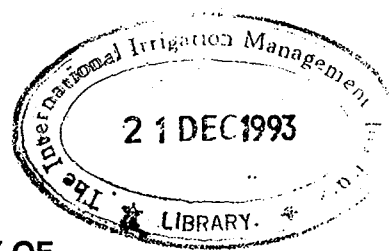


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## PERFORMANCE ASSESSMENT STUDY OF PATHRAIYA IRRIGATION SYSTEM, NEPAL

A Study Report by A. Valera

**Abstract:** A rapid appraisal study of the Pathraiya Irrigation System (PIS) was conducted in 1993. This system is managed by the Department of Irrigation (DOI). The objective of this study was to document the performance assessment methodology and performance indicators currently in use in this system. The data collected consisted of reviewing reports and other secondary materials, interviews with the system staff and sample farmers from the system. This study was conducted as part of the study in which irrigation system performance assessment methodologies used in selected irrigation systems from Nepal, Philippines and Sri Lanka, were compared. The framework used in this documentation study was based on the work of Bos, et. al., 1993. In particular, the elements of the management process were analyzed for this system.

On the elements of the management process, only semblance of planning process was evident. The management process components on implementation, monitoring and evaluation were not being carried out. In fact, there was no management process at all. The main concern of the PIS/DOI field staff was carrying out the water delivery schedule for which has been in place for the previous 2 years. The de facto system manager was the overseer particularly during the monsoon season. During the winter season, most of the staff are involved in other activities outside of PIS. There are two water users groups that were formed but are not working effectively with the PIS/DOI staff.

Responses from sampled farmers indicated dissatisfaction with the amount of water delivered to their fields as well as with the operation and maintenance of the system, among other things. The average estimated yield in the downstream portion was lesser but found to be not significantly different from the upstream areas of the system. There was no management process in place. The existing performance indicators used were main based on the adherence of farmers to the water delivery schedule and complaints of farmers. These contributed to the low level of output performance of the system. Recommendations for the system performance improvement are suggested based on the findings of this study.

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# Performance Assessment Study of Pathraiya Irrigation System, Nepal<sup>1</sup>

## Introduction

There are studies on the performance of irrigation systems. However, only few that systematically document performance assessment methodologies and indicators, currently in use and also outcomes of their use. This presents an opportunity to examine the utility of an effective performance methodology as a prerequisite for actual performance improvement of the irrigation system.

The performance assessment methodology as described in this report includes the management process, output and impact measurements that are used in the selected irrigation systems. The Pathraiya Irrigation System was selected as the system to be studied for performance assessment methodology comparison in Nepal.

Purpose of this report is to present the results of the study determining the existing performance assessment methodology and performance indicators in Pathraiya Irrigation System. Specifically, the report will: identify performance assessment methodology currently in use, management process, output and impact measurements and potential for the Pathraiya irrigation system performance improvement.

The data collection in this study consisted of secondary sources (i.e., reports, official acts, etc.) and primary sources (interviews with Department of Irrigation [DOI] staff assigned at the Pathraiya Irrigation System, farmers and other informants). Accordingly, the limitations of the report will be on the relatively rapid assessment of data based on the foregoing sources.

A case study approach has been used in synthesizing and analyzing the data gathered. Specifically, the performance framework developed by Bos, et.al., 1993 will be used to as the basis for analyzing, presenting and comparing this system with those from the Philippines and Sri Lanka. In this report, irrigation performance as defined will deal with: the degree to which the irrigation agency's (DOI) services respond to the needs of their users (farmers), and the efficiency with which the agency uses its available resources.

## System Background

The Pathraiya Irrigation System (PIS) is located in the Kailali District of the Far Western Terai Region of Nepal. The command area covers the village development committees of Simarana, Muddhi, Nawalpur, Simari and Lalpur Bani. The field office of the system is located near the headwork in the village of Thakurdwar. This is located about 60 km east of Dhangadi, the district town headquarters of Kailali district, which is about 800 km west of Kathmandu. The system is connected from the East-West Highway with an earthen road (10 km) that is not motorable during the monsoon season.

The system was completed in 1973. The former Department of Irrigation, Hydrology and Meteorology (DIHM) was responsible for the construction of the system. The cost of

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<sup>1</sup> A draft final report prepared by A. Valera, Head, IIMI-Nepal Field Operations, November 1993.

construction upon completion was about 4.6 million NRs. The system has a 10 km long main canal with one branch and 3 distributary canals (Figure 1). The total length of the canals is around 28 km (Table 1). The tertiary canals were not part of the original irrigation project. The farm level facilities were constructed under the Farm Irrigation and Water Utilization Division (FIWUD) of the Department of Agriculture, starting in 1978 and completed in 1983. These additional facilities provided by FIWUD were coupled with management procedures and corresponding field staff for appropriate water management at the farm level (McDonald and Partners, 1983). In 1988, all of the major irrigation functions were merged into the Department of Irrigation (DOI). The functions of DIHM and FIWUD were then transferred to DOI.

Table 1. Length of canal, design discharge and length of service road at Pattharaiya Irrigation System. (Source: Gitec, 1993).

Canal Name	Length (km)	Design Discharge (cumecs)	Service Road (km)
Main Canal	10.672	1.70	10.058
Branch Canal	6.416	1.13	4.374
Ghusari Distributary	4.905	0.71	2.133
Main Pokhari Distributary	3.201	0.51	1.158
Bankatta Distributary	3.048	0.34	-
Total	28.24 km		17.723 km

The irrigation system was designed as a supplementary irrigation scheme. This means that the main objective of the system was to provide supplementary irrigation water during the monsoon or main season to augment the inadequate rainfall. The critical stage was estimated to be around mid-September (paddy flowering stage). The system was not intended to provide irrigation water to a large area during the winter season. Generally, the main diversion and intake gate was closed starting in 15th February.











The full supply discharge at the main canal was designed at 2.83 m<sup>3</sup>/s. This was intended to irrigate a net command area of 1,840 ha planted to paddy. However, the most recent flow measurements made was in 1981. A survey made by Hydro Engineering Service indicated that the net irrigated area is only about 1,333 ha with about 400 ha of elevated or upland ("bari" land) within the command area (WECS, 1985). These bari land areas are irrigated by shallow tubewells and also pumping from the irrigation canals. The actual irrigated area is most likely to be less than the designed irrigated area. There is indication that the diverted water from the Pathraiya river has decreased since the last time it was measured.

The farming community at Patharaiya consists can be categorized in accordance with the land tenure characteristics. These are land owners, tenants and servants ('Komiers'). The households consist of land owners about 530, tenants about 100 and Komiers about 500 (Sir McDonald And Partners Ltd., 1983). These Komiers are bonded servants to the landowners that will work exclusively for the landowner and will make subsistence from the produce of the land (1 bigha [.67 ha]) which the landowner provides. The tenants normally pay about half the gross production as land rental payment to the landowner. The average land holding is about 3.5 ha with the modal range from 1.3 to 2.7 ha. Both Komiers and tenants are not permanent

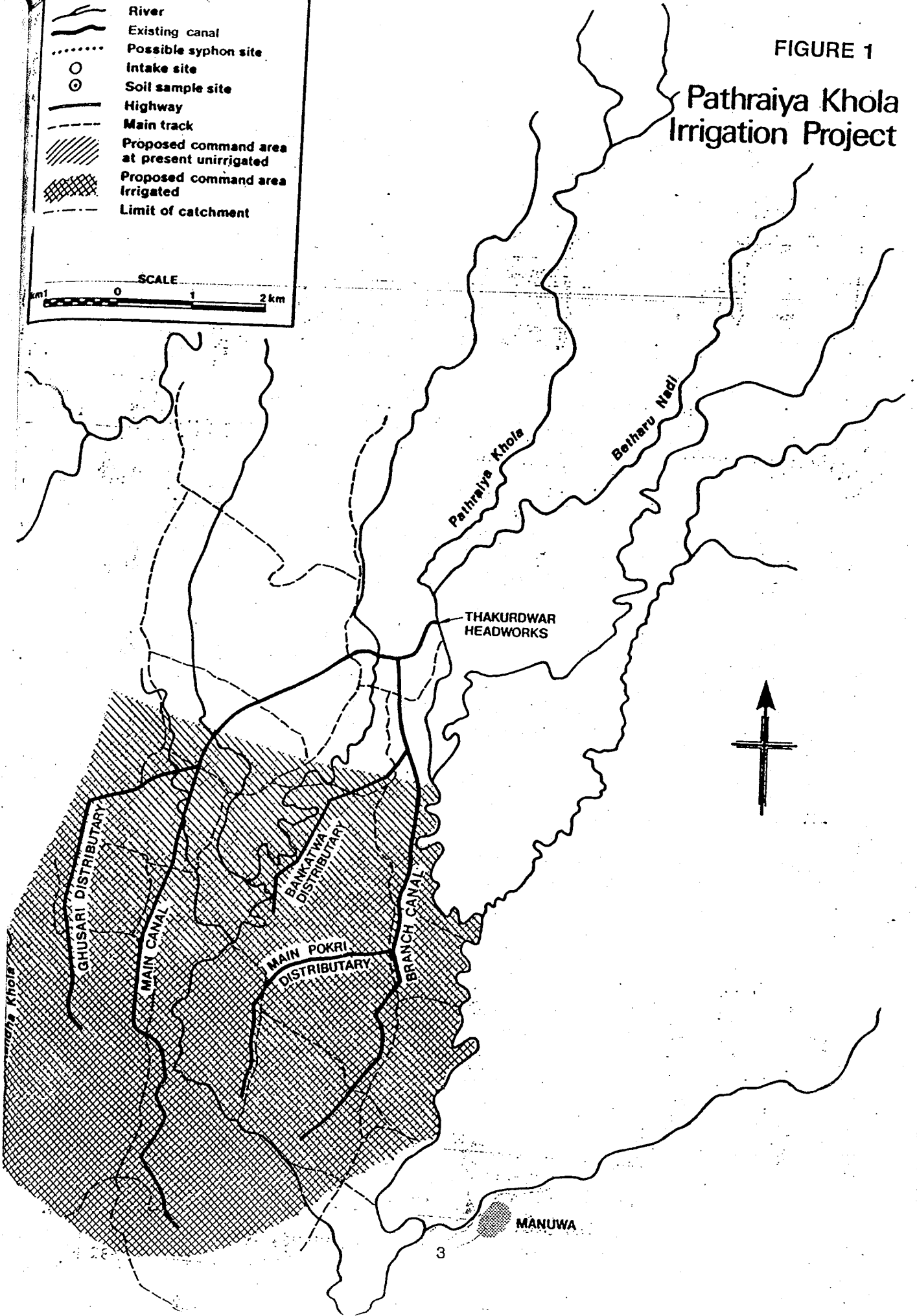
FIGURE 1

# Pathraiya Khola Irrigation Project

**LEGEND**

-  River
-  Existing canal
-  Possible syphon site
-  Intake site
-  Soil sample site
-  Highway
-  Main track
-  Proposed command area at present unirrigated
-  Proposed command area irrigated
-  Limit of catchment

**SCALE**



farmers in the command area.

In this study, the sample farmers interviewed consisted mainly of landowners with a few tenants with landholding ranging from 0.67 to 14.41 ha. The average land holding for the sampled farmers was about 4.91 ha.

### Operation

Presently, the Pathraiya Irrigation System is administratively under the DOI Kailali District Irrigation Office. The district engineer nominally supervises the operation and maintenance of the system, among his many other responsibilities. An assistant engineer is designated to fully manage the system. However, the asst. engineer is not also full time in this activity, since his office is located in Dhangadi. It is the overseer that supervises day-to-day operation of the system particularly during the monsoon season. There are 28 DOI staff presently working in the system (Figure 2). All of these are with permanent appointments from DOI. The previous FIWUD involvement in the system contributed to these relatively larger number of staff considering the smaller command area.

The system operates from July to November for the monsoon season. For the winter season, only a fraction of the command area is irrigated. This operation is based on farmers' demand and only for a limited period of time. Nominally, from December to February irrigation water is provided for winter wheat and also some area for mustard. Lentil is also grown in irrigated land right after harvesting the monsoon paddy crop, but does not require irrigation for its growth.

A schedule of water delivery is formulated by the Asst. Engineer and disseminated to the WUGs and farmers. This water delivery schedule indicates the location and duration of water delivery (Annex 1). The latest estimate of actual area irrigated is about 40% of the command area in the winter season (GITEC, 1993). Without any other source of reliable estimates, it is clear that even the basic data in actual area irrigated is not available from the DIO.

About half of the fieldmen were considered functional or concerned with their jobs, in accordance with the farmers. The rest were not even seen by the farmers even during the operational period in the monsoon season. Conflicts and complains over irrigation water are frequently observed. These are mainly due to inadequacy of supply. With only half of the fieldmen doing their job, conflicts and unresponded complaints are expected in an agency-managed irrigation system.

### Maintenance

The ineffectiveness of the DOI staff and WUGs is exacerbated by the conditions of the canal system and structures. The canal system badly needs reshaping, desilting, and improvement of the service road. Outlets, bridges and aqueduct need repairs to forestall further deterioration of these structures (GITEC, 1993). The system also lacks adequate maintenance budget. Only 50,000 NRs (about USD 1,200) was allocated and released for maintenance of the system last year. This is just token maintenance budget. In fact, this amount was not even felt or seen by the farmers spent for any of the canal structures. This amount was mostly used for cost of the maintaining the quarters of the DOI staff. This was one of the complaints of the

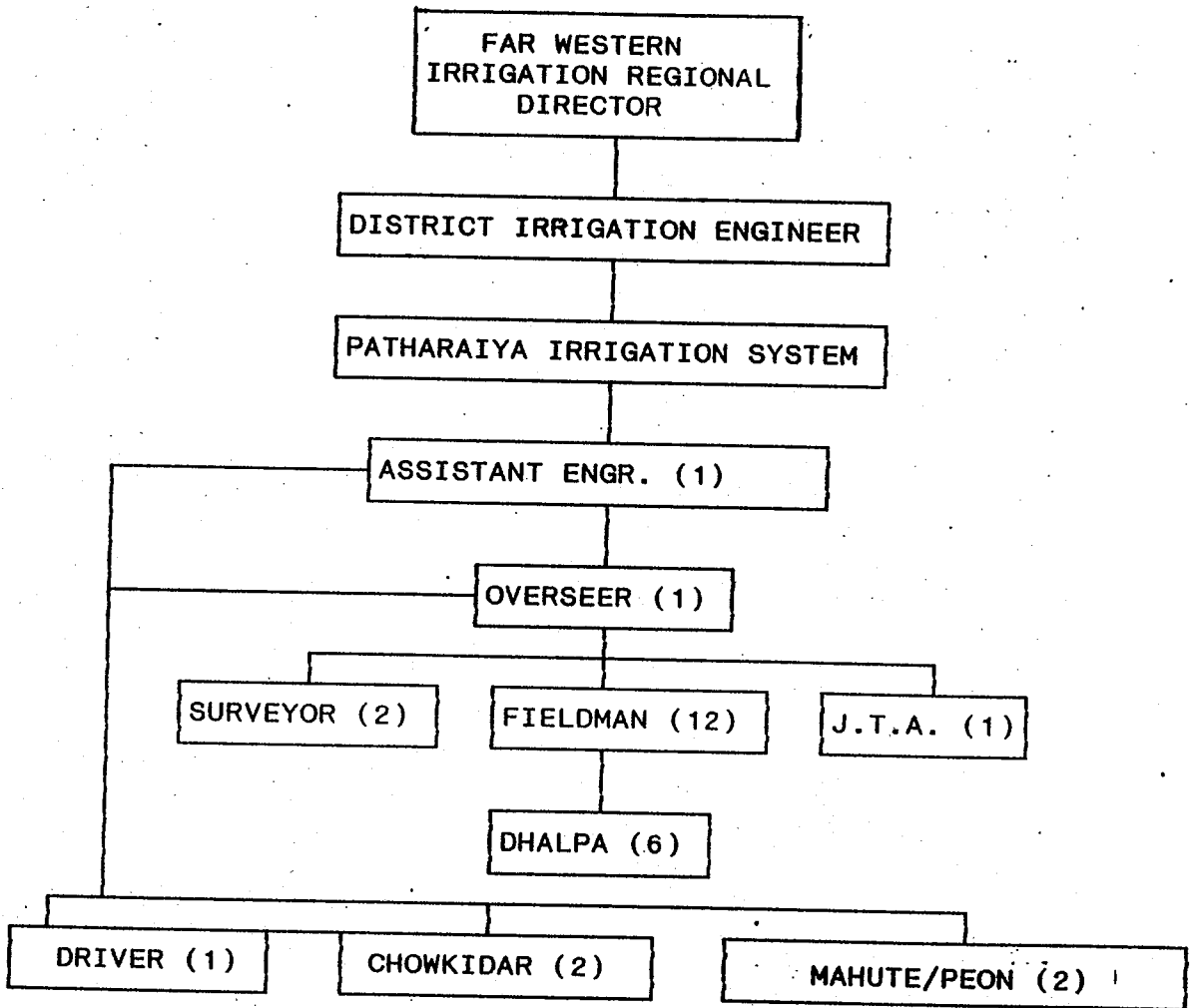


Figure 2: Organizational Chart of the Patharaiya Irrigation System

farmers. This year a request for 20 lakhs (20,000) NRs was made but only 1.5 NRs was approved and received. These in real terms, very much less than the amount provided more than 10 years ago.

Table 2. Annual operation and maintenance costs for the Pattharaiya Irrigation System, for the years 1974-1981. (Source: Sir McDonald & Partners Limited, 1983).

Financial Year	Operation Costs	Maintenance Cost	Total
1974/75	81,791	47,757	129,548
1975/76	78,606	225,232	303,838
1976/77	89,745	221,269	311,014
1977/78	107,121	233,629	340,750
1978/79	90,224	299,991	390,215
1979/80	100,408	226,259	326,667
1980/81	132,226	282,896	415,122

Note: Costs in Nepali Rupees

Although the farmers contributed labor to clean their field channels and distributary canals, no effort was made to desilt and clean the branch and main canals. The farmers argued that these canals should be maintained by DOI and not the farmers. Mobilizing local resources will be difficult if the expected services from the DOI staff are not forthcoming and reliable.

With the no effective procedure of allocating maintenance budget for existing irrigation systems, the inadequate maintenance budget will continue to plague most DOI systems. Until a system of allocating maintenance budget based on properly documented need rather than the subjective decisions, this inadequacy and deterioration of irrigation systems will persist. An estimate of needed repair works was recently made to bring back the physical structures to effective level of operation. This amounted to USD 275,000 or about USD \$ 138/ha (GITEC,1993). This will include training for DOI field staff as well as WUGs for maintenance, operation and share system to be implemented.

### Institutional Characteristics

The district engineer, asst. engineer and overseer and some fieldmen have only been working in Pathraiya system for the last 2 years. The longest serving DOI staff has only been with the system for the last 7 years. The orientation of the DOI staff particularly in the supervisory level, are still on construction. During winter season, the district engineer, asst. engineer and the overseer are all involved in construction, either in rehabilitation or construction of new small scale systems in the district.

With the FIWUD involvement in the system, water users groups (WUGs) were organized as early as 1980. These water users groups were responsible for operation and maintenance at the tertiary level and was also requested to provide occasional labor for cleaning certain portions of the distributary, and branch canals. With the construction of tertiary

level facilities, and active involvement of FIWUD staff during the period from 1978-1989, the WUGs were relatively active in distributing water within the 200 ha block for which they were organized, maintaining these field channels, resolving irrigation related conflicts among farmers and mobilizing resources for these activities.

With the merging of the FIWUD and DIHM, these WUGs gradually became ineffective despite the efforts of reorganizing by the present DOI staff for the last two years. The Asst. Engineer and the Overseer reorganized the water users groups in 1991. One WUG for the branch canal and the other for the main canal. Apparently, the withdrawal of support earlier enjoyed under the FIWUD project, the weak support of the remaining DOI staff for the WUGs and other factors (political interference, etc..) contributed to the ineffectiveness of the WUGs in the last 3 years. Nominally, there are two WUGs at the Pathraiya system. These are organized for one WUG, the command area the Ghaila Main Canal and Ghusari Distributary, and the other for the command areas served by Simarana Branch Canal including the Bankatta and Mainpokari Distributaries. The initial meetings of these two WUGs were recorded (Annex 2).

These WUGs have been inactive lately due to the allegations that DOI, specifically the Asst. Engineer did not fulfill the promise of providing resources or payment to the WUGS, for the maintenance of the main and branch canals. According to the Asst. Engineer, there was a misunderstanding regarding this issue. This breach of trust precipitated the ineffectiveness of the WUGS despite the organizational efforts on the part of the DOI staff. Token maintenance of cleaning the distributary and field channels are being undertaken by the WUGS, but no involvement in the cleaning nor maintenance of the main and branch canals.

One issue that needs to be raised at this juncture is the apparent failure of the agency (DIHM) then, to consult the existing farmer-managed irrigation systems (fmis) before the construction of the Pathraiya Irrigation Project. There were 4 fmis within the command area prior to the system construction. These fmis were apparently marginalized in terms of decision making regarding the canal alignment and other infrastructure that have affected their irrigation activities. Thus, even at present farmers from these fmis are still getting additional water from creeks and streams to augment whatever they receive from the system. Moreover, the DOI staff have perceived farmers from these fmis to be uncooperative in terms of participating in the WUGs as organized by DOI.

Another issue to be noted is the basis for organizing these WUGs. Based on the interviews with farmers and DOI staff, these WUGs formed were hydrologically based. However, the existing organizational patterns within the villages were not considered. Thus, there is a power structure conflict when it comes to sanctions, and adherence to rules, regulations and even irrigation schedules. A case in point is the procedure for notifying farmers about the agreed upon schedule of water delivery. The fieldman or chowkidar usually informs the village head or leader about this, while the WUGs are nominally responsible. Since the WUG leaders are not elected by the beneficiary farmers, then adherence to the schedule is not enforceable. The election of WUG office bearers from the general assembly of the users would have enhanced the effectiveness of the farmers' organizations.

## **Management Process**

In this study, irrigation system performance refers to organizational effectiveness that subsumes the performance of the organization's staff. The management process as adapted to irrigation systems consists of 4 major stages, namely: planning, implementation, monitoring



and evaluation (Bos, M.G. et.al., 1993). The existing management process at Patharaiya Irrigation System will be discussed in accordance with these stages.

### Planning

There is a nominal planning process in which objectives and targets are set. With the involvement of FIWUD, long term as well as short term objectives were set including seasonal targets (Table 3). According to this set of formal long-term objectives, items 3, and 6 are directly related to hydraulic performance. While for the short-term targets, only items 2&3 are not directly related to hydraulic performance. The rests of the objectives and targets are more related to agricultural performance. These planning process was part of the FIWUD efforts to provide a management process for the system. These objectives and targets were the formal ones established for the management of the system. During the FIWUD involvement, efforts were made to actually implement these targets. These were in accordance with the experiences as recalled by the farmers. With the termination of the FIWUD activities, this planning process of target setting with the DOI staff and WUGs has deteriorated.

The only semblance of a planning process is the yearly meeting convened by Asst. Ag. Engineer to present the forthcoming schedule of water deliveries for the monsoon season. The schedule is formulated by the Asst. Engineer, in accordance with the past year's experience. In this meeting, the Engineer explains the schedule to the system staff (overseer, fieldmen) and officers of the WUGs and interested farmers. According to the system staff, only few farmers attend this meeting.

Similarly, the meetings of the WUGs are called to inform members of the schedule. This is the only meeting before the season. No other meeting has been held outside of this information session on water delivery schedule. This then becomes the planning meeting for the WUGs.

The target set in this case is the schedule of water delivery for the monsoon season with the assumption that there will be adequate water supply for the entire command area, despite the absence of the an accurate assessment of the expected flows during the season.

### Implementation

The implementation of the plan is for the fieldmen and WUGs members coordinate in carrying out the water delivery schedule. However, with the present system only a few fieldmen are observed to be implementing the schedule of water delivery.

Nominally, there are total of 28 permanent staff in the system or a staffing density of 1 DOI staff per km of canal length. However, considering only the fieldmen and dhalpas, for a total of 18 field staff and total canal length of 28 km, the staffing density will only be 1.6 km per field staff. This length of canal can be traversed at least twice a day even on foot. Notwithstanding this availability of field staff, farmers seldom see some of them even during the monsoon season. It appears that there is enough human resources from the DOI side to implement the schedule of water delivery. There might be some deficiencies in the control facilities but these are not critical for effectively implementing the schedule.

Based on the indicative responses received from the sampled farmers in the system, during the monsoon season of 1992, there was unanimity in indicating that they received water in accordance with the schedule. However, the amount received was not adequate as perceived by the farmers (Table 4). In fact, several farmers were able to estimate the actually irrigated areas of their field during their turn in this water delivery schedule (Table 5). This further illustrates the inequity of water distribution in accordance with the farmers experience in the monsoon season of 1992. The main reason for this is that, during the turn of the middle and tail end sections of either the main or branch canals, the outlets and cuts along the embankments in the head sections are not plugged or repaired. Thus, only a small fraction of the available irrigation water supply is delivered to the lower sections of the system. This has been reported by the fieldmen to the Overseer and Asst. Engineer but apparently no action has been taken to correct or alleviate this situation according to the farmers and the fieldmen interviewed.

With the absence of the DOI field staff in most sections of the system, it is reasonable to expect the de facto management of farmers in terms of getting water for themselves by blocking canals to raise the water level and obtain more water for their fields. Thus, the implementation of the plan or in this case that of the water delivery schedule, was left more to the farmers to adhere to but lacking in enforcement by the DOI field staff.

### Monitoring

During the monsoon season, it is very difficult for the District Engineer and Asst. Engineer to monitor the operation of the system. Both the District Engineer and Asst. Engineer have their offices at the district capital town of Dhangadi. This is about 60 km from the system site. The unmotorable earthen road from the highway to the system office is a disincentive for any of these DOI staff to visit the system. Similarly, it will be difficult for the overseer to report to the district office any significant events in the system. There are numerous rivers to cross in addition to the difficult road link from the system site to the highway. It takes 3 hours by elephant ride to make a telephone call at the nearest town, to the district office.

The de facto system manager is the overseer during the monsoon season. Among the 12 fieldmen only 2 are not local resident in the system. Thus, the system is nominally managed by the overseer and the fieldmen. The monitoring of irrigation water flows and distribution of water are not undertaken by the system staff. The adherence to the water delivery schedule is major activity in monitoring in this system. The last time that the irrigation flows were measured was in 1981, when the consultants made measurements and estimates for the feasibility report. Since then, flow of irrigation water is based on "eye-ball" estimates by the overseer and fieldmen, using past experiences to monitor water adequacy.

The other indicators used in monitoring water delivery are conflicts and complaints. The more conflicts and complains, are indications of more difficulties in providing timely, and adequate irrigation water deliveries in accordance with the schedule, if the schedule is adhered at all. In both complaints and conflicts, majority of the farmers interviewed indicated a more frequency of complaints and reported conflicts (Tables 4 and 6).

Table 3. Formal list of objectives and targets as formulated by the Farm Irrigation and Water Utilization Division (FIWUD) of the Department of Agriculture and Development during its project at Pathraiya Irrigation System, 1978-1983.

### **PATHRAIYA IRRIGATION WATER USE AND DISTRIBUTION**

#### Long-term objectives:

1. To encourage quality and intensive agriculture among farmers by utilizing the solar energy, land and water.
2. To augment the income generating source of the farmers, to facilitate improved farming methods, and to create awareness among farmers about hygiene.
3. To eliminate inequity in the distribution of water by distributing water at turns.
4. To help the Govt. augment its exchequer by encouraging the farmers to pay water-tax.
5. To promote interaction with agriculture development agencies.
6. To expand the irrigated area.

The above-mentioned objectives are to be achieved over a period of time. Other activities are to be taken up on experimental basis as and when the demand is made by the farmers.

1. To construct field channels and other structures as well as residential quarters and seed storage facilities.
2. To train the farmers about improved farming methods, to distribute water at turns and to plant the crops on a rotational basis.
3. To effect land reforms, water drainage and other programs along with the farmers.

#### Short-term targets and programs:

1. To distribute water on time and on the basis of equity.
2. To develop high-quality seeds and broadcast the improved farming technologies among farmers.
3. To train the farmers regarding seasonal cropping patterns.
4. To encourage farmers to irrigate their farms at turns and to drain the excess water.
5. To form farmers' associations and to involve the farmers in the operation and maintenance of the system.
6. To arrange for timely distribution of water.

Table 4. Responses to water distribution related matters of sample farmers from the head, middle and tail sections of the Patharaiya Irrigation System for the monsoon season, 1992.

Item	Head	Middle	Tail	Total
Water Delivery on Schedule				
Yes	10 (33)	10 (33)	10 (33)	30(100)
No				
Adequacy of water delivered*				
Adequate	7 (23)	5 (17)	1 (3)	13 (43)
Inadequate	3 (10)	5 (17)	9 (30)	17 (57)
Frequency of Complaints **				
3 times during the season	5 (17)	8 (27)	10 (33)	23 (77)
More than 3 times	5 (17)	2 (6)		7 (23)
Equity of Distribution*				
Equitable	8 (27)	6 (20)	2 (7)	16 (54)
Not equitable	2 (6)	4 (13)	8 (27)	14 (46)

Notes: Total number of Samples = 30 Farmers

Numbers in parentheses are the equivalent percentage

\* Significant differences at .05 level using Chi-X<sup>2</sup> method.

\*\* Significant differences at .10 level using Chi-X<sup>2</sup> method.

Table 5. Average proportion (in percent) of area actually irrigated from sample farmers fields during one rotation as per schedule of water delivery in Patharaiya Irrigation System, monsoon season 1992.

Location	Head	Middle	Tail
Branch Canal	63%	17%	4%

Note: n=15

Table 6. Farmers satisfaction with amount of water delivered to their fields, operation and maintenance of the system, conflicts over irrigation water, and questions on water users groups, Patharaiya Irrigation System, monsoon season 1992.

Item	Head	Middle	Tail	Total
Satisfaction with water adequacy*				
Satisfied	8 (27)	7 (23)	3 (10)	18 (60)
Not satisfied	2 (7)	3 (10)	7 (23)	12 (40)
Satisfaction with system O & M *				
Satisfied	8 (27)	7 (23)	3 (10)	18 (60)
Not Satisfied	2 (7)	3 (10)	7 (23)	12 (40)
Conflicts in water sharing				
Yes	9 (30)	9 (30)	9 (30)	27 (90)
No	1 (3)	1 (3)	1 (3)	3 (10)
Need for Water Users group				
Needed	8 (26)	8 (26)	8 (26)	24 (78)
Not needed	2 (7)	2 (7)	2 (7)	6 (22)
Participation in meetings during the season **				
Once			10 (33)	10 (33)
Three times	10 (33)	10 (33)		20 (67)
Frequency in group canal cleaning				...
Once	10 (33)	10 (33)	10 (33)	30(100)

Notes: Total number of samples = 30 Farmers

\* Significant differences at .10 level using Chi-X<sup>2</sup> method.

\*\* Significant differences at .01 level using Chi-X<sup>2</sup> method.

The actual area irrigated is one basic information that is not monitored at all. Very gross estimates of paddy (khet) lands irrigated are made based on the report of the fieldmen and no records are kept to report this information accordingly. Nominally, the DOI field staff are required to make a survey of the area irrigated twice every year. Even this very basic information will be enough to determine the effectiveness of irrigation water delivery, if undertaken periodically within the season. Thus, except for very major events like drought, or floods and overtopping of embankments creating serious damage to crops as well as to canal structures, regular monitoring is not carried out by the DOI field staff in this system.

## Evaluation

No formal evaluation is undertaken to assess the performance of the system. The absence of useful indicators of performance contribute to this inability to evaluate system performance. In this system, the only available operational target is effective implementation of the water delivery schedule. If the schedule is met, then the targets are fulfilled, but only partially. If the scheduled is followed as indicated by the farmer responses but water is delivered in inadequate amount, surely conflicts and complaints will arise. Since irrigation water has not been measured since 1981, the consequent inadequacy is a logical result, despite the attainment of the scheduled deliveries. These responses from the farmers regarding adherence to water delivery schedules, satisfaction with the adequacy of water delivered and system operation and maintenance do not have the attributes of performance indicators but can be considered as indicators of social viability.

There are no administrative guidelines or policies within DOI to evaluate the performance of its field staff. For the DOI engineers, the guidelines are very subjective when it comes to performance evaluation. At the agency level, the present system of promotion from one grade to another is based on 4 criteria for which performance evaluation which is given a weight of 50%. However, no specific guidelines are provided on what this 50% consists of (Table 7). With the absence of a formal job description of the engineers, the evaluation of their performance by their supervisors becomes very subjective and also vulnerable to influence peddling and patronage. Similarly for the field staff. Without a formal and detailed/specific job description, performance evaluation will not be objective and the vulnerability for 'patron-client' relationship and 'rent-seeking' behavior, will tend to dominate the relationships of the supervisors and the field staff.

Efforts are underway to define and formalize the job description of all DOI staff. This is currently being undertaken by the System Management and Research and Training Branches under the Irrigation Management and Water Utilization Division of DOI. Once the job description becomes official, then there will be a better and objective basis for performance evaluation of DOI staff.

## **Outputs and Impacts**

In this study, the outputs and impacts have indicators which are grouped into: hydraulic performance, agriculture performance and non-agricultural performance. In this particular instance, the absence of actual measurements of irrigation water or manifestations of moisture in soils and crops, the nearest estimate available was the responses from the farmers and recall information from the system field staff which are not acceptable as indicators hydraulic performance.

For the indicators of agriculture performance, only the yield and cropping intensity were available from the system. The yield is monitored by the systems staff as collected from interviews from farmers in the command area. There has been increases in the yield through the years (Tables 8 and 9). Notwithstanding the adoption of modern varieties by most farmers, the yields are considered low due to unavailability and inability of farmers to procure chemical fertilizer (Gitec, 1993). Although the estimated yields at the tail end areas were lower than the upstream sections, no statistical significant differences were found (Table 8). Despite the less water delivered to the downstream portions of the system as claimed by the farmers, the yields were not significantly reduced due to this shortage. In some cases, shallow tubewells augmented this shortage particularly in the in the tailend Joshipur area of the main canal.

Table 7. Criteria for promotion of Engineers from 1st Class to 3rd Class in the Department of Irrigation, Ministry of Water Resources, HMG/N.

Grade Criteria	Points
1) Performance Evaluation	50%
2) Additional qualification & training	15%
3) Remote area assignment	15%
4) Seniority	20%
	=====
Total	100%

Table 8. Yield estimates for paddy (kg/ha) for the head, middle and tail sections of the Patharaiya Irrigation System, monsoon season 1992. (n=30)

Average	Head	Middle	Tail
2.43	2.47	2.50	2.25

Note: There were no significant differences among the sections using analysis of variance method.

Table 9. Yield estimates for different years at Patharaiya Irrigation System.

Year	1981 <sup>1/</sup>	1991 <sup>2/</sup>	1992 <sup>3/</sup>
Yield (t/ha)	1.8	2.24	2.43 (3)

Notes: Sources: 1/ Sir McDonald and Partners, Ltd., 1983  
 2/ Survey Report on Study on Terai Foodgrain Productivity. Winrock/Nepal, 1992.  
 3/ Survey Data (IIMI-RTB Study) 1993. Data in brackets reported from Gitec., 1993.

Estimates made in earlier reports and in this study on cropping intensity, are very close or similar at 140-160%. Irrigation during the winter months or for to establish early paddy, is very limited. Only about 40% of the command area is irrigated during the winter season with only the farmers in the head and middle sections of the system receiving irrigation water. This winter irrigation is mostly for the wheat crop with a limited area for mustard. The system is not really concerned with the winter season. The staff are expected to work in other projects during this time. Particularly, the Asst. Engineer and the Overseer. The intake from the diversion works is only opened upon request from the farmers, when there is sufficient head to divert water into the main canal. Thus, there is really no intention of providing irrigation water in the dry season.

In the non-agricultural performance indicators, measures or indicators relevant to employment generation was estimated. Additional labor due to irrigated agriculture are expected to increase, particularly for the transplanting and harvesting activities. About 15% of the total labor requirement is hired. Migrant labor is currently provided by the migrants from the hills with limited Indian labor also reported (Sir McDonald's And Partner, Ltd., 1983). With the increased irrigated area, the impact on employment is also expected to increase.

Other indicators such as farmers satisfaction and complaints are only collected during studies and in preparation of reports but not regularly undertaken to assess the social viability of the system.

### **Diagnostic Analysis**

The flow chart for assessing and diagnosing performance will be used (Figure 3). Using this flowchart as a guide, the major constraint is in the implementation. The system under study falls under the second group where the objectives were not met. The objectives on equity and expanded irrigated area were not met (Table 3). Using this chart, the targets were both feasible and appropriate. However, difficulties were encountered in the implementation. The boxes on the left most side of the flowchart are applicable in this case. With implementation as the major constraint, it was more of operation than maintenance that caused inequity in water distribution.

Using the responses received from the farmers and the system field staff, indications are such that operational procedures can be improved. Thus, changing the operational procedures will be recommended action since resources are adequate, considering the large number of permanent field staff in the system. Reallocation of the resources in the system and also providing accountability and incentives for both farmers and field staff will alleviate the inequity difficulties that farmers are experiencing during the monsoon season.

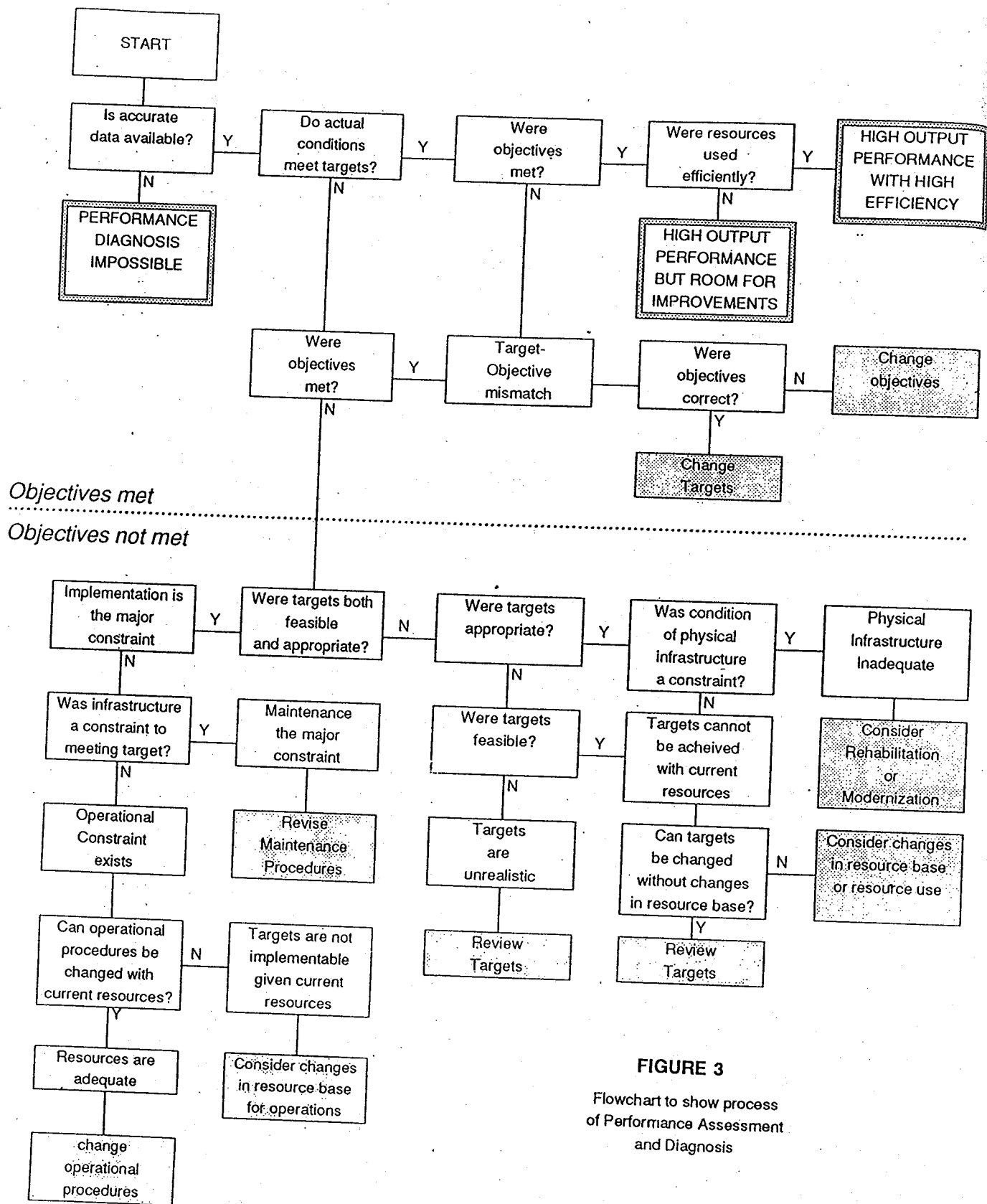
With no management process in place, in particular the evaluation of the field staff and the hydraulic performance of the system, there is no accountability accordingly. Thus, changes in the operating procedures will be needed and also a better procedure for obtaining funds and its disbursement for maintenance. The WUGs will respond positively if improved changes are made in the operational procedures.

### **Conclusions and Recommendations**

With the limited set of data and information available for assessing the existing performance methodology in use, there is indicative evidence that there is no methodology at all in assessing the performance of the Pattharaiya Irrigation System. However, there are bits and pieces of a methodology that can be improved upon to make the system more responsive to the needs of the users or farmers. Presently, the concern for providing irrigation water on time based on the water delivery schedule is the only target that was achievable.

Despite the achievement of this target, inequity in distribution was observed due to the lack of attention to the actual quantity or adequacy of water delivered to the different parts of the system. Appropriate motivation for the DOI system staff was absent, to enable them to provide the necessary services to meet the set of formal targets. Similarly, in the agency level, the absence of guidelines for staff performance based on job description prevents the objective assessment of DOI staff.





**FIGURE 3**  
Flowchart to show process of Performance Assessment and Diagnosis

Source: Bos et.al., 1993.

Although the trend in agricultural performance in terms of yield was increasing, there is still plenty of room for improvement. There is also an increasing trend on the cropping intensity but very dependent on the availability of river flows during the winter season. There are indications that with equitable distribution even during the monsoon season, the cropping intensity can also be improved. Other non-agricultural performance indicators reveal that employment and satisfaction of farmers with the operation and maintenance of the system have favorable impacts. This is indicative of the positive effects of the irrigation system on its viability and sustainability.

The following are recommendations to improve on the hydraulic performance of the Patthraiya Irrigation System:

- 1) Formalize the job description of the field staff;
- 2) Reduce the number of staff to only those that will be needed for effective operation and maintenance of the system (lay off the driver, mahutes [sell the elephant]). The JTA should be actively involved in agricultural extension activities. The savings from these reduction of staff will be more than enough to purchase a current meter to measure the flows accurately;
- 3) Measure the area irrigated during monsoon and winter seasons;
- 4) Estimate the inflow into the system and also at least in the main and branch canal bifurcations, measure the operational water requirements and losses;
- 5) Reorganize the WUGs, starting at the outlet level in line with the new Irrigation Policy 1992, and put the system under the irrigation management transfer program;
- 6) Strictly implement the water distribution in accordance with the schedule with the assistance of the WUGs particularly in plugging the cuts in the embankments and ungated outlets upstream;
- 7) Assist the WUGs to register in order that they are legally entitled to get contracts for maintenance activities such as desilting and repairing of cut embankments;
- 8) Provide incentive to DOI field staff for undertaking an excellent job based on the formalized job description (this incentive can be a plaque of recognition or material or cash reward, in accordance with HMG/N rules);
- 9) Likewise, provide incentive to the WUGs for assisting in maintaining the main and branch canals (i.e., award maintenance contract only to excellent WUGs members);
- 10) Implement a management process wherein the elements of planning, implementation, monitoring and evaluation will be institutionalized within the system with the participation of the WUGs.

These are not all encompassing recommendations that will automatically improve the hydraulic performance of the system but will initiate the improvement accordingly. Moreover, it will take more than a year to realize the effects of these improvements to reflect on the increases in yield or even irrigated area expansion.

## ACKNOWLEDGEMENT

The cooperation and assistance provided by the Kailali DOI District Engineer, Mr. R.C. Shah and his staff at Pathraiya Irrigation System are gratefully acknowledged. Special thanks is also due to Dr. K.R. Sharma, Chief, RTB/DOI for making valuable comments and suggestions in this report and most of all the farmers who patiently responded to the questions during the survey. This report would not have been made possible without the assistance provided by Messrs. Durga Bdr. K.C. and Vinay Gami, IIMI-Nepal research staff, for conducting the survey and synthesizing the data collected.

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## Abbreviations

DOI	-Department of Irrigation
DIO	-District Irrigation Office
FIWUD	-Farm Irrigation and Water Utilization Division of the Department of Agriculture
DIHM	-Department of Irrigation and Hydrometeorology
IIMI	-International Irrigation Management Institute
RTB	-Research and Training Branch of DOI
WECS	-Water and Energy Commission Secretariat
WUGs	-Water Users Groups
km	-kilometer
ha	-hectare (1 bigha = 0.67 ha)
cumecs	-cubic meters per second
m <sup>3</sup> /s	-cubic meters per second

Annex 1. The water distribution schedule for the Pattharaiya Irrigation System during the monsoon season.

WATER DISTRIBUTION SCHEDULE

For the Month of

July/ Aug 1992

DATE	VILLAGE	BRANCH CANAL
July 16, 1992	Closed no water	Ghaila Main Canal
July 17, 1992	Okharpur + Bauniya	
July 18, 1992	Ghaila + Gaddi + Muddi	Bhagatpur + Ghusari
July 19, 1992	Joshiapur + Badhadiya	Bargadi
July 20, 1992	Manakpur + Lakkad	Ghaila + Gadhi + Muddi
July 21, 1992	Bhagatpur + Ghusari	Joshiapur + Badhadiya
July 22, 1992	Badgadhi	Manakpur + Lakkad
July 23, 1992	Closed no water	
July 24, 1992	Bankatta	Simrana Branch Canal
July 25, 1992	Simrana	Simrana Branch Canal
July 26, 1992	Mainpokhari	Simrana Branch Canal
July 27, 1992	Kharchuwa	Simrana Branch Canal
July 28, 1992	Kamalpur	Simrana Branch Canal
July 29, 1992	Closed no water	
July 30, 1992	Okharpur + Bauniya	Ghaila Main Canal
July 31, 1992	Ghaila + Gadhi + Muddi	Bhagatpur + Ghusari
Aug 1, 1992	Joshiapur + Badhadiya	Bargadi
Aug 2, 1992	Manakpur + Lakkad	Ghaila + Gadhi + Muddi
Aug 3, 1992	Bhagatpur + Ghusari	Joshiapur + Badhadiya
Aug 4, 1992	Badgadhi	Manakpur + Lakkad
Aug 5, 1992	Closed no water	
Aug 6, 1992	Bankatta	Simrana Branch Canal
Aug 7, 1992	Simrana	Simrana Branch Canal
Aug 8, 1992	Mainpokhari	Simrana Branch Canal
Aug 9, 1992	Kharchuwa	Simrana Branch Canal
Aug 10, 1992	Kamalpur	Simrana Branch Canal
Aug 11, 1992	Closed no water	
Aug 12, 1992	Okharpur + Bauniya	Ghaila Main Canal
Aug 13, 1992	Ghaila + gadhi + Muddi	Bhagatpur + Ghusari
Aug 14, 1992	Joshiapur + Badhadiya	Bargadi
Aug 15, 1992	Manakpur + Lakkad	Ghaila + Gadhi + Muddi
Aug 16, 1992	Bhagatpur + Ghusari	Manakpur + Lakkad

Source: Pattharaiya Irrigation Project Office

Annex 2. Minutes of the initial meetings of the water users groups at the Branch and main canals of the Pattharaiya Irrigation System. (The following is a direct translation from Nepali to English of minutes of the meetings)

### FORMATION OF THE BRANCH CANAL CONSUMERS' COMMITTEE

Today, dated A.D. 1991/7/2, a meeting was held at the branch canal, under the chairmanship of Mr. Noor Mohammed Khan, In charge of the Pattharaiya Irrigation Project, and in the presence of the following farmer water users. The following resolutions pertaining to the smooth conduct of the water distribution task was unanimously approved:

#### Participants:

1. Mr. Biru Pd. Mahto
2. Mr. Bhim Lal Joshi
3. Mr. Lakhan Lal Chaudhary
4. Mr. Data Prasad Mahto
5. Mr. Sukh lal Chaudhary
6. Mr. Dan Bdr. Chaudhary
7. Mr. Chaudhary Ram Chaudhary
8. Mr. Ram Kisan Na
9. Mr. Ram Thapa
10. Mr. Padam Raj Joshi
11. Mr. Shiv Bd. Swar
12. Mr. Bhoj Raj Joshi
13. Mr. Chandra Lal Chaudhary
14. Mr. Uma Kant Joshi
15. Mr. Aitabari Chaudhary
16. Mr. Sekhar Bdr. Hamal Shankar
17. Mr. Prem Lal Kathariya
18. Mr. Chotte Lal Chaudhary

#### Fieldmen:

1. Mr. Sukre Bd. Chaudhary
2. Mr. Hari Narain Chaudhary
3. Mr. Nadeem Sheikh
4. Mr. Darbari Lal
5. Mr. Ramesh Chandra

#### ***Members of the Water Users' Committee:***

- |                     |  |
|---------------------|--|
| 1. President        | ; Mr. Bixit Pd. Mahto (Jhava)            |
| 2. Vice president   | ; Mr. Bheem Lal Joshi (Bankatta)         |
| 3. Member Secretary | ; Mr. Sukre Bdr. Chaudhary (Bankatta)    |
| 4. Secretary        | ; Mr. Darbari Lal Chaudhary (Simrana)    |
| 5. ....             | ; Mr. Lakhan Lal Chaudhary (Kamalpur)    |
| 6. ....             | ; Mr. Data Prasad Mahto (Taharberia)     |
| 7. ....             | ; Mr. Mazari Lal Chaudhary (Mainpokhari) |
| 8. ....             | ; Mr. Darbari Lal Chaudhary (Simrana)    |
| 9. ....             | ; Mr. Upendra Bdr. Thapa (Kharrchua)     |

**Resolutions:**

- (i). No villager would be allowed to draw water from the outlet unless it is the turn of his village. If anybody is caught stealing water, a fine of Rs. 500/- would be imposed upon him for the first offense.
- (ii). Wherever there is no outlet, no cutting of river banks and abstraction of water would be allowed. In case of violation, a fine of Rs. 100/- would be charged.
- (iii). In case the bund gets damaged by a pumping set laid over it for drawing water, then the owner of the pumping set is required to get the bund repaired the very next day. In case of his inability to do so, suitable action will be taken against him by the water users' group.
- (iv). If at a farmer's turn, the water cannot be diverted to his fields unless a check dam is constructed in the canal, then he would be allowed to construct it on his part of the land only but not beyond it. It is the responsibility of the farmer to himself pull down the structure once his turn is over.
- (v). The existing Kulos are not to be tampered with. In case of any violation, as soon as the water users' group comes to know of it, it will convene an emergency meeting and order the offender to repair it.
- (vi). Unless prior approval of the authorities has been obtained, pipes not to be laid over canal bunds for the purpose of drawing water.
- (vii). Every 27th of the month, at 2.00 p.m., meeting to be held at the Simrana fieldmen's quarters. Presence of all fieldmen, president, vice president and other members is mandatory.

Today 1992/7/11, as per the notification issued earlier, the water users' group at the branch canal of the Pattharaiya Irrigation Project held the meeting at three o'clock afternoon at the Simrana quarters. The meeting was presided over by the association chairman, Mr. Bir Prasad Chaudhary. The following resolutions were made at the meeting:

Resolutions:

Those appropriating water outside their turns have been exempted for their first offense up till now in the belief that they did so out of ignorance. But from now on, such pilferers would be fined in accordance with the prescribed rules.

Today 1992/9/12, in accordance with the prior notice, the branch canal meeting of the Pattharaiya Irrigation Project, Thakurdwara, was held at the Simarana canal quarters from 2 p.m., presided over by the vice-chairman, Sh. Bhim Lal Joshi, as the chairman did not turn up. The meeting was attended by the office-bearers of this committee and the main canal water users' committee and other distinguished persons. The following resolutions were passed at the end of the meeting:

Resolution No. 1:

The water releasing gate at the Simrana quarters, near Kharrchua and Mainpokhari canal having broken down, water delivery task has become extremely difficult. Since its repair as well as that of the regulator of the main gate at Bankatta has become very urgent, it was decided that a request would be made to the Pattharaiya Irrigation Project, Thakurdwara to carry out the necessary repair works.

Proposal No. 1:

Regarding the drainage of water from the old Kulo (running from Bankatta to east Mainpokhari).

Resolution No. 2:

It was decided that a request would be made to the Pattharaiya Irrigation Project to expand the drainage system of the old Kulo (running between Bankatta and east Bankatta), near the Mainpokhari road as the existing drainage system is too narrow and frequently damages the paddy crop.

Proposal No. 2:

Regarding the demand for bridge linking Bankatta and the east canal.

Resolution No. 3:

It was decided that the Pattharaiya Irrigation Project would be requested to construct a permanent bridge between the Bankatta village and the canal on the east, in response to the persistent demands from the farmers.

Proposal No. 4:

To request the Pattharaiya Irrigation Project, Thakurdwara, to construct a permanent bridge on the canal running from Kamalpur to Mainpokhari towards the south.

Proposal No. 5:

Regarding the next meeting.

Resolution No. 5:

The next meeting of this water users' association would be held on Aswin 16 from 2 p.m.

## FORMATION OF WATER USERS' GROUP AT THE MAIN CANAL

Today 1991/7/5, the farmer water users, take the following decisions regarding the water distribution table for the main canal under the chairmanship of Mr. Noor Mohammed Khan, in-charge of the Pattharaiya Irrigation Project, Thakurdwara:

### Resolutions:

- (i). Except during its own turn, no village would be allowed to appropriate water from the outlet through any means. If anybody is caught stealing water, a fine of Rs. 500/- would be charged for the first offence.
- (ii). Unless there is an outlet, no body would be allowed to cut the banks and appropriated water. If anybody is found contravening this injunction, he would be fined Rs. 100/-.
- (iii). In case any damage is caused to the bund through a pumping set passing through the canal bund while drawing water, the pumping set owner will have to get the damaged portion of the bund repaired the next day itself. Otherwise, action would be taken against him by the association.
- (iv). In case it is not possible to draw water without building a check dam on the canal, then the check dam should be constructed only to the extent it is necessary, but not beyond the water user's land. The water user himself will have to pull down the check dam.
- (v). Demolition of existing Kulos will not be allowed. The WUA would order the violator to reconstruct the original Kulo at an emergency meeting as soon as it comes to know of the violation.
- (vi). Even at ideal sites, nobody would be allowed to draw water by the means of pipe on the bund.
- (vii). In case, any damage is caused to the canal and the WUA doesn't take any step to rectify it, His Majesty's Government will initiate legal action against the offender.
- (viii). Every 26th of the month, a meeting would be convened at the Muddi quarter. Emergency meetings, however, may be convened any time, and the presence of all fieldmen, presidents vice presidents and other members is mandatory.



Today dated 1992/7/15, at the water delivery meeting, under the chairmanship of the chairman, Mr. Bir Bdr. Hamal and the following farmers, it was decided to operate the water distribution in an efficient manner.

Resolution No. 1:

Water to be irrigated at turns, and if the turn of a village is over, it is to allow the next village to draw water even if it requires closing of minor Kulas and gates: a notice to this effect is to be issued by the secretary for all WUA members and villagers through a written circular.

Resolution No. 2:

The next meeting is to be held in the Ghaila quarters. The secretary may convene a meeting at an earlier date if necessary, but unless the meeting is to be adjourned, the meeting will be held on the specified day and date, about which the secretary is to inform all members periodically. The meeting will commence at 3 in the afternoon.

Today 1991/8/13, under the chairmanship of Mr. Bir Bdr. Hamal and in the presence of the following farmers; measures were discussed to conduct the operation of water delivery in a smooth and efficient manner.

Proposal No. 1:

Regarding fieldmen

Resolution No. 1:

It is mandatory on the part of the fieldmen to carry out the water distribution task in the area under their jurisdiction, in accordance with the water delivery table. In case of their absence, the water users' group would report the matter to the project office and will bring up the matter in the next meeting and furnish the attendance records in for necessary action.

Proposal No. 2:

Pertaining to pipe near Ghaila Sukati in Ward no. 9, Baunia VDC.

Resolution No. 2:

It was decided that the fieldman of the Baunia VDC: Ward No. 9: Chaila Sukati, should pursue the matter of providing a pipe for connecting the road from Ghaila Sukati, near the house of Ramesh Shrestha to the road to Garhi, as no action has so far been taken upon the previous application to the engineer.

Resolution No. 3:

The next meeting will be held on September 10 at the Ghaila village.

Today 1991/9/14, under the chairmanship of the president, Mr. Bir Bahadur Hamal and in presence of the following farmers, the following proposals were passed and the following resolutions were passed to conduct the water delivery operation in a smooth manner.

Proposals:

1. Since the supply of water from the canal pipe at Okharpur village is very irregular, it was decided that the Pattharaiya Irrigation Project would be requested to construct a permanent outlet at that site.
2. In the Garhi village, the main canal of the Kulo (that runs on the south of the Garhi village and towards the fields on the west), the level of water cannot be raised without building a check dam. About 75 per cent of the fields has as a result got damaged. Therefore an inspection for raising the level of water was done, and it was decided to request the Pattharaiya Irrigation Project to construct a permanent Kulo from the field of Shiv Narain Kurmi to the west.
3. The main canal connecting the west of the Muddi village and the concrete bridge that leads to Joshipur and towards the field of Asrafi Kurmi has got breached and consequently the farmers in the low-lying Joshipur, Badharia, Mankapur and Lakkur and at the Ghusari village at the branch level from the west-east to the mango grove in the south and from Ghusari to Bargadi's field in the south are facing scarcity of water. Therefore the Pattharaiya Irrigation Project would be requested to devise a solution to the problem and reconstruct the damaged portion at a suitable time so that the supply of irrigation water is not disrupted.
4. The outlet gates have broken down at different places and the task of opening and closing them having become difficult. Therefore, the Pattharaiya Irrigation Project would be requested to restore the outlet gates at an appropriate time.
5. The water has gone dry in both the branches of the Kula (running from the main canal Ghaila Sukati to the east of the road that leads to Garhi in the south), and the canals are in urgent need of repair as well. Also there is no pipe linking that road to the west. The previous request to engineer to rectify the matter was not heeded. Therefore the Pattharaiya Irrigation Project would be requested to look into the matters.
6. Either of the sides of the bridge on the main canal at Ghaila is getting eroded by the river. Therefore gabion wire should be employed to reinforce the sides, and a request to this effect would be made to the Pattharaiya Irrigation Project.
7. The next meeting too, it was decided, would be held in this village (Ghaila) on the 15th of Aswin, and tomorrow (27th of the month), all committee members attend the branch canal water users' association meeting at Simrana, 12 noon.

Today 1991 /10/4 the meeting of water distribution users' committee has been adjourned to 1991 /9/3 at Ghaila in accordance with decision no. 7 owing to the lack of quorum.

1991/7/3

**Formation of the Water Users' Association:**

President	Mr. Bir Bahadur Hamal (Bauniya)
Vice president	Mr. Chandra Pd. Kusumi (Muddi)
Secretary	Mr. Ganesh Pd. Chaudhary (Fieldman, Simrana)
Member	Mr. Shankar Pd. Bharati (Fieldman, Simrana)
.....	Mr. Jagat Bd. Chaudhary (Fieldman, Simrana)
.....	Mr. Dhaniram Chaudhary (Joshipur)
.....	Mr. Bhagiram Chaudhary (Badgadi)
.....	Mr. Jagatram Chaudhary (Ghusari)
.....	Mr. Khadag Bdr. Chaudhary (Fieldman, Bhagatpur)
.....	Mr. Satish Pd. Shrestha (Fieldman, Ghaila)
.....	Mr. Prem Bdr. Chaudhary (Gadhi)
.....	Mr. Gedu Lal Bhalansa (Okharpur)
.....	Mr. Bhagwati Pd. Chaudhary (Garharia)
.....	Mr. Fatteh Bdr. Chaudhary (Dakshin Baunia)
.....	Mr. Shankar Chaudhary (Manikkapur)

(The formation of the Main Canal Water Users' Association)