or more). Too many members definitely make it difficult to act collectively in operating and maintaining their canal system even if the WUAs is well stratified.

In SMIP, the organizational structure of the WUAs is tall and highly centralized. The utmost authority and power are given to WUCC organized at secondary canal level (same as Shankarpur and Suksena in SRIP). This structure tells us that as the leadership structure moves up, the leaders become unreachable by the ordinary farmers at the levels of the lowest organ that is WUGs. There is too much concentration of power among the leaders and none is left among the ordinary farmers. The overall structure of SMIP, giving the highest authority and power to the big WUCC, seems not so functional from the view point of farmers manageability.

Taking above into account, Shankarpur and Suksena canals should not be transferred to the farmers in case of Sunsari River Irrigation Project. The command areas are about 5,000 ha each, which are so big in size that the canals should be operated and maintained under the jurisdiction of the DOI. Therefore, the management transfer should take place at the level of secondary[3] canals that branch off from the Shankarpur and Suksena.

7.1.3 Solidarity of the Member Farmers

The more members a WUA has, the more difficulty the WUA would face in discharging

[2] Water Users Committee (WUC) in this report is same as Water Users Association, which implies the association as a whole and does not mean a committee composed of elected/selected members only.

[3] In Sunsari River Irrigation Project, Shankarpur and Suksena canals are regarded as the main, though these are secondary in SMIP, and canals branching off from the two canals are called secondary.

collective task. One may say even big number of members could well be organized if it is stratified. However, practices on the ground have hardly proved it as shown in SMIP and according to a lesson gained from IMTP. The lesson[4] says; "The organizational structure of some IMT WUAs, particularly in the larger projects, may be overly complex with too many layers of bureaucracy. IMTP should stress leaner WUAs and help identify key leaders and mangers……."

Generally speaking from human attitude point of view, a number of 15 to 20 is considered to a certain extent to be a limit in organizing well cohesive group. This may be seen in the Stage I area of SMIP. The lowest farmers organ of SMIP Stage I area was organized to cover 50 ha each. The 50 ha area includes 50 to as many as 70 farmers that made them difficult to discharge collective work. The aftermath was that most watercourses disappeared in a couple of years, and the area was reduced to 28 ha in Stages II and III areas of SMIP.

The 15 to 20 members entail about 20 to 30 ha. However, this is too small from the viewpoint of overall system management if the group were given identical irrigation management authority. If a WUA is envisaged with 2 responsible layers[5] with the same limit in number in the organizational structure, it can cover 200 to 400 members (15 x 15 to 20 x 20). This would entail about 200 to 400 ha which is usually correspondent to the range of command area by a secondary canal. Therefore, the WUAs, as the farmers' collectivity, should be principally established at secondary canal level (not at the level of Shankarpur or Suksena level).

7.1.4 System Hardware Design

Taking into account the farmers manageability and also solidarity among the member farmers, any secondary canal covering more than 400 members (or about 400 ha) should be divided into smaller blocks by providing additional secondary between the main (Shankarpur or Suksena) and around mid point of the concerned secondary (see Figure 7.1.2).

If topographic condition does not allow this arrangement, the government should go down to the point below which the command area is less than 400 ha (see Figure 7.1.3). In this case, the upstream of the concerned canal is regarded as a part of main canal from the viewpoint of system management.

The case shown in Figure 7.1.2 took place in case of lower part of Shankarpur canal, and the case shown in Figure 7.1.3 occurred in the biggest secondary canal of Suksena named 4SRR (command area is 1051 ha). Given the arrangement, now Suksena canal has 26 WUCs ranging from 115 ha to 388 ha with an average of 213 ha and Shankarpur canal has 18 WUCs ranging from 131 ha to 402 ha with an average of 257 ha.

[4] Irrigation Management Transfer Project, Contract Completion Report, May 30, 1996 – November 20, 1999, prepared by Computer Assisted Development Inc., and APTEC Consultancy P. Ltd.

[5] There are actually three layers in the organizational structure of WUA in SRIP (refer to Chapter 8 INSTITUTIONAL DEVELOPMENT). However, the intermediary layer correspondent to tertiary canal is not given the responsibility of billing and collecting ISF and is only in charge of water distribution. The leaders of all the WUGs correspondent to watercourses go to the board of directors of the apex of the WUA, bypassing the intermediary layer. Thus, the layer of SRIP WUA can be regarded as two only from the view point of organizational operation principal.

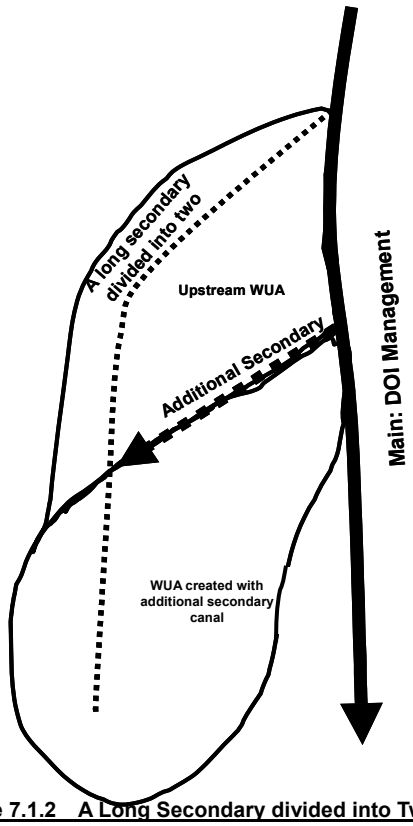


Figure 7.1.2 A Long Secondary divided into Two WUCs

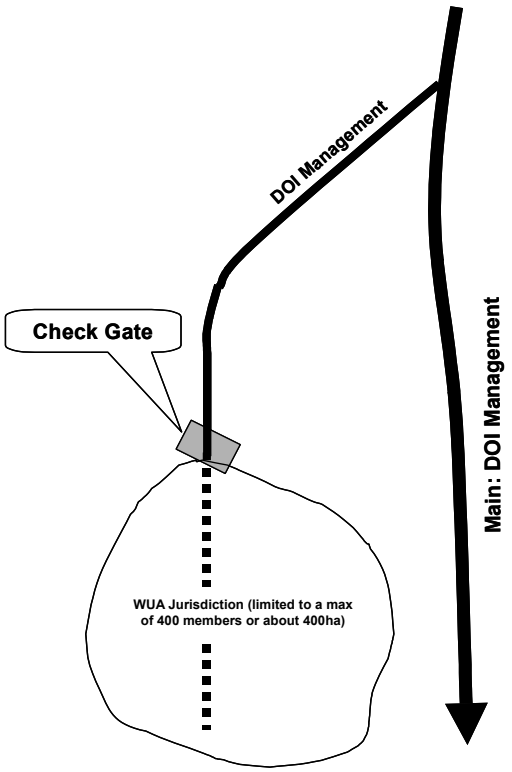


Figure 7.1.3 A Long Secondary partly covered by DOI

7.1.5 System Management

In summary, the main canals, Shankarpur and Suksena, and 4SRR will be managed by DOI, and secondary canals and below thereof are managed by the relevant WUCs. The gates attached to the main canals of Suksena and Shankarpur and secondary 4SRR will be operated and maintained by DOI with consultation of relevant WUCs. The demarcation of joint management is illustrated in Figure 7.1.4.

7.2 Water Management

Water management discussed here is how to convey the irrigation water by season, either continuous or rotation, and how to carry out the rotational irrigation whether it is by main canal and/or by a cluster of secondary canals or otherwise the combination of main canal and the clusters.

The conveyance of water during monsoon is done under continuous flow same as most of the irrigation systems over the world. However, as discussed earlier in Sub-chapter 6.4.4 "Preventive Irrigation", water during lean period is not enough to cover whole irrigable area, thereby requiring the rotational irrigation between main canals by year. Sub-chapter 6.4.4 says that rotational irrigation between Suksena and Shankarpur by year should be done in both cases of 50% and 20% water downstream releases (50% release with preventive irrigation requirement and 20% release with conventional requirement by Penman).

In any case of either preventive or conventional irrigation, rotational irrigation between the Suksena and Shankarpur by year cannot be avoided taking into account the area that can be covered by the limited water source during the lean period. Further, rotational irrigation by a cluster of secondary canals is required due to the introduction of un-gated opening type field inlet serving water courses. The un-gated inlet serves to realize automatic equal water distribution among water courses; namely, among water users groups (WUGs). However, to let the water getting into the inlet as required, always nearly about full design water level should be kept.

To keep such water level at the un-gated inlet, water volume going into each secondary canal should always be almost equal to the design discharge corresponding to each canal. This is realized by carrying out rotational irrigation among clusters of secondary canals during lean period. With some trials, this Study proposes three blocks rotation along each main canal taking into account a limit in terms of water duty not less than 70 % of the design duty (water duty is always kept more than 1.168 l/s/ha, otherwise water cannot get into the inlet) and not more than 120 % (otherwise the water overspills from the canal).

Table 7.2.1 shows the particulars for planning the rotational irrigation. Based on the particulars, following procedure gives how the rotational irrigation should be carried out. Table 7.2.2 shows the rotational irrigation composed of rotation between the two main canals, rotation among clusters of secondary canals, and continuous flow (See Figure 7.2.1 for Rotation Block).

1.	Decide the number of rotation block:	3 blocks
2.	Decide the number of irrigated blocks simultaneously:	usually 1 block
3.	Days of each rotation:	usually 3 days
4.	Confirm the available headwork discharge at the season:	as per water availability
5.	Check the rotated irrigation module:	70% < module < 120%

The operation plan proposed is:

1. From Nov. 1 to Feb. 28:
   Rotation between the main canals by year under which further rotation among 3 clusters of secondaries with 3 days each
2. From Mar. 21 to Apr. 30:
   1 cluster rotation among total 6 clusters of secondaries with 2 days each
3. From May 1 to Jun, 10 & Oct. 11 to 31:
   2 clusters rotation among 6 clusters of secondaries with 3 days each
4. From June 11 to June 30 & October 1 to October 20:
   4 clusters rotation among 6 clusters of secondaries with 3 days each

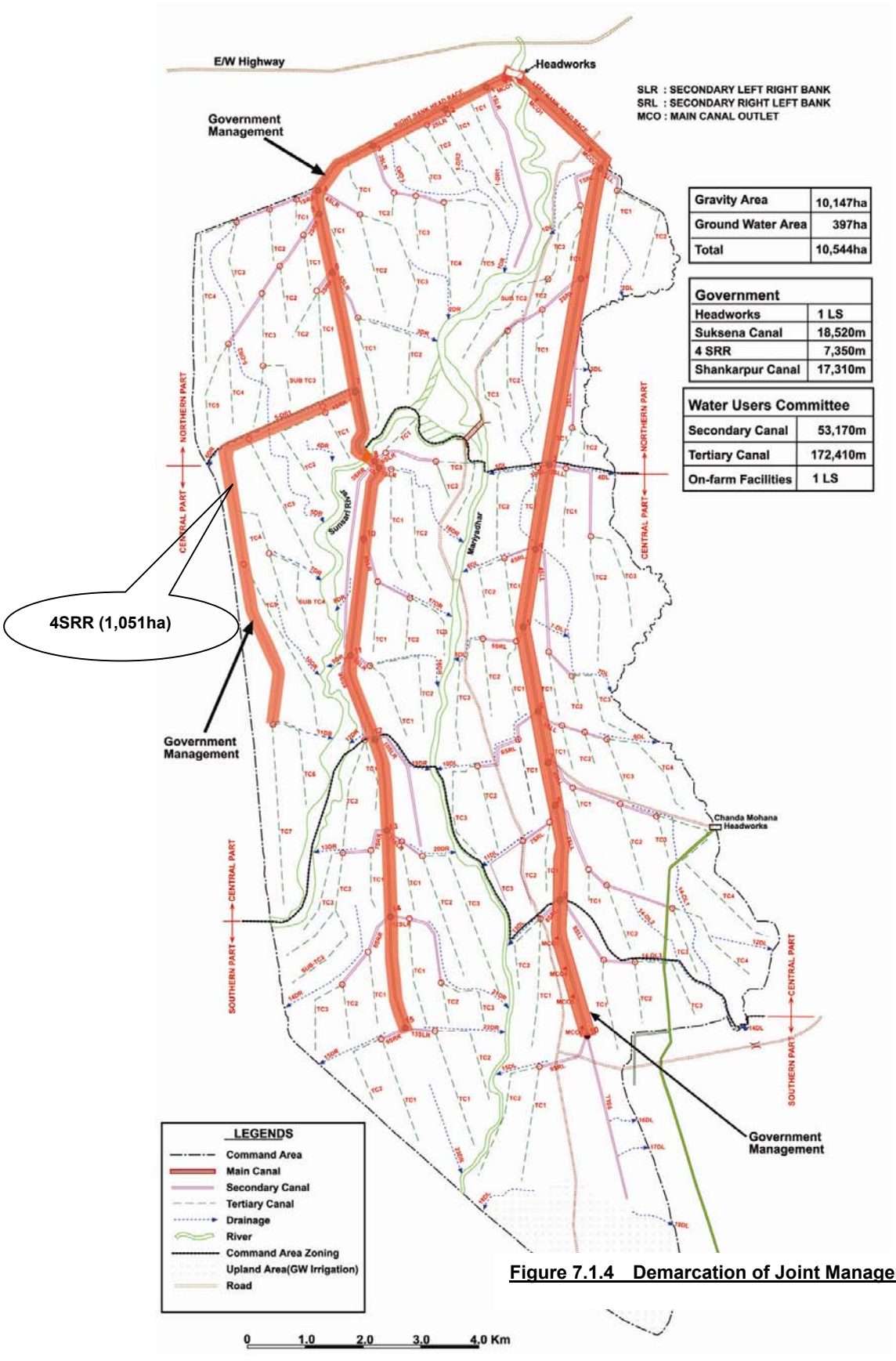


Figure 7.1.4 Demarcation of Joint Management

Table 7.2.1 Paticulars for Planning Rotation Irrigation

Particulars	Area	Q Max	Duty	1.2 x Q Max	0.7 x Q max	1.2 x Duty	0.7 x Duty
	ha	cum/s	l/s/ha	cum/s	cum/s	l/s/ha	l/s/ha
Whole Command Area	10,147	16.926	1.668	20.311	11.848	2.002	1.168
Shankarpur CA	4,618	7.703		9.244	5.392		
Suksena CA	5,529	9.223		11.067	6.456		

Table 7.2.2 Rotation Irrigation Plan

Particulars	Jan.			Feb.			Mar.			Apr.			May			Jun.			Jul.			Aug.			Sep.			Oct.			Nov.			Dec.		
	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L
Required Gross WR, cum/s	5.14	5.25	5.60	6.01	5.78	5.90	4.47	3.12	2.53	2.18	1.73	1.43	1.62	1.87	1.49	1.58	6.42	8.94	10.54	13.59	15.69	15.88	16.93	14.59	16.43	13.91	13.14	11.31	9.07	5.81	3.53	3.09	2.53	3.04	3.58	4.80
Preventive G. WR, cum/s	3.09	3.15	3.36	3.61	3.47	3.54	2.68	1.87																							2.12	1.85	1.52	1.83	2.15	2.88
Shankarpur CA G. WR, cum/s	2.34	2.39	2.55	2.73	2.63	2.68	2.03	1.42	1.15	0.99	0.79	0.65	0.74	0.85	0.68	0.72	2.92	4.07	4.80	6.18	7.14	7.23	7.70	6.64	7.48	6.33	5.98	5.15	4.13	2.64	1.61	1.41	1.15	1.38	1.63	2.18
Suksena CA G. WR, cum/s	2.80	2.86	3.05	3.27	3.15	3.21	2.43	1.70	1.38	1.19	0.95	0.78	0.88	1.02	0.81	0.86	3.50	4.87	5.74	7.40	8.55	8.65	9.22	7.95	8.95	7.58	7.16	6.17	4.94	3.16	1.93	1.68	1.38	1.66	1.95	2.62
Shankarpur CA Preventive WR, cum/s	1.40	1.43	1.53	1.64	1.58	1.61	1.22	0.85																							0.96	0.84	0.69	0.83	0.98	1.31
Suksena CA Preventive WR, cum/s	1.68	1.72	1.83	1.96	1.89	1.93	1.46	1.02																							1.16	1.01	0.83	0.99	1.17	1.57
Available Water (P80 - 1.8cum/s)	2.25	2.39	2.04	2.10	2.15	2.04	1.89	1.92	2.29	2.34	2.58	3.99	4.66	6.89	8.32	11.68	19.43	19.38	30.90	28.26	33.32	24.71	28.13	22.66	20.64	25.01	17.85	13.07	10.84	5.56	3.80	3.13	2.26	2.48	2.16	2.28
Available Water (P80 - 0.7cum/s)	3.35	3.49	3.14	3.20	3.25	3.14	2.99	3.02	3.39	3.44	3.68	5.09	5.76	7.99	9.42	12.78	20.53	20.48	32.00	29.36	34.42	25.81	29.23	23.76	21.74	26.11	18.95	14.17	11.94	6.66	4.90	4.23	3.36	3.58	3.26	3.38

Whole Command Area, 10,147ha

No. of Rotation Blocks	Rotation between main canals by year						Canal Close for Maintenance			6			3			3			Continuous Flow									3			3			Rotation between main canals by year					
No. of Irrigated Blocks simultaneously										1			1			2												2			1							
Days of each Rotation, days										2			3			3												3			3							
Headwork Discharge, cum/s										2.29			4.50			10.00			14.00			16.93			14.00			11.40	10.00	5.56							
Rotated Irrigation Module, l/s/ha										1.35			1.33			1.48			1.38			1.67			1.38			1.69	1.48	1.64							

Preventive Irrigation

Shankarpur Area, 4,618ha

No. of Rotation Blocks	3						Canal Close for Maintenance																								3							
No. of Irrigated Blocks simultaneously	1																														1					
Days of each Rotation, days	3																														3					
Headwork Discharge, cum/s	1.80																														1.80					
Rotated Irrigation Module, l/s/ha	1.17																														1.17					

Suksena Area, 5,529ha

No. of Rotation Blocks	3						Canal Close for Maintenance																								3							
No. of Irrigated Blocks simultaneously	1																														1					
Days of each Rotation, days	3																														3					
Headwork Discharge, cum/s	2.04																														2.20					
Rotated Irrigation Module, l/s/ha	1.11																														1.19					

Preventive Irrigation — Short Term Development

Conventional Irrigation

Shankarpur Area, 4,618ha

No. of Rotation Blocks	3						Canal Close for Maintenance																								3							
No. of Irrigated Blocks simultaneously	1																														1					
Days of each Rotation, days	3																														3					
Headwork Discharge, cum/s	2.80																														2.20					
Rotated Irrigation Module, l/s/ha	1.82																														1.43					

Suksena Area, 5,529ha

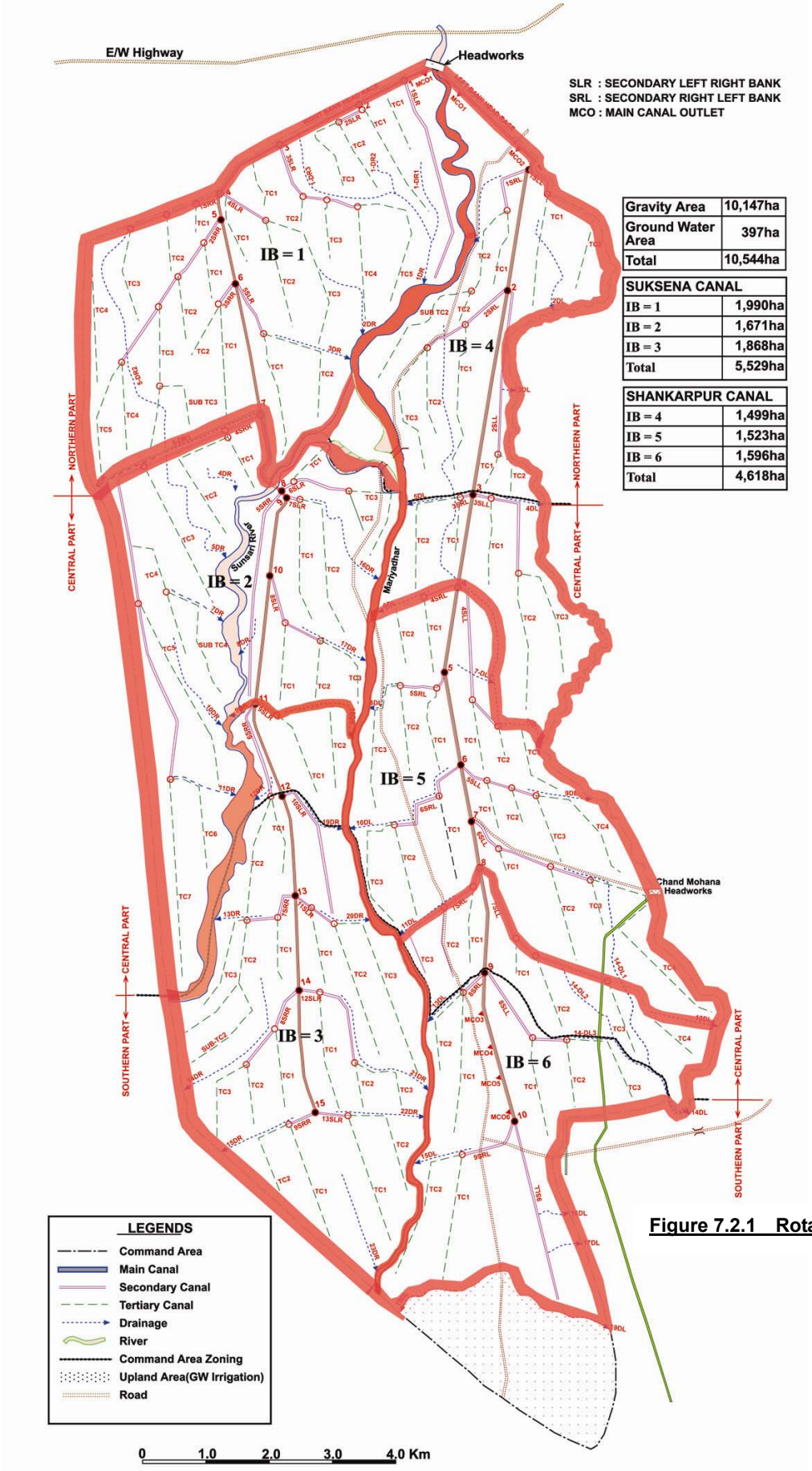
No. of Rotation Blocks	3						Canal Close for Maintenance																								3							
No. of Irrigated Blocks simultaneously	1																														1					
Days of each Rotation, days	3																														3					
Headwork Discharge, cum/s	3.00		3.14																												2.20					3.00
Rotated Irrigation Module, l/s/ha	1.63		1.70																												1.19					1.63

Conventional Irrigation — Mid/Long Term Development

	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L	F	M	L
	Jan.			Feb.			Mar.			Apr.			May			Jun.			Jul.			Aug.			Sep.			Oct.			Nov.			Dec.		

Area Ratio covered by each Irrigation

Rotation Rule	Rotation between main canals by year		Canal Close	Whole Irrigable area to be covered			Rotation between main Canals by year	
	Rotation among secondary canals			Rotation among secondary canals	Continuous Flow	Rotation among secondary canals	Rotation among secondary canals	



Gravity Area	10,147ha
Ground Water Area	397ha
Total	10,544ha

SUKSENA CANAL	
IB = 1	1,990ha
IB = 2	1,671ha
IB = 3	1,868ha
Total	5,529ha

SHANKARPUR CANAL	
IB = 4	1,499ha
IB = 5	1,523ha
IB = 6	1,596ha
Total	4,618ha

Figure 7.2.1 Rotation Block

7.3 Operation and Maintenance

In terms of operating and maintaining the Sunsari River Irrigation Project (SRIP), there are three options; namely, 1) stand-alone project operated and maintained by an independent project office, 2) stand-alone project but operated and maintained by Sunsari Division Office[6] (Sunsari District Irrigation Office as of October, 2002), and 3) as a part of SMIP irrigation system for which the O&M will be placed under the responsibility of SMIP office. Of them, the first option, stand-alone project with independent O&M office, may be out of consideration since DOI is now downsizing the whole administrative structure. Below is the discussion how the SRIP be operated and maintained in terms of administrative as well as staffing structure:

7.3.1 Administrative Responsibility

Chanda Mohana project, covering 1,800ha, is located within SMIP. However, the O&M is undertaken by Eastern Regional Irrigation Directorate (ERID) as the project construction was done under the responsibility of the Director of ERID. The O&M responsibility is supposed to go under the Sunsari Division Office but not under the SMIP, though yet to be finalized. This may reflect a decentralization policy of DOI. An example that a division office undertakes the responsibility of a large irrigation project is Kankai. Kankai irrigation project, covering about 10,000ha, once had the independent project office, but now is placed under the responsibility of Jhapa Division Office that is now merging with Ilam DIO.

In case that Chatra main canal could provide supplemental water to SRIP, the operation should have very established coordination with SMIP. In this sense, if the SRIP is placed under SMIP, the O&M may be well done. However, faced with the difficulty of receiving water from SMIP, O&M either under SMIP or as an independent system under Sunsari DO may have both merits and demerits. Table 7.3.1 shows the comparison between SRIP under Sunsari DO and SRIP under SMIP in terms of operation and maintenance.

The table shows that the O&M under SMIP may have advantages in terms of engineering, staffing and office setting up. On the other hand, O&M under Sunsari DO may have advantages from the viewpoint of decentralized responsibility, WUA's cohesiveness/solidarity, and future cost recover aspect. Especially taking into account the aspect of WUA and responsibility decentralization, if SRIP WUAs are merged into the many stratified SMIP WUAs, their functionality may not come up to the expected level.

Though WUAs in SRIP basically follows the structure of the SMIP, the major responsible level for the WUAs is one stratum down from the secondary (main in case of SRIP) to sub-secondary (secondary in case of SRIP). As well, farmers overall apex like WUCCC in SMIP is not foreseen in SRIP, but planned is a coordination committee having equal authority and power among all the concerned WUCs. To pursue the one-step down decentralized functionality with less pyramidical power structure, this Study proposes the SRIP should be operated and maintained by Sunsari Division Office in coordination with SMIP.

[6] Sunsari District Irrigation Office (DIO) is to merge with Morang DOI, and the office is to be at the present Sunsari DIO in Inaruwa according to the on-going restructuring plan.

Table 7.3.1 Comparison between under Sunsari DO and under SMIP

Particular	Sunsari Division Office	SMIP
Engineering	SRIP may need advices from SMIP to operate/maintain the headwork as well as carry out rotational irrigation.	SMIP has long been engaged in O&M of the Chatra intake as well as big canals, so that the experience would help to well manage the SRIP.
O & M Staffing	In case of smaller system, Government recurrent cost will usually increase as compared to bigger system.	As system becomes bigger, usually scale of economy works so that less number of staff engaged in O&M can be arranged, contributing to reducing the O&M cost.
O & M Office	The present Sunsari DIO is small, so that may need expansion, or otherwise headwork site operation office should be constructed enough to accommodate the additional staff.	The Inaruwa sub-divisional office can accommodate the additional staff with a little renovation.
Decentralization	SRIP is in principal hydraulically decentralized; so that administrative decentralization from SMIP can easily be set up.	SMIP is very big, covering about 68,000ha. In terms of manageability, the big system might still fall behind the expected level.
WUA	Primary responsibility is placed at secondary canal (defined as sub-secondary canal in SMIP) level covering 200 to 400 ha corresponding to Water Users Committee, smaller unit than SMIP arrangement. This would contribute to raising cohesiveness among the farmers and make easy to discharge collective task.	Primary responsibility is placed at secondary canal from the Chatra main canal, covering more than 10,000ha in cases, corresponding to WUCC. This arrangement raises difficulty for the farmers to be well consolidated and organized from the bottom to the apex of the WUCC.
Cost recovery on the government side	At present, the national treasury pays DOI staff salary. However, should the HMGN introduce full cost recovery system at each office, the division office needs incomes that come mostly from irrigation service fee (and amortization of initial investment though this is not yet practiced in Nepal[7]).	SMIP is a project office, so that ISF could be the income for the full cost recovery.

7.3.2 Staffing of Operation and Maintenance

To operate and maintain the SRIP, there should be engineers, overseers, institutional development officer, association organizer, administrative and assistant staff, etc. The staffing proposed here basically refers to the structure of the forthcoming division office but has new staff alignment that is not allocated under the present structure. New staff alignment is for: 1) institutional development officer, 2) association organizer (some project offices already have), 3) agriculture engineer, and 4) strengthening of accounting section.

WUAs foreseen in SRIP will have much greater role and responsibility than before. Therefore, an officer in charge of institutional development should be aligned, under whom association organizer and field surveyor (*Amin* in local language who knows cadastrals) are posted. An agriculture engineer together with junior technician is also proposed in order to increase the agriculture production as planned, and he is to work in collaboration with District

[7] In Philippines, the recurrent cost inclusive of staff salary of National Irrigation Administration (NIA), same as DOI in Nepal, comes from ISF in case of national irrigation project jointly managed by the NIA and WUA and from amortization in case of small scale irrigation project like FMIS. ISF supports the recurrent cost of the O&M project staff, and amortization supports the recurrent cost of provincial offices. Offices regardless of being project or provincial are supposed to be cost center that has to be financially variable and sustainable.

Agriculture Development Office. Accounting section has to be strengthened from ordinary setting up because the section will have to deal with irrigation service fee billing, collection and its monitoring. Therefore an account officer, an assistant accountant and a computer operator are proposed in addition to the accountant usually posted.

The proposed organizational set-up is shown below. The staff, total 15, in the shaded zone serves not only for SRIP but also for whole divisional office. The right side, rectangulared by dotted line, is the staff exclusively devoted for SRIP operation and maintenance. There are total 22 staff including 14 gate keepers, and it consists of two sub-sections; namely, institutional section devoted for WUAs and technical section. The technical section has one engineer under whom there are four overseers composed of 2 civil, one mechanical and one electrical.

One civil overseer takes case of one of the main canals together with 7 gatekeepers (total 14 gate keepers in SRIP). Out of the total 14 gate keepers, 6 gate keepers are posted at the headwork site since there have to be 24 hours stand-by under 3-shift a day (2 gate keepers x 3 sifts a day). Along the main canal, this Study proposes minimum number of gate keepers; namely 4 each (about 5 km reach per gate keeper).

Figure 7.3.1 Proposed Organizational Structure at O&M Stage

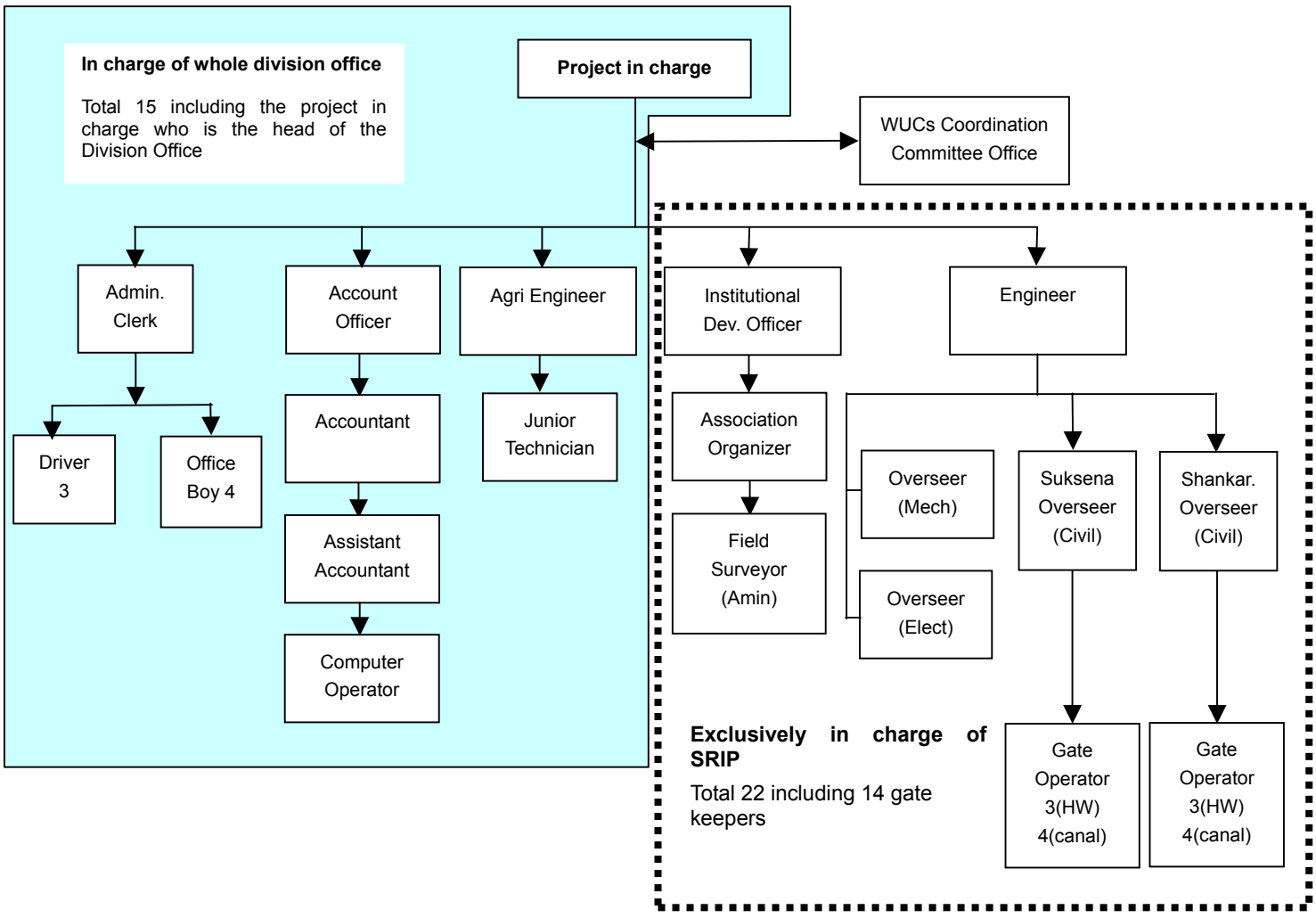


Table 7.3.2 SRIP Staffing at O&M Stage

S Nr	Description	Number	Excusively in charge of SRIP
1	Project in Charge: Senior Divisional Engineer (SDE)	1	
2	Engineer	1	○
3	Agriculture Engineer	1	
4	Institutional Development Officer	1	○
5	Account Officer	1	
6	Administrative Clerk	1	
7	Junior Technician (JT)	1	
8	Association Organizer (AO)	1	○
9	Field Surveyor	1	○
10	Overseer	4	○
11	Accountant	1	
12	Assistant Account	1	
13	Computer Operator	1	
14	Gate Operator	14	○
15	Driver	3	
16	Watchman/Officeboy	4	
Total		37	22

7.3.3 Maintenance Arrangement

Once large irrigation projects used to equip heavy equipment machines such as track, crane, loader, bulldozer, etc. for maintenance. However, most of those irrigation projects have faced difficulty to maintain the equipment due to not enough maintenance cost either from national coffer or from irrigation service fee. There are many cases that the equipment have deteriorated and became out-of-function even before the expected depreciation age. Two options can be found over the world if those equipment are well utilized; one is shared use among projects and the other is to rent out those equipment to local private civil contractors[8].

The re-structuring plan in Irrigation Sector of Nepal is to establish three mechanical divisions in such places; Jhumka of Sunsari District, Birganj and Nepalganj. The division at Jhumka will look after eastern region, and likewise Birganj looks after central & western regions and Nepalganji looks after mid & far western regions. Equipment and heavy machineries presently owned by project base will be collected to these 3 divisions and shared by concerned projects falling under their respective development region.

The plan to set up the mechanical division is following the first option mentioned above, and Jhumka is located only 10km north-eastward from Inaruwa. Therefore, the maintenance arrangement for SRIP is not to have own equipment but to ask the division at Jhumka to provide necessary equipment as need arises. The cost required to operate machines should always be born by the irrigation service fee (for detail cost recovery discussion, see the Chapter 9).

[8] The biggest irrigation system, UPRIIS, in the Philippine is now renting out heavy equipment, and the income consists of more than 30% of their total income (the rest mostly comes from ISF)

CHAPTER 8

INSTITUTIONAL DEVELOMENT

CHAPTER 8 INSTITUTIONAL DEVELOPMENT

The present Irrigation Regulation together with Irrigation Policy indicate that irrigation systems be operated in a manner more consistent with sustainability from technical, financial, institutional and environmental perspectives views and also envisage the reduction of the government's involvement in the construction, maintenance and operation of irrigation scheme by increasing the participation of organized users. The sustainability could be realized in such a way of managing the irrigation system with concerted efforts by both the parties: the DOI, irrigation water provider, and the farmers, the users.

The Water Act and Irrigation Regulation authorize the HMGN to delegate partial management of its national irrigation system to WUAs duly registered as legal entities. Unless WUAs were strong, it could become a shortfall to realize viable and sustainable management of the system, resolve conflicts and collect irrigation service fee from the WUAs' members.

8.1 Goal of the Institutional Development Component

The goal of the institutional development component or program of the proposed project is sustainable O&M of the system through the joint irrigation management of the DOI and the WUAs in the equitable, adequate and timely delivery and distribution of irrigation water to increase farmers' production, and thereby achieve higher levels of productivity per unit of land and water.

8.2 Objectives

Towards this goal, the specific objectives of the institutional development program of the project are as follows:

1. To organize and register WUAs for joint irrigation development in terms of planning and construction;
2. To organize functional Water Users Groups on the watercourses that will be federated at secondary canal levels as registered Water Users Committees for the effective water distribution and maintenance along these canals and ISF collection among the farmer members;
3. To organize Sub-Water Users Committees for the effective water distribution and maintenance along the tertiary canals;
4. To strengthen the capacity of the organized WUA: WUCs, SWUCs and WUGs in the management of the operation, maintenance and ISF collection at their respective levels;
5. To assist DOI through its Irrigation Management Division at the central level, IMD at the Directorate and Sunsari DIO in the recruitment, training and mobilization of WUA Development Officers (or AOs) in the organization, training and assistance for the WUA at different levels to perform their basic tasks;
6. To enhance the capacity of the Irrigation Management Division and Sunsari DIO to support the WUA in carrying out responsibilities for system's operation, maintenance, ISF collection and agricultural support tasks in line with joint management; and

7. To facilitate the joint irrigation management agreement between the DOI as supplier and the WUA as distributor of irrigation water.

8.3 Strategic Elements

In order to achieve the SRIP Institutional Development Program (IDP) objectives towards sustainable O&M of the system, the strategic elements include: 1) learning about the existing projects, 2) Coordinating socio and technical aspects, 3) setting up a federated organization of the autonomous WUCs, 4) setting up democratic as well as centralized internal structure, and 5) improving ISF Collection. The first four elements are discussed below, and the "ISF collection improvement" is discussed in "Chapter 9 Cost Recovery and Financial Management".

8.3.1 Lessons from Existing Project

Two lines of institutional development have been reviewed in this Study. One line is being applied in the IDA/World Bank-supported SMIP. The other line started with the USAID-financed Irrigation Management Project (IMP) where Kankai Irrigation System was one of the pilot areas and is being pursued further in the USAID/ADB-financed Irrigation Management Transfer Project (IMTP) where Chandra Canal Irrigation System is one of the 11 projects supported by the project. The former has been implemented from 1978 to 2003 and the latter from 1985 to 2002. A lot of lessons have been generated from the review of these two lines of institutional development implementation, and these lessons are to be incorporated in the SRIP as summarized below:

Table 8.3.1 Lessons learned from SMIP and Other Similar Projects

Lesson Learned	How it is to be incorporated in the SRIP
1. Collectivity of Farmer Beneficiaries In SMIP, it was the stage-wise approach and in Kankai it was a pilot approach. Both approaches have not achieved collectivity of the farmer beneficiaries in the systems. Instead, the approaches created divisions making it difficult for the systems' beneficiaries to work together to achieve the common purposes of irrigation; that is, equity, water adequacy and timeliness of water delivery to support production. In Chandra, institutional development has been addressed to the system as a whole. The results in terms of water distribution and ISF collection are far better than those of SMIP and Kankai.	Institutional development should be pursued from the point of view of the systems' beneficiaries as a whole with concrete guiding programs emanating from DOI. In SRIP, the approach to institutional development should be pursued relative to the system as a whole. The beneficiaries of the system should be organized also as a whole to deal with the total requirements of the system. The lessons of Chandra Canal Irrigation system should be followed in SRIP in terms of organizing all the beneficiaries of the system.
2. Structure of WUA The organizational structures of Kankai and Chandra are basically the same as both systems followed the IMP/IMTP line of institutional development. The WUA structures in both systems reflect the effort to promote grass-roots democracy and to allow the WUA to penetrate to the lowest reaches of large irrigation systems. The structure is an overlay of different leaders at the levels of the main, branch and village canal committees. There is, indeed, too much democracy. The different leaders at all levels can easily fall into communication problems as a subordinate in one level is the leader in a higher level. Discipline is difficult to promote under this structure because the basic organizational principle; that is, unity of command is	The two kinds of WUA organizational structures in SMIP as well as in Kankai and Chandra are extremely opposite. One concentrates too much power on the leaders and the other promotes too much democracy. A middle ground WUA organizational structure that facilitates democracy and power concentration to discipline members on democratic agreements has to be designed and applied. The organizational structure that will be organized in SRIP will provide a mechanism where the practice of beneficiaries' participation or democracy in arriving at decisions for the WUA. However, this

violated. On the other hand, the organizational structure of the WUAs in SMIP is tall and highly centralized. As the leadership structure moves up, the leaders become unreachable by the farmers at the levels of the WUGs. There is too much concentration of power among the leaders and none is left among the farmers.	democracy has to be balanced with the beneficiaries' discipline in obeying or adhering to the decisions arrived by them in a democratic way.
3. Cost Sharing In both lines of institutional development, cost-sharing arrangement for rehabilitation has become the precondition for transfer or joint system management. As there are funding constraints in rehabilitation just like in Kankai, and then transfer or joint management can no longer be pursued. Reversing this procedure, to transfer or joint management first before rehabilitation will produce a demand-driven rehabilitation by the farmers as opposed to the current rehabilitation-then-transfer modality.	The transfer before project design and construction in SRIP will be initially facilitated by the pre-construction agreement between the DOI and the WUCs. This agreement will make clear to all parties to be involved as to what are expected of the farmers in the construction of the project in terms of watercourse development, contribution of upfront cash, land or labor. This contribution is expected to move towards joint irrigation management between DOI and the WUCs after project completion.
4. Empowering People Institutional development means empowering people for irrigation. It does not, therefore, mean helping WUAs organize and afterwards not allowing them to do what they are supposed to do. As SMIP is doing water distribution and maintenance of the secondary and tertiary canals through its sub-divisional office and collecting ISF for the WUCC through the AOs, the true intent of joint management as provided for in the "handing over agreement" has not really been materialized.	In SRIP, the joint irrigation management between the Supplier and the Distributors will be spelled out according to the proposed arrangement of roles. It will be an arrangement that connects supply and payment as well as the connection of the receipt of the farmers of the water received and their payment of ISF. In SRIP, a true empowerment of people in irrigation will be pursued.
5. System as Self-supporting Account As evident in SMIP, the Government has been trapped in the subsidy-ISF remittance cycle. The subsidy is high because the DOI office does O&M up and down the system, leaving the WUA without their contract stipulated water distribution function, but only to collect water charges. Worse, even in ISF collection, it is the project-paid AOs who do the collection under a 50:50 ISF sharing arrangement just like in SMIP. But on the whole, the ISF remitted to the Government is very low in comparison with the subsidy. It is only a matter of time that the Government will recognize its self-defeating position and will eventually decide to end the vicious cycle of dependency.	In SRIP, the objective of ISF collection improvement is to get out of the cycle. Specifically, it will address O&M costs relative to two governing systems: the Supplier and the Distributor. Initially, the realistic total requirements to do the Supplier's job will be 100 percent subsidized plus costs requirements for institutionalizing the joint irrigation system management strategy for both the Supplier and Distributor. If the work is set up and done well during the project implementation process, then no more subsidy is required from the Government because all the total O&M costs for both the Supplier and the Distributor in effectively managing their respective parts of the system will be sourced 100% from ISF. These O&M costs will establish the true basis of the ISF rate per hectare per season.
6. Role of AOs The role of the AOs as organizers in SMIP are a little bit downplayed and their role in ISF collection for the WUCCs is overemphasized.	In SRIP, the role of the AOs will be that of WUA Development Officers (WUADOs) both form the organizing for participation during construction to the activation for joint management after construction. In the truest sense, the WUADOs will be trained to be development officers and they will be expected to perform as such until such time that the WUCs are able to perform what they are supposed to do under the joint irrigation system management.
7. Consistency of Approach In SMIP, there are variable approaches to the organization of the WUA in the different stages of the project.	In SRIP, the approach will be unified throughout the whole area of SRIP.

8.3.2 Socio-Technical Coordination

The design and construction/rehabilitation of irrigation projects intended for joint irrigation management require a close coordination between the Project Management Office, responsible for design and construction, and the WUA. This coordination is necessary because the distribution canal networks and the watercourses which are intended to be the areas of the WUA under a joint management in the future are not yet in place.

The coordination will ensure active participation of the farmers in the irrigation development stage of the future WUA areas. As the watercourses are not yet constructed, the WUA has to be established as an ad-hoc but registered one. The WUA needs to promote the generation of farmers' cash and labor contribution to the construction of the project. Furthermore, the socio-technical coordination will ensure farmers' participation in the planning and construction of the irrigation facilities and structures of the WUA area in the future.

The results of IIWI studies[1] on irrigation management transfer (WUA area intended for joint irrigation management with DOI) have pointed out lessons for development agencies. One of these states that: "Rehabilitation is often done just before the turnover of management. Where this is implemented without meaningful participation and investment by the farmers, it can reinforce the perception among farmers that the irrigation system belongs to the Government. By contrast, having farmers take the lead in setting priorities for construction, while investing a significant amount of their own labor and materials, can be an effective means of changing farmer perceptions about who is and who will be primarily responsible for the system after turnover."

In this context, socio-technical coordination means that the technical design and construction plans of the canals for rehabilitation or improvement prepared by the Project are understood, and accepted by the farmers. That is to say the social aspects are coordinated with the technical aspects. This is to be operationalized as follows:

- The Project consults the farmers about the plans for canal alignment and structures' locations in the secondary and tertiary canals, and if re-location needed, this will be reflected, wherever possible and practical, in the final design,
- Farmers propose their priorities and plans on the watercourses,
- The Project Management Office reviews the farmers' proposals,
- Both parties, the Project Management Office and the farmers (through their WUA), agree in a meeting on the design and construction plans for the secondary canal networks and watercourses and formalize these agreements in a Memorandum of Agreement specifying the farmers' contribution. This project is proposing 100 percent farmers' contribution on the development of the 20-hectare watercourses and to a certain extent, say 10 – 25 %, in the construction costs of the tertiary canals, and

[1] Vermillion, D. L., and C. Garcés-Restrepo. "Results of management turnover in two irrigation districts in Colombia". IIMI, 1996; WimH. Kloezen, Carlos Garcés-Restrepo And SamH. Johnson III. "Impact Assessment of Irrigation Management Transfer in the Alto Rio Lerma Irrigation District, Mexico". IIMI, 1997; and Sam H. Johnson III. "Irrigation Management Transfer in Mexico: A Strategy to Achieve Irrigation District Sustainability". IIMI, 1997

- Farmers, through their WUA, will be mobilized for construction with the guidance from the Project Management Office.

When this socio-technical coordination process will be done and the construction will be completed, the maintenance has already been transferred to the farmers of the watercourses and tertiary canals through the WUGs and the SWUCs. Considering that the canals belong to the farmers, the WUGS and the SWUCs will readily assume the subsequent routine maintenance and canal protection in the future for sustainable operation.

8.3.3 Federated Organization of the Autonomous WUCs

In this Study, hydraulically decentralized WUAs is proposed in conformity with any head gate or check regulator that controls the flow into their irrigation area. This is so made by establishing a WUA consistent with each head gate or check regulating gate of secondary canal. The WUAs is stratified, starting in all the cases with on-farm water users group, called WUG, whose irrigation area is commanded by a watercourse. After firming up WUGs along a secondary canal, a responsible organization for the canal will be established as the Water Users Committee (WUC) or upon combining neighboring tertiary level groups.

Referring to the canal network, there will be a total of 44 WUCs; 18 for Suksena area and 26 for Shankarpur area (see Table 8.3.2). The area coverage by a WUC ranges from 115 to 402 ha with an average of 231 ha. Number of WUGs per WUC ranges from as small as 6 to 20 with an average of 12. As all WUCs are to have joint management contract with the DOI project office, the head gate will be the responsible demarcation between the project and the WUCs; namely, above which the DOI project office will be the responsible and below which the WUCs will be the responsible for operation and maintenance. All the gates/turn-outs attached to the canals under the DOI's responsibility will be operated and maintained by the DOI project office.

The structure of WUC is stratified beginning with the WUG as its foundation. The stratum of the organizational structure should be limited as small number of layer as possible. Only two layers are preferable from the management point of view; consisting of the apex of the WUC and its constituents which are the WUGs. The former is responsible for the overall management of the secondary canal and the latter is responsible for their respective watercourse (on-farm) level management.

Table 8.3.2 Proposed Setting-up of Water Users Committee

Canal	WUC	Area, ha	Direct TO	Sub-WUC	WUG	Membership
Shankarpur Main	1SRL+MCO1&2	278.0	2	3	14	278
	1SLL	211.7		2	11	212
	2SRL	314.3		3	16	314
	2SLL	131.3		2	7	131
	3SRL	162.5		2	8	163
	3SLL	401.5		3	20	402
	4SRL	150.1		2	8	150
	4SLL	248.2		3	12	248
	5SRL	245.2		3	12	245
	6SRL	277.4		3	14	277
	5SLL	241.8		4	12	242
	6SLL	359.8		4	18	360
	7SRL	162.3		3	8	162
	7SLL	383.1		4	19	383
	8SRL+MCO3-6	233.4	4	2	12	233
	8SLL	332.8		3	17	333
	9SRL	232.5		2	12	233
	9SLL	252.1		0	13	252
Sub-total	**18**	**4,618.0**		**48**	**231**	**4,618**
Min		**131.3**		**0**	**7**	**131**
Max		**401.5**		**4**	**20**	**402**
Average		**256.6**		**3**	**13**	**257**
Suksena Main	1SLR+MCO1	183.1	1	1	9	183
	2SLR	167.7		3	8	168
	3SLR	353.3		5	18	353
	1SRR	292.5		4	15	293
	4SLR	274.2		3	14	274
	2SRR	388.3		5	19	388
	3SRR	126.8		2	6	127
	5SLR	204.1		2	10	204
4SRR	TC1&TC2	139.6		2	7	140
	TC3	210.5		0	11	211
	TC4	190.0	as required	1	10	190
	TC5	267.3		0	13	267
	TC6&TC7	243.2		0	12	243
Suksena Main	5SRR	115.3		0	6	115
	6SLR	136.8		3	7	137
	7SLR	199.5		2	10	200
	8SLR	168.4		3	8	168
	6SRR	174.7		2	9	175
	9SLR	172.0		2	9	172
	10SLR	134.9		0	7	135
	7SRR	256.1		3	13	256
	11SLR	281.4		3	14	281
	8SRR	211.1		3	11	211
	12SLR	199.1		3	10	199
	9SRR	217.7		2	11	218
	13SLR	221.4		2	11	221
Sub-total	**26**	**5,529.0**	**-**	**56**	**276**	**5,529**
Min		**115.3**		**0**	**6**	**115**
Max		**388.3**		**5**	**19**	**388**
Average		**212.7**		**2**	**11**	**213**
Whole SRIP	**44**	**10,147**	**-**	**104**	**507**	**10,147**
Min		**115**		**0**	**6**	**115**
Max		**402**		**5**	**20**	**402**
Average		**231**		**2**	**12**	**231**

Note: Taking into account cases having plural plots, expected membership was estimated on basis of average 1ha land per farmer though statistical average is 1.24ha.

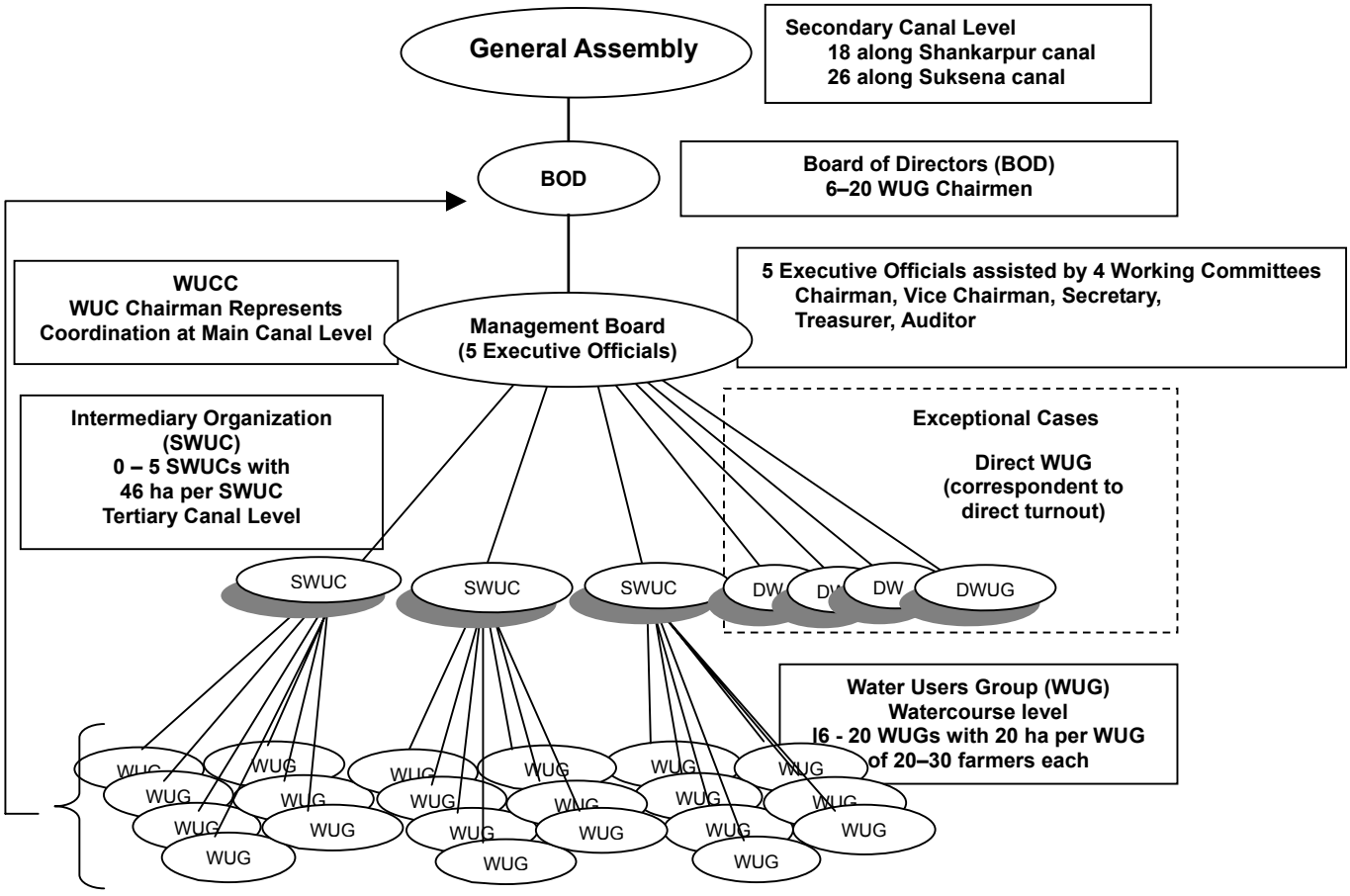
However, since there is a tertiary level canal between the secondary and the watercourses in most cases, an intermediary organization responsible for the tertiary area has to be incorporated in between the WUC's apex and the WUGs. The intermediary organization is

called Sub-WUC, responsible for the tertiary command area. The stratum is thus three and the role for the Sub-WUC will be very much dependent on the concerned farmers' inter-relationship.

One may remember the size of a village, which is usually composed of 50 to 80 households, and the villagers have in most cases kinship relationship. This implies that if the command area of a tertiary canal is mostly occupied by only one village's concerned farmers, the tertiary could be well managed by the villagers without having the smallest unit of WUG. In this case, the tertiary level Sub-WUC will be the foundation of the organization and WUG will become just a constituent. Though the Sub-WUC area, correspondent to tertiary canal area, is three to several fold bigger than the area of a WUG, the kinship relationship would facilitate them to discharge required collective work.

Apart from the case above, ordinary arrangement for the Sub-WUC should be limited to a minimal level from the overall organizational management point of view (see Figure 8.3.1). Though WUC and WUG management officers are usually composed of: 1) chairperson, 2) vice chairperson, 3) secretary, 4) treasurer, and 5) auditor, the intermediary organization shall not be necessarily composed of the full managerial positions. This is because that the Sub-WUC should be primarily responsible for: 1) the coordination of water distribution among the WUGs along the tertiary, and 2) maintenance and protection of the irrigation facilities under the tertiary.

Figure 8.3.1 Organizational Structure of a WUC in SRIP



No responsibility of collecting ISF is given to the intermediary organization since three strata's channel, composed of WUG, Sub-WUC and then WUC, on the course of collecting ISF will become bureaucratic. This bureaucracy would defer timely ISF payment to the DOI project office and in the worst cases might result in a delivery loss. Sub-WUC will, in terms of monetary, undertake only the monitoring of the ISF payment from WUGs to the WUC (this discussion applies to ordinary case but not to the Sub-WUC composed of kinship villagers).

The Sub-WUC will, except for the kinship villagers case, be furnished only with; 1) chairperson, 2) vice chairperson and 3) secretary. The chairperson will be responsible for overall coordination among the WUGs under him/her, the vice chairperson being responsible for equitable service delivery; viz, equitable water delivery among all the turnouts, and the secretary will be responsible for all the records keeping and monitoring of the ISF payment from the member WUGs to the WUC.

8.3.4 Democratic and Centralized Internal Setting Up

In carving the internal structure of an organization, authoritative rights in three dimensions, i.e., 1) plan formulation, 2) decision-making and 3) implementation must be definitely prescribed whenever the organization has a sizable membership. Given a water users' association for instance, a committee consisting of elected or arbitrary joined members such as water management committee should be responsible for the planning. Then, the general assembly or the board of directors exercises the decision making to the plan proposed. Under the board of directors, a management board comprising of the chairperson of the WUC, a vice chairperson, a secretary, a treasurer and an auditor is established to implement the proposed plan according to the decision made by the general assembly or the board of directors (see Figure 8.3.2).

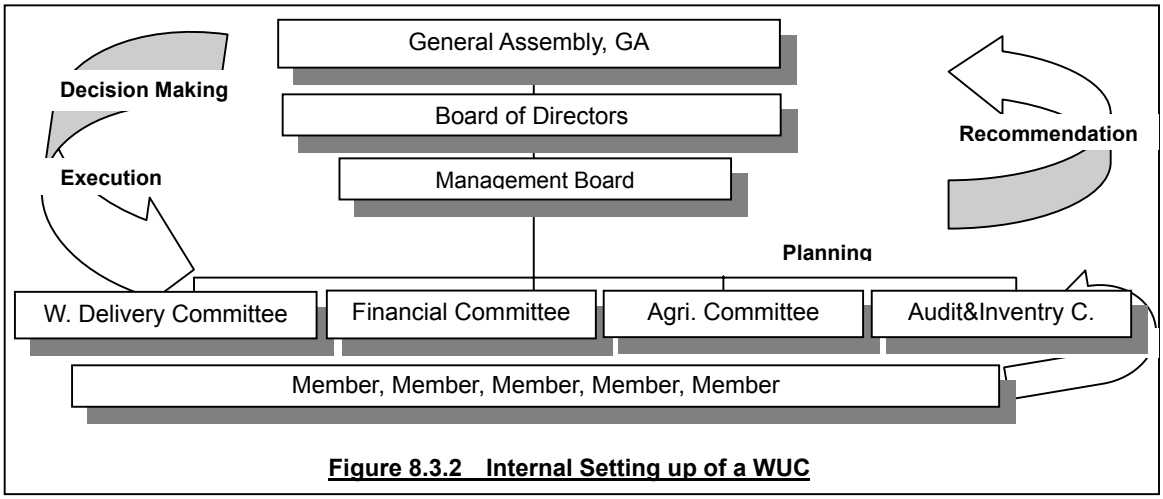


Figure 8.3.2 Internal Setting up of a WUC

To set up the Board of Directors (BOD) of a WUC (sometimes called management committee), all the WUGs' chairmen should represent since WUGs are the most fundamental organization. This arrangement enables all the concerned WUGs to convey its problem/opinion to the WUC's apex easily. Thus, the BOD is to be composed of all the WUGs' chairmen. In some cases, there are only several members of WUGs under a WUC. In this case, not only chairperson of the WUG but also vice-chairperson and if needed

secretary should also consist of the BOD to let the BOD members around 20 taking into account the burden they are to undertake.

General assembly (GA), proposed here, is a general assembly of representatives. This does not mean that only the chairmen of WUGs decide the most important issues such as policies, strategies, etc.. Since it is not practical to convene all the members amounting to more than hundreds, the general assembly convenes only the WUGs' chairmen by whom the issues are conveyed to all the members of his/her WUG. Then, actual general assembly takes place at every WUG level at different places and different times or otherwise simultaneously. Once after the issue is agreed among WUG members, the WUG's decision is conveyed by the WUG chairman and then consolidated by all the WUGs' chairmen in the general assembly of the representatives.

WUC should have standing committees that will be in charge of planning and recommending the plan to the BOD. Standing committees will serve the WUC as a think-tank wherein plans such as training, cropping pattern, water delivery, ISF collection, etc. are formulated according to the committees' mandate. The WUCs will be furnished with four committees as: 1) Water Delivery Committee, 2) Finance Committee, 3) Agriculture Committee, and 4) Audit and Inventory Committee.

Water delivery Committee will be headed by the WUC's Vice President, Finance Committee by the WUC's Treasurer, Agriculture Committee by the WUC's secretary, and Audit and Inventory Committee by the WUC's Auditor. All the board members, except the WUC president and the officers mentioned above, will serve one of the committees as the member according to their preferences.

Plan is formulated in a committee above and recommended to the BOD. BOD is the decision making body, and if a plan requires referendum, general assembly of representatives (WUG chairmen) is convened. The plan goes down to all the members via WUG chairmen and again is backed to the general assembly wherein final decision is made. Management officers of WUC, composed of 1) chairperson, 2) vice chairperson, 3) secretary, 4) treasurer and 5) auditor are in charge of executing the plan according to the decision made and have to take responsibility of day-to-day management.

Decision-making by either BOD or GA is dependent on the issues, as specified in their By-laws, to what extent it affects the WUC. Planning, decision-making and implementation are on a consistent line; namely, the persons who plan and make decision are the implementers as well. The principal to support this WUC structure, especially for the arrangement of BOD, GA and WUC management, centers on a concept of Democratic Centralization.

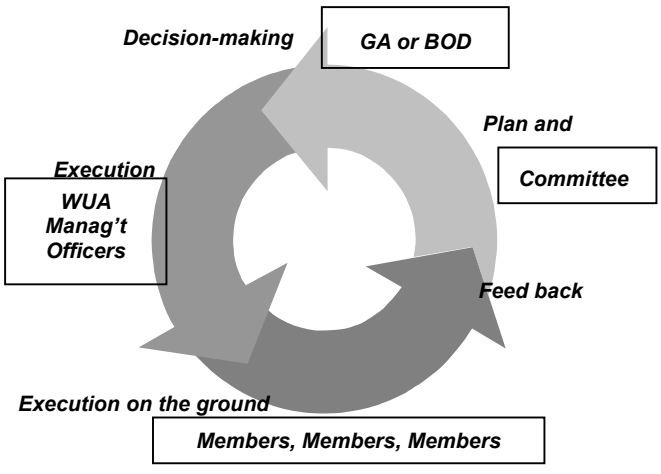


Figure 8.3.3 Planning, Decision-making, and Execution

8.4 Gender and Irrigation

In terms of any decision-making, for example, what to grow and/or where to sell and how to use the profit are mostly managed by male. This tendency is remarkable in relatively big landholder class. Women in lower class are less educated, but they have more big voice since they are earning money through farm labor, which the work is quite same or sometime heavier than male. This kind of cultural change observed among women in relatively lower class implies that the change in culture is possible depending on the social circumstances. Since low status of women is still remarkable in the Study Area, gender issue should be considered from the level of WID which more focuses on empowerment of women.

Present irrigation policy states that 20% of the WUA members should be women. One idea is to encourage women to participate in WUAs as following this policy and to gather them as a women's group as a sub-group of WUA, which could be called WWUG (Women in Water Users' Group). The member of the group decide the theme to work for such as joint sale of surplus of kitchen garden products, establishment of micro-credit program, hold literacy lessons, etc. depending on their needs. The fund for activity could come from a part of water fee, which the rate will be decided among WUG members. The leader of the women's group will be also a member of WUG itself and plays a role to connect WWUG with WUG.

The purpose of establishing this structure is to give opportunity to women to participate in communal work, starting from theme, which they have interests. It is expected that women may have confident to achieve their purpose by themselves. Once they achieve certain result, it is expected that male may gradually understand certain status of women. After experiencing this process, WWUG may be combined with WUG in future to contribute to strengthen WUG, which has a function of agriculture cooperative. Moreover, WWUG could be used for selection of participants of agriculture extension activities, since it is biased in terms of gender at this moment.

In conclusion, even if the policy of encouraging participation of women is kept, it cannot be effective in real meanings and just end up as symbolic practice without understanding the philosophy of the executing agency that claim this policy. If the Government tries to entitle women by way of giving opportunity to establish WWUG, the Government staff themselves should understand the significance and its importance beforehand.

8.5 IDP Components

8.5.1 WUC Organizing Process

The process of organizing the WUCs in the SRIP area encompasses three interlinked phases:

First: the Pre-Organization Phase deals with the commissioning and internal preparations of the Project PMO and the forging of understanding on the project development framework, methods and expected results among the relevant levels of the DOI organization together with the Project Consultant. On the side of the farmers, the organization of ad-hoc WUCs will be carried out at the start of the detailed engineering stage in order to forge a project agreement with the DOI/PMO where

farmers' role and contribution are made specific relevant to the project.

Second: the WUCs' Organization and Development Proper Phase covers the bottom-up participatory approach in the WUC organizing process and the conduct of various facilitating training packages.

Third: the Post-WUC/WUCC Organization and Development Phase facilitates, among others, the reorganization of the WUCs according to hydraulic boundaries and the firming up of the joint irrigation system management agreement of each WUC with Sunsari Division Office.

1) Pre-WUC Organization Phase

Here, two activities need to be carried out: the project orientation seminar and the training of the WUA Development Officers (WUADOs) or AOs. For a pioneering project to prosper on the ground, the Project should facilitate the conduct of the project orientation seminar among selected DOI officials, PMO management officers, and among the representatives of 44 ad-hoc WUCs together with the key officials of Sunsari District and the project area VDCs. This seminar will be a venue for participants to discuss, agree and commit on the Project's IDP, objectives, methods, resources required and anticipated results of the Project.

Immediately after a common understanding has been forged within the orientation seminar, the WUADOs of the Project will have to be trained as WUC organizers to facilitate the joint project development and irrigation system management. The key personnel from IMD must also be involved in this training to give inputs to the participants on the basis of their advanced experiences in IMTP and other AMIS institutional development work. The organizers training program will equip the WUADOs with the basic knowledge of their role, and the needed skills for them to carry out their duties in the organization and post-organization phases.

2) WUCs' Organization and Development Proper

This phase makes use of bottom-up participatory organizing and training approaches mainly facilitated by the trained WUADOs. Immediately after their training as WUC organizers, they will be deployed to their assigned areas according to the sequence of the infrastructure development of the Project in both Suksena and Shankarpur canals and according to the yearly phased-program of institutional development in the area. As designed, there are 237 WUGs in the Suksena area and 277 WUGs in Shankarpur area. To facilitate the organization of 514 WUGs, about 22 WUADOs are required within the project implementation period. After all the WUGs are organized and the WUCs are established, the number of WUADOs will be reduced to 15; 6 in Suksena and 9 in Shankarpur.

The WUADOs integrate with the farming households and their families through house-to-house visits, get to know their concrete problems and aspirations for their resolutions, discuss the WUC organization, solicit their willingness to join the organization of the WUGs, and maintains field notes and diaries of their daily activities in the watercourses' areas. They then firm up the list of farming households in said WUGs' areas, identify from

the list names of five to eight household heads, and invite them to become members of the WUG organizing core group.

Afterwards, they arrange for the first meeting of the core group to deepen their understanding of the irrigation situation and the WUG/WUC organization option, help them on the basics of planning the WUG organization meeting, and plan with them the pre-, during-, and post-requirement of the organizational meeting. Once one WUG is organized, each WUADO will move on to the next until he/she completes all the WUG organization assignment. The WUG organization work of the WUADOs will be closely monitored by their Supervisors, who will conduct weekly supervisory meeting to review their activities and plan further under the guidance of the Consultant.

After all the WUGs have been organized, all the elected Chairmen of the WUGs will be convened to act as Ad Hoc Council Potential Leaders (ACPL) for the future WUCs. The ACPLs have to be mobilized for collective work to maximize their individual contributions through committee work and expedite needed preparations for the organization of the WUC. Once all the preliminary Constitution of the WUC has been drafted, the ACPLs will conduct a series of consultative meetings with the WUGs and farmers to review with them the draft Constitution, hear and incorporate their suggestions, and solicit their general agreement to the revised WUC constitution.

After the completion of all WUGs' consultation meetings, the ACPLs are convened once more to review all the suggestions and comments of the farmers, finalize the Constitution and plan for its ratification by the all WUG members. With ratified Constitution of the WUC, the Council members prepare for the organization of the WUC through their attendance to the WUC Leadership Installation Conference/Seminar. This seminar will facilitate the participants' election of the WUC leaders, and the organization of the required standing or special committees. It aims to equip the leaders with knowledge on WUC leadership, develop their attitudes and organizational skills, and for a functional and viable O&M organization to assume O&M responsibilities (water distribution, ISF collection, maintenance and facilities protection) under the WUC's command area.

With the assistance of the WUADOs, the WUC leaders will pursue for the registration of the WUC at the District Irrigation Office of Sunsari to obtain its legal and business status. All the registration requirements will have to be prepared and submitted to appropriate agencies with the assistance of the WUADOs. This needs to be done to enable the WUC to enter into a joint irrigation system management agreement with the DOI and legally qualify it to negotiate for a loan or assistance from any lending institution.

3) Post WUC Organization and Development

When the WUC is registered and has completed the required training programs, it is said to be ready to start establishing relations with other organizations. This condition will give them the initial readiness and confidence to propose O&M, and negotiate a joint irrigation system management agreement with the DOI. When this becomes possible, then the management will have taken the pioneering step in the implementation of the Project's joint irrigation system management under the arrangement of a Supplier-Distributor relationship.

The joint irrigation system management agreement will revise existing formats and procedures of the concerned DIO office as the scope of responsibilities of the WUC is to be substantially scaled up. Thus, the process of joint irrigation system management agreement drafting, negotiations and subsequent signing will have to be undertaken by both parties. The ISF sharing scheme will have to be arranged and agreed as required under the Supplier-Distributor institutional arrangement.

To establish uniformity in the area in terms of relations with the concerned DOI irrigation office (Supplier) with the WUCs as Distributors, the WUCC has to be organized and made functional. This is essential because both parties will discuss and negotiate on the terms of the Agreement. All the operational details of the headworks and the main canal vis-à-vis the scheduling of water deliveries and other plans have to be discussed by both parties to the level of mutual understanding, acceptance and agreement.

8.5.2 Training Programs/Workshops (DOI, WUC Officers, Farmers)

The training programs, workshops and consultation meetings are essentially woven into the total process of implementing the Join Irrigation System Management strategy. These are basically of two sets of training inputs timed according to the need within the implementation process. One set is for the agency and the other set for the WUC and farmers.

The 1st set is directed at the various levels of DOI: the central and field-level IMDs, the Regional Directorate, the DIO, the irrigation system operators as well as the O&M personnel for them to understand and support the work called for under joint irrigation system management. The training programs for the concerned DIO personnel and the PMO include: 1) WUA Development Officers (AOs) training program, 2) Trainers Training for Farmers' Training Programmes, 3) Training of the DIO personnel and the PMO on Participatory Design and Construction of the secondary and tertiary canals, and 4) Socio-Technical Coordination Training among the design and construction staff of the DIO personnel, and the PMO, and the WUADOs. The second set of Training Programs for the WUCs mainly consists of: 1) WUC Establishment and Leadership Installation Seminar, 2) System O&M Management Training, and 3) Financial Management Training.

All these training programs, workshops, conferences and meetings, which are essential parts of the joint irrigation system management strategy are to be carried out to achieve the following objectives: 1) To enable the DIO management and the PMO to support the organization and development of WUCs as the institutional medium for joint irrigation management; 2) To facilitate the WUA Development Officers in acquiring the required knowledge and skills for organizing the WUCs, and conducting the training programs for the farmers; 3) To ensure that the leaders and members of the organized WUCs will acquire the skills to manage, maintain, and operate secondary and tertiary canals and watercourses under the WUCs' management responsibility including a simple recording of their O&M financial transactions; and 4) To facilitate the organization of the WUCC for coordination purposes between the WUCs and the concerned DOI office.

CHAPTER 9

COST RECOVERY AND FINANCIAL MANAGEMENT

CHAPTER 9 COST RECOVERY AND FINANCIAL MANAGEMENT

9.1 Principle of Cost Recovery for Sustainable O&M

Very often said not only in Nepal but also in any other courtiers is that most irrigation systems fall behind the expected performance level in term of almost every aspects such as water distribution, operation and maintenance, cost recovery, irrigated agriculture production, etc. Among them, sustainable O & M may be the issue any funding agency or donor countries are the most concerned.

Without sustainable O & M, periodical monetary input has to be made under the name of rehabilitation work. However, that kind of rehabilitation is not an actual rehabilitation by definition, rather just a liquidation of debt that has been accumulated during the many days the organization in charge of O & M, whether the government or the WUAs, have passed over.

The government is withdrawing from the heavy task of directly operating and maintaining irrigation systems since the government can no longer bear heavy financial burden required for the O & M. The government is reducing the workforce; one example is putting Jhapa and Ilam DIOs together with Kankai irrigation office. Officers who are to come to Kankai irrigation office have to look after not only Kankai but also irrigation activities of the two districts.

Faced with the situation above, how could sustainable O & M be realized? The answer is no longer at the government side simply because the government can no longer keep on giving heavy subsidy for the O & M. Two answers, then, come into sight; 1) involve the farmers in the O & M resulting in a joint management, and 2) establish cost recovery mechanism. The former would reduce the government burden in term of O & M. The latter should be much focused because the water is now an economy good, thereby requiring any irrigation system of being financially sustainable.

Cost recovery has not yet been achieved even at a minimal level in Nepal. There is an Asian country, where irrigation service fee is the principal revenue for the irrigation agency not only for carrying out O & M but also for running the agency itself. This means even recurrent cost including the staff salaries should come from the irrigation service fee that the farmers pay. Though the actual situation is not so easy as planned, the principal has to be well taken into account in irrigation development projects.

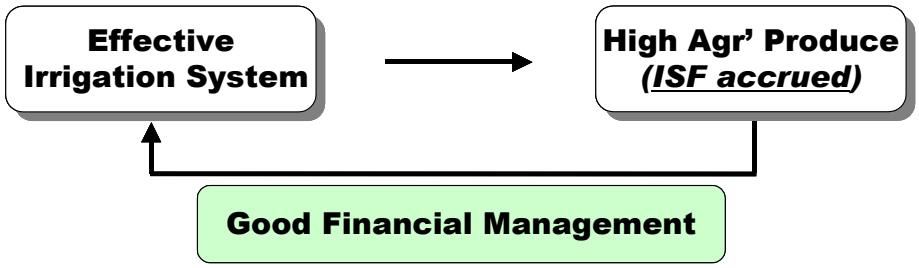
Against a suggested 700 Rs/ha for O & M in a cost recovery study[1] under NISP, the present level is just 100 Rs/ha in SMIP (total 200 Rs but half retained by the WUAs) and the collection efficiency is below 20 %. The money to operate and maintain the irrigation system is on the ground and not in the government coffer. The money required for sustainable O & M is in the farmers' pockets. With increased agriculture production by irrigation, the farmers' income will increase. A part of the incremental benefit will be the source of operating and maintaining the irrigation system. Financial sustainability based on

[1] "Nepal Irrigation Sector Project Irrigation Operation and Maintenance Cost and Water Charge Recovery Study Phase II: Main Report"

full cost recovery mechanism should be pursued, that is the foundation to realize the sustainable operation and maintenance.

Flow of financial resource will be created within the irrigation system. The project will provide effective irrigation system leading to higher agricultural produce, in which the source of fund for O & M, namely Irrigation Service Fee (ISF), accrues. Institutional set up will mobilize the flow of finance and to make the system really operational, a good financial management should be incorporated in the institution taking account the following aspects.

- Consider the system as a service industry: Water as commodity, Self-supporting account
- Pursue fairness: Fare share of cost and water according to circumstances
- Transparency: Government must be accountable to WUC and WUC must be accountable to farmer members under joint system management



9.2 Irrigation Service Fee (ISF)

The Irrigation Policy revised in 1997 provides in the clause 2.6.7, that the service charge rate can be different by the project and fixing the irrigation service charge should take into account the geographical setting, water resources, type of irrigation, and repair & maintenance as the base. Necessary rate of ISF for SRIP following the Irrigation Policy is, therefore, to be estimated independently from other existing irrigation systems.

9.2.1 Necessary O&M Cost of the Irrigation System

In principle as a self-supporting account, all the O & M cost of the irrigation system ought to be covered by the Irrigation Service Fee (ISF), so that the system can be financially viable. The O & M cost should include salaries of the government staff, honorarium for committee members of the Water Users' Committee, and fund for replacement, as well as the physical operation and maintenance expense.

It is estimated for the Sunsari River Irrigation System that the total annual O & M cost will be 10.1 million Rs or 998 Rs/ha. The breakdown of the O&M expenses is shown Table 9.2.1. The amount in the bracket on the table shows the cost in case that desilting and grass cutting of the canals under WUC jurisdiction are carried out by labor contribution. In such case, the total annual O&M cost expended in cash will become 8.4 miilon Rs or 826 Rs/ha.

ISF rate should be set enough to cover the estimated cost, though this required O & M cost per ha counts four times of the present ISF rate of 200 Rs/ha/year in SMIP or even higher than

the rate of 700 Rs/ha/year recommended for SMIP in the Nepal Irrigation Sector Project Cost Recovery Study in 2001. Feasibility or practicality of the principle to cover all the O & M cost by ISF collection will be discussed hereafter.

Table 9.2.1 Proposed O&M Expenses of Sunsari River Irrigation System

Party	Item	Annual O&M cost (Rs)		Share (%)	
		Total	per ha	in. labor	ex. labor
Government	Government administration reccurent cost	2,857,000	282	28	34
	Replacement cost	1,181,000	116	12	14
	Desilting at main canal	411,000	41	4	5
	Other maintenance at main canal	610,000	60	6	7
	Sub-total (1)	***5,059,000***	***499***	***50***	***60***
WUC	Commnad area structures under WUC jurisdiction	2,467,000	243	24	
	(Excluding labor)	(727,000)	(72)		9
	WUC administration recurrent cost	2,592,000	255	26	31
	Sub-total (2)	***5,059,000***	***499***	***50***	
	(Excluding labor)	***(3,319,000)***	***(327)***		***40***
Total	***Grand Total***	***10,118,000***	***998***	***100***	
	(Excluding labor)	(8,378,000)	(826)		100

Irrigable area: 10,147 ha、 Main canal length: 35,700 m

(Cost estimate)

Government administration reccurent cost:	Salary of 37 staff (1 senior eng., 4 eng., 8 junior eng. Class, 14 gateoperator, 10 others, sararies of some staff are allocated among concerning irrigation systems.)
Replacement cost:	3 4WD(456thou.Rs/yr), 4motorbike(128thou.Rs/yr), 10bicycle (13thou.Rs/yr), Gate(HW、MC head gate、SC head gate: 584thou.Rs/yr)
Desilting at main canal:	Desilting 8,800 m^3/yr(canal length 5.5km×H8m×D1m×1／5yrs; assumed that the canal is silited up in 5 years.)
Other maintenance at main canal:	Grass cutting(43.2km/yr: 100thou.Rs/yr), Concrete lining(70m/yr repair(0.2% of total length): 240thou.Rs/yr), Embankment of main canal(eqivalent to new const. of 120m/yr: 175thou.Rs/yr), Road maintenance(equivalent to new const. of 120m/yr: 95thou.Rs/yr)
Command area structures under WUC jurisdiction:	Structures under SC(727thou.Rs/yr), Desilting(123thou.Rs/yr(30% of main canal)), Grass cutting(53.2km of SC:124thou.Rs/yr, 172.4km of TC:241thou.Rs/yr)、Other maintenance of SC(equivalent to new const. of 180m(0.3% of total length:191thou.Rs/yr), Other maintenance of TC (equivalent to nnew const. of 580m(0.3% of total length): 311thou.Rs/yr)、Maintenance of watercourse(20ha/WC:750thou.Rs/yr)
WUC administration recurrent cost:	5.9千Rs/WUC×44WUC(1 bookkeeper employment, honorarium, stationary, transport cost etc.)

9.2.2 Proposed ISF Rate by Crop Season

To set ISF rate of the irrigation system as a service industry, there arises another principal, namely payment according to the service rendered. The O & M cost must be covered by the ISF collection and at the same time ISF must be charged for the service rendered. This Study proposes the distribution of surface water into 100 % of the irrigable area in monsoon season and only 50% of the irrigable area in winter season due to the water availability in Sunsari River. Therefore, it is proposed to set the ISF rate by crop season and those who do not receive irrigation water during winter season do not have to pay ISF.

Setting ISF rate according to crop is also another aspect to consider. This Study, however, proposes to apply for same ISF rate to different crops in the same crop season. One reason for it is to make the system as simple as possible so that the system can be more operational.

Another reason is that the significance of irrigation water will be equal to each crop, though the water requirement of crops is different from each other. In monsoon season, it is planned that the summer vegetables should start planting in early time like April to avoid the damage from heavy rainfall in July and August. Although vegetables require less water than paddy, farmers wishing to crop summer vegetables need to rely on more irrigation water than rainfall since there is little rainfall in April.

As estimated, the necessary cost for proper O & M of the irrigation system is around 1,000 Rs/ha. As it will be proposed hereafter, the regulation of exemption in ISF payment in case of crop damage will be introduced in the ISF collection system. Assuming that 10% of exemption would take place during a year, the necessary cost will become 1,100Rs/ha. Then it has to be considered that only a half of the irrigable area is serviced and charged for ISF payment during winter season.

Because effectiveness of the irrigation is much more visible during winter season due to the meager rain, farmers would pay ISF more willingly in winter season than in monsoon season. The ISF rate is, therefore, proposed to set higher amount in winter season than in monsoon season, but lower than the cost of STW enough for farmers to willingly use the surface irrigation water. In conclusion, the proposed ISF rate is set to be 600 Rs/ha in monsoon season and 1,000 Rs/ha in winter season as shown Table 9.2.2.

The proposed rate is very high comparing with the current rate of SMIP (200 Rs/ha/year). In case the government administration recurrent cost will be supported by the central treasury as current condition, the necessary O & M cost of the irrigation system including 10% of exemption is estimated at 790 Rs/ha/year. In this case, ISF rates would be proposed at 430 Rs/ha in monsoon season and 720 Rs/ha in winter season.

Table 9.2.2 Proposed ISF Rate by Crop Season in SRIP

Crop Season	Monsoon	Winter	Remark
Irrigated area (ha)	10,147	5,074	Yearly rotation between Sukusena & Shankarpur
Cropping intensity (%)	100	50	Under irrigation by SRIP
ISF (Rs/ha)	**600**	**1,000**	1,100Rs/ha/yr on average
Exluding administration cost	**(430)**	**(720)**	790Rs/ha/yr on average

On the basis of proposed ISF, those who receive the surface irrigation water only in monsoon will pay 600 Rs/ha per year and those who receive the water both in monsoon and winter will have to pay 1,600 Rs/ha per year. Though it seems that the proposed ISF rates are very high, the relevance of the proposed rates shall be examined from the viewpoints of farmer's affordability and willingness.

9.2.3 Farmer's Affordability

As per comparison with the irrigation systems in the world, the present ISF rate in SMIP is very low. Figure 9.2.1 shows the comparisons of ISF rate to gross income converted into paddy yield in Japan, Philippines and Nepal. As the figure shows, the ISF rate to gross crop production in each country is 11 mon to 190 mon in Japan (per year), 2.5 mon to 110 mon in the Philippines (per crop) and 0.8 mon to 105 mon in Nepal (per annum). Hence the ratio of

ISF to the gross crop production in Japan, the Philippines and Nepal are calculated at 5.8 %, 2.3 % and 0.8 % respectively. It is confirmed, from the comparison, that the ISF rate in SMIP is much lower than the other countries.

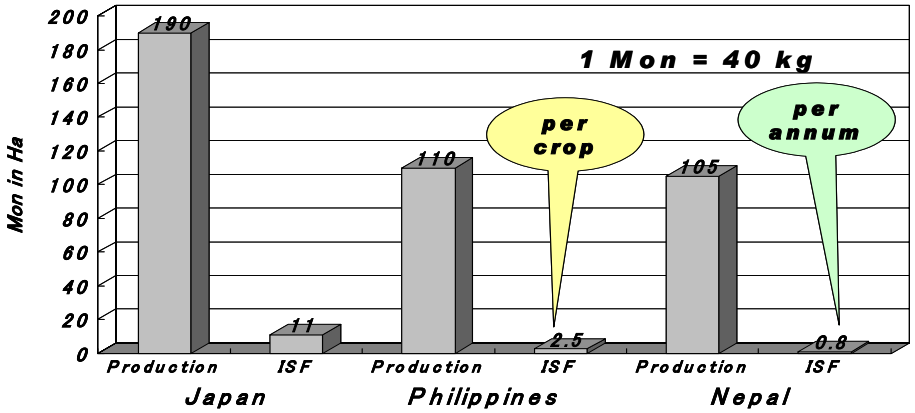


Figure 9.2.1 Crop Production and ISF Rate in Japan, Philippines and Nepal

Even to consider the proposed ISF rate of 600 Rs/ha (equivalent to 1.7 mon of paddy) in monsoon season and 1,000 Rs/ha (5.0 mon of cauliflower) in winter season, it is still as low as 1.6 % of gross yield of paddy in monsoon and 1.0 % of gross yield of cauliflower in winter season[2]. Therefore, it can be said, that the required ISF rate in this Study is still affordable for farmers.

The affordability of the farmer can be considered from the incremental income of the irrigation development project, as well. Logically thinking, the affordability of the farmers for ISF payment will be, at maximum, the amount of the incremental income with the project situation, although the incremental income will be distributed into reinvestment in economic activities, expenses for raising living standard, etc.

Incremental income of monsoon paddy and winter cauliflower by the project is estimated at 11,500 Rs/ha and 13,100 Rs/ha respectively. The share of the ISF rates in monsoon and winter seasons to the incremental income of the respective crops are, therefore, estimated at 5.2 % and 7.6 %. It is evaluated that these rates are low enough to confirm that the farmers are affordable to pay the required ISF rate. It is, therefore, considered that the required O & M cost is promisingly withdrawn from the incremental income by the project.

9.2.4 Farmer's Willingness

Though it is analyzed that the proposed ISF rates are affordable for farmers taking into account the world trend and the benefit of the project giving incremental income to the farmer beneficiaries, there are some aspects, which would discourage farmers to pay ISF. Although the rates are affordable for farmers, farmers may not be willing to pay such amount by several reasons.

Possible reasons for creating unwillingness of farmers are: 1) lack of assurance that the ISF

[2] Proposed yields of paddy and cauliflower in the Study area are 4.2t (105 mon) and 20t (500 mon) respectively.

collected is utilized in farmers' sole benefit, 2) norm that farmers are so poor that the government should give subsidy to them, 3) lack of justice, transparency and objectivity of ISF collection, 4) more reliable water supply by shallow tube well than surface irrigation water, and 5) farmers' feeling for fairness and equality in comparison to SMIP status.

The first three reasons would have to be handled with institutional aspects. However, the issue here in this chapter is not to discuss if farmers pay ISF or not, but how much farmer can avail for ISF payment in terms of their economic status. The above latter two reasons of unwillingness can be assessed by quantitative comparison. Therefore, here these two issues are particularly discussed to examine farmer's willingness to pay.

1) Farmer's Willingness Based on the Operation Cost of Shallow Tube Well

Application of shallow tube well (STW) to supplement required water for crop has been prevailing in the Study area. As the water resources assessment reveals, the groundwater in the Study area is abundant and it is considered that STW can provide more reliable, timely and controllable water compared to surface water irrigation, though the operation cost of the shallow tube well is certainly more expensive than that of surface water irrigation as it is estimated that the water price per cu.m is 0.56 to 0.80Rs for STW, 0.45 to 0.50Rs for deep tube well and 0.04Rs for surface irrigation water.

The Study team has conducted a questionnaire survey covering 78 farmers in the Study area about the operation cost of shallow tube well. The results of the survey are summarized in Table 9.2.3. Considering the fixed cost of pump set, which is 3 Rs/hr[3], it is estimated that the pumping cost on average by crop ranges from 1,280 Rs/ha/crop to 1,940 Rs/ha/crop. Weighed average pumping cost of the samples for winter crops is calculated at 1,640 Rs/ha. As for monsoon crop represented by paddy, provide that farmers irrigate paddy during monsoon season for only one time or half of volume of potato by STW, the pumping cost for it will be 640 Rs/ha.

Table 9.2.3 Average Pumping Cost of Shallow Tube well

Location	Wheat							Potato						
	Sample No.	Area Planted (katha)	Time Irrigated	Duration (hr/time)	Total Operation (hr/ha)	Volume of water(cm)	Fuel (Diesel) Cost(Rs/ha)	Sample No.	Area Planted (katha)	Time Irrigated	Duration (hr/time)	Total Operation (hr/ha)	Volume of water(cm)	Fuel (Diesel) Cost(Rs/ha)
Upstream	12	46	3	21	49	35	1,905	11	11	2	5	34	25	1,342
Midstream	23	98	3	51	50	36	1,804	18	16	2	8	37	27	1,350
Downstream	42	78	3	33	42	30	1,772	35	19	2	6	26	18	1,065
Total	77	79	3	37	46	33	1,802	64	17	2	7	30	22	1,193
Fixed Cost	3 Rs/hr x		46 hr/ha	=			138	3 Rs/hr x		30 hr/ha	=			90
Total Pumping Cost (Rs/ha)							**1,940**							**1,283**

Location	Vegetable(Cauliflower)							Vegetable(Cabbage)						
	Sample No.	Area Planted (katha)	Time Irrigated	Duration (hr/time)	Total Operation (hr/ha)	Volume of water(cm)	Fuel (Diesel) Cost(Rs/ha)	Sample No.	Area Planted (katha)	Time Irrigated	Duration (hr/time)	Total Operation (hr/ha)	Volume of water(cm)	Fuel (Diesel) Cost(Rs/ha)
Upstream	7	6	3	3	52	37	2,006	3	4	3	2	40	29	1,620
Midstream	13	8	3	4	45	33	1,655	2	6	2	3	33	24	1,170
Downstream	20	6	3	2	34	25	1,326	6	2	3	1	31	22	1,080
Total	40	7	3	3	44	30	1,558	11	3	3	1	38	24	1,244
Fixed Cost	3 Rs/hr x		44 hr/ha	=			132	3 Rs/hr x		38 hr/ha	=			114
Total Pumping Cost (Rs/ha)							**1,690**							**1,358**

Source: JICA Study Team

The proposed ISF rates for monsoon and winter seasons are, then, calculated at 94 % and 61 % of the pumping cost in each season. For monsoon paddy, though ISF rate does not make difference from using STW, the yield with project situation will be 180 % of the present

[3] Refer to Appendix-11

paddy yield (from 2.3t/ha at present to 4.2t/ha). If farmers fully irrigate paddy by STW to achieve as much as the target yield with this project, the pumping cost will be enormous. Farmers know and hardly practice it. Therefore, ISF rate of 600 Rs/ha in monsoon can still be competitive with STW.

For the winter crop, from the viewpoints of reliability and controllability, farmers may prefer to use STW even though the cost is higher than that of surface irrigation water. To attract farmers to apply for surface irrigation water, the proposed ISF has to be convincing farmers of the fact that the cost is worth paying, even considering the less reliability and controllability of the water than the STW water. The proposed ISF rate nearly halving the pumping cost of STW seems low enough to elicit farmer's willingness. This point is also examined from the following results of the field surveys

2) Bargaining Willingness

According to the results of the consultation meetings facilitated by the Study Team, most of the farmers are willing to pay ISF but reluctant to pay higher rate. Voices are raised as, the farmers think that the Government should provide the surface water free of charge and they also do not think that they should pay ISF more than the rate of SMIP, which is 200 Rs/ha/year. After all, farmers' willingness to pay ISF expressed during the consultation meetings ranged from 200 Rs/ha/year to 500 Rs/ha/year much lower than the proposed ISF rate.

But this announced willingness might not include the labor contribution to the desilting and grass cutting work for watercourse and tertiary canal since it is observed that labor contribution of farmers for canal maintenance has been practiced regardless of the ISF payment in SMIP and Chanda Mohana irrigation system. Farmers' perception might be only on cash payment.

Another findings, during a series of field interviews conducted by the Study Team, are the fact that there are some farmers who expressed their willingness up to 1,500 Rs/ha/year, though these farmers are considered to be advanced farmers frequently applying STW. It is conceivable that the farmers answering such high willingness would have compared to the cost of the shallow tube well in their mind.

Having observed that, some farmers may have the willingness to pay ISF close to the pumping cost of shallow tube well, although the farmers attended the consultation meetings were not with such enthusiasm. For the case of the consulting meetings, it might be considered that facing to the government staff (counterparts), the executive agency of the SMIP, the farmers, as a group having in mind the current ISF rate in SMIP, had got an opportunity of negotiation, namely they could start bargaining the rate to the government side with the rate in SMIP at bedrock price.

It is understandable that farmers' willingness can be inclined to the major state of their surroundings. It is, however, indicated from the survey that, if the surface irrigation water is reliably supplied close to the reliability of water from STW, farmers could be convinced to pay the necessary cost for the surface water distribution.

9.2.5 Evaluation of Proposed ISF Setting

Having discussed the relevance of the proposed ISF from the viewpoints of farmers' affordability and willingness, it can be said that the proposed ISF rates in monsoon and winter seasons are affordable for farmers, but rather debatable in terms of farmers' willingness. All the same, it is proved that the surface irrigation water is still advantageous to STW in terms of cost. It is, therefore, evaluated that the proposed ISF rates in both monsoon and winter seasons are relevant in operating and maintaining the Sunsari River Irrigation System.

The rates proposed may be ambitious referring to the current ISF collection efficiency on the ground. Taking into consideration the situation, it is proposed to apply for a temporary legislation prior to the enforcement of the proposed ISF, namely ISF would be partially collected like only for the cost of desilting of the main canal, adjusting to be the same ISF rate of current SMIP until the expected crop yields with project situation are realized. The duration of the legislation will be 5 years for monsoon crop (paddy) and 10 years for winter crop (vegetables).

It is also proposed that even after the enforcement of the proposed ISF rates, approval of exemption should be set according to the crop yield to secure the social justice. For example, if the yield of paddy is less than the current yield of 2.5 t/ha, 100% of the exemption will be approved and if the yield is 2.5t/ha to 3.5t/ha, 50% of ISF will be exempted and if the yield reaches more than 3.5t/ha, no exemption will be considered.

SMIP experience shows that salaries of association organizer (AO), who is hired by the SMIP project office and carrying out ISF collection, exceed the amount they collect as ISF throughout a year. If the salaries of AO are not provided by the project office, the task of ISF collection stops and the farmers' contribution to the O&M will be none. It comes, therefore, into a need to establish functional ISF collection system for better ISF collection performance.

9.2.6 ISF Sharing

Irrigation Policy in the clause 2.6.3 provides that under joint management, from the amount collected as service charge, concerned Water Users` Association can keep their share and the remaining balance amount shall be deposited in the government's revenue account. Also the policy stipulates, in index-3, the sharing ratio between the government and Water Users' Association according to the arrangement of joint management system.

In case of SRIP, the sharing ratio between the government and Water Users' Association guided by the policy will be 25 % and 75 % respectively[4]. It seems, however, from the estimation, that the O&M cost demarcated to the government side along the policy may not be able to cover all the cost by the ISF share. That may lead to the situation that the government may have to disburse some subsidy to cover the O&M cost of their responsibility.

Therefore, this Study would like to propose that the ISF share between the government and

[4] Applied Index-3 of Irrigation Policy in case the management for all canals below the main course is taken by WUA and the rest by HMGN.

WUC in SRIP is estimated in proportion to its managerial responsibilities enough to cover the necessary O&M cost for both parties (Figure 9.2.2). From this approach of defining ISF rate and the share between the government and WUC, the cost recovery will be attained as far as ISF is collected properly from the farmer members of the WUC. As the result of the O & M cost estimation for both the government and WUC shown above Table 9.1.1, it is proposed that ISF sharing ratio between the government and WUC is 50% and 50%. This sharing ratio will have to be stipulated when WUC enters into the contract of joint system management with the government.

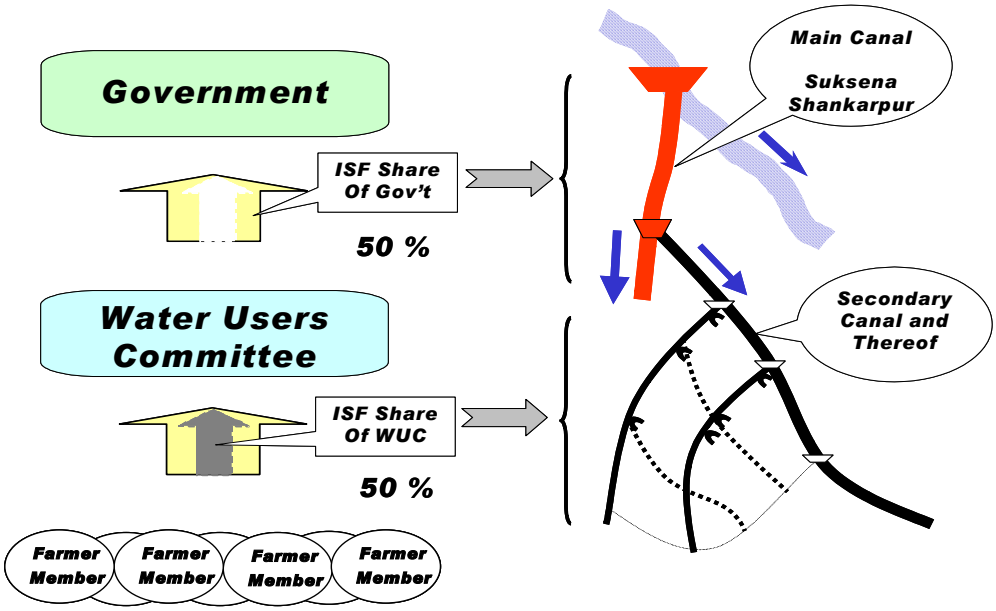


Figure 9.2.2 ISF Sharing and O & M Jurisdiction between Government and WUC

9.3 Basic Concept of Financial Management under JSM

Studies cited earlier compare ISF collection against the O&M costs' subsidy. Very seldom is the emphasis made on ISF collection against the actual irrigated areas for both monsoon and winter seasons. Against the O&M costs' subsidy, the ISF collection recovery in various AMIS ranges from 0.1% to 15% with an overall recovery of 1.3%. Other studies point out that the cost recovery is only 2 % of the total O&M costs. The O&M of the AMIS is, therefore, highly subsidized by the Government.

The rates of ISF vary from place to place. In SMIP, the rate of ISF is 200 Rs per ha per year, 68 Rs per ha per crop in Kankai and 40 Rs per bigha per crop in Chandra canal. As it has been mentioned, the ISF rates are very low compared to those in other Asian countries. Even with these low ISF rates, the collection efficiency ranges from nothing in Kankai for the last three seasons because of problems of low water availability, 14 % in SMIP and 20 % in Chandra canal for the year 2000/01. There are plenty of problems ranging from the overall ISF collection mechanism, institutional arrangement, variable ISF rates collected either per year per ha or per bigha/ha per season to the unappreciated conditions of service, if there is any, from the concerned DOI office; there is no water when the farmers need it and it comes

when it is not needed.

The proposals for ISF improvement in SRIP will address the above-cited problems. As shown in Figure 9.3.1, the Government has been trapped in the subsidy-ISF remittance cycle. The subsidy is high because the DOI office does O&M up and down the system, leaving the WUC without their contract stipulated water distribution function, but only to collect water charges. Worse, even in ISF collection, it is the project-paid AOs who do the collection under a 50:50 ISF sharing arrangement just like in SMIP. In Chanda Canal irrigation systems, the WUA is responsible for the O & M of the secondary canals down and the ISF collected is higher at 25:75 ISF sharing scheme in favor of the WUA. But on the whole, the ISF remitted to the Government is very low in comparison with the subsidy. It is only a matter of time that the Government will recognize its self-defeating position and will eventually decide to end the vicious cycle of dependency.

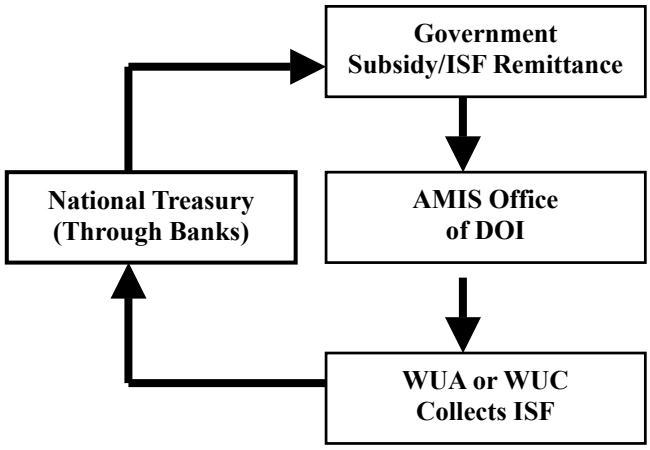


Figure 9.3.1 Flow of Subsidy and ISF Remittance

In SRIP, the objective of ISF collection improvement is to get out of the cycle. Specifically, it will address O & M costs relative to two governing systems: the Supplier and the Distributor. Initially, the realistic total requirements to do the Supplier's job will be 100 % subsidized plus costs requirements for institutionalizing the joint irrigation system management strategy for both the Supplier and Distributor. If the work is set up and done well during the project implementation process, then no more subsidy is required from the Government because all the total O & M costs for both the Supplier and the Distributor in effectively managing their respective parts of the system will be sourced 100% from ISF.

The farmers will be willing to pay ISF if they see the connection between water service and payment. This is only possible at the WUGs' level and, therefore, cannot be done by the bureaucracy. The ISF will answer 100 % of both O&M costs of the Supplier and Distributors. As already discussed, the rate will be established and collected per season as the irrigated and benefited areas per season vary. There is scarcity of water during the dry season and a lot of waterlogging during the rainy season. The farmers will pay on the actual benefit they get out of water minus the waterlogged areas. Again, this can only be monitored at the WUGs' level.

For the better performance of financial management of the irrigation system, importance of transparency has been pointed out in several studies such as National Irrigation Sector Project (NISP) Cost Recovery Study funded by the World Bank in 2001 and a Study[5] in Irrigation Management Project (IMP) in 1992. Particularly, the IMP study emphasizes the transparency of not the WUA but of the government for the better management. IMP study

[5] "Creating a Supportive Policy Environment for Irrigation System Turn Over and Joint Management" by David M. Freeman, A Study in Irrigation Management Project, 1992

states, "The government agents expect the farmers to keep their records and activities open for review, but they do not let farmers review government records and operations."

Here it is suggested that the government and the WUC should have better communication including the disclosure of the government's income and expenditure statement based on the ISF collection and the O&M of the irrigation system. Aside that, taking account of current low ISF collection efficiency of AMIS in Nepal, here in this chapter ISF collection system under joint system management will be proposed having a foundation of securing transparency of the system.

Fairness among the members of WUC as well as between the government and WUC will also be incorporated as a part of the transparent and effective financial management system. IMP study shows a lesson in Bangeri irrigation system saying, "These farmers are organized to control water in a way that serves productivity within their constraints and maintains a rough sense of social justice among the irrigators." Upon the lesson learned, the ISF collection system in this study also pursues some measures to accommodate social justice or fairness to circumstances.

9.4 Irrigation Service Fee Collection System

9.4.1 Present ISF Collection System in the Adjoining Irrigation Systems

As NISP study points out, ISF collection mechanism has some variations within the irrigation systems. Prior to describe the proposed ISF collection system, ISF collection mechanisms practiced on the ground in SMIP and Chanda Mohana Irrigation System are reviewed and some key items to discuss in establishing a functional ISF collection mechanism will be picked up.

1) WUCC in SMIP

In SMIP, WUCC is the apex of the ISF collection from the members and also WUCC opens their bank account and submit the government's share of ISF. WUCC is supposed to collect ISF from their members upon the transfer of the secondary canal concerned. However, it has been observed during the field survey that there are few WUCCs which collect ISF by themselves, but in general, association organizers (AO) hired temporarily by the executive agency has been collecting ISF from irrigation users.

The mechanism of ISF collection by AO is, 1) AO collects ISF from irrigation users, 2) AO deposits ISF collected to WUCC bank account every time after 10,000Rs is collected, 3) WUCC chairman gives AO a check to pay ISF share of the government, which is 50% in SMIP, and 4) AO bring the check to deposit ISF share of the government in the national bank account.

AO has also kept the individual record of ISF payment on his farmers list, but this list is not kept by WUCC. NISP study assesses the role of AO, as "The AO deployed from the projects neither possesses knowledge nor incentive and commitment for higher ISF collection. Because of the lack of authority with the WUCs and incentive and commitment with AOs, the efficiency of ISF collection has been affected adversely."

Here the key issue is who collects ISF in what sense. The practice in SMIP implies the question for it that as far as external body deals with the matter of money, sense of ownership to the irrigation system will not be perceived by the farmer members of WUC. Therefore, the mechanism should be built on the foundation that WUC themselves collects ISF for their own sake and so does the individual record keeping.

So many tiers of water users' association in SMIP from WUG to WUCCC has been pointed out to be an obstacle to high ISF collection efficiency in SMIP. Farmer member looks up to water users' group in water course level, water users' committee in sub-secondary level and water users' coordination committee (WUCC), which has the bank account where farmers' money is deposited.

Many tiers would limit the transparency and cause disconnection of information flow and also farmers become less acquainted with each other, which might ferment discontent to the management board. It is, therefore, proposed that the foundation should be fewer tiers to make the flow of money simpler. It is an understanding that more intervenient, less transparency. In line with this SMIP Stage III is studying to propose to step the apex of the financial autonomy down to sub-secondary level, namely WUC will open their ban account and manage ISF collection.

Project is creating dependency syndrome. Sometimes the project goes down to the watercourse level for O&M where canal is already transferred to the farmers. Even corruption by AO in collecting ISF is heard during the field survey. This information, at least, indicates that the credibility of ISF collection and its use has been ruined on the ground. Dual land ownership also spoils the ISF collection. In general large-scale landowners including absentee landowners are not paying ISF and the small-scale farmers are the one who pay ISF better. Non-existence of incentives and penalizing mechanism might hinder reversing the current situation.

2) Chanda Mohana WUA

Another example to extract lessons is Chanda Mohana Irrigation System just next to SRIP. The system has two features in its two main canals, namely the east and west canals. It has been observed that the performance of O&M for both main canals has difference. According to the field observation, the system is better managed in the east main canal system than the west main canal system. Illegal outlets are observed much more along the west main canal and its branch canals and the team also met more farmers who had not paid ISF and raised complaints on water allocation in the west main canal command area.

One reason for this could be borne to the designing for some extent. The length of idle canal in the west canal is so long that the first branch canal appears after 4.5 km long from the head intake of Bhudi River, giving some frustration to the farmers upstream who cannot legally divert the canal water onto their farmland. Inadequate number of outlets in the branch canals is also heard from the farmers, making a difficulty of not receiving timely and adequate water. Unwillingness of owners providing their land for facility construction during the implementation would have been an underlying cause of it.

From the east main canal system, we could see how farmers are managing the irrigation canal.

Farmers in upper part of the east canal has been paying ISF and showed their knowledge on the Water Users' Association as they know somehow where and how the money collected was kept and used. In their system, the chairman of each branch canal committee collects ISF, so the farmers even do not request the receipt. The current status in the WUA at the east canal is giving a possibility for practicing the concept of "collection by themselves for their sake". ISF collection efficiency was, however, as low as about 25% last winter crop season, according to the committee members of Chanda Mohana WUA.

Chanda Mohana irrigation system has just passed only for three crop seasons and it was the first time for them to collect ISF last winter. WUA is now planning to build a system of farmers to come to the office to pay ISF and if a farmer fails to show a receipt of ISF payment to the committee, water distribution into his farmland will be disconnected. This penalty is not for sure technically, but the WUA committee aims at creating social pressure to delinquent farmers by this way.

According to the field observation, the ISF collection efficiency seems getting lower as going down to the lower part of the main canal. Farmers in the tail end have not paid ISF yet, but told that they were going to discuss if they pay ISF. Even though they have not paid ISF in cash, they have done desilting work of the main canal as long as 1 km from the tail end to upward and grass cutting of more than 2 km[6]. This cooperative work can be counted as their ISF payment.

Each branch canal has formed their own rotational irrigation rule according to their circumstances and the rules are maintained by themselves, as it was observed that in a branch canal a few farmers in charge are patrolling by bicycle along the branch canal. Here we can quote a lesson that as long as within their permission, farmers' group should be able to form their own rules under their circumstances such as scarcity of water and form of ISF etc.

The virtue of relatively small-scale may as well work in the irrigation system of Chnada Mohana east main canal, whose command area covers 1,000 ha. Mutual arrangement among the farmer members has been taken place in the east main canal. For example, a branch canal committee agreed to close their head gate earlier than their given time against the rotation rule to divert more water into downstream reaches, because the command area of the branch canal was mainly occupied by sugarcane requiring less water than paddy fields.

In the midstream reaches of the east main canal, there found a farmer who provided his part of land for the canal construction and even remaining of his farmland is affected by the seepage of the canal. For this reason, he was exempted from ISF payment, though it is informal agreement. This arrangement will not destroy the fairness or social justice but create it. Exemption or any other regulations agreed among members can be a device for maintaining fairness of farmer members.

9.4.2 Basic Flow of Proposed ISF Collection System

NISP study summarizes the ISF collection system as "Appropriate incentives and penalties

[6] Total length of the east main canal is 7.5km and there are 6 check gates with 2 branch canals on both sides of their upstream reaches.

should be developed and transparency on resource use should be ensured. For this, action relating up-to-date record keeping, regular auditing, notifying people paying and not paying, and getting the statement of accounts approved by the general assembly are necessary." These summarized points and the lessons learned from the ground around the Study area will be incorporated in establishing the functional ISF collection system.

Under the joint system management, sharing of ISF collected between the government and WUC and ISF collection by WUC will be the basis of establishing the basic flow of ISF collection. Figure 9.4.1 below shows the basic-flow of the ISF collection under joint management. In this concept, WUC will bill and collect ISF from farmer members through the respective WUG. Record keeping of individual ISF payment performance, so called Irrigation Fee Register (IFR), will be kept and maintained by the WUC, as well. This IFR will be the basis of the financial management of WUC. The government, under the joint system management, only bills to WUC and collect its share of ISF from WUC.

As the Irrigation Policy clause 2.6.3 provides, it is proposed that WUG will be responsible to collect ISF from its members and WUC can appoint or employ person to support WUG for ISF collection upon agreement of the WUC by-law. Although for the SMIP, the executive agency contracts out AO personnel to collect ISF directly from farmers in most cases, for the genuine joint system management, WUC should take this responsibility.

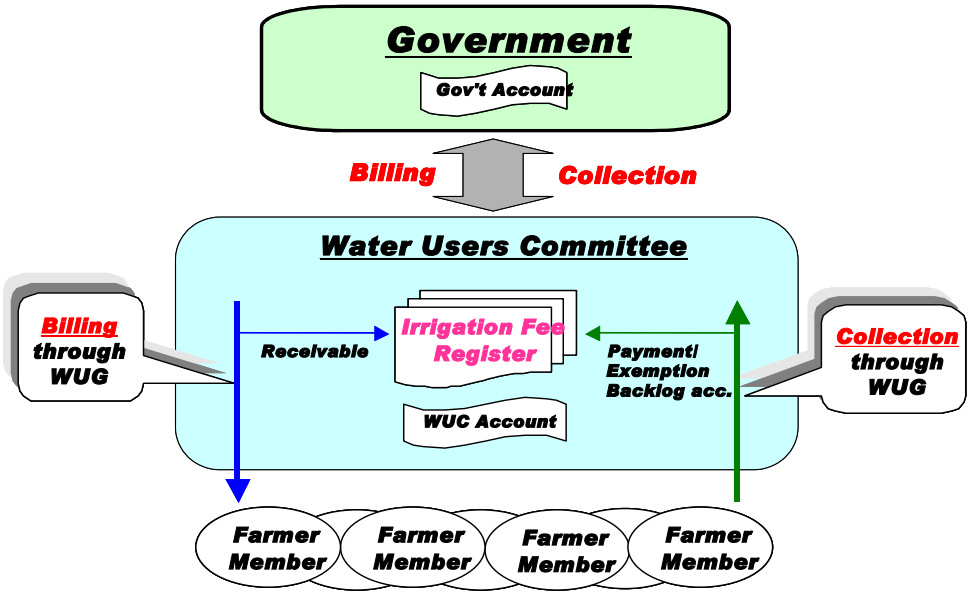


Figure 9.4.1 Basic Concept of ISF Collection System

9.4.3 Procedure of ISF Collection

In this section, the basic procedure of ISF collection mechanism according to the above basic flow is described. The procedure is classified in order of tasks such as 1) billing, 2) exemption, and 3) collection. For each task, the role of WUG and its farmer members, WUC, and the government will be defined.

1) Billing in every planting season prior to ISF collection

It has been found on the ground that, as NISP study reveals, "The officials deployed for collecting information on cropped area do not contact all the concerned farmers, which leads to taxing of fallow land and land swept away by the river, simply because such land is in the

record" and the same case is observed in SMIP area, as well. To countermeasure this discontents as one reason, it is proposed that the billing procedure shall be done by the WUG deputized personnel with farmer members in every planting season prior to ISF collection.

By assessing the planted or irrigated area in every planting season, acceptance of ISF payment by the farmer members would be affirmed. WUG chairman or personnel deputized by WUG committee goes to the fields concerned and notifies the members about the area receiving irrigation service. The area receiving the service must be agreed between the members and WUG personnel. It is the only way of assessing the irrigated area accurate to work with the farmer members who actually receive the irrigation water. After the agreement the bill of ISF rendered to the member according to the service area will be prepared and the information is sent to WUC. The bill on this season is recorded in the Individual Irrigation Fee Register by WUC.

2) Exemption

Although it seems that enforcement of exemption has not been in practice very much on the ground, this could be applied for securing the social justice and fairness within WUC. During the crop season, if the calamity causes the damage of the crop seemingly resulting in very low yield, the farmer member in question could have right to request exemption. As damage or low yield can come from various reasons, WUG and the farmer member upon request must agree to identify the damage caused of failure of irrigation service.

After agreement, WUG will send the request to WUC and WUC also recommends the exemption to the irrigation agency. The irrigation agency will approve the exemption. Or as long as WUC can have ability to pay the fixed share of the irrigation agency, WUC can manage within the committee to arrange the payment. In such case, this procedure of exemption could be undertaken as a mutual rule within WUC.

3) ISF Collection

As long as farmers have cash to pay, WUG can collect ISF at the same time of billing in every planting season. But the deadline of ISF payment should be set at the end of harvesting season, since farmers may think to pay ISF from the produce of the season. For those who did not pay ISF at a time of billing, WUG chairman or deputized ISF collector will visit farmer members to collect ISF in harvesting time, when farmers can mostly have money in his pocket.

WUG chairman or deputized collector gives receipt to farmer members upon their payment and submit to WUC treasurer and the treasure deposit the ISF collected in their bank account. After the deadline of the ISF payment, WUC will submit the share to the government. It has been an established custom that a minimum balance of 5,000 Rs is required to deposit an amount in the government revenue account. As NISP study indicates that there should be flexibility in limit of amount to be deposited. ISF collection left after the deadline is recorded as backlog account in IFR.

Mobility in collection is an aspect in formulating the collection procedure. In common practice like SMIP, ISF collector (AO in SMIP) is visiting door to door to collect ISF. There

will be another idea, as Chanda Mohana WUA, that farmer members go to certain place like WUC office to pay for ISF. It is a matter of once or twice per year for farmers and also visiting WUC office will facilitate the farmer members to know the status of WUC activity to date. Maybe collection should be done by both directions of door to door collection and farmer's to come to the office.

Method of combining ISF payment with land tax has been a recommended idea in the Nepal context[7]. VDC is in charge of collecting land tax and the tax delinquent is forbidden to sell their land, to borrow a loan and even to get any official certificate like a visa. With these rigorous regulations, the collection efficiency of land tax in the Study area is said to reach almost 100%. If the ISF payment combining with land tax is carried out, VDC will be the one to collect ISF and there is an expectation that ISF collection efficiency will rise in accordance with the land tax collection.

However, improvement of ISF collection efficiency may not be expected by the mean of combining ISF collection with land tax, because 1) Process of ISF collection by themselves will be the mean of empowering solidarity of the organization and WUC may be able to find a way of payment arrangement according to the circumstance of each member formalizing their own agreeable social justice, 2) The fact that VDC administrative boundary does not meet the boundary of WUC will hinder the transparent flow of money in and out within WUC or flow of money corresponding to the flow of water, and 3) the rate of land tax is much lower than the rate of ISF. The rate of land tax is only 5Rs per year for the land holding of less than 1ha and 6.8Rs per year for 1 to 2 ha. Adding ISF collection to land tax bring a big difference from the current tax payment. It might as well cause of arrears with land tax. Since this Study suggests that better institutional set up is the most effective way of increasing ISF collection efficiency, the combination of ISF and land tax collection is not recommended.

There will be three cases for ISF sharing. The first case is to divide the ISF collected according to the determined sharing ratio no matter how much collected. The second way is to submit fixed amount to the government no matter how much ISF is collected and the third case is to secure the WUC share at fixed amount and submit the remaining of ISF no matter how much collected. In the third case, the bill of delinquent will be sent to the government.

In the first case, the government and WUC will share the risk of deficit in O&M expenses. For the second case, if the ISF collection efficiency is low, the share retained to WUC will be less than they expect, namely the risk of arrears will be endured by WUC, but WUC has the right to collect and retain the arrears in their account. In the third case, ISF as receivable is transferred from WUC to the government and the government enforces to collect the arrears. The government could exercise the enforcement of regulations and sanctions in its legitimacy, more powerful than what WUC can do against delinquency. The government and WUC should agree on the issue of ISF sharing arrangement prior to enter the joint system management.

Considering the effective irrigation system, it is proposed that the government will take their

[7] Idea of collecting ISF with land tax is existent in Japan. Actually Land Improvement Act in Japan stipulates the tax office to collect ISF together with land tax. In such case, the tax office takes 4% of commission.

share in fixed amount determined prior to enter into the joint system management with the respective WUC. This arrangement could urge WUC to collect ISF as much as possible and also the subsidy from the government for the O&M expenses could be saved. WUC will keep the individual record (IFR) of payment and those who failed to pay ISF up to deadline will be asked continuously to pay their arrears. Figure 9.4.2 illustrates the ISF collection procedure.

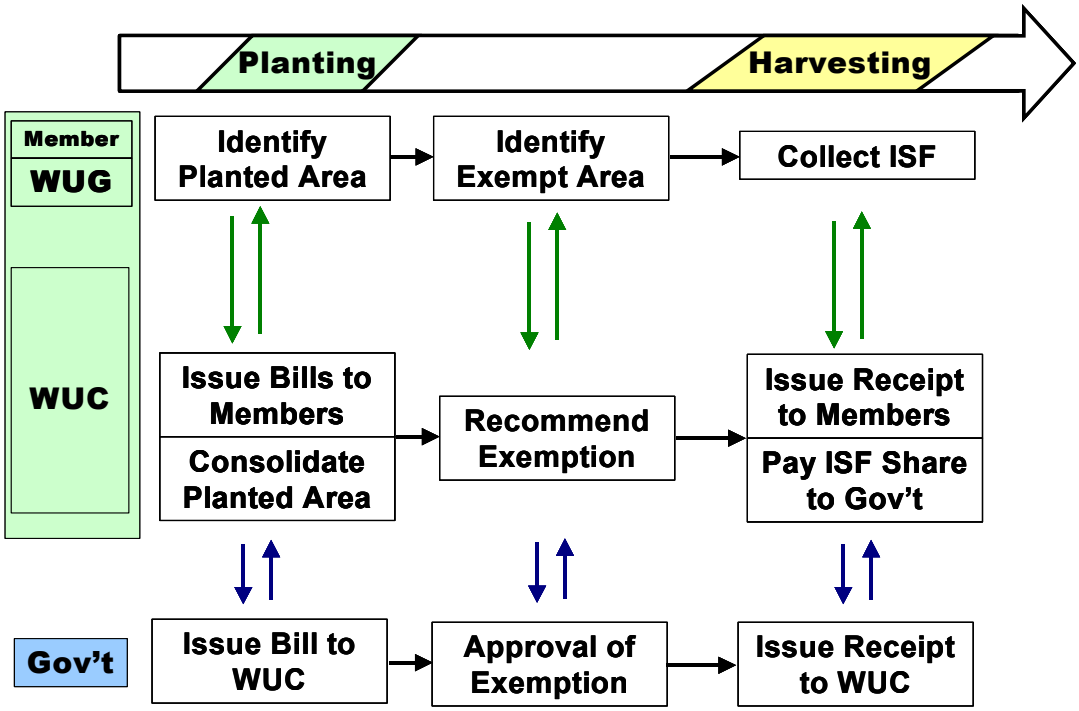


Figure 9.4.2 Basic Flow of ISF Collection

9.5 Record Keeping System of Water Users' Committee

9.5.1 Basis of Record Keeping

According to the Irrigation Policy clause 2.6.5, record keeping of the farmer members for ISF payment performance will be borne by the WUC. The government will have to assist WUC to practice such responsibility by providing a series of trainings and day to day supporting on the ground in the course of the irrigation practice.

NISP study says that the updated list of water users and the details of their irrigated land holdings are non-existent in almost all irrigation schemes. But there are such records in each irrigation system and the issue is the fact that the record is not well organized. This will create difficulties not only in ascertaining the real extent of the irrigated area in a particular season and annually, but also justifying the collection fairly done. To avoid the difficulties, it has been proposed above that individual record, so called Irrigation Fee Register, containing

of billing, payment, exemption and arrears will be kept and updated by WUC.

Proposed form of IFR is shown in Figure 9.5.1. IFR will be made of a hard paper durable enough to store for long years. On the top of the paper, individual profile of the water user is recorded and if any change of ownership or tenancy, the IFR will be closed and a new one for new registration will be prepared. Each one line is to enter a record of one crop season. Billing, payment and exemption done during the crop season will be recorded with the respective date. Accumulated backlog account as well as the balance of each crop season will be calculated on this IFR. Based on this IFR, WUC will demand the arrears to the delinquent farmer members.

Owner:	**K. Suresta**						**Tenant:**						
WUG:	**S-1**						**Plot No.**	**1234**					
WUC:	**Dewanganj-1**						**Area:**	**1.5 ha**					
Billing					**Payment**		**Exemption**		**Balance**	**Backlog Account**			
Crop Year	**Date**	**Area Irrigated (ha)**	**ISF rate (Rs/ha)**	**Bill (Rs)**	**Date**	**Amount (Rs)**	**Date**	**Amount (Rs)**	**(Rs)**	**Cumulated (Rs)**	**Date**	**Paid (Rs)**	**Total (Rs)**
2002 Summer	5-Jun	1.5	400	600	22-Sep	600			0	0			0
2003 Winter	25-Nov	0.7	400	280	10-Mar	200			80	80			80
2003 Summer	31-May	1.5	400	600	20-Sep		15-Jul	600	0	80			80
2004 Winter	1-Dec	0.9	400	360	25-Mar	300			60	140			140
2004 Summer	1-Jun	1.5	400	600	3-Oct	600			0	140	3-Oct	140	0

Figure 9.5.1 Sample Form of Irrigation Fee Register

9.5.2 Accounting of WUC Income and Expenditure

Apart from IFR, WUC, of course, must have their accounting system. It is just same as any business entity. Therefore, WUC will settle their account in every accounting period. WUC shall prepare their balance sheet at the period and prepare a statement of income and expenditure. Income of WUC will be ISF collected and sometimes may be membership fee and expenditure will be the desiliting cost, honorarium, wage for employment, fund for replacement etc. Backlog account of each member will be accounted as receivable on WUC's balance sheet and remain as asset of WUC. Income and expenditure statement and balance sheet will be the basis of decision making for WUC in running the irrigation system.

To operationalize the financial management, necessary documents should be prepared by WUC, such as bill, receipt, disbursement voucher, income and expenditure statement, balance sheet etc. These documents should be printed by WUC on their expenses with the assistance of the government. To deal with accounting, WUC may have to employ a bookkeeper. Disbursement voucher and other documents, which summarize the financial status of the WUC, must be certified by the signing of the WUC chairman. This practice will serve the securing of accountability of the WUC.

9.6 Regulations for ISF Collection

NISP study indicates the regulatory arrangement among existing water resources related laws and mostly the provisions made in the existing legal framework are not brought into practice. Here from the viewpoints of practicality, some regulation to consider will be proposed though they might not be clearly stipulated in the national regulations.

9.6.1 Exemption

As discussed above, it is recommended to apply for exemption in the irrigation system to those who suffer from calamity causing of lower yield of a certain level agreed among the WUC members. This exemption system can be enforced duly based on Irrigation Regulation, or WUC could apply for it within the organization as a mutual rule, in case of which, WUC should submit the share of ISF at fixed amount given prior to harvesting season to the irrigation agency. By this arrangement the government can fulfill their share, while WUC takes all the risks of crop damage. Arrangement should be discussed and agreed between the irrigation agency and WUC upon the joint management.

9.6.2 Incentives

Measure using incentives can be a way of contributing to high ISF collection efficiency if it is felt necessary. Incentives are given by WUC as its own budget in such ways as ISF collector can be given an incentive for their ISF collection task, and farmer members who pay ISF in early time or pre-payment can be given a discount of ISF due etc. To make it practical, incentives have to be counted as part of O&M cost to collect necessary amount to sustain the O&M activities. Also as long as the irrigation water delivery is effective, these incentives may not be needed in practice.

9.6.3 Penalty against Delinquency

According to the Irrigation Regulation, the government can stop the service to a farmer who does not pay ISF, but this is impractical since the parcel of a land belonging to the delinquent farmer cannot be isolated from the water delivery through the canals. Considering the practicality, the penalty for delinquent farmer is suggested as follows:

- If farmer fails to pay ISF before deadline, additional penalty can be charged to the one.
- Farmer cannot transfer their ownership of land without clearing their backlog account.

9.6.4 Discretion of WUC

1) Form of ISF

Form of ISF within WUC does not only have to be cash but also labor or kind as far as WUC submits ISF in cash to the government. For instance, WUG will have to maintain water courses. WUC can hire some laborers for desilting and grass cutting. But the members can also contribute their labor to the maintenance. In this case, the contribution of labor can be counted as a part of their ISF payment.

The clause 2.6.9 of the Irrigation Policy provides that while collecting irrigation service

charge, concerned water users` association may collect commodity, labor, cash or all of these from all the users` getting water; after calculating the amount needed to handle the responsibility for repair & maintenance, operation and management. ISF in kind may also work for collective marketing by WUC if they develop their organization toward multipurpose one.

2) Additional Levy

Irrigation Policy in the clause 2.6.8 as well provides that if the amount of ISF collected is insufficient for the O & M expenses of the canal system of WUA's share, the WAU may collect extra tax in accordance to the decision made by the association under the limitation of the principle of WUA. For this case still, the government's share of ISF should be fixed prior to the collection and the government firstly secure their share and with the remaining WUC will make decision whether they collect additional fee from members.

3) Business Management

If WUC is to engage in some activities apart from irrigation management such as collective marketing, micro-credit, etc., their accounting system will be much more complicated. For such reason, WUC may have to hire an accountant. Also to start with business operation, WUC should make regulations including the distribution of profit or deficit by the business into the members.

CHAPTER 10

THE PROJECTS AND THE IMPLEMENTATION ARRANGEMENT

CHAPTER 10 THE PROJECTS AND THE IMPLEMENTATIOPN ARRANGEMENT

10.1 The Proposed Projects

Referring to "THE DEVELOPMENT PLAN in Chapter 6", this Study proposes following project components as the Sunsari River Irrigation Project (SRIP) being the core.

Table 10.1.1 Proposed Project Component

Project Component	Major Items	Reference	Remarks
Main Component: Sunsari River Irrigation Project (SRIP)	Headworks constrcuction: 1 LS	Chap.6.5.8	Flood mitigation is included in the construction of Suksena and its secondary canals (Chap.6.9)
	Main canal: 35.8 km (inclusive of conveyance canal)	Chap.6.5.9-10	
	Secondary canal: 60.5 km	Chap.6.5.9-10	
	Tertiary canal: 172.4 km	Chap.6.5.9-10	
	On-farm development: 1 LS	Chap.6.5.9-10	
	Drainage structure: 1LS	Chap.6.7.1	
	Consultancy services, Administration, Others		
Supporting Infrastructure	Access road: 11.8 km (5.0km: Dewanganj – Ghuski, 1.3km: Harinagara – Basantapur, and 5.5km: Ghuski – Basantapur)	Chap.6.8.1	To western side
	Collection point: 1 place	Chap.6.10.2	For vegetable promotion
Agriculture Supporting	Extention program for vegetable production	Chap.6.10.1	
	Promotion program for vegetable marketing	Chap.6.10.3	
Environmental Mitigation	Inland fisheries promotion (compensation for fishmen)	Chap.12.2.3	Detail is discussed in Chapter 12.
	Environmental monitoring/auditing	Chap.12.3	
Drainage re-use	Old Sunsari river development for drainage re-use	Chap.6.7.2	Mid-term development
Groundwter Development	Shallow tubewell development	Chap.6.6	Upland area 397ha

Table 10.1.2 Dimensions of Main Component (SRIP)

1) Head Works/Intake

-Type of Headworks	Barrage type	fully movable type using gates
-Catchment Area	300 (km^2)	
-Design High Flood Discharge	650 (m^3/s)	
-Width of Headworks	72 (m)	
-No. of Spillway Gate	5 (nos.)	Gate Size 6.20m*3.60m
-No. of Under Sluice Gate	4 (nos.)	Gate Size 6.20m*3.85m
-Design Water Intake Discharge	16.93 (m^3/s)	
-Related Structure	Fish Path	on both side of the headworks

2) Canal

Canal / Items		Conveyance Canal		Main Canal		Secondary		Tertiary	
		Suksena	Shankarpur	Suksena	Shankarpur	Suksena	Shankarpur	Suksena	Shankarpur
Command Area	(ha)	5,529	4,619	-	-				
Design Discharge	(m^3/s)	9.23-8.05	7.70-7.64	8.05-0.73	7.64-0.81	3.00-0.20	3.00-0.20	0.50-0.10	0.50-0.10
Canal Length	(km)	3.32	2.01	15.20	15.30	34.72	25.80	100.10	72.40
Canal Slope	(1/n)	4,310	5,000	4,000-3,000	2,800-2,500	2,000	2,000	2,000	2,000
Cross Sections									
-Bed Width	(m)	6.80-5.90	6.00	5.20-2.00	4.50-2.00	3.30-0.55		1.50-0.45	
-Side Slope (inside)		1:1.0	1:1.0	1:1.0	1:1.0	1:1.0	1:1.0	1:1.0	1:1.0
(outside)		1:1.5	1:1.5	1:1.5	1:1.5	1:1.0	1:1.0	1:1.0	1:1.0
-Lininig		Concrete Lining t=10cm		Concrete Lining t=10cm		Earth Lining		Earth Lining	
-Canal Density	(m/ha)	-	-	-	-	4.66	5.58	18.08	15.67

3) Drainage Structures

Items	Nos.
Drainage Culvert	
-Type A (Box Culvert, $Q>5m^3/s$)	4
-Type B (Box Culvert, $3<Q<5m^3/s$)	4
-Type C (Box Culvert, $2<Q<3m^3/s$)	5
-Type D (Pipe Culvert)	8
Drainage Outfall	43

The SRIP, the main component, is to construct a headworks in the Sunsari river together with extensive canal networks and on-farm development. Of the construction components, the

on-farm development, basically 20 ha watercourse command area, is to be undertaken by concerned WUG and no government budgetary assistance is foreseen in the construction. The Government is to construct up to tertiary canal level to which organized WUCs can participate through labor contract with the contractor concerned.

10.2 Implementation Schedule

As aforementioned in Chapter 6.2 "Overall Development Strategy and Framework", this Study proposes following overall development schedule:

- SRIP Stage I: Year 0 to Year 4 (headworks to man canal)
  - Appraisal: Year 0
  - Detail design/tendering: Year 1
  - Construction: Year 2 – 4 (3 years construction)
- SRIP Stage II: Year 4 to Year 7 (secondary to on-farm)
  - Detail design/tendering: Year 4
  - Construction: Year 5 – 7 (3 years construction)
- Project Operation: Year 5 – 24 (1st – 20th Year after the operation)
  - Short Term(5yrs): Year 5 – 9 (1st to 5th Year after the operation)
  - Medium Term(5yrs): Year 10 – 14 (6th to 10th Year after the operation)
  - Long Term(10yrs): Year 15 – 24 (11th to 20th Year after the operation)

  Note: full operation will be realized in year 8 upon completion of Stage II.

10.2.1 SRIP Implementation Schedule

The implementation of SRIP is divided into two stages; namely, Stage 1 covers the construction of the headworks to the main canals of Suksena and Shankarpur. Then, Stage II will cover the construction of secondary to the tertiary canals inclusive of on-farm development. The Stage I requires a total of 4 years, one for detail design/tendering and the rest three years for construction. The Stage II requires same 4 years with same arrangement but the first year will be placed at the fourth year of the Stage I. Thus, a total of seven years will be required to complete the SRIP (see Figure 10.2.1 below). The rationale why stage-wise implementation of SRIP with a total of 7 years is required is:

- Stage I is composed of major construction work including gate manufacturing and the setting, while the stage II composed of minor construction works such as simple cut/embankment civil works. The stage II construction work is not so complicated, thus local contractors should be opened for the bidding. If the loan or grant arrangement for the funding allows un-tied bidding, the Stage II should be tendered under domestic competitive bidding (DCB) while the Stage I be International competitive bidding (ICB).
- All the on-farm development under SRIP is supposed to be done by the beneficiaries including land acquisition, construction of watercourses and field channels. Foreseen ISF, about 1,000 Rs/ha/yr, is very high as compared with the prevailing 200 Rs/ha/yr. Arrangement for the on-farm development as well as consensus for the high ISF would require a series of consultations with the farmers all the class from upper to lower. This

process will require longer time than ever before, thus the stage-wise implementation requiring a total of 7 years will much contribute to the success of the SRIP.

- One of the reasons, which causes water users' organization un-functional, may be rooted in the process of establishing the organization. If the Project approaches in a hurry or pushily without believing farmer's capacity, it is no wonder that farmers consider that they organize themselves for "external convenience", but not for "themselves". In this sense, The Project should be in the stance of not pushing but stressing "ownership of farmers" with enough time. Stage-wise implementation will facilitate the process in which ownership would be well nurtured.

Table 10.2.1 Stage Wise Construction Schedule of SRIP

Particulars	Yr0	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8 onwards
Appraisal	▼								
Stage I SRIP		◄	----	----	----	----	----	----	
Detail Design		▬							
Tendering			▬						
Mobilization				▬					
Headworks				▬	▬	▬	▬	▬	►
Main Canal				▬	▬	▬	▬	▬	
Stage II SRIP					◄	----	----	----	►
Detail Design					▬				
Tendering						▬			
Mobilization									
Secondary Canal						▬	▬	▬	
Tertiary Canal							▬	▬	
Watercourse Development					▬	▬	▬	▬	
Field Channel Development					▬	▬	▬	▬	

HW operation to start
Progressive operation until year 8

Full operation from year 8

The SRIP will start diverting the Sunsari water at year 5 upon completion of the Stage I though it will irrigate only the areas along main and existing secondary canals. The area to be irrigated by the main and existing secondary canals is estimated at about 20 to 30 percent of the whole 10,147 ha according to the existing canal network. The irrigated area by Stage I may be enlarged with additional 10 – 20 percent area taking into account plot-to-plot irrigation. Full operation will come at the year 8 upon Stage II completion.

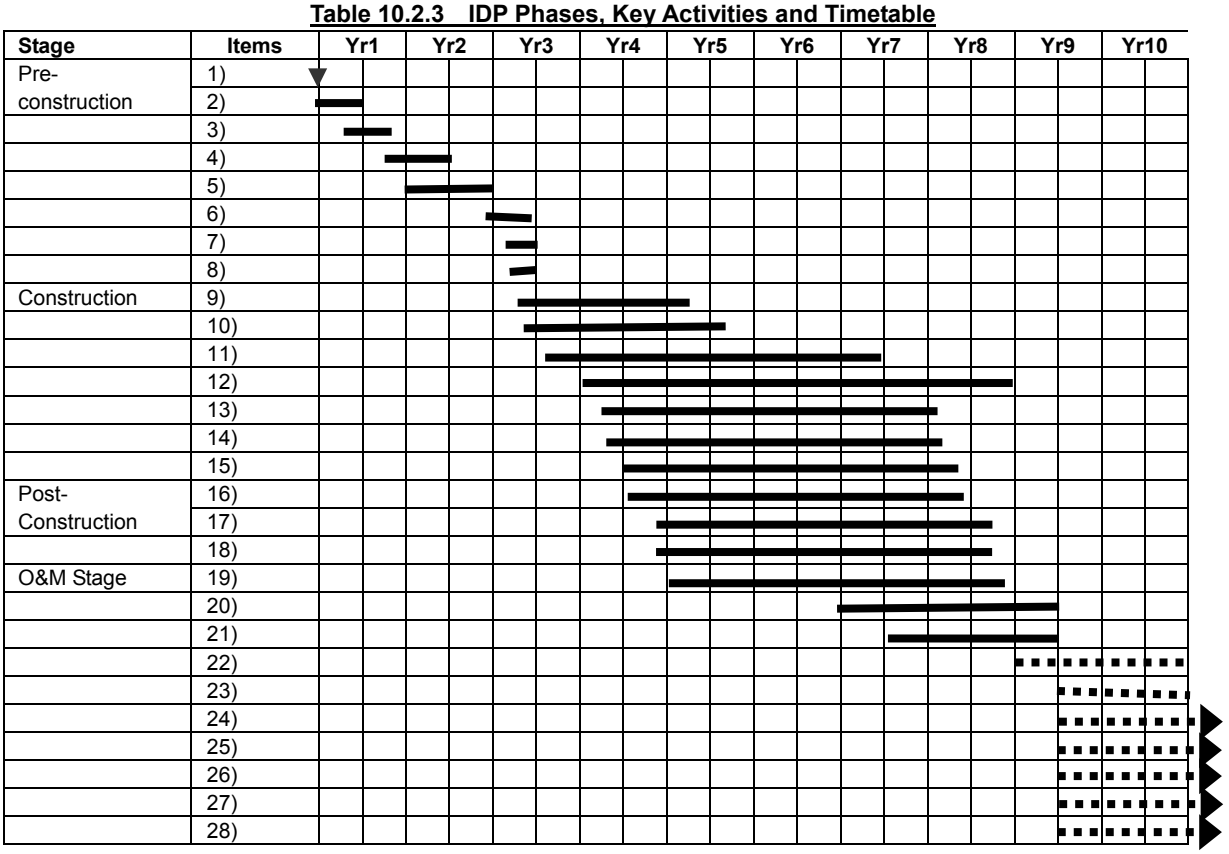
There is an issue of how to synthesize institutional development program (IDP) and the physical construction. Right after the establishment of the project's PMO, the IDP starts with the recruitment of the WUA development officers (WUADOs). On the 2nd quarter of year 1, their training as the WUAs' organizers will be conducted. They will facilitate organization of the ad-hoc WUCs following the organizing process up to the WUCs' registration.

This work will culminate in the forging of project development agreement of each WUC with DOI concerned office. During construction, the WUCs' and farmers' participation will be made possible through the WUC-PMO project management committee. The WUCs will participate in the construction of secondary and tertiary canals as labor contractors but will construct their 20 ha watercourses by themselves with the design from the PMO. These major activities of SRIP IDP is shown in Table 10.2.2, and how these proceed with physical construction hand in hand, including post construction stage, is illustrated in Table 10.2.3;

Table 10.2.2 SRIP IDP Phases and Key Activities

Phases	Key Activities
Pre-construction	1) Organization Of Project Management Office (PMO)
	2) Recruitment And Training Of Staff (Technical And Institutional)
	3) Training of WUADOs as Organizers; Planning And Deployment
	4) Social Mapping of the Secondary Area
	5) WUC Organization For Project Development Agreement With DOI
	6) Attends Leadership Installation Conference
	7) WUC Prepares Needed Documents and Registers WUC With DIO
	8) Signing of Project Development Agreement
Construction	9) WUC-PMO Consultation Workshop And Establishment Of WUC-PMO Project Management Committee
	10) WUC Meeting with PMO on Construction Plans And Schedules
	11) Attends WUC Training On Financial Management
	12) WUC Participates As Labor Contract For Construction Of Sec. & Tertiary Canals And Assists In Land Acquisition
	13) WUC Attends Pre-Construction Conference
	14) WUC Receives and Reviews Designs For Watercourse Development
	15) WUC Firms Up List Of Farmers, Organizes WUGs, and Mobilizes Farmers For Watercourse Construction
Post-Construction	16) WUC Reorganizes as per organizational Structure through Leadership Training
	17) Attends WUC Training On System O&M And Water Management
	18) Prepares For Joint Management Agreement with DOI
O&M Stage	19) WUC-IMD/DIO Discuss and Agree On Contract For Joint Management
	20) Formal Signing Of Joint Management Contract
	21) IMD Provides WUC Training On ISF Collection And Record Keeping
	22) Attends WUCC meeting
	23) Provides WUC Training On Maintenance And Water Distribution
	24) Implement Water Distribution Plan According To Cropping Pattern
	25) Regularly Manages Its Work On Water Distribution, ISF Collection And Maintenance
	26) Conducts Review And Planning To Improve It O&M Work
	27) Regularly Conducts With WUCC Coordination Meeting To Review And Plan System-Level Water Distribution
	28) Monitors WUC in implementation and provides access to agri-support services

Table 10.2.3 IDP Phases, Key Activities and Timetable



Note: Activity number is correspondent to the number in Table 10.2.2.

10.2.2 Overall Implementation Schedule

Together with the SRIP implementation, other components such as supporting infrastructure should also be implemented in order to bear the expected full benefit. The implementation is shown in Table 10.2.4, and most infrastructure components are to complete by year 7 together with SRIP except the drainage re-use. Drainage re-use intends to divert the drainage water coming into Old Sunsari river into a sub secondary canal of Suksena area. The drainage re-use is to be implemented in years 10 and 11 after confirming how much drainage water is actually coming into the river.

Agriculture supporting program requires longer duration than infrastructure construction. This Study proposes 5 years duration for the both extension and vegetable promotion programs. Both programs are to start at year 5 upon completion of SRIP Stage I. Inland fisheries promotion which is a compensation for 180 fishermen dependent on Sunsari river should start at an early stage of the project implementation, say year 2, and complete until the year 7 before the SRIP start full operation (see Chapter 12 for detail discussion for the fishermen). Environmental monitoring and auditing will start with the project commencement and proceed to project operation period.

Table 10.2.4 Implementation Schedule

Particulars	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr11
SRIP											
Stage I SRIP	◄	———	———	———	►						
Stage II SRIP				◄	———	———	———	►			
Supporting Infra.											
Access Rd			———	———	———						
Collection point					———						
Agr. Supporting											
Extension					———	———	———	———	———		
Veg. Promotion					———	———	———	———	———		
Environm'l Mitig'n											
Inland Fisheries		———	———	———	———	———	———	———			
Monitoring/auditing	▪▪▪	▪▪▪	▪▪▪	▪▪▪	▪▪▪	▪▪▪	▪▪▪	▪▪▪	▪▪▪	▪▪▪	▪▪▪
Drainage Re-use										———	———
Groundwater Dev.			———	———	———						

10.3 Project Cost and Disbursement

10.3.1 Basic Criteria

The project costs for each component consists of construction cost, institutional development, administrative cost, consultancy services, land acquisition, and physical and price contingencies. To estimate these costs, following basic criteria are adopted:

- The exchange rate is applied at 1 Rs = 0.0128 US$.
- The unit rates of materials and labor are based on the district standard of fiscal year 2001/2002.
- It is assumed that all the construction will be carried out by international contractors through international bidding.

- Price contingency is considered as 5% of the cost for each component.
- Physical contingency is estimated at 10% of the cost for each component.

10.3.2 Cost Estimation and Disbursement

1) Cost by Component

The project costs are totaled at around 1.41 billion Rs or 18.1 million US$, of which the main component (SRIP), supporting infrastructures, agriculture supporting, environmental mitigation, groundwater development, and others are respectively estimated at 1.27 billion Rs (16.3 million US$), 23.3 million Rs (300 thousand US$), 42.5 million Rs (540 thousand US$), 45.8 million Rs (590 thousand US$), 11.7 million Rs (150 thousand US$), and 14.3 million Rs (180 thousand US$). SRIP is proposed to implement in two stages and the costs of Stage I and Stage II are estimated at 783 million Rs (10 million US$) and 492 million Rs (6.3 million US$) respectively. Tables 10.3.1 and 10.3.2 show the summary of the project costs and the break-down of SRIP respectively.

Tabe 10.3.1 Summary of Project Costs

Description	Total Cost (Rs)	Contents		Remarks
		Construction (Rs)	Land Acquisition (Rs)	
1. Main Component (SRIP)	1,275,183,000	1,161,375,000	113,808,000	
1.1 Stage I	(783,181,000)	(774,394,000)	(8,787,000)	
1.2 Stage II	(492,002,000)	(386,981,000)	(105,021,000)	
2. Supporting Infrastructures	23,318,000	23,083,000	235,000	
3. Agriculture Supporting	42,465,000	42,465,000	0	
4. Environmental Mitigation Measures	45,874,000	40,884,000	4,990,000	
5. Others (Drainage Development)	14,273,000	13,743,000	530,000	
6. Groundwater Development	11,699,000	11,699,000	0	
Grand Total Rs	1,412,812,000	1,293,249,000	119,563,000	
US$	18,084,000	16,554,000	1,530,000	

Table 10.3.2 Cost Breakdown of Main Component (SRIP)

Description		Total Cost (Rs)	Contents		Remarks
			Construction (Rs)	Land Acquisition (Rs)	
Hard Component	Headwoks/Intake	288,152,000	286,472,000	1,680,000	Stage I
	Main Canal	285,816,000	279,888,000	5,928,000	Stage I
	Secondary Canal	136,591,000	126,835,000	9,756,000	stage II
	Tertiary Canal	135,723,000	100,944,000	34,779,000	Stage II
	Farm Development Works (Watercourse)	72,155,000	25,763,000	46,392,000	Stage II 100% farmers' due
	Canal Protection Works	4,902,000	4,902,000	0	Stage II
	Drainage Structure	13,244,000	13,244,000	0	Stage II (Box Culvert, Pipe Culvert, Outfall)
	Office Building	1,000,000	1,000,000	0	Stage I
	Quality Testing Lab	3,000,000	3,000,000	0	Stage I
	Sub Total (1)	940,583,000	842,048,000	98,535,000	
		100%	90%	10%	
Soft Component	Institution Development	50,600,000	50,600,000	0	
	Consultancy Services	94,059,000	94,059,000	0	
	Administration	18,812,000	18,812,000	0	
	Sub Total (2)	163,471,000	163,471,000	0	
Sub Total (3)=(1)+(2)		1,104,054,000	1,005,519,000	98,535,000	
Price Escalation 5 %		55,203,000	50,276,000	4,927,000	
Total		1,159,257,000	1,055,795,000	103,462,000	
Contingency 10 %		115,926,000	105,580,000	10,346,000	
Grand Total	Rs	1,275,183,000	1,161,375,000	113,808,000	
	US$	16,323,000	14,866,000	1,457,000	
Total Cost of Stage I	Rs	783,181,000	774,394,000	8,787,000	
	US$	10,025,000	9,912,000	113,000	
Total Cost of Stage II	Rs	492,002,000	386,981,000	105,021,000	
	US$	6,298,000	4,954,000	1,344,000	

2) Foreign and Local currencies

The project costs are divided into foreign currency portion and local currency portion. While foreign currency is composed of imported goods and services, local currency consists of local materials, unskilled and skilled labor, and land. The total costs of the foreign and local currencies are estimated at 794 million Rs (10.1 million US$) and 619 million Rs (7.9 million US$) respectively. The share of foreign and local currencies is estimated at 56% and 44% respectively. As for the main component (SRIP), the share between foreign and local currencies is estimated at 60% and 40% amounting to 763 million Rs (9.8 million US$) and 512 million Rs (6.5 million US$) respectively. For stage-wise, the shares of foreign currency of Stage I and II are respectively estimated at 66% and 50%.

Table 10.3.3 Local Portion and Foreign Portion of Project Costs

Description	Total Cost		Contents					
			Foreign Currency			Local Currency		
	(Rs)	(US$)	(Rs)	(US$)	(%)	(Rs)	(US$)	(%)
1. Main Component (SRIP)	1,275,183,000	16,323,000	763,113,000	9,768,000	60	512,070,000	6,555,000	40
1.1 Stage I	(783,181,000)	(10,025,000)	(516,029,000)	(6,605,000)	(66)	(267,152,000)	(3,420,000)	(34)
1.2 Stage II	(492,002,000)	(6,298,000)	(247,084,000)	(3,163,000)	(50)	(244,918,000)	(3,135,000)	(50)
2. Supporting Infrastructures	23,318,000	298,000	7,424,000	95,000	32	15,894,000	203,000	68
3. Agriculture Supporting	42,465,000	543,000	2,119,000	27,000	5	40,346,000	516,000	95
4. Environmental Mitigation Measures	45,874,000	587,000	2,979,000	38,000	6	42,895,000	549,000	94
5. Others (Drainage Development)	14,273,000	183,000	9,140,000	117,000	64	5,133,000	66,000	36
6. Groundwater Development	11,699,000	150,000	8,798,000	113,000	75	2,901,000	37,000	25
Grand Total Rs	1,412,812,000	18,084,000	793,573,000	10,158,000	56	619,239,000	7,926,000	44

3) Cost Disbursement

The project costs are disbursed according to the implementation schedule shown above Table 10.2.2. Table 10.3.4 below shows the cost disbursement by projects. The cost of Main Component (SRIP) is disbursed from year 1 to year 7, during which year 1 to year 4 will be the Stage I implementation and year 4 to 7 will be the Stage II implementation period. In total the peak period of the project cost disbursement in 10 years will be in year 3 and 4 amounting to 315 million Rs (4.0 million US$) and 291 million Rs (3.7 million US$) respectively.

Table 10.3.4 Disbursement Plan of Project Costs

Description		Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Total
1. Main Component (SRIP)	,000 Rs	41,320	226,793	291,790	279,598	152,271	173,149	110,262				1,275,183
	,000 US$	529	2,903	3,735	3,579	1,949	2,217	1,411				16,323
	(%)	3	18	23	22	12	14	9				
1.1 SRIP Stage I	,000 Rs	41,320	226,793	291,790	223,278							783,181
	,000 US$	529	2,903	3,735	2,858							10,025
	(%)	5	29	37	29							
1.2 SRIP Stage II	,000 Rs				56,320	152,271	173,149	110,262				492,002
	,000 US$				721	1,949	2,217	1,411				6,298
	(%)				11	31	35	22				
2. Supporting Infrastructures	,000 Rs				3,903	5,869	7,771	5,775				23,318
	,000 US$				50	75	99	74				298
	(%)				17	25	33	25				
3. Agriculture Supporting	,000 Rs					8,493	8,493	8,493	8,493	8,493		42,465
	,000 US$					109	109	109	109	109		543
	(%)					20	20	20	20	20		
4. Environmental Mitigation Measures	,000 Rs		9,979	13,591	5,460	10,014	3,415	3,415				45,874
	,000 US$		128	173	70	128	44	44				587
	(%)		22	30	12	22	7	7				
5. Others (Drinage Development)	,000 Rs				1,168	6,871	6,234					14,273
	,000 US$				15	88	80					183
	(%)				8	48	44					
6. Groundwater Development	,000 Rs			4,679	3,510	3,510						11,699
	,000 US$			60	45	45						150
	(%)			40	30	30						
Grand Total	,000 Rs	41,320	236,772	310,060	293,639	187,028	199,062	127,945	8,493	8,493	0	1,412,812
Grand Total	,000 US$	529	3,031	3,968	3,759	2,394	2,549	1,638	109	109	0	18,084
	(%)	3	17	22	21	13	14	9	1	1	0	100

10.4 Implementation Responsibilities

It is proposed that the DOI will be the main executing and implementing agency for the investment of the proposed Sunsari River Irrigation Project (SRIP). There are to be three levels of implementation functions and responsibilities described below:

The Project Steering Committee (PSC) is to be established with responsibility for project monitoring and supervision as well as interagency coordination. It is to be chaired by DOI's Director General. The PSC will include representatives of all relevant participating agencies such as Department of Agriculture and Cooperatives (DOAC), etc. to meet in Kathmandu once every quarter to ensure effective coordination and implementation.

The Project Co-ordination Office (PCO) is to be established within DOI's Surface Water Division in Kathmandu. It is to be managed by an experienced Project Coordinator who will report, through the Deputy Director General, to the Director General as the chairman of the PSC. The PCO is to have the following responsibilities and functions, and will require full time staff to perform the responsibilities and functions;

- Overall project coordination including liaison with other Government Offices,
- Provision of technical support to the Project Management Office (PMO) responsible for implementing the SRIP, and
- Liaison with selected NGOs to implement procedures and practices to facilitate effective participation of users in decision making (during all phases of the project development and system management cycle), WUC capacity building and transfer of irrigation systems to self reliant WUCs for sustained operation and maintenance.

The Project Management Office (PMO) is to be established in the project site. It is proposed that the Director of the Eastern Regional Irrigation Directorate will act concurrently as the Project Manager reporting to the Project Coordinator. The PMO is to manage the implementation of SRIP and will consist of four divisions. The PMO requires the following minimum full time staff to perform the function:

Project Manager	
Irrigation Engineer	Engineering Design Division
Construction Engineer	Construction Division
Institutional Development Specialist	Institutional Development Division
Financial Officer/Administrator	Administrative Division
Agro-engineer (from year three)	PBME & Extension
Secretaries/Computer Operators	
Drivers	

The management of SRIP is centered on the PMO which will have 4 basic Divisions as mentioned above. Without undermining the roles of other 3 Divisions, what will be emphasized here is the institutional development division (IDD). This Division is charged with promoting the change from the current practices of irrigation administration to the desired joint irrigation system management as proposed for the Project. The project management structure with the emphasis on IDD is illustrated as Figure 10.4.1 below and the staffing schedule is shown in Table 10.5.1.

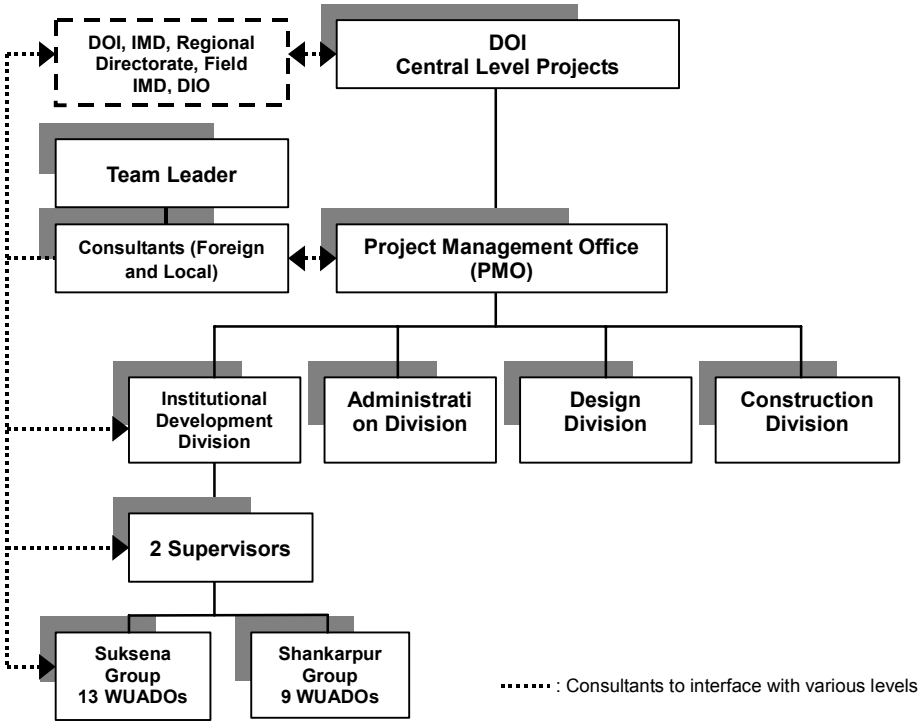


Figure 10.4.1 Project Management Structure with Emphasis on SRIP's IDP

As such experienced, domestic and foreign Consultants with the capabilities to interface with DOI, vertically or horizontally, in various levels are required. As the Irrigation Policy

provides, national or foreign consultants shall be used only in the most essential areas for the purpose of irrigation development and management. Such engagement of the Consultants shall help improve the organizational structure and management to increase the effectiveness and reliability of the irrigation service.

10.5 Technical Assistance

Aside from the Consultants to be employed in implementing the SRIP, this Study proposes that a technical assistance team should be assigned to the project. The technical assistance team will be in charge of achieving the full benefit from the project and composed of the team leader fully assigned and such experts as water management, irrigated agriculture development inclusive of vegetable marketing promotion, financial management, and institutional development. The team is expected to start the assignment at year 5 and the duration requires at least 5 years (refer to Table 10.5.1 and Figure 10.5.1).

Table 10.5.1 Staffing Schedule of PMO and Technical Assistance

Particulars	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr11
SRIP											
Stage I SRIP	◀	—	—	—	▶						
Stage II SRIP				◀	—	—	—	▶			
Supporting Infra.			—	—	—						
Agr. Supporting					—	—	—	—	—		
PMO											
Project Manager	—	—	—	—	—	—	—	—	—	Full assigned	
Irrigation Engineer	—	—	—	—	—	—	—	—	—	do	
Construction Eng.	—	—	—	—	—	—	—			do	
IDP Specialist	—	—	—	—	—	—	—	—		do	
Finance/Admin.	—	—	—	—	—	—	—	—	—	do	
Agro-engineer			—	—	—	—	—	—	—	do	
Secretaries/Operators	—	—	—	—	—	—	—	—	—	do	
Drivers	—	—	—	—	—	—	—	—	—	do	
Consultants											
Team Leader	—	—	—	—	—	—	—			Full assigned	
4 Design Engineers	—	—			—	—	—			do	
Supervisor for HW		—	—	—	—	—	—			do	
Supervisor for Canal		—	—	—	—	—	—			do	
Techn'l Assistance											
Team Leader					—	—	—	—	—	Full assigned	
Water Management					▪	▪	▪	▪	▪	Short term	
Agronomy/market					▪	▪	▪	▪	▪	do	
Financial Manag't					▪	▪	▪	▪	▪	do	
Institutional Dev.					▪	▪	▪	▪	▪	do	

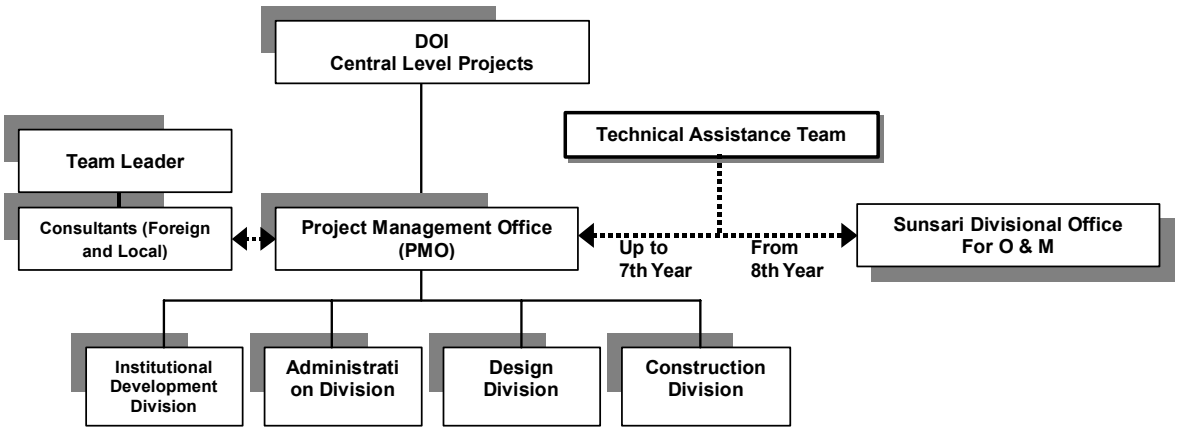


Figure 10.5.1 Structural Position of Technical Assistance Team

CHAPTER 11

PROJECT JUSTIFICATION

CHAPTER 11 PROJECT JUSTIFICATION

Justification of the project is discussed in this chapter from the viewpoints of economy. The evaluation is made applying both quantitative and qualitative methods. Direct and tangible effects are evaluated from the viewpoint of national and farm economies. Indirect and intangible impacts are discussed qualitatively.

The economic analysis of the project is carried out by the discounted cash flow analysis using shadow prices, which reflect economic efficiency in the national economy. The economic internal rate of return (EIRR) is used as a measure to determine the economic feasibility of the project. Possible risks are assessed by several case studies as well as sensitivity analysis.

11.1 Projects for Economic Evaluation

Economic evaluation is principally conducted with the major projects, which target on the realization of irrigated agriculture by Sunsari river water. Of the six projects proposed in this Study, the said major projects include four projects, which are SRIP as the core, supporting infrastructures, agriculture supporting and environmental mitigation. Integration of these four projects will enhance the realization of the expected project benefit, thus they should be implemented in close relation.

As for the remaining, the project of groundwater development is excluded from the analysis, since the project will be independently implemented in the southern most part of the Study area, where the Sunsari river water cannot be given by gravity. Another project of drainage re-use is also excluded from the major ones due to uncertainty of the realization of the project benefit. Table 11.1.1 summarizes the costs of the major projects.

Table 11.1.1 The Major Projects Cost (Financial Price excluding Tax)

Description	Project Cost		Remarks
	(Rs)	(mil US$)	
1. SRIP			
1.1 Hardware			
1) Headwoks/Intake	330,875,000	4.24	1)+2)=
2) Main Canal	323,271,000	4.14	(Rs) 654,146,000
3) Secondary Canal	146,495,000	1.88	(mil US$) 8.39
4) Tertiary Canal	116,590,000	1.50	
5) Canal Protection Works	5,662,000	0.07	
6) Drainage Structure	15,297,000	0.20	3)~9)=
7) Office Building	1,155,000	0.02	(Rs) 318,420,000
8) Quality Testing Lab	3,465,000	0.04	(mil US$) 4.08
9) Farm Development Works (Watercourse)	29,756,000	0.38	
Sub Total (1)	972,566,000	12.47	
1.2 Software			
1) Institution Development	58,443,000	0.75	
2) Consultant Services	108,638,000	1.39	
Sub Total (2)	167,081,000	2.14	
1.3 Others			
1) Land Acquisition	113,808,000	1.46	
2) Administration	21,728,000	0.28	
Sub Total (3)	135,536,000	1.74	
Main Compornent Total	**1,275,183,000**	**16.35**	
2. SUPPORTING INFRASTRUCTURES	23,318,000	0.30	
3. AGRICULTURE SUPPORTING	42,465,000	0.54	
4. ENVIRONMENTAL MITIGATION MEASURES	45,874,000	0.59	
Grand Total	**1,386,840,000**	**17.78**	

The supporting infrastructures include improvement of access roads and preparation of collection point of vegetables. Extension program for vegetable production and promotion program for vegetable marketing will be implemented as the agriculture supporting program. As for the environmental mitigation measures, fishponds are planed to construct as hardware, and also extension services, environmental monitoring and auditing will be carried out as software. Contents and costs before taxes are added are summarized as Table 11.1.1.

11.2 Basic Assumptions

Following are the assumptions for the economic evaluation of the proposed project.

1. Prices are given in 2002 constant prices with an exchange rate of US$ 1.0 = Rs 78.0.
2. The economic life of the concerned project is assumed to be 50 years.
3. In economic evaluation, all of the financial costs and benefits are converted to economic values (shadow price or efficiency price), which embody resource endowment of the national economy.
4. A standard conversion factor (SCF) of 0.90 is ever used in Nepal to adjust the foreign exchange premium or trade distortion. In Nepal, trade interventions have been reduced along with the liberalization policy of the Government. In accordance with such environmental change, it might be required to revise the SCF. However, to keep consistency with the analyses of the other projects, SCF of 0.90 is employed in this Study.
5. The economic farm gate prices of traded agricultural inputs and outputs are to be given in form of their import or export parity prices. These values are derived from the World Bank Global Commodity Markets in June 2000. Paddy, wheat and sugarcane are assumed to be import substitutes in view of increasing trend of import amounts. Jute is treated as an export commodity.
6. Since the Study area is regarded as labor excess economy, a shadow wage rate of 0.75[1] together with SCF of 0.90 is applied for converting unskilled labor cost into economic price. Hence, the conversion factor for unskilled labor is calculated at 0.675 (0.75 x 0.90 = 0.675).
7. Transfer payment such as tax, duty, royalty, subsidy, interest, etc. are considered as a domestic monetary movement without direct good and service. These transfer payments are excluded in estimating economic costs and benefits.
8. Local currency portion of the construction costs is converted using construction conversion factors (CCFs). The CCFs are estimated on the basis of the proportion of the foreign and local currencies including transfer payment and other local cost items applying by SCF (0.90) and conversion factor for unskilled laborers (0.675).
9. Economic cost of land acquisition is estimated by the marginal profitability of the land to be consumed for the Project.
10. The opportunity cost of capital applied in Nepal is 12 %.

[1] SMIP III Detailed Feasibility and Design, 1995

11.3 Case Study

For the economic evaluation of the Project, following four cases are examined. In monsoon season, all cases will execute Surface Water Irrigation (SWI) for the whole command area, and achieve to full yield expected by the Project. In Case 0, which this Study proposes as the Base Case, the Sunsari river water will not be diverted at all during winter season in order to maintain the current volume of the river flow at lean period, considering the adverse affect to the fishery in the river. The entire area during winter season would be covered by Tube Well Irrigation (TWI) as practiced at present. Therefore, the yields of winter crop will not change by the Project.

In Case 1, the river water is distributed into about a half of the command area during winter season, through either Suksena or Shankarpur canal by every year rotation assuming that paper factories located down stream reaches of the river should establish a treatment plant reducing the effluent by 80%. However, the amount of water extracted from the river is 50 %, only to be the level of enabling preventive irrigation to meet the requirement of the downstream river water quality, according to the degree of reduction of the effluent from the paper factories and the compensation to the fishermen whose occupation will be affected by the project (50 % of whole compensation cost is appropriated). This case would not allow the increase of the crop yields from the present level but only to save the pumping cost of shallow tube well by alternating the source of water.

As for Case 2, the command area covered by the SWI would be same as the Case 1, namely about a half of the area would be irrigated by the rotational irrigation. But the system can extract 80 % of the river water and provide the water onto the farm by the level of conventional irrigation, assuming the establishment of treatment plant in the paper factories meeting with Nepal Standard, and agreement of compensation to the concerned fishermen (100 % of whole compensation cost is appropriated). In this case, the increase of yields at full extent can be realized by the Project.

Table 11.3.1 Description of Cases

Case	Spring Monsoon	Winter		Water Extraction during Winter	Conditions
Case 0 (Base)	SWI Full Yield 10,147ha	TWI No Yield Change 10,147ha		No extraction from Sunsari River	No condition is required.
Case 1	SWI Full Yield 10,147ha	SWI No Yield Change 5,074ha (Diesel cost reduction is the benefit.)	TWI No Yield Change 5,074ha	50% extraction (Min. 1.8 cum/s DS release)	1. Paper factories should establish a treatment plant reducing the effluent by 80%. 2. 50% of aquaculture promotion in Maria Dhar or any form of compensation including farm land provision is agreed with and arranged for the concerned fishermen (about 180 HHs).
Case 2	SWI Full Yield 10,147ha	SWI Full Yield 5,074ha	TWI No Yield Change 5,074ha	80% extraction (Min. 0.7 cum/s DS release)	1. Paper factories should establish a treatment plant meeting with Nepal Standard. 2. Aquaculture promotion in Maria Dhar or any form of compensation including farm land provision is agreed with and arranged for the concerned fishermen (about 180 HHs).
Case 3	SWI Full Yield 10,147ha	SWI Full Yield 7,131ha	TWI No Yield Change 3,016ha	Min. 3.8 - 5.0 cum/s water release from SMIP, and min. 1.8 cum/s DS release	No condition is required.

Note: SWI = Surface Water Irrigation, TWI = Tube Well Irrigation

For Case 3, the case assumes that the irrigation water from SMIP through Suksena and Shakarpur canals could serve the command area in winter season with 3.8 to 5.0 cum/s. In this case, about 70 % of the command area would be serviced by the surface water and therefore, surplus O & M cost for SMIP is required. Every year, 70 % of the command area could enjoy the sufficient surface irrigation water accruing the full extent of crop yield increase and saving of the pumping cost. The conditions of each case are summarized as above Table 11.3.1.

11.4 Project Cost

11.4.1 Initial Investment Cost and Replacement Cost

The total initial investment cost at financial price with taxes included is estimated at 1,509 million Rs (19.3 million US$) in the Base Case. In Case 2, the cost of which amounts to the largest sum among the four cases due to full compensation for fishermen, it is estimated at 1,560 million Rs (20.0 million US$). The cost of the Base Case is converted to 1,160 million Rs (14.9 million US$) at economic price by applying the respective construction conversion factors (CCFs) according to the components and eliminating the transfer payments. In Case 2, the cost is converted to 1,200 million Rs (15.4 million US$) at economic price.

Table 11.4.1 Initial Investment Cost (Financial Price including Tax / Economic Price)

Description	Case 0 (Base Case)				Case 2			
	Financial Price		Economic Price		Financial Price		Economic Price	
	(mil Rs)	(mil US$)	(mil Rs)	(mil US$)	(mil Rs)	(mil US$)	(mil Rs)	(mil US$)
1. MAIN COMPORNENT	1,275	16.35	1,104	14.15	1,275	16.35	1,104	14.15
2. SUPPORTING INFRASTRUCTURES	23	0.30	19	0.25	23	0.30	19	0.25
3. AGRICULTURE SUPPORTING	42	0.54	37	0.47	42	0.54	37	0.47
4. ENVIRONMENTAL MITIGATION MEASURES	-	-	-	-	46	0.59	40	0.51
5. Tax	169	2.15	-	-	174	2.22	-	-
Total	1,509	19.34	1,160	14.87	1,560	20.00	1,200	15.38

The machineries and equipments need to be replaced when their useful lives end. The construction or procurement costs together with the useful lives by component are shown in the following Table 11.4.2.

Table 11.4.2 Summary of Replacement Cost

Component	Useful life (Years)	Financial Cost (mil. Rs)	Economic Cost (mil. Rs)
Headworks/Electric	10	15	11
Main Canal	30	368	277
Secondary Canal	15	133	101
Tertiary Canal	15	191	144
Farm Development Works	15	105	67
Canal Protection Works	15	7	5
Drainage Structure	30	19	15
Access Road	20	24	18
Collection Point	35	2	1

Note: Each component is a title of its items, which need to replace in the economic life.

11.4.2 Operation & Maintenance Cost

As it has been mentioned in Chapter 9, operation and maintenance costs consist of salaries of the government staff in charge of the SRIP and administrative cost of WUCs such as employment of book keeper and honorarium of the committee members, as well as the

physical maintenance for the headworks, main canals etc. The total O & M cost of the SRIP is estimated at 10.1 million Rs per year and then its economic cost comes up at 8.0 million Rs per year.

11.5 Project Benefit

11.5.1 Crop Production Benefit

The primary benefit of the project accrues from the increase of agricultural production, namely increase of yields and cropping intensity, and also introduction of diversified crops will bring the increase of agricultural profit. To estimate the economic benefit of the crop production, the economic price of crops and inputs shown in Table 11.5.1 below are applied;

Table 11.5.1 Prices of Inputs and Outputs

Item	Fin. Price	Eco. Price
Paddy	8.7	16.9
Wheat	9.0	19.9
Oilseed/Mustard	16.6	14.9
Pulses/Lentil	18.4	16.6
Potato	8.8	7.9
Cucumber family	10.5	9.5
Cauliflower	5.0	4.5
Sugarcane	1.3	2.4
Jute	9.7	18.3
Urea	13.0	19.0
DAP	17.8	25.7
Potash	13.1	20.7
Unskilled Labor (Rs/day)	58.4	39.4

(Unit: Rs/kg)

Incremental benefit is derived from the difference of net production values between with and without project conditions. The economic benefits at Base Case and Case 2 are given in Table 11.5.2 below;

Table 11.5.2 Economic Incremental Benefit of Crop Production

Items	Net Production Value in Base Case			Net Production Value in Case 2		
	Without Project	With Project	Incremental Benefit	Without Project	With Project	Incremental Benefit
Paddy	179,016	312,699	133,682	179,016	312,699	133,682
Cucumber Family	19,325	166,264	146,939	19,325	166,264	146,939
Wheat	123,415	123,415	0	123,415	189,318	65,903
Lentil	1,910	1,910	0	1,910	6,619	4,709
Mustard	231	231	0	231	943	711
Potato	87,120	87,120	0	87,120	108,188	21,068
Cauliflower	4,919	4,919	0	4,919	36,265	31,346
Jute	46,873	49,849	2,976	46,873	49,849	2,976
Mungbean	1,236	5,365	4,129	1,236	5,365	4,129
Sugarcane	11,339	78,456	67,117	11,339	78,456	67,117
Total	475,384	830,228	354,844	475,384	953,966	478,581

(Unit: thousand Rs)

The project activities including preparatory works, survey and detailed design, construction, water users group formation and relative support are scheduled at the beginning of the implementation. The project commenced with the survey and detailed design is planned to complete in 7 years.

After the completion of the headworks and the main canal within the first 4years (Stage-I), a quarter of command area will be able to start using the water every year. Since the

beginning of surface water irrigation, the benefit of the vegetables production is assumed to realize 10 % of the full benefit every year. Therefore, the full benefit of the vegetable production will be realized upon 10 years. For other crops including cereals, sugarcane and jute, the benefits are assumed to realize 20 % of the full benefits every year, namely, reach to the full benefits upon 5 years.

11.5.2 Saving Cost of STW's Operation

Another expected benefit of the project is a saving of STW operation cost. For the proposed Case 1, due to limited water supply from Sunsari river during winter season, the situation would force farmers to practice preventive irrigation. Under such condition, the crop production would not increase during winter season, but what can be expected is the saving of the STW operation cost. In the Case 1, about a half of the whole command area would receive the water from Sunsari river, so that the farmers receiving the surface water could save the operation cost of STW totaling 15.7 million Rs at economic price for winter crops.

11.6 Economic Evaluation

11.6.1 EIRR

EIRR calculation is carried out for the four cases and the EIRRs from Case 0 (Base Case), 1, 2, and 3 come up at 15.6 %, 16.1 %, 18.9 % and 20.2 % respectively. EIRRs of all the cases are over the opportunity cost of capital in Nepal, which is 12 %. It is, therefore, evaluated that the Project is economically feasible in each case as well as the Base Case. The NPV of the Base Case is estimated at 343 million Rs or 4.4 million US dollar. Table 11.6.1 summarizes the results of economic analysis.

Table 11.6.1 EIRR of 4 Cases

Case	Case 0 (Base)	Case 1	Case 2	Case 3
EIRR (%)	15.6	16.1	18.9	20.2
PV Cost (mil. Rs)	822	835	848	847
(mil. US$)	(10.5)	(10.7)	(10.9)	(10.9)
PV Benefit (mil. Rs)	1,165	1,235	1,587	1,735
(mil. US$)	(14.9)	(15.8)	(20.3)	(22.2)
NPV B – C (mil. Rs)	343	400	738	888
(mil. US$)	(4.4)	(5.1)	(9.5)	(11.4)
B / C (12%)	1.42	1.48	1.87	2.05

11.6.2 Sensitivity Analysis

A sensitivity analysis of the Project is carried out for the Base Case with several conditions; increase of initial cost, or O & M cost, decrease of vegetable prices and reduction of crop yield. Table 11.6.2 shows the results of the analysis, indicating that the feasibility of the Project would be the most sensitive to the failure of achieving the expected crop yield increase among the factors.

Table 11.6.2 Results of Sensitivity Analysis

Items	Change In variable	EIRR (%)	Sensitivity Indicator (%)	Switching Value EIRR; 12%
Base Case		15.6		
1. Cost increased				
Initial cost Increased (a)	+ 20 %	13.8	9.0	+ 46 %
O&M cost Increased (b)	+ 20 %	15.5	0.5	+ 950 %
2. Benefit reduced				
Vegetable prices decreased (c)	- 20 %	14.7	4.5	- 72 %
Crop yield lowered (d)	- 20 %	9.2	32.0	- 13 %

Note: Sensitivity indicator is % change in EIRR over % change in variable.
Switching value is change in variable, with which the EIRR will be 12 %.

11.7 Farm Budget Analysis

11.7.1 Farm Models

According to the household survey, total average of farm size is 1.84 ha and average family size is 6.4 people. Five strata, which are Marginal, Small, Medium, Medium-Large and Large, were set up by farm size using the conclusion of the survey. Basic information of each class is shown in the following Table 11.7.1;

Table 11.7.1 Farm Model Divided by Farm Size

Stratum	Category (ha)	Average Farm Size (ha)	Average Family Size (people)	Household Distribution (%)
Marginal	Below 0.4	0.21	6.0	13.9
Small	0.4 ~0.9	0.75	5.9	26.2
Medium	0.9~1.8	1.59	6.4	25.2
Medium-Large	1.8~3.0	2.54	7.0	20.3
Large	3.0 and above	5.33	6.9	14.4
Overall		1.84	6.4	100.0

11.7.2 Incremental Net Income

Incremental benefit of overall is about 293 million Rs, in the Base Case of financial analysis, and about 410 million Rs in Case 2. The average per hectare is expected 28.9 thousand Rs in Base Case, and 40.4 thousand Rs in Case 2. Incremental benefit and the percentage of total income and agricultural income are summarized in following Table 11.7.2;

Table 11.7.2 Incremental Net Income in Each Farm Model

Category	Present			Base Case					
	Net Income			Net Income			Incremental		
	Crops a	Others b	Total c=a+b	Crops d	Others e=b	Total f=d+e	Net Income g=d-a	Proportion (%) h=g/c	i=g/a
Marginal	12.5	44.2	56.7	15.3	44.2	59.5	2.8	4.9	22.4
Small	20.4	27.6	48.0	28.8	27.6	56.4	8.4	17.5	41.2
Medium	32.5	33.8	66.3	59.5	33.8	93.3	27.0	40.7	83.1
Medium-Large	40.2	38.6	78.8	70.3	38.6	108.9	30.1	38.2	74.9
Large	93.5	56.3	149.8	245.5	56.3	301.8	152.0	101.5	162.6
Category	Present			Case 2					
	Net Income			Net Income			Incremental		
	Crops a	Others b	Total c=a+b	Crops d	Others e=b	Total f=d+e	Net Income g=d-a	Proportion (%) h=g/c	i=g/a
Marginal	12.5	44.2	56.7	17.0	44.2	61.2	4.5	7.9	36.0
Small	20.4	27.6	48.0	40.1	27.6	67.7	19.7	41.0	96.6
Medium	32.5	33.8	66.3	94.3	33.8	128.1	61.8	93.2	190.2
Medium-Large	40.2	38.6	78.8	143.9	38.6	182.5	103.7	131.6	258.0
Large	93.5	56.3	149.8	330.0	56.3	386.3	236.5	157.9	252.9

(thou Rs/household)

The Small model is considered as an average category of whole command area since total average farm size per household including landless family is estimated 0.77 ha. In the Base Case, 48 thousand Rs, at present annual net income will increase to 56 thousand Rs (about 20 % increase). For the Case 2, it will be expected to increase up to 68 thousand Rs (about 40 % up).

Incremental net income per hectare in Base Case is estimated at; Marginal = 13 thousand Rs, Medium = 17 thousand Rs, Large = 29 thousand Rs, namely, the bigger the farm size is, the higher the incremental net income per hectare because the marginal-scale farmer is already practicing high crop intensity even at present (191 %), there are less surpluses for expansion of cropping area, but large-scale farmer has low crop intensity at present (156 %), so that irrigation water can make a big raise in agricultural income.

To get the project effects as high as possible, active expansion of cropping area is required in more than medium size of farm household, which means the farmers should try to increase cropping area by employment of farm labor, since the current cropping plot is so small that it is difficult for them to apply farm machines rapidly in their command area. This increase of farm labor employment would lead to creating opportunity of employment for landless people, which can make poor class enjoy the project benefit.

11.8 Indirect and Intangible Effects

In addition to the direct benefit from the increase of agricultural production and saving cost of STW's operation, the project will bring various effects, which are indirect and intangible so that it is difficult to grasp them quantitatively, but there are a lot of related effects as described below.

1) Solution of Confusion in Chanda Mohana

In the middle of the east side of Shankarpur canal, some farmer beneficiaries of SRIP (about 300 ha) take water illegally from Chanda Mohana irrigation area, which is adjoining land of the east side of SRIP. They have bored holes in the upper part of the west main canal in Chanda Mohana, which causes shortfall of the irrigation water and difficulty in the management in the lower part of the area. Implementation of SRIP would stop the farmers in question taking water from Chanda Mohana. Therefore, the confusion in the stricken area would be solved.

2) Increase in Employment Opportunity

In a short term, a large number of farmers will be involved in construction works, which are spread over seven years. Average annual employment for construction labor will be about 630 man-year in the hard ware of the main component alone. They are equivalent to about 10 % of landless population in the Study area, supposing the number of landless household is 6,640.

In a long term, with the irrigation development, crop yield will increase and cropping intensity will also be intensified. Increase of crop production creates job opportunities for harvesting labor and crop diversification proposed in this Study as well contributes to creating opportunities for farm labor. Other way of job creation with the proposed project is a canal

maintenance work. Canal maintenance works such as desilting and grass cutting in some canals can be done by hired labor and the source of wage could be born to ISF. The distribution of the benefit from irrigation development is illustrated the right Figure 11.8.1.

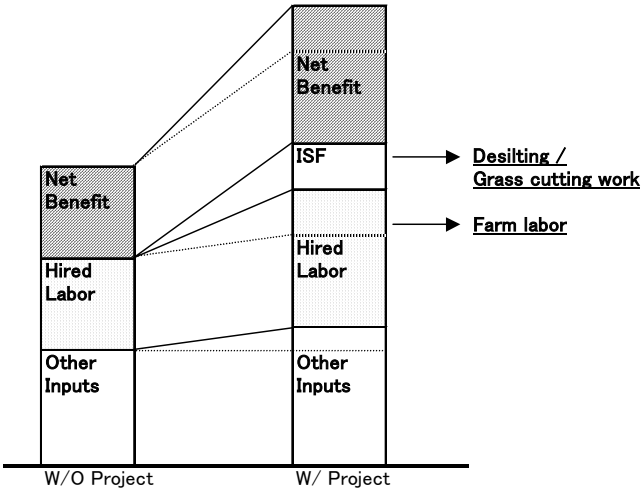


Figure 11.8.1 Benefit Distribution into Landless

The major projects will generate incremental annual farm employment of about 400 man-years for the Base Case, as agriculture production will increase in the command area, and about 570 man-year for the Case 2. They mean new employment creation of 6.0 % of landless household in Base Case, and 8.6 % in Case 2 every year.

In addition, the major projects will also increase labor hour of family in their own land, as rising crop production and O & M works for the irrigation. It generates an income opportunity instead of being employed, like a migrant worker during the slack season. Even desilting and grass cutting under WUC's jurisdiction need about 14 thousand man-day every year, which is equivalent to about one man-day share for all households in command area.

3) Improvement of Transportation

SRIP includes the improvement of canal maintenance roads from main canals to watercourses, which will be mainly used for the maintenance and transport of agriculture inputs and products, and commute between houses and fields. On the other hand, they will be also used as community roads so that they will reduce time to go to school or hospital etc.

Especially, the maintenance roads of the main canals are used as main community roads even now, but sometimes floods interrupt the traffic in monsoon season. Therefore, SRIP will be able to contribute to securing transport capacity in monsoon season since the project reduces damage of canals and roads from floods.

Also, the proposed road network improvement in the western part of the Study area, illustrated right Figure 11.8.2, is put in high priority taking into account the

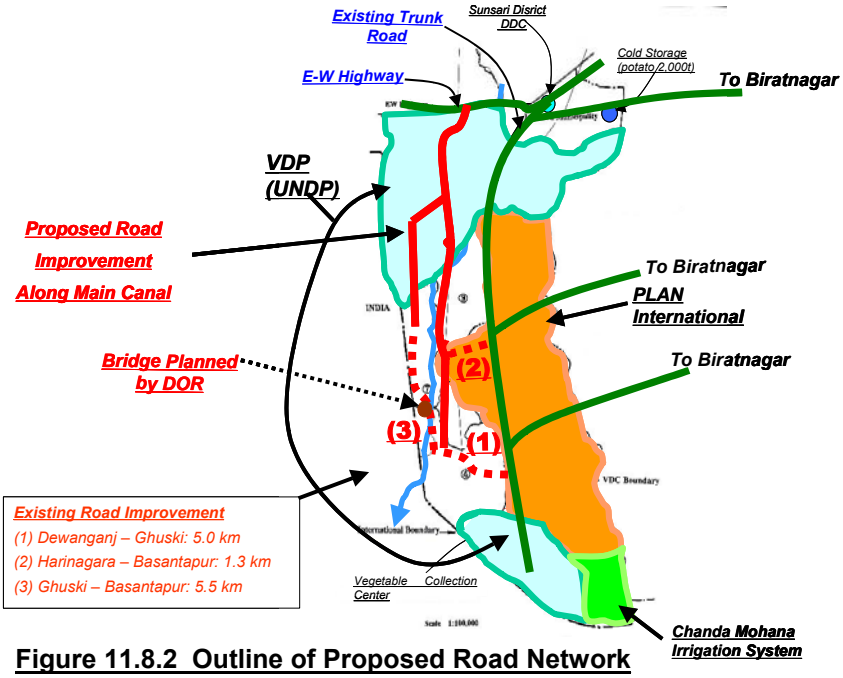


Figure 11.8.2 Outline of Proposed Road Network

locational disadvantage of the area. As it is indicated from the figure, the western part of the Study area due to the poor access have got little attention from development support agencies tackling poverty alleviation. UNDP has implemented Village Development Program consisting of saving scheme, skill development and organization development in the northern and southern parts of the Study area. PLAN International has supported minorities in the eastern part of the Study area. The proposed road network improvement in the western part of the Study area will contribute to attracting these agencies as well as improving the marketing condition of the area.

The calculation of the above IRR includes the proposed road improvement. If the road improvement was implemented as a single project, the EIRR with the benefit from time saving of the transportation would be estimated at about 3 %. Though its internal rate of return as a single project is low, implementing the road improvement combined with the irrigation project is proved to get high EIRR, and these access roads are indispensable for the marketing of the crop production, which is expected to improve by the irrigation project.

4) Enhancement of Living Condition

An increase in income will bring about better-off farmers. They can spend more on their housing, clothing, health care, sanitation, education, and others. These will collectively improve social and cultural amenities of villages and give an impetus to further development within the region.

Table 11.8.1 Saturation of Industrial Goods in the Study Area in 1998

Iron roof	Toilet facility	Piped water	Kerosene for cooking	Radio
15%	1%	Almost none	1%	23%
TV set	Bicycle	Motorbike	Thresher	Tractor
2%	43%	1%	2%	Less than 1%

Source: “LGP Household Survey” in 1998

5) Linkage Effects

A production increase in agriculture sector will induce economic activities in other sectors through linkage effects. The secondary and tertiary benefits will accrue in any sector related to agriculture. Farm inputs suppliers and laborers are those having backward linkage effects and traders and millers are those having forward linkage effects.

6) Increase in Land Value

Financial value of farmland and residential land will be increased by the major projects implementation. This means the value of land assets as a mortgage and the larger class farmers will have more monetary power in the future. On the contrary, the condition of tenant and marginal class farmers will be hard to acquire own farm land due to increase in land prices.

7) Saving of Foreign Exchange

Paddy, wheat and sugarcane out of the increased agricultural products by the major projects

are regarded as import substitutes and then contribute to reduction of the country's chronic trade deficit. In total it is estimated that Rs 209 million or US$ 2.7 million equivalent can be saved annually from Nepal's foreign exchange payment (increment in gross production value of traded farm products) in Base Case. The savings for Case 2 is estimated that Rs 261 million or US$ 3.4 million.

CHAPTER 12

ENVIRONMENTAL ISSUES

CHAPTER 12 ENVIRONMENTAL ISSUES

12.1 Water Quality for Irrigation

Water quality is a main concern in terms of both efficient irrigation and environment protection. The Team has conducted a series of water quality tests in both monsoon and winter seasons of year 2001, and one test for a test deep tube well constructed by this Study in September of year 2002. Six points from surface water and 5 points from groundwater (2 from shallow tubewells and 3 from deep tubewells) had been sampled for the water quality test. The locations of sampling points are shown below;

Table 12.1.1 Location of the Sampling Points in River and Groundwater

Sample No.	River/Ground water	Location
1	Chatara main canal	Main canal at intake
2	Sunsari-U/S	At upstream of Sunsari river on the E-W highway bridge
3	Sunsari-M/S	At midstream of Sunsari river near at Siphon
4	Sunsari-D/S	At downstream of Sunsari river, in Sucumbashitor
5	Budhi-U/S	At upstream of Budhi river in Jalkapur
6	Budhi-D/S	At downstream of Budhi river in Laljtol
7	Shallow tube well	At Babiya VDC
8	Shallow tube well	At Harinagar VDC
9	Deep tube well	At intake of Chatra to Suksena canal
10	Deep tube well	Kaptanganj VDC
11	Test deep tube well	Kaptanganji VDC, well with 120 m depth constructed by this Study

The parameters analyzed are pH, Electrical Conductivity (EC), bacteriological test, Dissolved Oxygen (DO), T-C in TSS, Suspended Solids (SS), Total Nitrogen in Total Suspended Solids (T-N in TSS), Bicarbonate, Nitrate, Nitrite, Ammonia, Total Phosphate, Chloride, Sulfate, Calcium, Magnesium, Total Hardness, Iron, Sodium, Potassium, Arsenic, Manganese, PV value which equals to Dissolved Organic Carbon, Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD).

As Table 12.1.2 shows in next page, most particulars of water quality show less value than irrigation standard values adopted in Nepal; namely, “FAO Recommendation of Irrigation Water” and “Recommendation on Maximum Concentration of Trace Element in Irrigation Water in England”. For example, the EC ranges from 8.84- 49.90 mS/m. According to the EC values prescribed in the FAO standard, less than 75 mS/m is suitable for irrigation without any restriction. The pH value ranges from 6.84 - 8.46, and it is almost within the standard of 6.5 - 8.4.

Arsenic value in all samples is less than 0.01 except for sample No.11 which is from the newly constructed test deep tube well. Sample No.11 shows 0.03mg/l arsenic concentration. This is higher than the WHO Limits for Drinking Water but still permissible for irrigation according to the recommendation of England. The Standard of England for irrigation use recommends 0.1 mg/l as the limit. As for Iron, sample No.10 shows 8.38 mg/l, which exceeds the England standard value of 5.0 mg/l. Since sample No.11, which is from the test deep tube well, shows 0.45 mg/l only, this high iron in sample No.10 must have come from rusted steel casing.

Table 12.1.2 Result of Water Quality Test on the River water and Groundwater

Sample		In site test			Laboratory test				Remarks
No.	Season	pH [pH]	EC [mS/m] λ 18	DO [mg/l]	BOD [mg/l]	COD [mg/l]	As [mg/l]	Fe [mg/l]	
1	Dry season	8.04	**8.84**	6.89	1.80	8.60	<0.01	0.02	Chatara Main Canal
	Rainy season	8.46	9.10	-	1.40	6.60	<0.01	3.37	
2	Dry season	7.92	21.83	5.07	3.30	5.50	<0.01	<0.01	Sunsari river
	Rainy season	7.82	23.40	-	2.80	4.60	<0.01	4.30	
3	Dry season	8.24	29.51	4.46	**9.60**	**59.70**	<0.01	0.01	Sunsari river
	Rainy season	7.86	24.10	-	6.20	32.80	<0.01	1.45	
4	Dry season	7.81	31.12	3.80	3.90	17.90	<0.01	<0.01	Sunsari river
	Rainy season	8.02	26.60	-	1.60	9.40	<0.01	1.54	
5	Dry season	7.00	16.72	4.17	3.60	7.20	<0.01	<0.01	Garaun Khola
	Rainy season	7.48	13.10	-	3.00	6.60	<0.01	2.29	
6	Dry season	7.47	28.84	4.36	2.00	3.10	<0.01	<0.01	Budhi river
	Rainy season	**6.84**	21.30	-	1.80	2.60	<0.01	0.79	
7	Dry season	8.01	14.91	1.80	2.10	3.00	<0.01	<0.01	Deep tube well
	Rainy season	**8.46**	13.10	-	2.00	2.90	<0.01	0.41	
8	Dry season	7.54	28.28	1.25	2.00	3.00	<0.01	<0.01	Deep tube well
	Rainy season	8.10	33.70	-	1.90	2.80	<0.01	1.07	
9	Dry season	7.24	10.35	1.79	2.10	4.80	<0.01	0.01	Shallow tube well
	Rainy season	7.70	15.20	-	1.80	4.00	<0.01	2.85	
10	Dry season	7.13	20.81	1.24	1.50	2.10	<0.01	<0.01	Shallow tube well
	Rainy season	7.40	**49.90**	-	1.70	2.90	<0.01	**8.38**	
11	Rainy season	7.78	41.4	4.81	1.40	4.00	**0.03**	0.45	Test deep tube well
WHO Standard		-	-	-	-	-	0.01	<0.30	Desirable Level (Tap Water)
Standard of England		-	-	-	-	-	0.10	5.00	Recommended Maximum Concentration of trace Elements in Irrigation water
Standard of Japan		6.0-7.5	<30.00	>5.00	-	<6.00	<0.05	-	For paddy field
FAO Standard		6.5-8.4	<75.00	-	-	-	-	-	

Dry Season Sampling; 6 May. - 7 May. 2001 except DO on 5th Feb.
Rainy Season Sampling; 6 August. - 7 August. 2001.
Sampling date of No.11 only is September 4

On the other hand, DO at most of the sites don't satisfy Japanese Irrigation Standard (No DO standard in Nepal). Generally, an amount more than 5 mg/l for DO is applied to the limitation for irrigation in Japan. The samples from the groundwater range from 1.24 to 3.79 mg/l only. These low values do not originate in contamination but from a feature of groundwater. Also, the samples from rivers range from 3.8 - 6.89 mg/l, the more downstream the sampling point is, the lower the value is. This indicates that the river water is replenished by the groundwater, and thereby the water quality in DO is affected.

According to the irrigation standard for paddy in Japan, less than 6 mg/l for COD is applied (No irrigation standard in Nepal). Some samples from rivers are over the standard value, especially the value of sample No.3, sampled from midstream reach of Sunsari river (near Suksena canal crossing point), is quite high. It shows 59.7 mg/l in winter season (while, No.2 sample, upstream of Sunsari river near E-W highway shows 5.5 mg/l only). Considering that the values of BOD show the same trend and there are paper factories at about 800 m downstream of E-W Highway Bridge, it is concluded that the results came from the wastewater of the paper factories (9.6 mg/l for No.3 against 3.3 mg/l for sample No.2 in BOD).

Judging from above results, it can be said that the water qualities of the Sunsari river, Budhi river and groundwater in the Study area are suitable for irrigation except the water of the Sunsari river after it receives industrial effluent from the paper factories.

12.2 Issues due Considered and the Mitigation

As Sunsari River Irrigation Project (SRIP) is an irrigaiton project and is planned to provide irrigation facilities for the command area, impact to be caused by taking water from Sunsari river is one of the largest issues. Major impacts on the Sunsari river may be; dilution of industrial effulent from the paper factories, decreasing of fish cathch negatively affecting fishermen's livelihood, change of biodiversity of the river, difficulty of presently practiced pumping up from Sunsari river for irrigation, etc. Following issues are considered important, which affect the environmental resources even if little is done at any stage of construction and operation.

Table 12.2.1 Summary of Activities and Adverse Impacts

			Elements of Environment																	
			Physical								Biological				Socio-economic					
			Water quality		Ground water		Water volume		Land		Fishes		Vege-tation		Health		Eco-nomic		Social, cultural	
Project Stage	Activities	Likely Adverse Impacts	Magnitude	Extent	Magnitude	Extent	Magnitude	Extent	Magnitude	Extent	Magnitude	Extent	Magnitude	Extent	Magnitude	Extent	Magnitude	Extent	Magnitude	Extent
Construction Stage	Migration of labors during construction	Loss of woods, sanitation											△	△	△	△				
Operational Stage	Reducing flow in the river	To make water quality worse	●	●							●	●	●	●	○	○	●	○	△	△
		To make less habitat area									●	◎					●	○		
		Lowering velocity of the flow									○	○								
		Less quantity of water available					○	◎					○	○			○	◎		
		Lowering ground water table along the river			△	○											△	○		
	Reducing sediment load of the flow	Downstream erosion at the initial stage							◎	◎										
	Headwork construction	Upstream sedimentation															○	○		
	Canal operation	Sedimentation in the canal							○	○							○	○		
	Stagnation of water	Vector-borne disease													△	△				

Note: ●= very high or large
◎= high or large
○= medium
△= low or small

12.2.1 Paper Factory Effluent

There are 2 paper factories; namely, Arvind factory and Baba factory both of which are located just downstream from the site of the proposed headworks. These 2 factories discharge the wastewater into Sunsari river; through ponds in case of Baba and directly in case of Arvind. People around the area have often protested against the factories, and even cited in a local newspaper. No local people around the factory now do water their cattle in the river. Local people have quoted that the number of fish has also decreased by as much as half since the factories started their operation about 5 years ago.

Baba factory consumes approximately 4,000 cum of water per day and Arvind factory, which recycles paper, consumes approximately 150 cum of water per day. Baba factory has two ponds of approximately 50m (length) x 20m (width) x 1m (depth) beside Sunsari river, but the total capacity is about 2,000 cum which is about half of the daily water consumption. That means Baba factory needs to discharge the effluent twice a day at full operation. At worse, Baba factor has installed new production lines, increasing the production to 40 ton/day from the present 10 ton/day.

Effluent from Baba Paper Factory into Sunsari River

There is an on-going international assistance in industrial sectors in Nepal. Danish International Development Agency (DANIDA) is implementing Cleaner Production (CP) and Environment Sector Program Support (ESPS) in five industrial sectors including paper mills. As of October 2002, a study is on-going under the program, which opportunely deals with the two paper factories. If concerned stakeholders reach to an agreement, construction of an effluent treatment plant (ETP) jointly managed by Baba and Arvind factories is expected to start in December 2002.

1) Water Quality for the Effluent

The factories' effluents have undergone a series of water quality check. Sampling was done twice; first in August 2001 for the both factories and second in June 2002 for Baba factory only. Sampling points were at the effluent outlets of the both factories. Sampling technique and the analysis methodology applied were mainly based on "Standard Methods" (APHA-AWWA-WPCF, 19th edition) and on "Method for Collection and Analysis of Water Samples for Dissolved Minerals and Gases".

The parameters analyzed in a laboratory are as follows; Salinity, Total Suspended Solids (TSS), Total Volatile Solids (TVS), Total Dissolved Solids (TDS), Total Alkalinity, Bicarbonate, Carbonate, Hydroxide, Nitrate, Nitrite, Ammonia, Total Phosphate, Chloride, Iron, Lead, Zinc, Copper, Cadmium, Chromium, Sodium, Potassium, Arsenic, Mercury, Cyanide, COD, BOD, Oil & Grease, Phonetic Compounds and Fluorine.

The wastewater from the paper factories contains high-level values of TSS, BOD, COD, etc. Micro fiber, mineral, saccharide, alcohol, lignine and its decomposition materials made in the process of paper production bring about the increase of these values. The particulars beyond the standards of "Tolerance Limits for Industrial Effluents Discharge into Inland Surface Waters", Nepal Bureau of Standards and Metrology (NBSM) are TSS, Ammonia, Chloride, Lead (Pb), Chromium (Cr), COD and BOD (Chloride was referred to a German Standard because no standard in Nepal).

Table 12.2.2 Wastewater Analysis Data beyond Standard

Parameters	Results			NS*	German Standard 1)	Units
	ARVINDA	BABA(1st)	BABA(2nd)			
T. Suspended Solids	**1,634.6**	**1,445.9**	**436.9**	30 – 200	<20	mg/l
Ammonia (NH_3)	1.64	**133.00**	25.57	< 50	–	mg/l as N
Chloride (Cl)	139.5	**744.0**	198.4	–	<350	mg/l
Lead (Pb)	0.06	**0.17**	**0.12**	< 0.1	–	mg/l
Chromium (Cr)	0.08	**0.26**	**0.13**	<0.1	–	mg/l
Sodium (Na)	25	1,104	828	–	–	mg/l
COD	**252**	**2,965**	**2,570**	< 250	<85	mg/l
BOD	**168**	**2,025**	**1,416**	30 – 100	<25	mg/l

NS* = Nepal Bureau of Standards and Metrology (Ne. Gu. Na. 229-2047).

Source: 1) Galvonotechnic(1971, 62, No.12sss L'ultima acqua, A.Canuti, 1974, AFEE 2482/2)

Looking at the table above, it is obvious that the effluent of both factories should not be discharged into Sunsari river without treatment, especially in case of Baba paper factory. Environment Protection Rules (EPR) in Nepal states that no person shall cause the emission of waste from any place in contravention of the standards prescribed by the Ministry of Population and Environment. The EPR describes in Rule 17 "Complaints may be lodged in case anyone causes pollution or emits waste." In other word, VDCs or Municipalities can and should address this problem to the Ministry of Industry.

2) Impact on Water Quality of Sunsari River

The proposed headworks is located at an upstream side from the paper factories, so that the irrigation water will not receive any of the industrial effluent. However, the effluent content against the Sunsari river flow will increase after the headworks starts diverting the Sunsari river water into Shankarpur and Suksena canals. The present content in the leanest season is estimated to be about 1.6 % of the river flow (leanest flow is assumed at 3 m^3/s). It would, however, become as high as 16 % of all the leanest season flow if the headworks diverted as much as 90% river water as usually practiced in Nepal.

As the present situation is not already permissible, SRIP may not be allowed to take any water during lean period unless otherwise the factories take any kind of measures of reducing the effluent. Though the factories are already violating a law in Nepal, the practice on the ground might continue. Faced with this situation, impact assessment on Sunsari river water quality should be done from the view point of how further deterioration of the river water can be avoided upon the SRIP coming into operation.

As mentioned before, there is a possibility that the factories construct EPT under the assistance from DANIDA. This ETP, however, is not supposed to run up to the level at which Nepal Standard is satisfied but to reduce the effluent by 80% from the present (with the 80% reduction, COD will be about 600 mg/l against the standard of 250 mg/l in case of Baba). Also, Baba factory would probably increase the production to as much as four times owing to the new production line.

The impact assessment considers these two scenarios; ETP construction and production

increase under different diversion volumes. Impact associated with the water diversion can be discussed in terms of change of the concentration of COD and BOD since these are the main wastes coming through the paper production. Assessment on COD change is exampled below, and the change of COD and BOD is summarized in Table 12.2.3 and Figure 12.2.1:

Condition:

COD of Baba effluent:	2,965 mg/l
Water consumption of Baba:	4,000 m^3/day
COD of Arvind effluent:	252 mg/l
Water consumption of Arvind:	150 m^3/day (4,150 in total water consumption by both factories)
COD at 3 km downstream	59.7 mg/l in dry season (measured on 6/7 May 2001)
Discharge of Sunsari river:	2.7 m^3/s (the leanest runoff, measured on 6/7 May 2001)

COD load (concentration value times the amount of water):

2,965 mg/l x 4,000 m^3/day =	11,860 kg/day of COD load by Baba
252 mg/l x 150 m^3/day =	37.8 kg/day of COD load by Arvind
	say 12,000 kg/day of COD load in total
2.7 m^3/s x 86,400 s/day =	233,280 m^3/day in Sunsari river in the leanest season
233,280m^3/day + 4,150 m^3/day =	237,430≒240,000 m^3/day
12,000 kg/day /240,000 m^3/day =	50 mg/l of additional COD downstream
	in the leanest season, and this is well correspond to the actual measured value of 59.7 mg/l.

It is a very simple way of estimating the COD assuming the value downstream is proportional to the amount of discharge. The minimum runoff calculated by tank model in 80% probability is 3.69 m^3/s, and diversion of river water is considered at 50%, 80%, and 90% of the 3.69 m^3/s. Baba factory's present capacity is 10 ton/day but has already installed a new line with additional 30 ton/day production capacity. Therefore, "production doubled" and "production four times" are also considered.

Base flow (80% probability of Sunsari river runoff):

3.69 m^3/s x 86,400 s/day =318,816 ≒	320,000 m^3/day of water
50% diversion:	0.5 x 320,000 = 160,000 m^3/day in river
80% diversion:	0.2 x 320,000 = 64,000 m^3/day in river
90% diversion:	0.1 x 320,000 = 32,000 m^3/day in river

Case 1. No ETP:

50% diversion: 12,000 kg/day / (320,000 m^3/day x 0.5)= 75mg/l ×

Case 2. COD load is reduced to 20 % (target for DANIDA ESPS) by ETP:

12,000 kg/day x 0.2 / 320,000 m^3/day = 7.5mg/l of additional in dry season

50% diversion: 12,000 kg/day x 0.2 / (320,000 m^3/day x 0.5) = 15.0mg/l ○

80% diversion: 12,000 kg/day x 0.2 / (320,000 m^3/ day x 0.2) = 37.5mg/l ○

90% diversion 12,000 kg/day x 0.2 / (320,000 m^3/day x 0.1) = 75.0mg/l ×

Case 3. Production doubled but COD unit load is reduced to 20% by ETP:

12,000 kg/day x 2 x 0.2/320,000m3/day = 15mg/l of additional

50% diversion: 12,000 kg/day x 2 x 0.2 / (320,000m^3/day x 0.5) = 30 mg/l ○

80% diversion: 12,000 kg/day x 2 x 0.2 / (320,000m^3/dayx0.2) = 75.0mg/l ×

Case 4. Production four times but COD unit load is reduced to 20% by ETP:

12,000 kg/day x 4 x 0.2/320,000m^3/day = 30.0mg/l of additional

50% diversion: 12,000 kg/day x 4 x 0.2 / (320,000m^3/day x 0.5) = 60.0 mg/l ×
80% diversion: 12,000 kg/day x 4 x 0.2 / (320,000m^3/day x 0.2) = 150mg/l ×

Case 5. Production doubled but COD of effluent follows Nepali Standard of 250 mg/l:

250 mg/l x 4,150,000 l/day = 1,037.5 kg/day of COD load in total

1,037.5 kg/day x 2 / 320,000m^3/day = 6.5 mg/l of additional

50% diversion: 1,037.5 kg/day x 2 / (320,000m^3/day x 0.5) = 13.0mg/l ○
80% diversion: 1,037.5 kg/day x 2 / (320,000m^3/day x 0.2) = 32.4mg/l ○
90% diversion: 1,037.5 kg/day x 2 / (320,000m^3/day x 0.1) =64.8mg/l ×

Case 6. Production four times but COD of effluent follows Nepali Standard of 250 mg/l:

250 mg/l x 4,150,000 l/day =1,037.5 kg/day of COD load in total

1,037.5 kg/day x 4/ 320,000m^3/day = 13.0mg/l of additional

50% diversion: 1,037.5 kg/day x 4 / (320,000m^3/day x 0.5) = 25.9mg/l ○
80% diversion: 1,037.5 kg/day x 4 / (320,000m^3/day x 0.2) = 64.8mg/l ×

Note: ×: water quality will be worse than the present COD condition of 50mg/l
○: water quality will be better than the present condition of 50mg/l

Table 12.2.3 Estimated COD and BOD values (mg/l)

	Diversion for irrigation	Case2 load 20% (DANIDA)	Case3 doubled with 20% (DANIDA)	Case4 four times with 20% (DANIDA)	Case5 doubled with NS	Case6 four times NS	Present Condition
COD	50%	15.0	30.0	**60.0**	13.0	25.9	**50.0**
	80%	37.5	**75.0**	**150.0**	32.4	**64.8**	
	90%	**75.0**	**150.0**	**300.0**	**64.8**	**129.7**	
BOD	50%	10.1	20.3	**40.5**	5.1	10.1	**33.8**
	80%	25.3	**50.6**	**101.3**	12.7	25.3	
	90%	**50.6**	**101.3**	**202.5**	25.3	**50.6**	

Water quality will be worse than the present condition
NS: Nepal Bureau of Standards and Metrology (Ne. Gu. Na. 229-2047).

Findings from the above table and figure are as follows:

- In case of 50% water diversion during lean period:
  As far as the paper factories reduce the load to 20% of the present value by ETP, even if the production

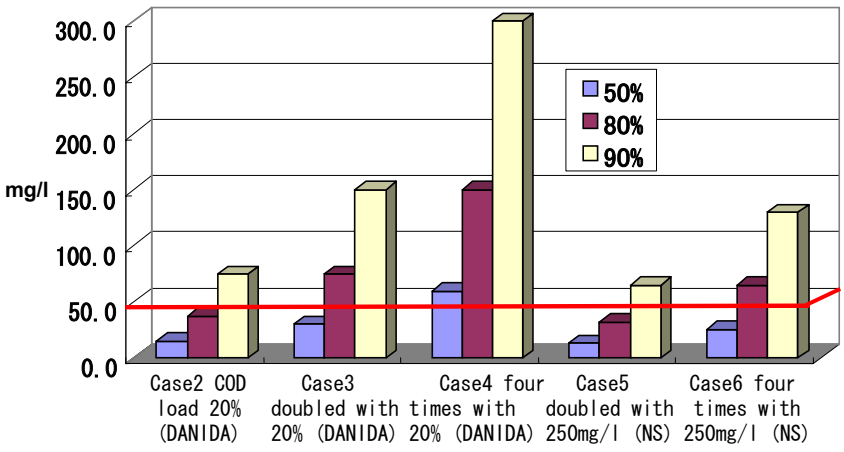


Figure 12.2.1 Estimated COD Values

is doubled, values of COD and BOD will not exceed the present condition and it is likely to have less adverse to the water. However, if the production is increased to four times, the values of COD and BOD will exceed the present condition unless the factories obey the Nepal Standard.

- In case of 80% water diversion during lean period:
  If the paper production remained same as the present with the ETP reducing the effluent to 20%, 80% water diversion would not worsen the values of COD and BOD. However, if the paper production is doubled, the COD and BOD will be worsening than the present condition. If the factories reduce the effluent to the level of Nepal Standard, 80% diversion would not so worsen the present condition though COD under four times production would become a little worse than the present.

- In case of 90% water diversion during lean period:
  90% water diversion may be out of consideration since the COD and BOD would be worsening very much even under the condition that the factories abide by the Nepal Standard except BOD under doubled production with Nepal Standard compliance.

Taking into account above findings, this Study recommends:

- The factories should reduce the effluent with assistance from DANIDA or otherwise by their own responsibility. If the present situation prevails, the SRIP should not take any water during lean period since the present situation is already beyond the permissible level.

- On condition that the factories install an ETP reducing the effluent to 20%, the SRIP may take Sunsari water up to 50 %. However, if Baba factory runs the production line with the full capacity (four times production than the present), the situation would become worse than the present situation even with the ETP. According to the table above, three times more production would be still within the present condition. Therefore, 50% water diversion during lean period should accompany careful monitoring of both paper production and the river water quality. Also, compensation for fisheries has to be considered (the project is planned to undertake half of the 180 fishermen in this case).

- If the SRIP intends 80% water diversion, the Government should enforce the factories to obey the Nepal Standard. Unless otherwise the factories abide by the Nepal Standard, the SRIP should not proceed to the 80% water diversion. Compensation for fisheries should also be considered in case that the SRIP diverts 80% water. Compensation in this case should consider all the concerned 180 fishermen.

12.2.2 Aquatic Biodiversity of Sunsari River

Many and various aquaculture from microorganism to large-size fish like eels or catfishes range in the Sunsari river. They affect each other in the river and they have quite close relationship. If the environment surrounding them were changed, they would receive adverse effects. Based on this understanding, this Study undertook an investigation of the present aquatic biodiversity in Sunsari river together with Budhi river, and an impact

assessment of the Project on the aquaculture.

1) Planktons, Larger Invertebrates, and Fish Species Diversity

Aquatic invertebrates are the most important resources, which are the link in the production process in aquatic ecosystem, because they are primary consumers and carnivores. They form the natural food source for several fishes. Altogether thirty-five species of phytoplankton belonging to cynophyceae bacillariophyceae, chlorophyceae and pyrrophyceae were recorded during the investigation period of April to May, 2001. Zooplanktons found were only rotifers, copepods and cladocerans. During the investigation, rotifers were found to be more abundant than copepods and cladocera.

As per larger invertebrates, altogether thirty-five groups of macro invertebrates belonging to seven orders of arthropods were identified during the same investigation period. Two types of animal (temporary and permanent fauna) are found in the fresh water environment. Temporary fauna spend only a part of their life whereas permanent fauna spend their entire life in the ecosystem.

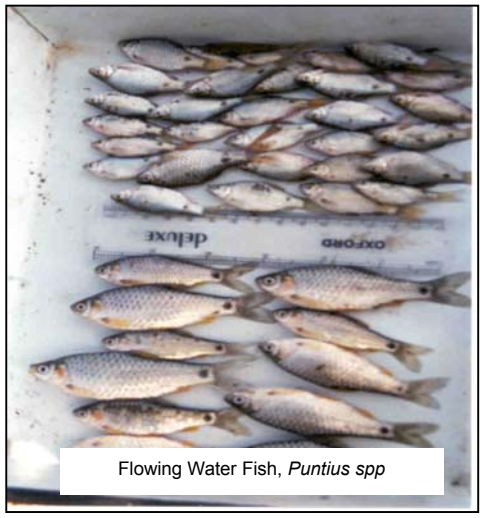
The fish species in the rivers were found to be forty-eight. These rivers support biological diverse species like carps, catfishes, loaches and minnow. The principal fish species of Sunsari river are grouped as follows:

Carps:	River carp (*Lebeo rohita, L. gonius, L. dero, L. pangusia, Catla-catla, Cirrhina mrigal*) and other species like *Crossocheilus latius, Chagunius chagunio*, etc.
Cat fishes:	*Clupisoma garua*, *Mystus spp*.
Loaches:	Stone loach (*Noemacheilus beavani, N. botia, Lepidvcephalichthys guntea, L. nepalensis, heteropneustes fossils*.
Eels:	Swamp *eel (Amphipnous Cuchia, Mastacembelus pancalus, Macrognothus aculatus*) fresh water eel (*Anguilla bengalensis*).
Barbs:	*Puntius sophore, P.ticto, P.titius, P.sarana, Chanda nama, Colisa patius, Sicamugil cascasia.*
Minnows:	*Barilius shacra, B, barna, Essomus dandricus*, *Rasbora daniconius* etc.

2) Adverse Impacts on Aquatic Biodiversity in Sunsari River

Should complete dewatering below the headworks for a stretch of about 26 km in Sunsari river take place, serious impacts would take place on micro flora and aquatic invertebrates. Mainly three groups of fauna, Plecoptera, Ephemeroptera and Tricoptera would get more affected if most amount of water were diverted and the river became half-dried. These faunal groups have a narrow range of tolerance to changes in the nature of environmental factors such as temperature, dissolved oxygen, pH and carbon dioxide levels.

The number of abundant groups of the fauna, *Baetidae, Heptageniidae, Simulium (Simulium) himalayense Simulium (Simulium) sp.* would be decreased drastically if most of the water were diverted. Rare faunal groups e.g. Leptophlebidae, Tricorythidae and Lepidostomidae might disappear from the river due to changes in the environmental conditions of the river. These groups of animals may be replaced by other groups of fauna. Macro-invertebrates are considered as the major food resources of fishes. Therefore, some groups of the fishes may either disappear from the river or change their feeding habit.


Flowing Water Fish, *Puntius spp*

The fish species which have ecologically adapted to a flowing conditions will find the new condition in the Sunsari river untenable, while species which in the river system are restricted to pools would adapt to the new conditions. Changes in the composition and abundance of both the planktonic and benthic communities resulting from the reservoir formation would also affect the food supply of many species of fish, some adversely, some favorably. This factor will eventually influence the species composition in the fish population.

It is therefore possible to predict, before the formation of the Sunsari headworks, that the fish population will be dominated by pool dwellers and species unselective in their choice of habitat. Likewise the species, which for various reasons require a riverine environment, would decrease in number if most of the water were diverted. A list of major fishes, which require flowing condition and pool dwellers, is presented below:

Table 12.2.4 List of Major Types of Fishes (Pool Dwellers and Flowing Water)

Pool Dweller Fishes	Flowing Water Fishes
Channa marulius	*Catla catla*
C. panctatus	*Labeo rohita*
C. striatus	*Noemacheilus spp.*
Clarius batrachus	*Puntius spp.*
Heteropneustes fossilis	*Barrilius spp.*
Macrognathus aculeatus	*Mystus spp.*
Mastacemblus puncalus	*Wallago attu*
Labeo gonius	*Anguilla bengalensis*
Cirrhinus rewa	*Xenentodol concila*
Oxygaster bacaila	
Cirrhinus mrigala	

Taking into account above, this Study recommends that, after the headworks starts operating, at least 20% of the flow in winter season should be released. This 20% regulatory volume is more than 10% which is the general practice in Nepal. Also, if the paper factory does not comply with Nepal Standard, the SRIP will have to release 50% of flow to the downstream. Based on the probability 80% river discharge, the 20% regulatory downstream flow and 50% release are estimated below:

80% probability of Sunsari river runoff: 3.69 m^3/s (during leanest season, early March)
20% regulatory downstream release: 3.69 m^3/s x 0.2 = 0.8 m^3/s (minimum release)
50% release: 3.69 m^3/s x 0.5 = 1.8 m^3/s (depend on paper factory)

Note; If the paper factory does not take any measure, the SRIP should not take any water, releasing all the water to the downstream.

Fish path to conserve fish species should also be provided to the planned headworks. The headworks is now designed with two fish passes, one in each side, so that the fishes can go up and down with the regulatory downstream release. The fish pass designed is a ladder type, same as shown in the photo.

12.2.3 Fisheries dependent on Sunsari River

1) Social Dimension of Fisheries

The major ethnic groups in and around the Study area are Tharu, Yadav, Mehata, Jhangadh, Bahun, Chhetri, and Mallah. Out of these groups, Mallah people who are sometimes called Gudhi have been traditionally engaged in fishery depending on Sunsari river, Old Sunsari river (Mariya Dhar), and other rivers. Their communities lie in such VDCs as Ghuski, Ramnagar Bhutaha and Narusimha. Total number of their household is estimated at around 180 according to interviews to the fishermen, of whom only 17 are part time fishermen and the rest are all fully engaged in fishing.

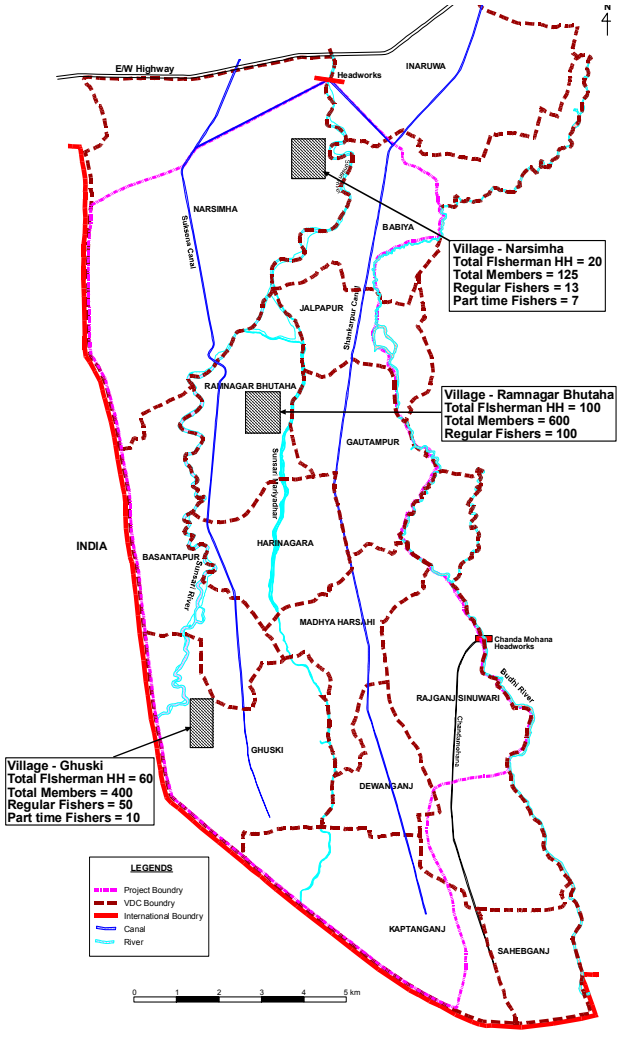


Figure 12.2.2 Location of Fishermen Village

Fishing is completely men's job. At present, individual small-scale fishing is carried out. Maximum fish catch on average is about 6 kg/day during October to December while minimum catch on average is about half kilogram per day during July to August. The fishermen's communities are relatively small. They are marginalized people, and many of them are landless. A typical example is Vikrampur village in Ghuski VDC where 50 households out of all 60 households are landless. Even if they have a land, the area is usually less than 0.5 ha. Thus, their income mainly relies on fishery.

2) Interaction/consultation with People

Having seen the economic condition of the fishermen and the benefit they receive from fishing at present, any decrease in fish populations that the Project may bring about cause drastic adverse impacts on the local earning and protein intake of the Mallah families. Absolutely fishermen, who are the poor even now, could be poorer. In addition to that, their situation would be more serious due to degradation of water quality, if any counter measure for reduction of the pollution from the paper factories were not placed in.


Fishermen Community

In line with above, an interaction/consultation meeting was organized on August 14, 2002 with the fishermen of Ramnagar Bhutaha VDC Ward No. 8 in their locality. 42 fishermen from the village took part in the discussion. Their opinions, suggestions and comments were found to be as follows:

- Most of them were of the opinion that irrigation project, though essential, would be beneficial for farmers but would be of no use to landless fishermen.
- They emphasized that their main occupation is fishing.
- Irrigate the proposed study area of SRIP from SMIP and do not disturb Sunsari River,
- Some of fishermen said that Sunsari river is a better source of fishes as compared to other rivers in the locality.
- They suggested fish culture in community ponds as an alternative managed by their own organization. When asked about their contribution in making these ponds, they said that they would contribute to an extent possible.
- Those with some lands agreed that they would be benefited through irrigation by growing vegetables, etc.
- They were of the opinion that downstream releases of the order of 10-20% during lean period are not likely to work due to low velocity and consequently no upward migration of the fishes.
- Most of them did not accept the idea of earning by working as farm labor, simply by saying that they are not used to it. They prefer to go for fishing irrespective of getting good catch or not.
- They said that fish population in Sunsari river was constantly decreasing after the paper factories started operating. They were of the opinion that the factories should not be allowed to release the untreated effluents in the river.
- Regarding fishing in Mariya Dhar, at present many people claim the land within the Dhar as private. They expressed doubts whether the land that people are claiming as private are really private. Quite often there are conflicts that are generally settled by giving half of the catch. In their opinion, resolution of the ownership problem and a weir/bund for

ponding about one meter depth of water in it (Dhar) would be the most appropriate alternative to them.

3) Mitigation on Fisheries

Though the headworks will release a regulatory flow to the downstream reaches to keep the biodiversity in Sunsari river, there will be adverse effect on the fisheries due to the decrease of the flow. In reality, the two paper factories have already affected the fisheries to certain extent. Taking into account the present situation already deteriorating and also their social status, the Project should actively undertake a measure to promote fish culture for the fishermen.

A Fisherman

There is already a program funded by UNDP, called "Park and People Program". The program has promoted fish culture apart from other rural development programs since 1995. They have facilitated the fishermen to organize a group. They have also provided trainings of fish cultivation together with the construction of fishponds. DADO has also been in charge of fish culture promotion. The officers have sufficient experience. If they are involved in the program, they can give a training package of production, harvest, processing and marketing.

There are three public sector fish hatcheries in the Eastern Development Region; Fisheries Research Center in Tarahara, Fisheries Development Center in Fattepur of Saptari District, and Fisheries Development Center in Lahan, Siraha District. Required number of fish seed could be supplied from one of these hatcheries together with the training package available from the UNDP funded program or DADO.

As for lands for fishponds, utilization of Mariya Dhar (old Sunsari) should be firstly considered for the fish culture promotion. Though sandy soil is prevailing in the Study area, there are clay soil areas partly ranging along Mariya Dhar. However, while fishing in Mariya Dhar at present, many people claim the land within the Dhar as private. The Study Team, therefore, to find the status of the land within the Dhar contacted District Survey Office, Land Revenue Office, and Land Reforms Office etc., in Inaruwa. But almost no information was obtained. The only information the Team could obtain was that the land within the Dhar was distributed to landless people by different Commissions at different times. Some of them were already given the ownership certificate (Lal Purja), and others are not yet.

Now a new committee has been formed under the chairmanship of CDO with a mandate to finalize the task within six months for cases already decided by the latest Commission. The cadastral maps of the Dhar showed a number of small plots with plot number. But, whether the ownership certificates have been distributed to all those plots or not was not clear. The record in the Survey Office only had a remark saying "Plottings as obtained from the High Level Commission". All the above offices were of the same opinion that real status of the

lands could only be obtained through field verification and enquiry.

Referring to the fishermen's opinion participated in the August 14 meeting, resolution of the ownership problem and then a weir/bund for ponding about one meter depth of water in Dhar would be the most appropriate alternative to them as a compensation for diverting water from Sunsari river. When asked whether VDC can resolve the ownership issue they answered in negative and indicated towards some higher levels of HMG/N.

This Study is proposing 50% diversion during winter season in case that the paper factories reduces the effluent by 80% (upon Nepal Standard compliance, 80% diversion is expected). Under 50% diversion, how much the fisheries would be affected is not clear but devastating aftermath could be avoided. Though one may say fish culture promotion, as compensation, may not be necessary in case of 50% diversion, this Study recommends to promote the fish culture even in case of 50% diversion. This early promotion of fish culture would well prepare the fishermen to operate full fish culture in lieu of fishing in Sunsari river at the time the SRIP start diverting 80% of water.

Table 12.2.5 Fish Culture by Type

Particular	Extensive culture	Semi-Intensive	Intensive culture
Feeding	Nothing	**Nothing**	Applied
Fertilizer	Nothing	**Applied**	Applied
Liming	Applied	**Applied**	Applied

According to estimation by DADO, the comparison of income among present fishery, extensive culture, semi-intensive and intensive culture is as following Table 12.2.6. Taking into account their skill already familiar to fishing, semi-intensive culture could be applicable. The table shows that 0.2 ha semi-intensive fishpond can compensate the income that at present one fisherman is earning annually.

Table 12.2.6 Comparison of Incomes from Fishery and Fish Culture (Rs/year)

	Fishery per HH at present *	Extensive culture per 0.2 ha	Semi-Intensive culture per 0.2 ha	Intensive culture per 0.2 ha
Cost	-	5,100	5,295	13,255
Income	25,200	24,150	31,500	49,000
Net income	25,200	19,050	26,205	35,745

*Roughly estimated based on the results of interviews to fisherman.

There are around 180 fishermen's households. If they are to be all converted to fish culture, an area of about 40 – 45 ha is required for constructing the fishpond. Pond construction cost per hector is about 200,000 Rs excluding the land acquisition. Land acquisition in Mariya Dhar is said to be about 100,000 Rs (farm land is about 300,000 Rs/ha). Therefore, about 14,000,000 Rs should be prepared for the pond construction in Mariya Dhar aside from other expenses such as trainings.

12.2.4 Water Use along Sunsari River

Often seen is pump irrigation from Sunsari river. Practice of extracting water include pumping of water into a circular earthen bund. Small earthen canals carry the water from the pool of water collected into the circular bund to the fields. However, such canals irrigate fields only up to 200 m from the bank of rivers, as irrigating land at a distance more than that becomes economically unfeasible. Thus, farmers generally use shallow tubewell for irrigating their fields that are more than 200 m away from the river bank.

A total of 266 pumping locations of the type mentioned above were observed in May 2002 at the downstream of the bridge of East-West highway to the border with India. Approximately 230 ha of land is being served by the 266 pumping stations along the Sunsari river. By considering pumping capacity of 20 l/s and number of pumps available in nearby villages which is about 20 according to interviews, the total maximum water extraction during dry season from Sunsari river is calculated below:

Total water drawn from Sunsari river = 20 X 20 = 400 l/s 0.40 m^3/s (at maximum)

Note: this is regarded as maximum value since all the 20 pumps are supposed to operate simultaneously.

SRIP is to release 50% water, which is 1.8 m^3/s, to downstream during winter season in case that the paper factories reduce the effluent by 80%, so that the pump irrigation requiring 0.4 m^3/s at maximum would not be affected. At a latter stage, SRIP may divert 80% water on condition that the paper factories abide by Nepal Standard. 80% diversion means 0.7 m^3/s release to downstream, which is still more than the total pump irrigation requirement. Therefore, the SRIP is not expected to take any compensation measure for the pump irrigation along the river. Noted here is that the pump irrigation should be alternated to shallow tubewell since the water is already heavily polluted. The government should facilitate the farmers to stop pumping up the polluted water and shift to shallow tube wells irrigation.

Pump Irrigation from Sunsari River

12.3 Environmental Monitoring Plan

Based on the activities and adverse impacts in the environmental scoping together with the issues discussed above, the following indicators in Table 12.3.1 are proposed to monitor the changes of environment due to the construction and operation of the Project and to check the effectiveness of the mitigation measures planned. The areas most noticed are: water quality of the Sunsari river together with the flow volume, biodiversity of the Sunsari river, and compensation and follow-up for fisheries. Monitoring provides necessary information for decision makers to evaluate the situation and to take additional measures to minimize the adverse impacts, which might be bigger in magnitude and larger in extent than originally thought.

Table 12.3.1 Environmental Monitoring Plan

Indicators	Schedule	Method	Main Actor(s)	Sampling Points	Particulars
Preparation Stage					
- Incorporation of mitigation measures in the design and tender document	During approval	Review process	Project and MOWR	-	-
- Production, water consumption and environmental management of Baba Paper Mill	Once a month	Observation and inquiry	Project	-	-
- Construction of ETP at Baba and Arvind Paper Mills	-	-	The Paper Mills	-	-
- Water Quality of Sunsari River, discharge from Baba and Arvind Paper Mills and groundwater around Baba Paper Mill	Once a month in lean season	On-site check	Project	See Figure 12.3.1	pH, EC, COD and DO
	Once in monsoon season	On-site check	Project	Ditto	Ditto
	Once in three months	Laboratory test	Project	Ditto	A*
Construction Stage					
- Water Quality of Sunsari River, discharge from Baba and Arvind Paper Mills and groundwater around Baba Paper Mill	Once a month	On-site check	Project	See Figure 12.3.1	pH, EC, COD and DO
	Once in three months	Laboratory test	Project	Ditto	A*
- Condition of woods	Once in three months	Observation and inquiry	Project	Around the camp(s)	Density and species of plants
- Health and sanitation facilities at work and labor camp(s)	Once in three months, or if required	Observation and inquiry	Project	At the camp(s)	Water works and sewerage
- Heavy traffic, noise, social disharmony etc.	Twice a year or if any complaints	Public hearing	Project	At east-west highway bridge	Any complaints
Operational Stage					
- Water Quality of Sunsari River, discharge from Baba and Arvind Paper Mills	Once a month	On-site check	Project	See Figure 12.3.1	pH, EC, COD and DO
	Once in three months	Laboratory test	Project	Ditto	A*
- Flow in Sunsari River	Everyday	Measurement	Project	See Figure 12.3.1	Flow
- Fishes in Sunsari River	Once in each monsoon and lean season	Observation and inquiry	Project	See Figure 12.3.1	Identification of the fish species
- Grass along Sunsari River	Once in each monsoon and lean season	Observation and inquiry	Project	See Figure 12.3.3	Identification of the grass species
- Water use by pump irrigation along Sunsari River	Once in lean season	Observation and inquiry	Project	Along the Sunsari river	The number of pump station
- Water use by hand-pump wells along Sunsari River	Once in lean season	Observation and inquiry	Project	Ditto	Ditto
- Compensatory fish culture	Once in lean season	Inquiry	Project	At three VDCs See Figure 12.2.2	Cost and income of aquaculture
- Downstream erosion at the initial stage	Once in lean season	Observation and inquiry	Project	Just downstream of the headworks	eroison
- Silt load in Sunsari River	Once in lean season	On-site check	Project	See Figure 12.3.1	Suspended solid of the river
- Silt deposit in the canals	Once a year	Observation	WUC	See Figure 12.3.1	The depth of silt in the canals
- Plantation on the spoil banks and its management	Once in monsoon season	Observation	WUC	At the banks	The density of plants
- Vector-borne diseases	Once after and before monsoon	Public hearing, Inquiry	Project	At hospitals	The number of patients
- Plantation of catchment area and its management	Twice a year	Plantation and management	Project, WUC	At catchement	The density of plants

A* The parameters of water quality test in laboratory are COD, BOD, Iron, Arsenic, Chromium and Manganese.

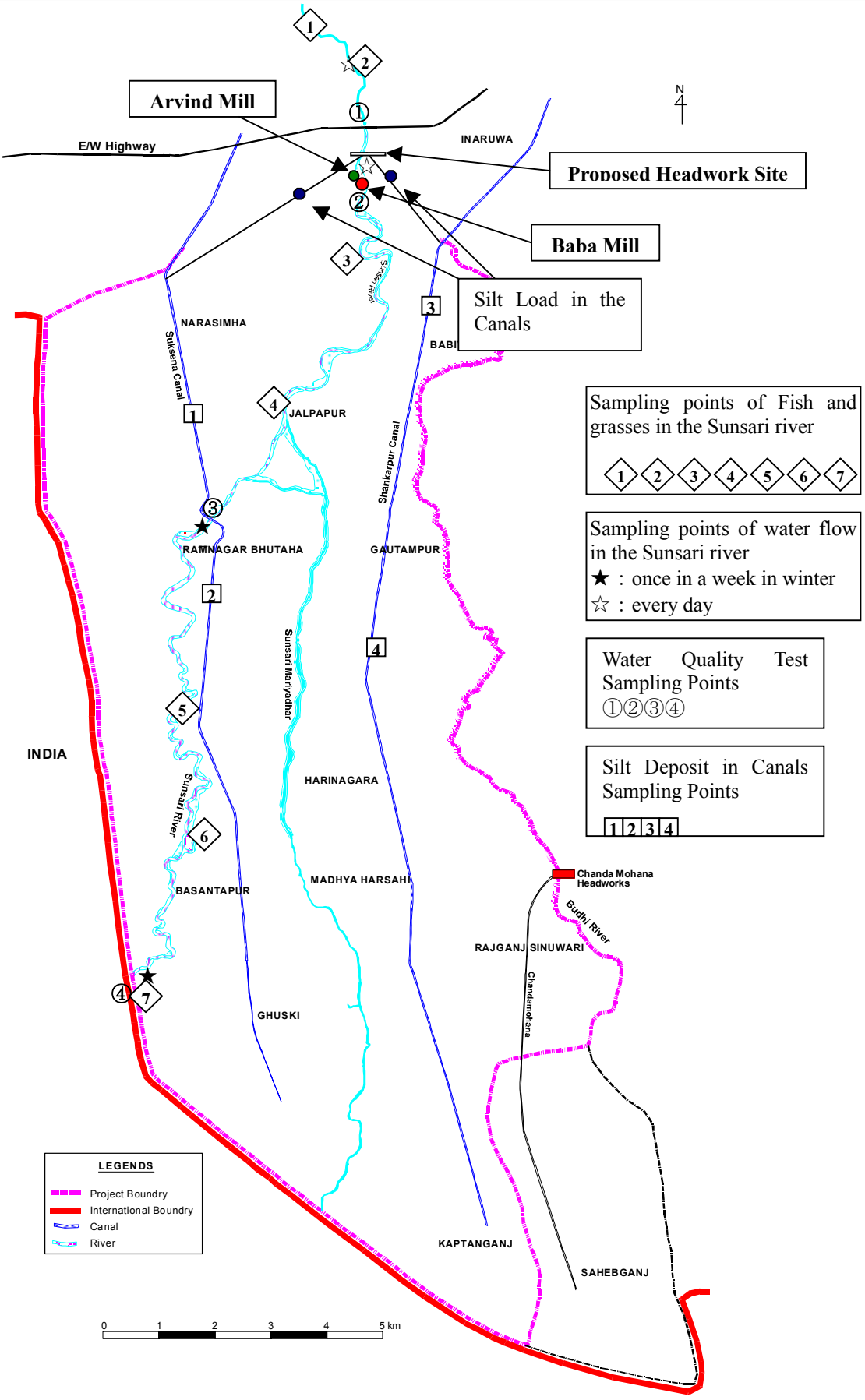


Figure 12.3.1 Sampling Location Map

CHAPTER 13

CONCLUSION AND RECOMMENDATIONS

CHAPTER 13 CONCLUSION AND RECOMMENDATIONS

13.1 Conclusion

The Sunsari River Irrigation Project (SRIP), once implemented, will realize the people's long lasting dream to come true; that is agriculture development well supported by irrigation water. The proposed SRIP will improve the living standard of the local people through the irrigated agriculture. For instance, if the SRIP operates only during the monsoon season, (existing STWs will irrigate the land during winter season) even as the base case, the incremental agricultural income for marginal, small, medium and large-scale farm households will be 13,000 Rs/ha/yr, 11,000 Rs/ha/yr, 17,000 Rs/ha/yr and 29,000 Rs/ha/yr respectively. In case SRIP diverts 80% of the river water into farmlands during winter season, the incremental income of the above-mentioned farm households will be 21,000 Rs/ha/yr, 26,000 Rs/ha/yr, 34,000 Rs/ha/yr and 44,000 Rs/ha/yr respectively.

The SRIP, from the viewpoint of national development, gives EIRR 16 % higher than the opportunity cost of capital of 12 % in Nepal even at the base case. It is expected with the SRIP that the unit yield of paddy will increase to 4.2 t/ha from the current 2.3 t/ha and gross production in the Study area, at the base case, will add 7,600 tons of paddy, 17,700 tons of summer vegetables etc. Should the SRIP divert 80 % of the river water into farmlands during winter season, the EIRR would become 19 % and the incremental production will further add 3,500 tons of potato and 9,200 tons of winter vegetables from the base case, contributing not only to the local people's food security but also enhancing the living standard as well as the national food security level.

The SRIP furthermore will create job opportunity particularly for the landless. The project will generate 116,830 man-days at the base case (166,170 man-days if 80 % of the river water were taken for irrigation during winter season) for agricultural work. For desilting and grass cutting work in maintaining irrigation canals, 14,290 man-days of labor will be generated, thereby contributing to poverty mitigation. The SRIP also pays attention to the disparity in location; namely, road-networking improvement in the western part of the Study area is incorporated to mitigate the disadvantage of accessibility to the area. This improvement will carry farm extension services or NGO assistances into the area as well as increase a sales opportunity of farm products, contributing to raising the people's living standard.

Taking into account all of the above benefits, this Study concludes that the SRIP should be implemented as soon as possible. The HMGN should take action immediately toward arranging the required funds available. Appropriation from the Government coffer should be made at least for land acquisition, administration, and other supportive components such as agriculture extension services, promotion of inland fishery, etcetera. Also, assistances from donor country(ies) as well as international funding agency(ies) should be sought.

13.2 Recommendations

13.2.1 Issues relative to Project Implementation

1) Operation of SRIP during Winter Season

SRIP should not divert any water during winter season unless otherwise the two paper factories, located just downstream of the proposed headwork site, establish effluent treatment plant (ETP) since the river's present condition is already beyond the permissible level. In this case, irrigation during the winter season will have to be dependent on existing STWs (about 80 % farmers are using STWs even at present).

On condition that the factories install an ETP reducing the effluent by 80 %, the SRIP could proceed to diverting Sunsari water up to 50 % during winter season. The diversion of 50 % during winter season should accompany careful monitoring of both paper production and the river water quality. Such monitoring is required because the situation of Sunsari river would become a little worse than the present even with the ETP if Baba factory runs the production line with the full capacity (four times production than the present). Also, compensation for 180 fishermen dependent on the Sunsari river should be undertaken to about half of the fishermen to be affected.

If the SRIP intends 80 % water diversion during winter season, the Government should enforce upon the factories to obey the Nepal Standard. Unless otherwise the factories abide by the Nepal Standard, the SRIP should not proceed to the 80 % water diversion. Compensation for 180 fishermen dependent on the Sunsari river should also be considered to full extent in case that the SRIP diverts 80 % water.

As per downstream regulatory release, this Study recommends that at least 20 % of the flow in winter season should be released. This 20 % regulatory volume is more than the general practice in Nepal, which is 10 %. Based on the probability 80 % river discharge, the 20 % regulatory downstream flow is 0.8 cum/s. Even in case that the factories comply with the Nepal Standard, the SRIP should release at least 0.8 cum/s in order to keep downstream environment in a proper condition.

2) Process of Establishing Organization

One of the reasons, which causes water users' organization to become non-functional, must be rooted in the process of establishing the organization itself. Observing the manner of approach in existing organization, it seems that the organization was formed due to the convenience of the external agency side without fully consulting with all the farmers. If the external agency approaches in a hurry, without believing in the farmer's capacity, it is no wonder that farmers consider that they organize themselves for "external agency", but not for "themselves".

In this sense, the manner of approach should bear the active participation of farmer beneficiaries of the Project from its initial period and take enough time for establishing the organization. The external agency should also be in the stance of not pushing but stressing "ownership of farmers" for sustainability of the function of the organization.

3) Establishing Clear Information Dissemination and Transparency

For equal distribution of water, common information should be shared among all the users properly. Equal information dissemination will provide equal access and control to all users, regardless of poor and rich. Since the rotation use of irrigation water is required during winter, communication among WUG, WUG-WUC, WUC-WUC, and WUG/C with the Project Office must be very important. Especially communication between upper reach and lower reach must be very necessary in order to distribute the water equally.

Furthermore, in existing irrigation projects, there are various misunderstandings among users, and, in some cases, the farmers are not sure even who collects ISF and how the ISF is used. Above all, there are a lot of doubts by farmers, saying that the committee members of WUC are corrupted. If the corruption is a biggest issue, a way to solve this problem is to make the system transparent. For keeping transparency, information should be disseminated well to all the concerned people. The Government should pursue this transparency to all the concerned farmers.

4) Accountability of the Irrigation Agency

NISP study stresses the issue of budgetary system relative to the ISF collection, saying that non-earmarking the funds collected as ISF for covering O&M expenditure in the irrigation systems would aggravate the poor performance of ISF collection. Namely, collected ISF goes to the government's central treasury and is not related to the O&M budget of the irrigation system, which leaves no material incentive to increase ISF collection efficiency. The ISF collection efficiency does not influence the budget allocation of the irrigation systems. Therefore, the rate of farmer's payment for ISF virtually lacks any effect on the quality of O&M.

The Government should be accountable to WUC about who pays ISF and how it is used. The current budgetary system cannot provide an exact balance sheet or income/expenditure statement of an irrigation system. It is, therefore, recommended that to make it possible to examine the financial autonomy of the irrigation system in order to show accountability to the farmer members, a budgetary arrangement to reflect ISF collection to the budget of the irrigation system should be considered.

5) Coordination among WUCs by the DOI

The organizational structure of the WUAs in SMIP is tall and highly centralized. As the leadership structure moves up, the leaders become unreachable by the farmers at the levels of the WUGs. There is too much concentration of power among the leaders and none is left among the farmers. The organizational structure that will be organized in SRIP will provide a mechanism where the beneficiaries' participation or democracy arrives at their decisions for the WUA and at the same time which has to be balanced with the beneficiaries' discipline in obeying to the decisions arrived by them in a democratic way.

Thus, the WUC operation is simply from-the-farmers-to-the-farmers mode. The farmers are also represented by the WUC (secondary canal level) Chairmen in the WUCC (main canal level) to coordinate water delivery and schedules along the main canal with concerned

officials of the Project. For coordination purposes, the WUCC is not registered and no chairman is required for the WUCC except presiding officer for the purpose of facilitating a meeting. Only the WUCs are registered because they enter Joint Irrigation Management Agreement with DOI for the O&M of their respective command areas. The DOI should coordinate with all the chairmen representing their WUCs for equal water distribution along the main canal. This mechanism could avoid the tall and highly centralized structure unreachable by ordinary member farmers.

6) Coordination among Other Agencies

There have been several agencies in the Study area such as the Bank assisted SMIP, UNDP assisted LGP, and so forth, carrying out irrigation or rural development projects / programs. The SRIP will be able to contribute to the rural development of the Study area more effectively, if SRIP is properly positioned among the development activities of the area. Therefore, coordination among the agencies acting in the Study area should also be pursued even by the initiative of DOI if appropriate. For instance, since the landless could not be a member of WUA to be established for the irrigation development, SRIP could suggest other agencies to prioritize their target beneficiaries by land holding status.

This Study has proposed that SRIP should be operated and maintained by Sunsari Division Office in coordination with SMIP. Performance of both SRIP and SMIP will influence each other for sustainable O & M of the irrigation system. Furthermore, there would be a case that SRIP could receive supplementary water from SMIP during winter season. In such case, issues of water and O & M cost allocations should arise between the systems. Therefore, coherent coordination between the two systems in O & M should be established.

7) Inconsistency of Policy Implementation

Irrigation policy of Nepal, which imposes upfront payment for the beneficiaries of irrigation projects and the cost sharing of 10 % for the capital cost in case of new construction, has not been consistent on the ground. For example, Chanda Mohana Irrigation System, whose part covers a southern part of the Study area (Sahebganj), was constructed without any due of the repayment from the beneficiaries. This inconsistency may discourage the potential beneficiaries of the irrigation development in the Study area to burden such expenses. The Government should purse the public equity based on the consistent policy implementation and if any exception takes place, the Government will have to be accountable in explaining to the people.

The issue of the consistency will also be crucial for the case of ISF collection, as the low ISF rate in SMIP (200 Rs/ha/yr), which can hardly cover the necessary O&M cost of the irrigation system (it is estimated that SMIP would require 1,100 to 1,300 Rs/ha/yr to cover the O& M cost), would discourage farmers to pay higher ISF in other irrigation systems. The ISF rate should be identified based on the necessary O&M cost of the irrigation system and equal rate should be applied for the similar type of irrigation systems.

13.2.2 Refining the Existing Policy and Regulations

Institutionalized policies and regulations guide the concerned officers, consultants, and planners in preparing such development plan as SRIP. Policies and regulations are, on the other hand, refined in such a way of getting feedback from the ground where actual planning and implementation take place. Following are the feedback from this Study, which may serve for refining the present policies and regulations:

1) Project Development

The Irrigation Policy (IP) of 1992 (2049) section 3.24 provides that "His Majesty's Government shall invest in the project only after having formal agreement with the Water Users' Association by clearly defining the functions, duties and rights of the concerned Irrigation Office and Water Users' Association by adopting a transparent method in relation to the construction, implementation, operation and management of the project." Further, section 3.25 stipulates that the agreement concluded with the Water Users' Association should be regarded as the basis of resource mobilization.

This pre-project investment agreement includes areas that have something to do with the project such as land for the watercourses, cost sharing according to the levels of canals and upfront deposit of the WUA. As such, all pertinent conditions and stipulations can be included in the Agreement. However, making farmers' contribution mandatory not only to provide land free of cost for the small canal that is to irrigate up to 30 ha block (IP Article 2.2.3) but also a cost sharing of 25 % on the cost of construction thereat and without contributions on the higher level canals such as sub-secondary or secondary contradicts the essence of the pre-project investment agreement.

The policy should not limit, and specifically mandate at what level and at what rate the farmers' contribution should be. There are tertiary canals which may cover 20-ha watercourses. With the policy, the farmers' contribution has been set at 25 % but the farmers and their organizations can also contribute 100 %. If the contribution is already mandated at a given level with a given rate, what is there to agree between the Water Users' Association and the concerned Irrigation Office? Thus, there are contradictions within the IP itself.

The defined cost contributions of both parties contradict the provision on the farmers' donation of land for small canals to irrigate up to 30 ha block and of the construction cost of the field channels. The contradiction confuses the meaning as to the size of the watercourse particularly in the field. In order to rectify the essential contradictions, the provisions of the IP in terms of fixed contributions relative to the area and level of canals should be relaxed in favor of a mutually understood pre-project investment agreement. The Water Users Committees and the concerned Irrigation Office will have to go through an agreement process without being restricted because of the fixed contributions provisions. In other words, the Policy and the practice in the field should be guided by an open pre-project investment agreement within the context of the parameters to be agreed upon by both parties. In this way, the contradictions within the Policy can be resolved.

2) Operation and Maintenance

Rules 7 and 8 of the Irrigation Rule of 2000 provide for the organization of the Users Coordination Association and the establishment of deposit for maintenance fund. Furthermore, it provides that the Coordination Association will be registered. In the proposed SRIP, however, the Water Users Committees (WUCs) at the secondary level are planned to be the Associations that will be registered. All levels from the watercourses to the headworks require coordination where higher level coordinates the works of the lower levels. Without specifying which level this coordination will be confuses which level should be registered. This confusion will be cleared out if the IR specifies the Water Users Coordination Committee is not to be registered but mainly serves coordinative purposes.

On the maintenance fund, the Rule stipulates that the Users' Association shall establish a separate fund for the maintenance of the irrigation system and the structures and deposit at least 90 % of the Service Charge and other income. The WUCs will determine how much will go to maintenance and other works of the Association and fixing maintenance to be 90 % does not have meaning. So, in SRIP it is up to the WUCs to decide this purely internal and very specific matter like maintenance fund allocation.

If the Irrigation Policy, Water Resources Act and the Irrigation Rule have to be reformed, these will be stated as general guidelines and not as specifics. The general guidelines will serve as the framework of the specifics on the ground. These guidelines should not be stated as specifics because these will limit flexibility and innovations as implementers pursue these in the field. The specifics are the expressions of the guidelines best formulated according to the requirements of the actual local situations.