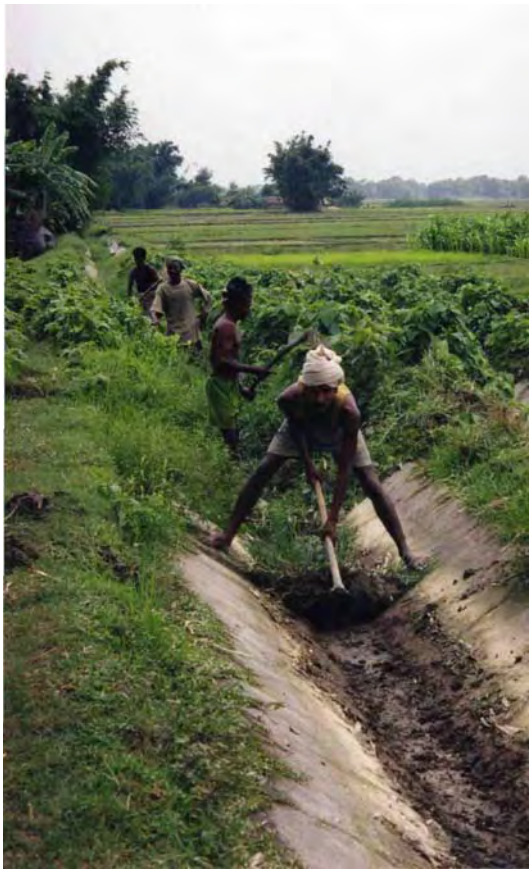
DFID Department for International Development

Equity, Irrigation and Poverty

Guidelines for Sustainable Water Management

Final Report - Appendices



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Equity, Irrigation and Poverty

Guidelines for Sustainable Water Management

Final Report

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Abbreviations, Acronyms and Glossary

AABC: Aravan Ak Buura Canal (Kyrgyz Republics)
AAP: Agreed action plan
ADB: Asian Development Bank
AE: Assistant Engineer (India)
AMIS: Agency-managed Irrigation System
AP: Andhra Pradesh
APERP: Andhra Pradesh Economic Restructuring Project
APFMIS: Andhra Pradesh Farmers' Management of Systems Act
APIP: AP Irrigation Project
APM: Adjustable proportional module
adhiya: sharecropping (50% share) (Nepal)
ailani : Government-owned common land along river banks etc (Nepal)
aksakal : Elder (Kyrgyz)
ashar: Labour contributions for community activity (Kyrgyz)
ayil bashi: Village head (Kyrgyz)
ayil okmutu: Local administrative unit (Kyrgyz)
BA: Branch Assembly (Nepal)
BC: Backward Castes (India)
BC: Branch canal
BCC: Branch canal committee (Nepal)
bataiya: sharecropping (Nepal)
bigha: Unit of area (Nepal) equivalent to 0.67 ha
bighatti: system of local cash contributions for maintenance of infrastructure (Nepal)
birta: now obselete form of land tenure in Nepal: form of land grant from the state to individual for past services symbolizing high social and economic status
CAD: Command area development
CID: Chitwan irrigation District [office] – responsible for KIS (Nepal)
chak: area irrigated by an outlet (India0
chaukidar: guard
CMC: Chatra Main Canal (Nepal)
DADO: District Agicultureal Development Office (Nepal)
DC: Distributaty Committee (India)
DFID: Department fotr International Development (UK)
DIO, District Irrigation Office (Nepal) [now irrigation division]
DL/AP: Diagnostic learning/action plan – participatory process used in Nepal
DOC: Drivers of change
DOI: Department of Irrigation (Nepal)
dalit: "Untouchable caste" (Nepal and India)
dhalpa: Ditch rider (Nepal*)*
EE: Executive Engineer (India)
EIP: Equity, Irrigation and Poverty (DFID-KAR R8338) – this project
FAO: Food and Agriculture Organisation of the United Nations

FFS: Farmers' field school

FGD: Focus Group Discussion

FMIS: Farmer-managed irrigation systems

FO: Farmer Observer/organizer

FSL: Full supply level

GA: General Assembly

GGG : Guidelines for Good Governance (DFID-KAR R8023) – Mott MacDonald (2004)

ghol: Low-lying land, largely relying on subsurface seepage (Nepal, esp. Khageri)

gram panchayat: village council (India)

gunta: 0.01 ha (AP) (ie. 40 gunta = 1 acre)

HMGN: His Majesty's Government of Nepal (now Government of Nepal)

HR: Head regulator

jagir: now obselete form of land tenure in Nepal: form of land grant from the state to individual in compensation for services

KFO: Key Farmer Observer/organizer

KIS : Khageri Irrigation System

kulo: Canal (Nepal)

I&CADD: Irrigation and Command Area Development Department (India)

IA: Irrigation association (Philippines)

ID: Irrigation Department (used as generic term in all countries)

ID: Irrigation District (China)

ID: Irrigated dry [crops] (India)

ILC: Irrigation Line of Credit (Nepal)

IMP: Irrigation Management Project (Nepal)

IMT: Irrigation Management Transfer

IMTP: Irrigation Management Transfer Project (Nepal)

IP: Irrigation policy (Nepal)

IPM: integrated pest management

IR: Irrigation regulations (Nepal)

ISF: Irrigation service fee

ISP: Irrigation Sector Project (Nepal)

IW: Irrigated wet [crops] (India)

IWMI: International Water Management Institute

IWRM: Integrated water resources management

jagir: now obselete form of land tenure in Nepal

jamindar: Landlord (Nepal and India)

janajati: indigenous Tibeto-Burman ethnic groups in Nepal

JA: Jany Aryk (Kyrgyz)

JMA: Joint management agreement

JT: Junior technician – Agricultural extension worker in Nepal

JTA: Junior technical assistant – Agricultural extension worker in Nepal

KIS: Khageri Irrgation System (Nepal)

KK: Kapakhori – upper part of KIS (Nepal)

KKC: Kakatiya Main Canal (AP, India)

karyadal: working party (Nepal)

kattha: Unit of area (Nepal) equivalent to one twentieth of a *bigha*

kharif : Monsoon season (July-November) (India)

kolkhoz: Former collective farm (Kyrgyz)

kulo: Irrigation canal (Nepal)

lashkar: Gate operator (India)

LMC: Lower main canal (KIS-Nepal)

LMD: Lower Manair Dam (AP, India)

LSGA: Local self governance act (Nepal)

M&E: Monitoring and evaluation

MCC: Main canal committee (Nepal)

MWR: Ministry of Water Resources (China)

makhalla: neighbourhood (Kyrgyz)

mandal: sub-district (India)

mirab: Ditch rider (Kyrgyz)

NFIWUAN: National Federation of Water Users' Associations of Nepal

NGO: Non-Government Organisation

NIE: New institutional economics

NISP: Nepal Irrigation Sector Project

O18: Outlet 18 of BC-1 - detailed study area in KIS

O&M: Operation and Maintenance

OC: Other Caste (India)

OH: Obu Haet (Kyrgyz)

OIP: On-farm irrigation project (Kyrgyz)

oblast: Province (Kyrgyz)

PBK: *Pachas bigha kulo* – detailed study area in KIS (Nepal)

PCPS: problem census problem solving

PD: Proportional divider

PGW : Pilot gate west - detailed study area in KIS (Nepal)

PIM: Participatory irrigation management

PIP: Policies, institutions and processes

PLA Participatory learning and action

PRA: participatory rural appraisal

pachas: Fifty (Nepal)

panchayati: Traditional dispute resolution in Nepal (not to be confused with the previous 'panchayat' system of government, or the panchayat institutions in India)

pani bahuse: communal water guard (Nepal)

parma: Exchange labour (Nepal)

QID: Qingtongxia Irrigation District (China)

RA: Representative Assembly (Kyrgyz)

RD: 'Reduced distance' = 1,000 feet

RID: *raivodkhoz* (Kyrgyz)

rabi : Dry season (December-March) (India)

raion: District (Kyrgyz)

raivodkhoz: raion irrigation department

RD: Reduced distance (ft)

SAGUN: Strengthened actions for governance in utilisation of natural resources project (Nepal)
SC: Scheduled Castes (India)
SEAGA: Socio Economic and Gender Analysis
SIDD: Self-financing (managing) irrigation and drainage district (China)
SISP: Second Irrigation Sector Project (Nepal)
SLA: Sustainable livelihoods approach
SLLP: Sustainable livelihoods for livestock producing communities project (DFID)
SMIP: Sunsari Morang irrigation Project (Nepal)
SRSP: Sri Ram Sagar Project
SS9E: Sub-secondary canal E (Joginiya) from Secondary canal 9 (Sitaganj)at SMIP (Nepal)
sarpanch: village leader (India)
shejpali: system of water distribution prevalent in western India
sovkhoz: Former state farm
TC: Territorial Constituency – subdivision of WUA (India)
tandi: Upland entirely reliant on irrigation (Nepal, esp. Khageri)
tarai: Plains in southern Nepal
thel: obstruction in canal – informal check structure (Nepal)
toli: Group (Nepal)
UMC: Upper Main canal (Khageri – Nepal)
USAID: United States Agency for International Development
WB: World Bank
WC: Water course (Nepal)
WID: Weining Irrigation District (China)
WRA: Water Resources Act (Nepal)
WRB: Water resources Bureau (China)
WRR: Water Resources Regulations (Nepal)
WSC: Water supply company (China)
WSU: WUA Support Unit (Kyrgyz)
WUA: Water users' association
WUC: Water users' committee (Nepal)
WUCC: Water users' coordination committee (Nepal)
WUCCC: Water users' central coordination committee (Nepal)
WUG: Water users' group (sometimes referred to as *toli*) (Nepal)
WUS: Water users' schools
warabandi: System of irrigation rotations developed in Punjab (India and Pakistan)
YRB: Yellow River Basin

Appendix A Objectives of study

A.1 Justification

A.1.1 What is the research problem?

Equitable distribution of water on irrigation systems is crucial to small farmers' livelihoods and thus play an important role in reducing poverty. However, in practice it is difficult to achieve or to monitor. Supplies from the main system to WUAs may be monitored accurately and the WUAs may even be charged according to the actual volume of water used. However, it is usually assumed that local water users associations will be able to manage the internal distribution without needing any formal mechanism. This assumption is often not valid: distribution then becomes inequitable, disputes are common and livelihoods suffer.

Some way of monitoring the flows to each user is needed to ensure that users get what they pay for – this is required for transparency and trust in operation, which usually affects the poorer farmers most severely. However, actual flow measurement is always difficult, often inaccurate and easy to disrupt, and the cost of collecting and using data is very high. Proxy indicators of flows are more likely to be appropriate and they need to be suited to specific local requirements.

Possible measures include time or depth of irrigation, rotational (on-off) distribution, or proportional division of flow. Other solutions include appointment of common irrigators by the WUA. The type and accuracy of measurement needed depends on the situation – social conditions, the types of crops grown, land ownership patterns, and the availability of water being among the key factors. It will not be possible to identify standard solutions, but it should be possible to develop appropriate procedures on selected projects and use this process as a basis for establishing a common, systematic approach to developing procedures elsewhere.

There are many issues that influence the performance of WUAs. However, the question of how to distribute water and monitor its distribution has not been adequately addressed by previous research even though it is at the heart of effective irrigation water management. Realistic, rational and socially acceptable solutions now need defining.

A.1.2 What work has previously been done or is currently being pursued in this field?

Accurate proportional distribution is common in certain situations on traditional irrigation in Nepal. For example, farmers on the Julpha system monitor distribution carefully, with precise timings and allocations of water. They do not quantify water in litres/sec, but they do divide flows accurately and proportionately using 49 wooden proportional weirs on a 200 ha system with rotations timed to the minute (Parajuli, 1999). However, where the situation does not warrant it, they use simpler methods. On some schemes they have careful allocation in one season and more informal methods in the other.

In pilot areas of the Tarim basin project in China, measurement weirs for individual farms have been installed and farmers pay for and are issued with receipts for each delivery. This is highly appreciated but it is difficult to replicate widely (Mott MacDonald, 2002). Some work has been done by IWMI on developing simple measurement structures but even the simplest are administratively complex, often inaccurate, expensive and easy to bypass or damage (Makin, pers com).

Time is the easiest proxy for flow if the entire watercourse flow or a known proportion of flow is diverted to each farmer in turn, in the fields. The *warabandi* system of northern India is a widely recognised and effective form of this approach (Malhotra, 1982) but this cannot always be imposed and there are signs of increasing deviations in practice (Bandaragoda, 1998). Farmers on the Sunsari Morang Irrigation Project in Nepal also rejected this approach as being too inflexible to be useful and adjust flows informally which defeats the purpose. In some

places, such as in Ningxia in China, common irrigators are employed by the farmers to manage irrigation on a consistent basis but they are still vulnerable to pressures by influential people. Elsewhere, for example at Hardiya *khola* in Nepal, a specified depth of water is applied to each field in turn (which ensures that soil types and losses are allowed for). This is very clear to the users, but it is difficult for the managers to plan the canal flows that will achieve this distribution.

The need for a monitoring system within WUAs is widely recognized now and there is an increasing need for one but there appears to have been little progress. Most emphasis has been given to measuring and charging for bulk water supplies to the WUA, although even there progress has been limited and slow for similar reasons (Bhatia, 2002). Even at that level many observers are now seeking proxy measures instead of volumetric charging since area-based charging mechanisms can achieve almost the same efficiency gains (Perry, 1996). Further, the elasticity of demand is such that it is rarely possible to reduce demand significantly by charging according to volume.

Water distribution within WUAs was discussed in general terms in a recent email conference (FAO, 2001), but specific successful examples could not be identified. Meinzen-Dick (2001) stated that "water can be measured and charged at the point of delivery into a block of land served by a WUA, and the association left with the burden of delivering the water and collecting fees from the individual members. But this shifts the problem of how to create incentives to conserve water to the WUA. They, in turn, often have no way to measure or charge individual members volumetrically." Johnson (2001), in the same conference reported on some methods that have been adopted successfully in China, but these are not widely applicable (Bhatia pers com). It is apparent from our ongoing KaR (R8023) and other projects that this is an important problem, and further discussions with representatives of IWMI (Makin pers com), and others from IPTRID, IFPRI, WB and FAO who participated in the FAO email conference confirm the need for additional work on this topic. Although IWMI are working on related programmes in South and Central Asia, few projects have focused on how to distribute the water amongst farmers in detail.

The relation between irrigation management and poverty has received considerable attention recently with work in progress by IWMI (Hussein & Biltonen, 2001), as well as recently published report on IMT and poverty in Andhra Pradesh and Gujarat (Koppen et al 2002). Syed Hassan (2001) stresses the importance of "WUAs to help the farmers to know when the irrigation will be available to the users, how much water they will get, how long they will get irrigation, at what interval they will get irrigation and how they can enforce their entitlement". The precise mechanism for achieving this needs further investigation, but Hassan suggests that it can be achieved through "building up at the grass root of empowered community structure (WUA)" – the approach we intend to adopt in this study. In China, Huang et al (2001) study on the poverty impact of irrigation in Hebei and Ningxia, they reported on different procedures adopted for allocation of water but analysis of the reasons and methods used was beyond the scope of their study.

Appropriate technical solutions and transparency in institutional arrangements are amongst the issues stressed in the DFID strategy paper *"Addressing the water crisis"* for ensuring sustainability of water services. The 1997 White Paper stressed the policy to "focus on small producers and productive systems which maintain or improve the productivity of land and water resources. This should promote both poverty reduction and environmental sustainability"

References

D. J. Bandaragoda. (1998). Design and practice of water allocation rules: Lessons from warabandi in Pakistan's Punjab. Research Report 17. Colombo, Sri Lanka: International Irrigation Management Institute.

Bhatia A, Gau Hong & Mollinga P (2002) Irrigation Reform in the People's Republic of China, 6th INPIM Seminar, Beijing

FAO (2001) Email conference on irrigation management transfer

Hassan, S (2001) Pro-poor Intervention Strategies in Irrigated Agriculture in India, IWMI conference on irrigation against rural poverty

Hussein I & Biltonen E (2001) Irrigation against Rural poverty, Proceedings of National Workshops IWMI Sri Lanka

Johnson S (2001) Intervention 97 in FAO (2001)

Koppen B van, Parthasarathy R, Constantina Safiliou (2002) Poverty dimensions of irrigation management

transfer in large scale canal irrigation, IWMI Research report 61

Malhotra SP (1982) The warabandi system and its infrastructure, Central Board of Irrigation and Power, New Delhi

Meinzen-Dick R (2001) Intervention 95 in FAO (2001)

Mott MacDonald (2002) Guidelines for Good Governance: Stage 1 report. DFID KaR R8023

Parajuli, U (1999) Agro-ecology and Irrigation Technology, PhD thesis, Wageningen

A.1.3 Who are the end-users and target audiences for the research?

The end users are the small farmers and self-managed water users associations, particularly small landowners who may also lease land to increase the size of their holdings, and pure tenant farmers (who may not be represented on WUAs). The WUA need to be able to manage water supplies between irrigation users, and the users themselves need to be able to monitor the supplies that they actually receive. Farmers in Nepal and China identified this as a specific need during studies for KaR R8023. More specifically, the end-users are the poor farmers who are less able to get water when the management is weak; in sample schemes in Nepal in R8023 the proportion who suffer from poor water supplies for this reason was estimated at over 30% of the population.

The target audience for the research outputs are irrigation agencies and NGOs who promote or support the development of water users associations, so that they can use the new techniques for helping WUAs to develop effective systems for monitoring water distribution. Although the countries proposed for inclusion in the study are all in Asia, the proposed approach should be applicable in many other countries where water is managed by smallholders through WUAs or similar organisations. The detailed methods will, however, vary according to the local situation.

A.2 Project description – Log frame

	Narrative summary	Measurable indicators	Means of verification (MoVs)	Important assumptions
Goal	Improved assessment, development and management of water resources			
Purpose	Improve livelihood outcomes of poor farmers in South and East Asia, by enabling user organisations to share water in an agreed and trusted manner, so that poor farmers receive an improved supply and wastage is reduced	Volumes of water supplied to different users	Direct measurements of sample farmers (data recorded by project team)	Main system is managed so that it can deliver water to WUAs in accordance with agreed schedule
Outputs	1. Evaluation with key stakeholders of existing procedures for monitoring water distribution by WUAs in different social and agro-ecological conditions 2. Participatory identification and introduction of proxy (or direct) indicators for monitoring flows on selected schemes and enabling planned distribution of water to all users including disadvantaged groups 3. Guidelines for developing and introducing these techniques to enable monitoring on other WUAs, and the process for making this information available 4. Publication of findings and dissemination via national workshops and international journals	Report produced by month 6, (type of monitoring system, equity of distribution, conflicts on different types of projects) Monitoring systems set up on pilot schemes by month 10, evaluated by month 16, using indicators of water delivery to sample areas, participation in WUA and disputes Guidelines complete by month 19 and adopted by collaborating agencies Final reporting by month 20 including submission of papers to international journals and networks	Project reports and monitoring studies	Richer farmers dominate or obstruct the reform process

	Narrative summary	Measurable indicators	Means of verification (MoVs)	Important assumptions
Activities	1.1 Secondary data collection with selected stakeholders and analysis to identify range of methods used in study countries and regions. Field observations in selected areas 2.1 Identify potential study sites 2.2 Seminars to review findings, confirm site selection 2.3 Participatory studies to assess need for improved measures on pilot schemes, and identify appropriate methods for each individual scheme 2.4 assist WUA to use new proxy or direct measures to manage and monitor distribution over one cropping season 2.5 participatory assessment of changes in water distribution after introduction of new procedures; analyse positive and negative impact on different categories of users 2.6 seminars to review findings 3.1 prepare guidelines summarising methods found to be effective on sample projects and methods for establishing appropriate methods on other projects 4.1 Disseminate conclusions through locally through water users associations, irrigation agencies and other relevant stakeholders. Publish findings internationally.	Inception report (month 4) Literature review and secondary data analysis, summarising procedures used on existing systems analysed by month 6 Participatory study reports (month 9) Reports on implementation (month 19) Guidelines (month 20)		Water users have in sufficient interest and confidence in the approach to participate effectively Monitoring systems will be too complex or expensive to administer. Insufficient secondary data is available
				Preconditions Security or political situation in target countries or districts obstructs the work

Appendix B Irrigation Management Reforms in China

B.1 Introduction

This section provides a review of irrigation management reforms in China, supplemented by findings from brief visits to two provinces (Ningxia and Xinjiang) in the North-West of China and observations from shorter visits to Hubei, Jiangsu and Hebei provinces. This provides further observations to supplement the quantitative data on Ningxia presented in Appendix D. These provinces have introduced reforms more recently than some other provinces in China, particularly in the Yangtze basin, but significant progress has already been achieved and this experience should be valuable elsewhere.

B.2 Literature review

B.2.1 Introduction

China provides contrasting picture to the other study countries. There is some evidence of significant improvements in water management being achieved in China (Feng, 2001 and FAO 2001), although there is very little literature available internationally which makes it difficult to assess the reforms systematically. There does not appear to have been any rigorous independent evaluation and some believe that the literature may give a misleading impression of progress (Mollinga et al 2003). Hussain & Biltonen (2004) report that "*most evaluations are only based on anecdotes or case studie … and despite the high stakes of the reforms there is little or no empirical-based research that has been conducted to understand and judge the effectiveness of water management reforms*" (ibid p.7).

Many aspects of rural life in China are fundamentally different from South and Central Asia, and this clearly affects the nature of water management and the opportunities for learning from each other. One area of comparative advantage in China is the relative equity in access to land. Land is owned by the village and contracted to individuals – there are no large landowners or complicated or variable sharecropping arrangements as are common in South Asia. Farm size is a poor proxy for household weatlth. In their study of Ningxia and Henan, Hussain & Biltonen report that small farms (average size 0.29 ha) have a greater per capita income than large farms (average size 1.22 ha) – the reasons being in the share of non-agricultural income (58% for small farms and 19% for large farms). Small farms also use more water per hectare than large farms in their sample. They also found that poor farmers[1] (regardless of farm size) use more water than the non-poor and presume that this is because they are more dependent on agriculture and therefore devote more effort to working with water managers to gain access to water

[1] those with a per capita income below the official poverty line of 625 yuan per annum

B.2.2 Management reforms

B.i General

There is a strong rhetoric of participatory management - which is much discussed, but it is important to note that participation is interpreted in different ways to other countries (and as, Plummer and Taylor, 2004, note there is a '*tendency to use the term liberally and without specific definition*'). Taylor (2004) regards that 'participation' is still of marginal importance given the ubiquitous nature of the Chinese State and Communist Party and indicates that there is very little role for participation in decision-making or self-management. Rather, the role of farmers is "*through a process of limited consultation to confirm what the Government already knows*". Participation is also distrusted by farmers who may associate it with earlier mass-mobilisation campaigns and unpaid participation in infrastructure development.

Various different approaches have been tried in different provinces (MWR, 2002), but simplifying the management structure, reducing total water use, charging for water according to the volume actually used, and keeping fees collected within the system to be used for O&M are important features (Gao Hong, 2002).

Johnson et al (1995) reported on reforms in two irrigation districts in Hebei, each about 4,000

ha in area. These were part of wider rural reforms following the dismantling of People's Communes in the early 1980s and were found to have led to effective local management and significant improvements in financial and agricultural performance. Key features were clear delineation of rights and responsibilities, and a linkage between payment of fees and receipt of water (with payment according to volume of water used).

The Chinese are particularly concerned with reducing water consumption, and traditionally place greatest emphasis on introduction of water-saving technology. They also now stress institutional reforms, including payment according to the actual volume of water used. The evidence on the specific impact of volumetric water charges is, however, rather limited. In general, flow is only measured as far as the turnout to WUAs who then allocate water on an area basis, with group pressure being regarded as effective in controlling water use (CCAP, pers comm, 2001).

Zhou (2002) reviewed all aspects of the reforms, and it is clear that there are a number of interlinked aspects, although they place great emphasis on pricing to ensure that farmers pay for what they use, and to reduce demand. In some places, measurement down to individual farmers is attempted – for example in the Tarim Basin (HeHai, 2001). The transaction costs in measuring water use, collecting and accounting such fees are clearly high, and some do not consider it practicable (Lohmar et al, 2001). However it has further advantages in achieving very high transparency in water deliveries, and for this reason it is apparently very popular (Mu[2], pers com).

One strong advantage in China (as compared to other countries), is that there is a long tradition of paying for water services. There have been water charges at Qingtongxia (QID) for over 2000 years. The rates have increased sharply recently, but the concept is well-established and accepted.

B.ii Self-managed Irrigation and Drainage Districts (Yangtze and Tarim basins)

The World Bank has had a powerful influence on irrigation reform in China, through programmes introduced on a series of projects since the Yangtze Basin Water Resources Project (see World Bank 2003, for a description of the achievements of this project which started in 1995). The WB describe this model as follows.

> "*The project would incorporate institutional measures to improve the management and sustainability of irrigation and drainage systems through establishment and support of self-financing irrigation and drainage districts (SIDDs) based on farmer participation. Initially, on a pilot basis, main storage, diversion, conveyance and drainage facilities would be managed by Water Supply Corporations (WSCs) which would be organized to manage all main system irrigation, drainage and water supply facilities within an irrigation area. Water User Associations (WUAs) would be established by farmers based on hydraulic boundaries, to take over operation and maintenance of secondary and tertiary irrigation and drainage systems. The WSCs and WUAs would be self-financing through water charges paid by farmers to WUAs which in turn pay WSCs for bulk water deliveries using a part of the water charge collections*".

[2] Project management office of Tarim II project

They stress the need for participation by the farmers at both tertiary and higher levels in the system: "*Farmers would form WUAs which would be responsible for the operation and maintenance of secondary and tertiary irrigation and drainage systems. Farmers would also be represented on the boards of directors of WSCs.*" (Irrigated Agriculture Intensification II Project, World Bank, 1998). In practice, it has generally been easier to establish independent WUAs than WSCs (Mollinga *et al*, 2003).

The Zhanghe ID is close to Wuhan city and thus much visited[3]. 27 WUAs – typically serving 200 ha, but possibly as large as 1,500 ha - were set up in the late 1990s with strong support from the mayor of Jingmen city. The main system has not yet been reformed, although the main canal is reported to function like a water supply company. The managers (ie the 3-member WUA board) are entitled to retain 3% of fees for their salary and may also manage sideline enterprises. Water is measured at the point of delivery to the WUA and then shared internally proportionate to area (which is said to be relatively easy to manage as landholdings are so uniform). The objectives of the reforms at Zhanghe are reported to be to:

- Improve and simplify water charge collection
- Increase irrigation efficiency
- Decrease burden on local government, by simplifying the management hierarchy (ie: WSC-WUA rather than county water management division-township-village, and with dedicated irrigation managers).

There is no readily available objective data to evaluate the performance to date, and the two WUAs visited (Yangchang and Hungmiao, both in Jingmen City) reported very different achievements.

Yangchang WUA was set up in 1999 [?], but as a result of water shortages in 2003, were only able to irrigate half their land (ie 650ha) and could not retain any money for their own salary, nor did they have the resources to repair missing or damaged gates. Maintenance is done by production groups directly, and they planned to clean the rather overgrown canal before the next season (which starts in April with irrigation continuing to August).

The Hungmiao WUA is older and was set up in 1995. The first chairman was chosen by production group leader but the new leader appointed in 2003 was nominated the leader. Fees are collected by the village but managed by the WUA. The infrastructure here is in excellent condition, with the canals being newly-lined, and they report that the WUA is highly beneficial – perhaps because it enabled them to get the canals lined rather than because it actually improved management.

Zhang et al also reported on performance of these WUAs and reported that "*in the areas where WUAs are properly designed and implemented, it is observed that canal construction and maintenance as well as the timely water delivery have improved a lot and the improper intervention by water authorities has declined, and farmers has relieved unreasonable burden.*" It is not possible to isolate the impact of the management changes from that due to rehabilitation, but they observed that that WUAs, particularly where the leader is democratically elected were able to mobilise more labour for canal cleaning and hence improve irrigation performance and producttivity. Between 1995 and 2001, rice yield

[3] these notes are based on a brief visit in December 2003

increased by 6% to 8,785 kg/ha and the irrigation frequency from 3.5 to 4.1 irrigations per season.

B.iii Hebei and Anhui provinces

Other provinces have followed different models and are less reported internationally. Ministry of Water Resources (2002) provides an overview of many of these programmes, although with insufficient detail or analysis to comment on their performance. The managers of Shijin ID (see Mollinga *et al* 2003 for an overview of this project) state with a degree of pride that they do not follow the World Bank model and regard their own reform process as more appropriate to their local situation.

Li Ou et al (2002) provide a rare self-critical analysis of another donor funded irrigation rehabilitation project, giving a realistic assessment of the scope for participatory management. Despite the very different context, their observations are equally applicable to many situations in India, Nepal or Kyrgyzstan, although the WUAs which result from application of these conclusions may be very different.

- PIM needs to combine top-down and bottom-up approaches
- Establishing effective WUAs takes time
- Provision has to be made for the costs involved in the reform process (training, public awareness etc)
- Reforms need the support of local government, but should be independent of it
- Managing the change process cannot be left solely to the water management authority
- Flexibility and 'partnerships' are needed to adapt the approaches over time

Their conclusion that "*participatory approaches are intended to give greater voice to farmers and sections of the population generally disenfranchised … these sections of the community don't take naturally to the approaches… the alienation from the local government hierarchy … has to be overcome and a sense of ownership (which is not actively sought by farmers) has to be fostered*" is equally widely applicable.

B.iv Ningxia Hui Autonomous Region

Yet other provinces, such as Shaanxi and Ningxia have introduced 'contractor' models of water management. Although conceptually very different from WUAs, the differences in practice are rather smaller. The performance of contract management in the Guanzhong ID has been very impressive as reported although it remains to be seen whether contractors would sustain their interest after the initial construction phase is complete (Mollinga et al, 2003).

We include a report on WUAs in Ningxia in Section B.3[4]. This provides a preliminary review of the irrigation management reforms that have been introduced since 1999. Under these reforms, management of over 1,000 tertiary units has now been changed either by formation of Water Users Associations or by organisation of short-term management contracts. The main purpose of these WUAs and contracts is to collect water fees and ensure adequate water

[4] this was prepared under a related project – Guidelines for good governance (KAR R8023)

distribution within the tertiary units, within an overall objective of reducing total water consumption and improving revenue collection. Other aspects of management are little changed, and reforms have not been introduced at higher levels in the system – there are no Water Supply Companies, nor plans to introduce them.

Most emphasis is given to water fee collection. The new system gives an incentive to the Contractor or WUA to reduce water consumption since they keep the difference between what they receive from the farmers and what they pay on to the ID – this covers their O&M costs and their own profit. There is less incentive for farmers to be economical, since they pay according to their area irrigated and the average of past years water use in the tertiary canal – it is difficult to relate this to actual use at a farm level, even though they have a system of a common irrigator. Charges do not vary within a tertiary unit to suit reliability of water distribution or even crop type. This is very similar to the practice in the Kyrgyz Republic.

The contract system introduces a private party between the ID and the farmers. The contractors have a strong financial incentive to persuade farmers to use less water, which they are able to do as they are local farmers. It is potentially an inequitable system, because the contractors seek to maximise profit and have no interest in or obligation to promote equitable water distribution. This can be mitigated by careful selection of contractors and possibly other reforms to the system.

The reforms have apparently been effective in their aims of reducing overall water use and in increasing revenue. Although the WUAs are intended to be participatory organisations, they do not fully achieve this, at least partly because of a lack of awareness of their role. The reforms thus fall short of the ideals of participatory irrigation management but are a valuable first step. Further reform may depend more on strengthening main system management, since unreliability at this level makes it difficult for farmers to manage their supplies well. Clarifying responsibilities and removing overlapping roles will be important, but this may well provoke resistance at township level.

Other literature (eg Shah et al, 2004) on the reforms focuses on the importance of incentives to the managers. Hussain and Biltonen (2004) attempt to quantify the performance of different management systems with strong and weak incentives for the managers. Unfortunately there is too little data to draw rigorous conclusions although they believe that water use can be reduced by 20% or 3000 m^3/ha (equivalent to an irrigation depth of 300mm) if managers are given good incentives. Existing water use is clearly very high and wasteful. It is also necessary to consider the current use of return flows, and how they might be affected by upstream improvements in efficiency.

It should be noted that the data in Appendix D and in Hussain & Biltonen (2004) is based on a comparison of a small number of WUAs with another small number under collective management. It is not a before and after comparison of the same areas, and there is a large variety in conditions and it is difficult to isolate the impact of management differences. However it is a rare example of quantitative data on WUAs in China and is invaluable for that reason.

B.v Comparison of Chinese and Indian approaches to irrigation management reform

Shah *et al* (2004) make an interesting comparison between the Chinese and Indian approaches to reform. Reporting again on of four irrigation districts in Ningxia and Henan (including those covered in Appendix D), they quote Wang et al (2002) who found the proportion of villages where traditional collective management of irrigation systems was practiced fell from 100% to 27% between 1995 and 2001. However, most villages changed to a system of contracting to individual managers, rather than to democratic WUAs. Where WUAs exist, they are often just a guise for management by the village leader himself (81% had a village leader as chairman).

They also found that management reforms had gathered pace in Ningxia, largely because of strong drive for reform at the provincial level. At a local level, they found evidence that the new managers have begun to worry about farmers turning to groundwater irrigation in the face of poor quality of surface irrigation service – this would affect their remuneration and thus forced them to improve water delivery services. Thus Shah et al found that "*the direction in which institutional reforms in irrigation management are heading in China is different from south Asia where reforms are still shrouded in obscure communitarian logic. In PIM/IMT projects in India, the focus of government, NGOs and donors is on organising the communities, forming WUAs, capacity building, empowerment, and creating the right 'process'. There is little engagement with the nuts-and-bolts issues of managerial rewards and incentives, clarifying roles and responsibilities and, above all, getting results in terms of improved services, better fee collection, and more crop per drop*."

By contrast China's reforms "*seem focused on results … the institutional design discussion was centrally about shaping incentives, authority, checks and balances, and contract design and enforcement*." They describe key elements of the Chinese model as:

- insisting that the manager makes a substantial cash investment, to ensure that he is serious about running a profitable water business;
- allowing the manager a high gross margin which makes it worthwhile for him to do proper O&M;
- ensure the manager's monopoly, through water withdrawal permits issued by the local water bureau; but
- controlling the monopoly by requiring the manager to seek approval from the bureau before raising the water price.

It is based on the assumption that a well-run, even if somewhat expensive, irrigation system would lift the entire economy to a higher plain of welfare.

B.vi Conclusions

Hussain and Biltonen report that "*even in those areas in which management reforms have been well-designed, effective implementation of the reforms has been difficult*". Implementation of reforms is indeed a fundamental problem in all countries, requiring a commitment at all levels, but we focus here more on the design than the implementation of the reforms.

Water charges are seen as a means of raising revenue and reducing demand. Fees thus need to be continuously raised so that IDs can continue to collect sufficient resources from a diminishing supply. On a wider scale this is less of a problem since water saved can be sold further downstream, but within a WUA the managers would face a prospect of dimishing finances as they become more efficient in managing water.

The difference between resource fees (volumetric charges payable to the ID) and water charges (area charges received from farmers) constitute the WUA revenue. The managers need to maximise this difference to ensure that they can continue to manage the scheme and receive an adequate recompense for their efforts (and they already report that the burden of collecting fees is very onerous). As the WUA becomes more efficient, the ID will reduce the target colume to be delivered to the WUA making their task more difficult in subsequent years. In the early years, when water usage is high (15,000 to 20,000 m3/ha) the scope for profit is large, but this potential will decrease rapidly in future years. Although there is some evidence that the current incentive system is effective in reducing water usage, we have no information yet on how sustainable this will be.

Tertiary level management reforms thus appear to rely mainly on financial incentives, with managers dependant on providing and being paid for delivering a good service. If their standards of management decline then their income will also drop. Some farmers are however able to get a better supply than others – which Hussein and Biltonen attribute to the willingness of some farmers to work "*with local water managers to find ways to provide them with more water access*" (Hussain & Biltonen, 2004, p106). However, they go on to say that "*farmers with poor water access will allocate more labor in non-agricultural work*" – ie they are accepting that some inequity in water delivery is inevitable and should be offset by off-farm activities. Whether this is possible depends on the locality and opportunities for off-farm income.

As we noted in section B.2.1, access to land is relatively equitable in China. Land is owned by the village and contracted to individuals – there are no large landowners or complicated or variable sharecropping arrangements as are common in South Asia. Water use by poor and non-poor and by large and small farms is also relatively similar.

B.vii Lessons that can be learnt from the Chinese experience

Shah et al (2004) draw three conclusions of direct relevance to south Asia.

- China has already given up on traditional communitarian model of organisation for managing irrigation projects. It has experimented with a variety of models of 'irrigation service providers' who are incentivised for better service delivery, improved water use efficiency and better performance in water fee collection;
- North China's agrarian economy is highly dependent upon high energy use for pumping groundwater. It has emphasised the need metered electricity supply and full cost recovery (in contrast to the subsidised flat rates charged in India);
- They have made good progress in demand management such as promotion of water saving approaches and technologies, implementation of withdrawal permits, pricing of water resource as well as services, enforcement of water withdrawal quotas, crowding out urban tube wells by surface water imports and such like.

The first of these is particularly relevant for our study. The traditional collective management system is in principle similar to the concept of a WUA (Hussain & Biltonen, 2004). However, it differed in practice because the heads of democratic management organisations were in fact appointed by the government and not elected – Hussain & Biltonen conclude that "*water users or farmers only provide labor or money-based requirement of the democratic organisation and seldom participate in any other management activities*".

A similar observation can be made about newly-formed WUAs elsewhere – they are rarely as democratic as intended. In both cases there is poor engagement and a lack of common understanding or interests between water users and leaders of water management institutions at a local level (ie tertiary canal).

China has adopted several alternative solutions to this problem. These include measures in some provinces (such as Hunan, Hubei and Jiangsu, and particularly in projects promoted by the World Bank) to establish democratic WUAs where the leaders are elected by and accountable to the water users. However, as Giordano *et al* note (see above) they seem to favour approaches which give managers a financial incentive to manage water efficiently. Accountability is achieved simply by farmers refusing to pay if they do not receive an adequate water supply.

We note in the main report the importance of identifying champions to drive the reform process. The Chinese approach of giving local individuals the financial incentive to implement the reforms may be sufficient to drive water management forward to a self-sustaining higher standard, but the financial incentives will almost inevitably reduce with time as the scope for water savings declines. The willingness of the leaders to continue 'championing' the reforms may similarly decline, and there is a risk that individuals may capture the short-term benefits without giving a longer-term commitment to reform. It also appears from the discussion above that such an incentive-based system may not be sufficient to ensure equitable access to all farmers.

A second problem - the difficulty of raising sufficient revenue from irrigation for the WUA - has long been recognized in China. The concept of diversified sideline enterprises was introduced as long ago as the 1980s to help cover the shortfall. The profits from these are intended to be invested in the irrigation system, but often they are invested in other businesses or paid out as bonuses (Hussain and Biltonen, 2004). This may change as agriculture with a well-managed water supply becomes more profitable and better able to cover part of the shortfall, but the risk is that the sideline enterprises become dominant. This can seen in the case of Zhaohe ID in Jiangsu and Tieshan ID in Hunan. Both are widely cited as success stories (MWR 2002), but they are very largely dependent on sideline enterprises. Aspects of canal maintenance appear to have been neglected as a result. Furthermore, areas where the resources, skills or infrastructure do not permit development of profitable sideline enterprises will remain disadvantaged.

These two factors together highlight the need to embed the management organisation better in the community. This is necessary to ensure that the incentive system works for the benefit of all farmers and not just the managers, and also provides the long term commitment to sustained operation in the face of limited revenues.

B.3 Reforms in Ningxia Hui Autonomous Region[5]

B.3.1 Introduction

A programme of irrigation management reform was introduced in Ningxia in 1999. The objective of these reforms was to save water, with the additional benefit of increasing revenue for O&M without increasing the burden on the farmers. The latter objectives may seem to be self-contradictory but it is intended that water saved in one tertiary can be used (and sold) elsewhere, while increasing the productivity of water. These reforms were planning following visits by the provincial Water Resources Bureau (WRB) to WUAs in Jiangsu and Hunan.

This programme focused on management of tertiary units (typically 100-300 ha), for which two basic models have been developed, here referred to as Water User Association (WUA) and contract models. These are very different in concept but the practical details are remarkably similar.

> *Water user associations*: A users committee of 5-7 members, comprising chairman, treasurer and general members selected from the farmers within an tertiary unit form an association registered with the human resources bureau and take over responsibility for management of the tertiary canal. Their responsibilities include collection of irrigation fees and distribution of water within the tertiary unit. They pass part of the fee collected to the Irrigation District. Farmers are represented in a general assembly, and select the committee members.
>
> *Contract management of tertiary units*: One person is awarded a contract to collect fees and to manage water distribution within the tertiary canal. This contract may be with a new WUA or it may be with the previous management organisation (village, township or irrigation district). He is required to pay part of this fee to the ID, township, village or WUA and he retains a management fee to cover his expenses and profit. The contractor is required to pay a security to the village as well as an advance on water fees. The farmers may be involved in selection of the contractor, or he may be selected on a competitive basis with the contract awarded to the one bidding the lowest management fee.

The similarity between the two lies in the fact that the user committee members and contractors are drawn from the same small pool of people (typically village and canal leaders), and there is little participation by other farmers in either arrangement. The units are defined according to hydraulic boundaries but correspond as closely as possible to village boundaries; thus they may comprise one canal, a number of small tertiary canals or discrete parts of larger canals. The offtakes to tertiary canals are operated by the ID who measure the total volume of water delivered and charge accordingly per cubic metre. Fees by farmers are paid according to area irrigated, regardless of actual consumption or even crop grown. However, there is a relation with water use since the fee is calculated according to the consumption over the past three years, plus the management fee.

[5] This brief review is based on a reconnaissance visit to Ningxia by Simon Howarth and Wang Jinxia in March 2002, including visits to provincial and county water resources bureaux and 5 tertiary units, and discussions with township, village, WUA and contractors.

So far 188 WUAs have been set up and 935 Contracts awarded. The provincial WRB stated that a combination of the two is the best arrangement – in this case a WUA is established and awards a contract for management. However, the decision on which model to follow is taken at the county level. This is said to be done so that the reforms reflect local aspirations and conditions, although the village and water users do not appear to be directly and formally involved in planning the reforms. The process of reform is seen by the WRB to be beneficial, with the main advantage of WUAs reported to be improved co-ordination. The WRB reported a water saving of 17% in 2001 as compared to 2000.

Unlike the sites visited in Jiangsu and Hunan, there have been no management reforms at a higher level in the system, such as the introduction of autonomous water supply companies (WSCs), nor are there plans to do so. No specific information is readily available on the relative significance of losses at main system and tertiary level in Ningxia, but main system management on large scale canal irrigation such as this is often more important than tertiary level management (Chambers, 1988).

Improved management of the main system is essential in Ningxia since a key objective of the reforms is to reduce water use. There will need to be a reduction in the amount supplied to each WUA and it is unrealistic to expect users to take on additional responsibilities, to limit their use of water and to pay higher water charges unless there is some improvement in the reliability of main canal operation. This can be partly achieved by involving users in the planning and management of these canals through WUAs or federations of WUAs, but further control on water use requires a system of restricting the allocation to each irrigation district. The development of such a system is is not reviewed further in this report.

B.3.2 Characteristics of Tertiary Unit Reforms

B.i Introduction

The main aims of the reforms are to localise management and to strengthen fee collection by linking it to actual water usage. Management, however, remains somewhat non-participatory, and increasing popular participation isnot seen as a priority. The link between water charges and volumes used is also still relatively weak. Some repairs (gates, canal lining, etc) are usually done before reform of management.

Some general points should be noted:

- The emphasis is on controlling supply rather than managing demand. It is possible that some losses ‘saved’ might in fact have been used productively elsewhere;
- Many traditional roles are unchanged – some of these are rather bureaucratic or confused;
- Participation is less of a priority than improving efficiency; and
- There is no change to systems of conflict management (the contractor has no role, and refers to village/township, although he may be able to resolve some minor issues).

Salient details of the tertiary units visited are given below.

Table B.1: Tertiary units visited in Ningxia.

Name	Township / County	Irrigation District	Type	Area (ha)	Layout	Water Charge
Xing Tan	Dong Yue ZhongWei	Weining LB	WUA	280	Tail of 7,500 mu canal (1 village)	¥ 35 / mu
Kaige	Zheng Wio ZhongWei	Weining LB	Contract (1 yr)	440	One canal (3 villages)	¥ 30 / mu
TaiPing	Shekong Zhongning	Weining RB	WUA + Contract (1 yr)	220	4 canals (1 village)	¥ 38 / mu
Ton Zhang	Chao Yuan Zhongning	Weining RB	Contract (1 yr)	120	1 canals (1 village)	¥ 45 / mu
Yong Gu	Yong Gu Yinchuan	Qingtongxia	Contract (3yrs)	800	1 canal (4 villages, 2 counties)	¥ 32.65 / mu

B.ii Contract management

This option has advantages for contractors, which may be one reason why it is so popular. It is also beneficial to the end user since it results in a single relatively well-defined management organisation at a local level for each tertiary canal. However, there are a number of advantages and disadvantages to the contracting organisation, contractor and user and these will be reviewed in turn.

Contracting organisation

The responsibility and hassle of fee collection is avoided, and is separated from other local revenue collection. Water allocation, minor (emergency) maintenance and minor dispute resolution is delegated, but responsibility for maintenance (both using village or township funds for major works, or unpaid labour contributions for annual canal cleaning) as well as conflict resolutions remains with the village. In theory the township is excluded from management and would lose the corresponding revenue: their attitudes to reform are often negative and this is seen by the provincial WRB to be a significant risk. However, in many if not all cases, the township retains some involvement in many aspects of maintenance, and are paid either directly by the contractor or via the ID. This means that the potential advantage of reducing the number of organisations involved in management is lost, but there is little alternative until other arrangements for maintenance are developed and the township can be persuaded to relinquish this role.

Contractor

The main incentives to the contractor are to:

- save water so that they minimise payments to ID, which are made on the basis of actual volume delivered, and
- ensure they provide an adequate delivery to farmers so that they are willing to pay the fee. In one case they were reported even to pump water to a small area of high land to ensure that farmers were prepared to pay.

These two factors are seen as providing a strong incentive to the contractor to manage water distribution and monitor water flows carefully. The amount retained by the contractor is only a small proportion of the total fee – about 5% or less - so the contractor must ensure that the farmers are satisfied with water deliveries. Any shortfall in payments will directly reduce the amount that contractor can retain. This makes the system better than it might intuitively appear to be.

There are some disadvantages:

- The contract is of short duration (usually one year, may be up to 3 years) so the contractor only undertakes essential maintenance to ensure water is not wasted.
- There is little participation by the farmers, and water allocation relies on informal understanding between the contractor and farmers (the contractor is in general a farmer in the tertiary unit).
- The contractor may ask the ID to cut off supplies after sufficient water has reached the official tertiary unit command. This may affect farmers further downstream who used the excess water in the past.
- The contractor may not deliver water to marginal land which is difficult to irrigate if the cost he would have to pay to the ID for the volume of water needed to irrigate this exceeds the fee that the farmer would pay. This might apply to the tail end of leaky canals or slightly high land for which greater water depth is needed in the canals.
- The contractor invests and takes risks, but he has potentially large profits.

Farmers

The main advantage is that there is a single point of management at local level for routine activities. Other agencies only become involved for maintenance and resolution of more contentious disputes. This simplification of responsibilities is a significant advantage and may outweigh the disadvantages which are listed below:

- No direct incentive to individual farmers to save water as the charges are calculated as uniform rate per unit area (ie, they are averaged over the whole tertiary unit and are unrelated to actual water consumption or even crop grown).
- a weak incentive to farmers to act collectively to reduce water use, since the profit from saving will go to the contractor. This will be reflected in lower charges in subsequent years, but there will be a slow response as the charges are based on the average of the past three years.
- No recourse for the farmers if the contractor fails to deliver water, except that they can (*in extremis*) refuse to pay.

B.iii Water User Associations

The WUAs comprise a committee of 5 – 7 members selected by consensus in a general assembly of farmers. Their tasks are the same as for the contractor; but with the difference that the profit would remain with the association for the benefit of the farmers rather than the contractor. In practice, the difference may be small since the salaries of the WUA committee members are similar to the contractor's management fee.

Often the committee members are village leaders, and thus the WUA may not be a very independent organisation. The WUAs are, however, usually defined to match canal commands rather than village boundaries which makes them much better suited for water management. There is, nevertheless, still much scope for enhancing awareness and understanding of the concept and functions of WUAs

B.iv Water Charges

Water charges to farmers vary from 30 – 45 ¥/mu, which is equivalent to US$ 50-80/ha[6]. This is calculated in advance on the basis of the average of the past three years' water use, minus 5% which is the target annual reduction in water use per unit area. The bulk charge paid by the contractor or WUA is calculated according to actual (measured) water diversions through the tertiary head gate at the rate of ¥ 0.012/m^3. The increased transparency in collection process, whether by contractor or WUA is seen as a major benefit of the reforms. This is achieved by separating the water fee collection from other village level fees and taxes, and is equally applicable to contract management and WUAs.

In addition to these water charges which are largely (95%) for payment of bulk water charges, farmers are also obliged to undertake maintenance of the tertiary canals (in labour, but equivalent to ¥15/ mu or $25/ha). This seems a high figure but is presumably due to the high sediment content of the water. There is also a system of irrigation operators in some places, paid by the farmers to manage irrigation for them at a cost of about ¥ 1/ mu ($ 2 / ha).

The make-up of costs to farmers is thus (in US$/ha)

Bulk charge	48–75 (includes up to $5 for tertiary maintenance)
Tertiary Management	2-5
Maintenance	25
Irrigation	0-20
Total (US$/ha)	**75– 125**

Assuming a yield of 9 tonnes/ha, an output price of ¥ 1,600 / tonne and net returns of 30% of gross output value, the net benefit is around $500/ha. Thus water charges are 15-20 % of net returns, or 4-7% of gross production costs. Assuming a capital cost of irrigation of $ 2,500/ha, O&M costs are likely to be of the order of $25/ha, indicating that water charges are sufficient for full O&M cost recovery (including WUA salaries/costs) and a significant element of capital cost recovery.

Although these fees are rather higher than those reported by Greonfeldt & Svendsen (2000), which range from US $ 25 – 77 / ha in Turkey, Mexico, Colombia, Argentina and the Philippines, they are in line with their recommendation that fees should be in the range of 5–8% of gross production costs.

B.v Water distribution system

Water management at tertiary unit level is not very sophisticated and does not require complex skills – neither the WRB nor the village leaders regard this to be a priority problem. One issue is the method of control: there are slide gates to control flow into sub-laterals in most tertiary units inspected. There are few cross-regulators, and the canal needs to be

[6] These are 2002 figures and exchange rates

operated full, or water level raised by placing timber checks. This is likely to contribute to the wastage as well as inequities in distribution. Water is released from the sub-lateral to the field by cutting the canal bank.

There is an interesting system of communal irrigators, who are paid by individual farmers to irrigate their fields for them. They operate the field canals and divert water onto farmers' fields. This system has been in place since around 1990 and is used particularly where improved (water saving) field irrigation techniques are used. Gao Hong (2002) reports that this has been refined if there is a`WUA by imposing penalties for poor performance. The irrigators are generally chosen by, or with the approval of, the village leader.

Given the bulk charge of ¥0.012/m^3 and the stated bulk water fees, the water use can be calculated as 3–5 l/sec/ha. This is a very high figure when compared with the consumptive use by rice and wheat and confirms that there is significant scope for further savings or that there is considerable reuse of losses which is not accounted for.

Some measures have been introduced to save water. These include rotation of sub-laterals, and water saving irrigation techniques (wetting/drying for paddy). There appear to be no formal procedures for water allocation planning, but contractors and WUAs do develop some informal watering plans and ensure timed deliveries to farmers. They request the Irrigation District (ID) to deliver specified volumes and durations through the tertiary offtakes to suit this schedule. The relative roles of WUA, irrigators and ID in planning water allocations were not entirely clear, and probably vary from canal to canal. Direct farmer involvement appears to be relatively low. Operation of the tertiary gate remains the responsibility of the ID.

B.vi Maintenance

Maintenance is undertaken by a number of different agencies, and the responsibilities are not well-defined. The province arranges maintenance before management reform, and possibly for some time afterwards; townships undertake some periodic maintenance; villages organise canal cleaning; and WUAs or contractors do emergency maintenance to ensure continued operation and to minimize losses during the irrigation season. The village but not the WUA has authority to organise village labour which is required for canal cleaning (as part of their 20-day annual compulsory labour contributions[7]).

The townships regard themselves as the *de facto* owner and to have the prime responsibility for maintenance. However, ownership of these collectively built tertiary units and thus responsibilities for maintenance remains unclear and contentious.

B.3.3 Potential Improvements to Tertiary Level Management

B.i Incentives to the managers

Much literature (eg Shah et al, 2004) on the reforms in China focuses on the importance of incentives to the managers. Hussain and Biltonen (2004) attempt to quantify the performance of different management systems with strong and weak incentives for the managers. Unfortunately there is too little data to draw rigorous conclusions although they believe that

[7] this formal requirement has now been abolished

water use can be reduced by 20% or 3000 m^3/ha (equivalent to an irrigation depth of 300mm) if managers are given good incentives. Existing water use is clearly very high and wasteful, and it is also necessary to consider the current use of return flows, and how they might be affected by upstream improvements in efficiency.

It should be noted that the data in Appendix D and in Hussain & Biltonen (2004) is based on a comparison of a small number of WUAs with collective management – it is not a before and after comparison of the same areas, and there is a large variety in condition. It is difficult to isolate the impact of management differences from the many other factors influencing performance. However it is a rare example of quantitative data on WUAs in China and is invaluable for that reason.

B.ii Farmer Participation and Incentives

Farmers apparently see little reason to participate in management, and they have little incentive to do so. There are some ways in which they could usefully be involved - for example, the contractors could be selected by farmers via a WUA. The selection could be based on other factors in addition to price, so that the management fee can be structured to give both parties an incentive. For example:

- there could be a rebate on payments by farmers proportional to actual savings in water volume rather than all the benefit going to the contractor.
- charges could be structured to vary according to crop type (at present the assumption is that farmers grow wheat and rice in alternate years and thus a single rate is adequate, but this weakens the link between consumption and water charge).

There needs to be an accurate and agreed database of landholdings to be used as a basis for water charges and maintenance contributions. In many cases, this is based on 1980s land allocation, which is often out of date. This has, however, been updated in some places.

B.iii Clarification of Responsibilities

The reforms are currently focused on specific tasks – fee collection and water distribution. Although responsibilities for these tasks are now defined, there appears to be some overlap in roles for planning, implementing and monitoring water distribution where FWMs are also involved. There are also a number of other important tasks where responsibilities are still confused, particularly related to maintenance for which several agencies are involved.

Responsibilities for the key functions can be summarised as :

- Operation – common irrigator, (WUA or contractor)
- Routine maintenance – village
- Major repairs - WMS
- Finance – WUA or contractor
- Conflict resolution – (WUA or contractor), village
- Representation at main system level - (WUA or contractor)

It can be seen that the WUA responsibilities are at present relatively small, but they fit into a broader system that can be further reformed. Options for these reforms need to be considered in the light of the overall objectives and other ongoing rural reforms.

B.iv Water distribution system

There is scope for water saving, although the impact of this on irrigation in adjacent areas needs to be considered. In some places losses may be reused for irrigation elsewhere. Measures could include:

- More accurate water allocation plans, and strict adherence to these;
- Better control of water level, by rotational irrigation in canals where command at low discharge is a problem;
- Rotation of sub-lateral canals;
- Improved on-farmer water management.

B.v Flow measurement

If charges are based on volume used, then measurement needs to be reliable and trusted by farmers.

Flows are measured using a depth-discharge relationship for the head reach of the canal. This relationship is established by current metering. In a well-defined channel, such as those seen, this can be expected to be within $\pm$ 10%. There would be further reduction in accuracy if there is any sediment in the canal. 10cm sediment in a typical tertiary channel would reduce discharge by about 10% for a given water level. If the water level needs to be ponded close to the measurement point, this would reduce the discharge further and make the method of measurement invalid. Such checks should be removed before recording the water level.

Consistency may be almost as important as absolute accuracy. Provided considerable care is taken (particularly if there is weed growth in unlined canals), this method should be acceptable. As so much depends on the measurement, it is likely that the contractors are conscientious in this, but they should be aware of the potential inaccuracies and take measures to minimize these. Farmers should also be aware of the methods and the issues related to accuracy of measurement.

Measurement of flows to individual farmers is not possible, but these flow volumes can be estimated since there are common irrigators managing the irrigations and there a small number of farmers irrigating at any one time.

B.vi Technical Support

The programme is very new and has been introduced with as yet a relatively low level of support, and relatively modest targets. Some training and technical assistance has been given by counties and townships, with guidance from the provincial WRB.

Experience on the WB supported projects (Yangtze Basin, Integrated Agriculture Intensification, Tarim, etc) as well as internationally suggests that strong and continued

technical support to farmers and local level government agencies is important to establish and sustain reforms – this should include awareness of the reforms and their purpose, as well as technical, administrative and managerial skills.

B.4 Irrigation Management Reform in Xinjiang, China[8]

B.4.1 Introduction

With its extreme climate and limited water resources, Xinjiang poses great challenges for irrigation management. The total irrigated area is more than 2.6 million ha, and it is the main cotton producing area of China. Participatory irrigation management is clearly only part of the solution to the diverse problems facing irrigated agriculture in the region, but it is an important innovation which is considered beneficial (Ministry of Water Resources, 2002). The policy of water supply to households, whereby water should be delivered to individual households and paid for according to the volume received is a key feature. Under the Tarim Basin II Project, a pilot programme for self-managed irrigation and drainage districts (SIDDs) has been established, comprising one WSC and one WUA in each of the five project prefectures.

B.4.2 SIDDs in Xinjiang

A WSC has been set up for the Kuche-Tarim (KuTa) branch canal, in Bayingol, which serves 12,000. Initially one WUA has been set up and planning is in progress to expand this following the successful pilot study (Hehai, 2000). The existing WUA serves 400 ha for 280 households. As improved control and accurate flow measurement was seen as essential, these canals were improved at a cost of around £ 200 / ha including canal lining as well as control and measurement structures. Measurement is done down to approximately 5 ha units using prefabricated cipolletti weirs. The rotational system is designed so that farmers receive the entire measured flow when it is their turn for irrigation.

The system is new and there is little need for rigorous maintenance in the short term, but effective maintenance systems will need to be introduced if the system is to be sustainable. It is apparently already very popular – particularly for the improvements in physical condition and the ability to measure (and pay for water) actually received.

Where measurement is not possible (for example, if weirs are damaged, submerged or otherwise non-functional), a proportional allocation based on area below a higher measurement point is used. Responsibilty for payment for losses is not clear. The WUA should pay for flow measured into the lateral but in fact just passes on the fees collected on the basis of flows measured at sub-lateral level. However, in these newly lined canals the losses are probably small compared to the errors in flow measurement.

Water charges are calculated according to the national standard formula (depreciation, major repairs, O&M and bulk cost of water). They are collected by the WUA and paid entirely to the township. The calculation includes elements for maintenance, which is the responsibility of the WUA, as well as for depreciation, which should also logically be retained by the WUA.

[8] This review is based on a reconnaisance visit to Xinjiang by Simon Howarth in Novermber 2001

They are not legally entitled to keep this, but as a special dispensation from the WRB the WUA is allowed to retain 1% of the fees collected. They do have some alternative sources for maintenance funds – direct labour contributions, additional collections as required, or village funds. It appears that most maintenance only involves labour, with a small amount required for greasing gate spindles. Being newly rehabilitated, the system is in good condition, but problems of damage to lining (leaking joints, vegetation damage) and gates (broken spindles) and measurement weirs (chipped concrete, unclear markings) are already emerging.

Financial aspects are strongly stressed – both the need for cost recovery for O&M / depreciation, and to reduce demand for water by raising prices. These are related but distinct topics, and need to be analysed separately. Improved management of water by collective action within a lateral command, a common WUA objective, is not seen as separate task but a natural consequence of achieving direct measured supplies to individuals. Cooperative action is thus seen as unnecessary, beyond that which is said to be already adequately covered through existing village level organisations. This approach assumes that measurement is physically and administratively sustainable. This is a demanding assumption, but is locally believed tro be realistic.

The Water Supply Company manages the KuTa canal, but the intervening branch canal (Xingping) is managed at county level thus breaking the direct link between the WUA and WSC that is the key feature of the SIDD concept. The WSC is part of the prefecture WRB; it is a discrete unit, but not autonomous or independent. KuTa is one of several main canals offtaking from the Kuche river in Korla. The WSC is locally regarded as less successful than the WUA, since it appears to be little changed from the previous system.

Water charges are lower per unit area in Xinjiang than most other parts of China, but this is partly because of lower water use. The bulk charges in Xinjiang are higher than in Ningxia - ¥0.018/m^3 for wheat and ¥0.032/m^3 for cotton as compared to ¥0.012/m^3 in Ningxia. The main crop in Xinjiang is cotton for which the price has dropped sharply (by about one third) since 1997 owing to the abolition of price support. With a yield of 1,360 kg/ha, the net return was $275/ha in 1999 after allowing for water charges of $30 per hectare. The returns to wheat for which the yield is 4.5 tonnes/hectare, are even lower at only $150/ha despite a lower charge per cubic metre for food crops. Although the water charges are quite a small percentage of the total output prices, they are 12 to 20% of the net returns, and so it is not surprising that there is strong resistance to increasing water charges. In addition to this fee, they undertake maintenance which is valued at $3/ha.

B.5 Conclusions for EIP

China has evidently made considerable progress in reforming irrigation management, and has shown a much greater commitment to quantifying volumes of water used than the other study countries. This is seen as essential for ‘transparency’ of management systems, collection of fees, and saving water. Key conclusions include:

- WUAs are part of a much largely package of reforms in the water sector, which are aimed at simplifying and streamlining management, but there is resistance at some levels;

- WUAs are reported to be effective but there is little objective data available in the public domain. WUA development is often associated with infrastructure rehabilitation, and usually the latter is seen as essential for sustainable WUAs. There are many types of WUA: the 'World Bank model' is strongly promoted but it is not universally favoured;
- There is a strong focus on incentives for WUA managers, with a common belief that managers will work best if they are given a strong economic incentive – some see this as the main driver for successful WUAs. However, irrigation is seen as inherently uneconomic, and many WUAs rely on sideline enterprises (small industry) to make up the shortfall;
- Landownership patterns are to some extent supportive of effective management, as areas per household are relatively uniform and types of tenure are simple. However, plots are often fragmented and scattered which partially offsets this advantage;
- The heritage of collective agriculture strongly affects attitudes to irrigation and to WUAs. There is a tension between expectations that others will manage irrigation and make many decisions, and desires to act independently without being constrained by cooperative management organisations;
- Flow measurement to WUAs and even to individual farmers is widely attempted, with varying degrees of success. There are clearly some problems but it is difficult to obtain reliable data on achievements. In many places informal proxy indicators (typically time) of flow are adopted, but these are negotiated individually and it is not clear whether they are reliable and even the extent to which they are applied in practice. Common irrigators are used in some places which helps ensure a consistent approach to irrigation.

Thse factors suggest that the other countries can learn from Chinese experience, but there are few, if any, lessons which can be directly applied elsewhere.

References

Chambers (1988). Managing Canal Irrigation: Practical Analysis from South Asia. Cambridge

FAO (2001) Irrigation Management Transfer E-mail Conference. http://www.fao.org/ag/agl/aglw/waterinstitutions/default.stm

Feng Guangzhi (2001) Irrigation Reforms in China, 6th INPIM Seminar, Beijing

Gao Hong, Reng Qing-en and Jiang Xizhong (2002) Irrigation Management System Reform in Qingtongxia Irrigation District, Proc. 6th International Seminar on PIM, Beijing April 2002

Groenfeldt D and Svendsen M (2000) Case studies in Participatory Irrigation Management, World Bank Institute, Washington.

HeHai University (2001) SIDD Development and Recent Status, Tarim Basin Irrigation and Improvement Project, Urumqi

Hussain I & Biltonen E eds (2004) Pro-poor intervention strategies in irrigated agriculture in Asia (China country report) IWMI/ADB Colombo

Li Ou , Zachernuk T, Han Yon (2004) Participatory irrigation management: promoting community-based WUAs in the Piyuan canal rehabilitation project. In Plummer & Taylor, 2004

Lohmar B, Wang J, Rozelle S, Huang J, and Dawe D (2003), China's Agricultural Water Policy Reforms: Increasing Investment, Resolving Conflicts, and Revising Incentives China's Agricultural Water Policy Reforms/AIB-782 Economic Research Service/USDA. Market and Trade Economics Division, Economic Research Service, U.S. Department of Agriculture. Agriculture Information Bulletin Number 782.

Mollinga P, Gao H, and Bhatia AM (2003). Leadership and turnover: The contradictions of irrigation management reform in the People's Republic of China. Paper presented at the Conference "Asian Irrigation in Transition–Responding to the Challenges Ahead", Asian Institute of Technology, Bangkok, Thailand, 22-23 April 2002.

Ministry of Water Resources, PR China (2002) Proceedings of the Sixth International Seminar on PIM, Beijing China

Plummer and Taylor (2004). Community participation in China, Earthscan, London

Shah T, Giordano M, Wang J (2004). Irrigation Institutions in a Dynamic Economy: What Is China Doing Differently from India? Economic and Political Weekly, July 31, 2004

Taylor (2004). The context for community participation in China *in* Plummer and Taylor (2004)

Wang, J, Z Xu, J Huang, S Rozelle, I Hussain and E Biltonen E (2002): Water Management Reform, Water Use and Income in the Yellow River Basin.

World Bank (1998) Irrigated Agriculture Intensification Loan II. Staff Appraisal report

World Bank (2003) Yangtze Basin Water Resources Project: Implementation Completion Report, Washington

Zhou Yaozhou and Wei Bingcai (2002). Pricing of Irrigation Water in China, *in* Irrigation Water Policies: Micro and Macro Considerations, Agadir Conference, World Bank

Appendix C Legal and Policy Background to WUAs in Nepal[9]

C.1 Introduction

C.1.1 Background to this report

The Nepali government is strongly promoting irrigation in order to increase agricultural production and meet the demands of its growing population[10]: currently only 17% of the cultivated area in the country is irrigated all year round, despite a generous endowment of water resources. There is therefore significant scope for extending the existing network of irrigation systems.[11] His Majesty's Government regards participatory irrigation management (PIM) as an essential requirement in meeting its target of year-round irrigation of 90% of irrigable lands by 2027.[12] PIM has historically been implemented in Nepal through farmer-managed groups (FMIS) and in recent years increasingly through agency or joint-managed systems, but the latter have failed to match the productivity of the former.[13] One of the reasons for the comparative lack of success of agency and joint managed systems is the absence of a strong regulatory foundation: the legislation that has been put in place is often ignored or not enforced. There are a number of reasons why this is the case: for example the legislation lacks detail in crucial areas; the necessary financial resources are not available to those enforcing the provisions or to those who must obey them; and the rules are mutually contradictory or inconsistent.

In order to address these problems, this paper assesses the legal and policy context of irrigation management in Nepal, focusing in particular on the issues raised by agency and joint managed irrigation systems. The broader water use management context will be investigated since irrigation management does not exist in a vacuum, but may affect, and be affected by, other water uses[14]. Solutions and remedial actions will be suggested with respect to the difficulties identified, including, where appropriate, remedies that have been applied in other parts of the world in an effort to resolve similar problems.

C.1.2 Scope and structure of the report

The report is structure as follows, so that first the legal problems currently affecting irrigation management are identified and then potential remedies are suggested.

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[9] This review was prepared by Andrew Allen and Patricia Wouters of the International Water Law Research Institute, University of Dundee in 2003/2004

[10] See Irrigation Policy, 2060 (Department of Irrigation, available from www.doi.gov.np), paras.1.1-2. See also WATER RESOURCES STRATEGY – NEPAL (WECS, Kathmandu 2002), para.1.1.

[11] Water Resources Strategy, *supra*, note 8, para.2.4.2. 452,000ha are irrigated out of a possible irrigable area of 1,766,000ha, although the total cultivated area is currently 2,642,000ha (*id.*). See also Irrigation Policy, *supra*, note 8, para.1.3. For further details of the hydrologic and economic context in Nepal, please see Water Resources Strategy, especially ch.2.

[12] Water Resources Strategy, *supra*, note 8, para.6.5.

[13] See for example, S.K.Shukla, *Policies, processes, and performance of management turnover and agency-initiated interventions*, in G.P. Shivakoti and E.Ostrom, eds, IMPROVING IRRIGATION GOVERNANCE AND MANAGEMENT IN NEPAL (ICS, USA, 2002), 76.

[14] The work is based on a review of all relevant legislation in Nepal, discussions with Nepali specialists, and supplemented by fieldwork in November, 2003

- systematic legal analysis of the legal and policy context, identifying particular gaps, weaknesses and problems within the following framework:
    - Ownership and Allocation
    - Restrictions on use
    - Relevant environmental legislation, policy and practice
    - Governance
    - Dispute resolution and access to justice
- Conclusions: legal, policy and financial improvements that could be made in Nepal to enable effective and efficient irrigation management, taking into account the particular local circumstances as well as international best practice (where appropriate).

C.1.3 Legislative background

The regulatory regime in Nepal with respect to water use management is largely governed by the Water Resources Act ("WRA) which sets out the general principles to be applied to water resource management. This includes broad provisions relating to the ownership of water, and to the establishment of User Associations ("UAs"). UAs are organisations that may be formed by groups of individuals who wish to make use of water resources on a collective basis.

Certain uses are licensable while others are exempt: two pieces of secondary legislation set out more detailed application rules, one dealing with irrigation management (one of the exempt uses)[15] and the other with licensable activities.[16] Further legislation addresses one specific licensable activity, electricity generation,[17] while broader environmental control is governed by the Environmental Protection Act and its subsidiary rules.[18]

In addition to the above legislation, water use management may also be affected by the Muluki Ain, which codified the law of Nepal in 1854 and again in 1963. The Muluki Ain contains a chapter dedicated to irrigation management, some of which is consistent with the current legislation[19] and some of which directly contradicts it.[20] It is unclear what status the Muluki Ain has in Nepal currently – although it has not been expressly repealed by subsequent legislation, the two are not always consistent. In the absence of detailed information regarding the Nepali courts' treatment of the Muluki Ain,[21] the author has concentrated on the current legislation as far as possible.

[15] The Irrigation Regulations 2056, as revised in February 2004 ("IR"). No official English translation was available at time of writing, and the author has therefore used an unofficial translation along with the official translation of the previous version.

[16] The Water Resources Regulations 2049 ("WRR"). UAs may be established with respect to licensable activities, but licences must first be obtained under the WRR. However, see *infra*, para.1.2.1 regarding the current state of the licensing process.

[17] The Electricity Act ("EA").

[18] The Environment Protection Rules ("EPR").

[19] For example, the rule that a new irrigation canal can be constructed upstream of another canal only if it does not harm the downstream one. See Khadka, S.K., *Water Use and Water Rights in Nepal: Legal Perspective* in Pradhan, Rajendra *et al*, Water Rights, Conflict and Policy (IIMI, Kathmandu, 1997), 23.

[20] The "first come, first serve" rule with respect to irrigation waters is not conducive to ensuring that tail farmers, for example, have access to irrigation water. See Khadka, *supra*, note 5, 15.

[21] Bishal and Santosh outline the Supreme Court's water-related decisions during the period 1980-90, and note that the Supreme Court recognised customary water rights, but they do not include an analysis of decisions made

All references to Nepali legislation and policy, unless otherwise indicated, are taken from the official English translations provided either on the Nepali government's official websites or as published by the Ministry of Law, Justice and Parliamentary Affairs.

C.2 Ownership and Allocation (in relation to both water resources and land)

C.2.1 Ownership

C.i Water

Ownership of Nepal's water resources is vested in the Kingdom of Nepal itself: "*The ownership of the water resources available in the Kingdom of Nepal shall be vested in the kingdom of Nepal*." (s.3, Water Resources Act 2049). For the purposes of the WRA, "water resources" includes all surface and ground water, along with water in any other form.[22]

C.ii Land

Both private individuals and Water User Associations formed under the WRA have the capacity to own land and moveable property.[23] With respect to land registration, there is no central cadastral system, as registration takes place at the local District Land Revenue Office only.

As regards ownership of canals, those that are constructed by the Department of Irrigation remain vested with the DOI. Only management responsibilities can be transferred to WUAs, although the extent of transfer will depend on the terms of the transfer agreement.

C.2.2 Allocation

C.i Introduction

A system for the allocation of water use rights through a licensing and registration procedure has been set out primarily in the WRA and the Water Resources Regulations, together with further provisions contained in the Electricity Act.[24] Although the practice followed deviates from the letter of the law somewhat, a description of the provisions relating to the licensing arrangements will be given here to indicate what would take place if the law was enforced. The practical situation will also be described where it differs from the legal ideal.

after the enactment of the Water Resources Act in 1992. See Bishal, S and Santosh, K.C., *Analysis of Supreme Court Cases and Decisions related to Water Rights in Nepal* in Pradhan, Rajendra *et al*, Water Rights, Conflict and Policy (IIMI, Kathmandu, 1997), 47-62.

[22] Water Resources Act 2049 ("WRA"), s.2(a).

[23] WRA, s.6(3).

[24] Electricity Act 2049 (the "EA") – see also the Hydropower Development Policy 2049, both available at www.doi.gov.np.

The default position set out in the WRA is that a licence is needed for all water utilisation.[25] The following uses, however, are exempt from this requirement:

1. *"For one's own drinking and other domestic use on an individual or collective basis,*
2. *For the irrigation of one's own land on an individual or collective basis,*
3. *For the purpose of running water-mill or water grinder as cottage industry* [sic],
4. *For the use of boat on personal basis for local transportation,*
5. *For the use, as prescribed, of the water resources confined to a land by the owner of such land."*[26]

In the light of these exemptions, the principal water use that still requires a licence is hydropower.[27] Further provisions contained in the Electricity Act, 2049, however, exempt hydroelectric power projects with a capacity of less than 1000KW.[28] It should also be noted that the emission of pollutants into watercourses is not covered by the WRA licensing regime as the issuing of Pollution Control Certificates falls within the remit of the Ministry of Population and Environment ("MOPE").[29]

More importantly, for the purposes of the current study, it would appear that as "irrigation of one's own land on an individual or collective basis" is exempt from the licensing regime,[30] no licence would be needed by water user associations as these would be regarded as irrigation on a collective basis.[31]

The broad position with respect to allocation of water use rights on watercourses is therefore mixed. A number of bodies have specific responsibilities for controlling limited types of water uses, and irrigation management sits uncertainly amongst these.

[25] WRA, s.4(1), states that "*[n]o person shall be entitled to utilize the water resources without obtaining a license under this Act*". Section 22 of the WRR underlines this by stating that "*[t]he licensee, who has obtained license for the works relating to utilization of water resources under this Regulation, shall have the right to use the water resources for the works as mentioned in the license to the extent of water resources of such place and area as specified in the license*".
This follows practice in a number of countries, notably South Africa, where certain permissible uses of water can be made without licences or permits, but other uses must be authorised – see National Water Act, s.4 (available on the DWAF website at www.dwaf.gov.za).

[26] WRA, s.4(2).

[27] Commercial navigation, the other major potential use of a watercourse, does not exist in Nepal, and has therefore been ignored. It would appear from this list of exemptions that, for example, uses such as fish farming, would require a licence. However, see para.1.2.1 below for details of the licensing system.

[28] S.3 states that:

> "*no license shall be required to be obtained by a national or a corporate body for the generation, transmission or distribution of electricity up to 1000 Kilowatt and for conducting necessary survey therof. Before generating, transmitting or distributing hydro-electricity of the capacity ranging from kilowatt to 1000 kilowatt, information to that effect shall be given to the prescribed officer in a manner as prescribed*".

This reflects the wording of para.4(1) of the Hydropower Policy. This policy also states that such licences as are necessary for hydropower projects must be sought from the Ministry of Water Resources, rather than the Water Resources Committee (para.4(2)), although the licensing authority is not defined in the Electricity Act but in regulations made under that Act to which the author has been unable to access. See also WRA, s.9.

[29] See, *infra*, para.2.1.1.

[30] See *supra*, note 16, subsection (2).

[31] See also WRA, s.5, where the rationale behind establishing a WUA is described with reference to its "collective" benefits.

C.ii Licensing

The body charged with the task of issuing water utilisation licences is the District Water Resources Committee ("DWRC"), established under the Water Resources Regulations as the "prescribed committee" for the purposes of the WRA.[32] However, despite being only indirectly relevant to irrigation management as a result of the exemption noted above the theoretical licensing process will be outlined in order that possible improvements may be suggested. The licensing of other uses of water resources in the wider basin or watershed context may have an impact on the resources available to WUAs, and on the way that these organisations are managed.

The WRR sets out in detail the licensing process, beginning with the composition of the DWRC. It is made up of nine members, representative of various bodies and interests concerned with water utilization.[33] This body is not responsible for issuing hydropower licences – the Ministry of Water Resources has sole capacity for this.[34] The WRR goes on to establish the procedural requirements relating to the meetings of the DWRC, and sets out stipulations with respect to licence submission and assessment, renewal and fees chargeable.[35] No perpetual licences for hydropower may be issued as policy states that the maximum duration of such licences is limited to fifty years.[36] However, no mention is made in the legislation regarding restricting the duration of any other licences that might be issued if the exemptions under s.4 of the WRA were ever amended.[37] Licences are cancellable under s.21 of the WRA, where that Act, or regulations made under it,[38] have not been complied with – again, the DWRC is vested with this power under the WRR.[39]

Under the WRA, the DWRC is obliged, "in general", to follow a particular order of priorities in allocating water utilization licences:[40]

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[32] See WRA, s.8, and WRR, s.8(1).

[33] See WRR, s.8(2): the membership consists of the following persons:

- Chief District Office (Chair);
- Representative of the District Agriculture Office;
- Representative of the District Forest Office;
- Representative of the District Drinking Water Office
- Representative of the District Irrigation Office;
- Representative of the office of any electricity project run by HMG in the area;
- Representative of any other office in the area concerned with water utilization;
- Representative of the District Development Committee; and
- The Local Development Officer (Secretary).

Note that membership may be above or below nine, depending on the relevant offices in the area.

[34] See *supra* notes 17 and 18.

[35] WRR, ss.9-27.

[36] Electricity Act, 2049, s.5(2) (available on the Department of Irrigation website at www.doi.gov.np).

[37] Unless the licensing regime provides for review and revision of allocations, perpetual licences may be seen as being inimical to good water resources management as they do not allow for water rights to be adjusted to take account of different circumstances. The water rights allocation mechanisms must be flexible enough to allow for the review of the uses of a particular watercourse, while giving adequate protection and stability to the holders of those rights. See for example, the position in South Africa, which permits a maximum duration of forty years for water licences (National Water Act, no.36 of 1998, s.28(1)(e)). However, all licences must be reviewed not less than every five years (*id.*, s.28(1)(f)), and can be varied if circumstances demand (*id.*, s.49(2), which sets out these circumstances in more detail). Variation can only be done if the other uses of the same watercourse have also been equitably changed as part of a general review (*id.*, s.49(3)). The duration of a licence cannot be altered as part of such a process (*id.*, s.49(2)).

[38] This would therefore include both the WRR and the Irrigation Regulations.

[39] WRR, rule 36.

[40] WRA, s.7(1). S.7(2) states that:

a. "Drinking water and domestic uses;
b. Irrigation;
c. Agricultural Uses such as animal husbandry and Fisheries;
d. Hydroelectricity;
e. Cottage Industry, industrial enterprises and mining uses,
f. Navigation;
g. Recreational uses;
h. Other uses".

No indication is given however with respect to application of these priorities: the implication is that the list indicates the relative ranking of each use, and therefore the degree of protection that each enjoys when the DWRC is assessing licence applications. It is not clear if existing low-priority uses would be vulnerable if an application for a higher ranked use were to be considered by the DWRC in the context of an already fully-utilised watercourse. It should be pointed out, however, that existing uses appear to be protected to the extent that "*[a] person or a corporate body making use water resources shall make its beneficial use without causing damage to other*" uses.[41] The interaction between the protection of existing uses and the water use priority list above is not elaborated upon and the concept of beneficial uses is flimsy in the WRA.[42] As regards the considerations to be considered by the DOI in allocating water, there is no indication as to the level of importance that will be attached to each of the factors.

C.iii Allocation in context of WUAs

The practicalities of the situation with respect to the allocation of water resources become more complicated when the terms of the Irrigation Regulations 2056 ("IR") are considered. A distinction must be made between the licensing authority identified in the WRA/WRR (i.e. the DWRC) and the authority responsible for distribution of the water itself. In the IR, the body responsible for distributing water to irrigation systems is either the local office of the DOI, in situations where the government remains in control of a system, or the relevant WUA where management has been transferred.[43] In order to establish the priorities for provision of water, the service provider (or "Project Office" as it is referred to in the IR), in conjunction

"If a dispute arises while utilizing water resources, the prescribed committee shall, on the basis of priority order as set out in Sub-section(1), the beneficial use or misuse made of the water resources in accordance with sub-section(3) of Section 4 [obligation to make beneficial use without damaging other users] *and also by conducting other necessary enquiries, decide as to whether or not or in what manner such use could be made."*

See also WRA, s.8(2) regarding the link between the priorities and licensing:

"*On receipt of an application pursuant to sub-section(1), the prescribed officer or authority shall conduct or cause to conduct necessary enquiries and issue a license to the applicant by prescribing necessary terms according to the format as prescribed within 30 days of the receipt of such application in the case of license for conducting survey of water resources and within 120 days in the case of license for the utilization of water resources in accordance with the priority order as set out in sub-section (1) of Section 7*."

[41] WRA, s.4(3).

[42] It may be that the translation of s.4(3) is incomplete, and that the words "beneficial uses" should appear at the end of the provision. If this is the case, existing beneficial uses would have greater importance than is currently apparent. As the clause stands, however, all potential existing uses are nominally protected, although this appears to be subject to the water use priority list.

[43] The licence holder, where one has been issued, may also be considered to be a service provider, but the regulations do not provide further detail regarding what situations may be covered by this. It appears simply to be a reference back to the abortive licensing regime of the WRA, although licence holders under that Act would still be WUAs. As shall be seen below, the WRA requires that WUAs be licensed, but the IR merely require that they be registered.

with the District Agriculture Development Office and relevant WUAs,[44] must take the following considerations into account:

i. Geographical location of the concerned area
j. Area of land
k. The quantity of water available at the source
l. Type of crop to be cultivated on the land.
m. Nature of soil of the land
n. *The capacity of the structure and other technical matters".*[45]

The allocation of water to watercourses by Project Offices is based only on the factors in IR rule 21, although, again, no assistance is provided which illuminates the way in which these criteria should be applied in practice. In addition, when considering how water should be distributed, it is not possible for Project Offices to guarantee that they are in possession of all relevant information regarding a particular watercourse. This is especially true with respect to the availability of the resource, because additional licences may already have been allocated by other responsible authorities for that water, whether in the same District or not. This raises the broader issue of how an effective licensing regime can be possible in circumstance where licences may be issued by a number of separate and independent bodies, each responsible to different ministries. None of these bodies operate on a catchment basis and none of them control all the water uses within their respective areas. Ideally, there would be only one licensing agency controlling all water use in a particular catchment,[46] and this must be the recommendation in Nepal for the longer term.

In addition, the entities responsible for licensing and registration are constituted on the basis of political (i.e. District) boundaries rather than hydrological ones. There are no provisions ensuring information transfer between districts as regards inter-district watercourses, and the result of this is that in the event of the licensing regime being put into effect, conflicting licences could be issued for the same watercourse, with consequent impacts on downstream water quality and quantity. This is compounded by the fact that an individual watercourse may be affected by licences issued by the relevant DWRCs and also by the pollution control licensing of the MOPE. Shrestha cites the problems encountered in one example where a downstream WUA was significantly affected by the establishment of a fish farm upstream.[47]

The advantage derived from bringing irrigation activities within the licensing regime as a whole is that this would allow the DOI and the DWRCs to exercise a degree of control over one of the major uses of water in Nepal. Currently, the Project Office must take account of the availability of water at the source.[48] Without information detailing the level of water use on a watercourse, it will not be possible for the Project Office to do this with any degree of accuracy. A comprehensive licensing regime would increase the authorities' understanding of the way in which a canal is used and, in cases where no transfer agreement is in place

[44] IR, rule 21(1). Prior to the introduction of the most recent version of the IR in February 2004, WUAs had no right to be consulted in this process.

[45] IR, rule 21(2).

[46] As is the case, for example, in South Africa and in parts of Australia.

[47] Shrestha, A., "Building Gender-Responsive Water User Associations in Nepal", in ADB Case Studies, 15, available at http://www.adb.org/Water/Actions/NEP/gender_responsive_associations.asp.

[48] See, *supra*, note 33.

between the government and a WUA, should provide an enforceable right that can be relied upon by licence-holders.[49]

The licensing of WUAs in the context of subsistence farming, raises a number of problems, however, especially where the WUA is part of a broader irrigation system. In such cases, the identity of both licensor and licensee becomes an issue, as does the necessity for having a single body in charge of all water uses. Where the WUA is part of a much larger irrigation system, the Project Office for that system will normally be part of the DOI, although it may also be a private operator.[50] The party withdrawing water from the original watercourse, and consequently the entity that would be licensed in the South African context, is the DOI. A general requirement for WUAs to be licensed would cause problems for such organisations operating within these larger projects as the *control* of water use would be the responsibility of the Project Office. The WUA would be taking water from the canal system controlled by the Project Office, but would be licensed by the body responsible for the watercourse as a whole. This separation of the responsibilities for licensing and management would have the effect of either taking control away from the Project Office or rendering worthless the licence itself.[51]

Notwithstanding the provisions detailed above regarding the licensing of water use and allocation of resources, the government retains the capacity to issue unchallengeable directives regarding water use.[52]

With respect to the criteria to be taken into consideration by the Project Office when distributing water, questions may be raised as to whether or not the list is comprehensive enough to meet the objectives of the Nepali government. For example, the Branch Committee of the Bijayapur WUA is bound by its constitutive documents to distribute water according to

[49] See also Svendsen, M. and Nott, G., *Irrigation Management and Transfer in Turkey: Process and Outcomes*, in Groenfeldt, D. and Svendsen, M., eds., Case Studies in Participatory Irrigation Management (World Bank Institute, Washington, 2000). Securing enforceable water rights was regarded as essential if the organisations set up in Turkey were to be sustainable.

[50] See IR rule 43A and 43B regarding the potential for transfer of operation and maintenance responsibilities to private concerns:

43A. To be operated on lease:

(1) Notwithstanding anything contained in this regulation, Department may lease out the responsibility of maintenance and operation as whole or in a partial manner on the basis of competition to a person Users' Association or Non Governmental Organization of the canal, secondary canal, sub secondary canal and water course under the system operated by His Majesty's Government or conducted in under the joint Management system.

(2) The notice of at least 35 days shall be published in the national daily newspaper for the lease pursuant to sub rule (1) and other procedure shall be as mentioned on Directives.

43B. Management may be transferred:

(1) The regular management responsibility as carried out by His Majesty's Government on large and medium irrigation system constructed by His Majesty's Government and presently managed under joint management system shall be transferred to the local bodies on the basis of demand, technical capacity and availability of resources of the local bodies.

[51] In South Africa, difficulties have been encountered with respect to the licensing of WUAs formed from groups of subsistence farmers. Individual subsistence farmers do not appear to need a licence (Sch.1 of the Natioanl Water Act allows "small gardening not for commercial purposes"), but this acts as a disincentive for farmers to form WUAs, as this makes administrative and economic demands that farmers cannot afford or do not wish to make. This in turn may result in lack of water for downstream WUAs due to the cumulative effect of large numbers of unlicensed subsistence farmers upstream. For further information, please see Chancellor, F., Upton, M. and Shepherd, D., "*KaR Project R7810 Final Report: Revitalisation and Transfer of Smallholder Irrigation schemes to Farmer Managers, and the Establishment of Water User Associations*".

[52] WRR, s.39 and IR, rule 41.

equity.[53] This is a concept that the Project Office is currently not obliged to take into account. While equity is a difficult standard to measure, it may be that by adding it as one of the criteria to be used by the Project Office in distributing water, members will gain some degree of protection. It may also encourage other WUAs to include equity as a governing principle in their own constitutive documents.[54]

C.iv Allocation in times of shortage

It is the responsibility of the Project Office,[55] as water distributor, to decide how water should be allocated in the event of a shortage.[56] In making these decisions, the Project Office must take account of the six usage priorities listed in the IR, and is required to "*consult with the concerned Irrigation Office and the concerned local body*", the local body presumably being a body defined as such under the Local Self-governance Act.[57] The Project Office must also "coordinate" with the affected WUA before making such a decision.[58] The wording of the provision implies that the Project Office need not actually *consult* with the WUA, but must inform the WUA in advance. No appeal appears to be available against the decisions of the Project Office in such circumstances, as the Irrigation Regulations are silent on the subject of dispute resolution. Joint-managed projects may allocate specific roles to the managing partners in such circumstances, but it is hoped that details will be contained in the relevant transfer documents and in the WUA constitutive documents. In the case of the Sunsari Morang Irrigation Project, no provision relating to the allocation of water in times of shortage is evident: the Water Users Committee is responsible for setting rotational schedules, but need only *involve* water users and keep them informed.[59]

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[53] Constitution of Water Users' Institution 2058 – Lekhnath Municipality (Bijayapur Irrigation System), para.15(h).

[54] This, of course, will only be of use if members have the capacity and means of enforcing this standard – see, *infra*, para.3.1 especially. It may also be noted in the context of the Andhra Pradesh reforms, that while the Farmers' Management of Irrigation Systems Act 1997 acknowledges that the state depends upon "*efficient and equitable supply and distribution of water*" (preamble), there is no explicit requirement for the WUA to create an *equitable* system (see *id*., s.16, for example).
Equity underlies the entire water use management system in South Africa, with duties being placed on the relevant Minister (National Water Act 1998, s.3) and equity being the driving factor behind the licensing strategy (*id*., s.27) and in the reviewing of licenses (*id*., s.49 *et seq*). In Kyrgyzstan, WUA members have the right to receive a" fair and equitable" share of the water distributed in the irrigated area (see Law on Unions of Water Users, art.9). See also Hodgson, S., *Legislation on Water Users' Organizations*, (FAO Legislative Study 79, Rome 2003), 48.

[55] The Project Office will be either the DOI in the case of agency and joint-managed projects, or the respective WUA in the case of farmer managed projects – see IR, rule 2.

[56] IR, rule 22.

[57] Section 2(a) of the Local Self-Governance Act 2055 ("LSGA") defines a Local Body as a Village Development Committee, Municipality or District Development Committee.

[58] IR rule 22:

(1) On the circumstances that due to the demand for water exceeding the availability of water at the source or the capacity of Structure, the Service could not be supplied in accordance with the demand, the Project Office upon coordination of Users' Association may decide to reduce the service partially subject to the order as specified in Rule 21.

(2) While making decision pursuant sub-rule (1), the Project Office shall be required to consult with the concerned Irrigation Office and the concerned local body.

[59] See Agreement of Hand over to Water Users Committee For Operation and Management of SS9E sub-secondary canal in Sitagunj secondary canal of Sunsari Morang Irrigation Project (on file with author), para.(b)(v):

"WUC is fully responsible to manage rotational practice between users of canal command area to best utilize limited water in agriculture by informing all users about rotational schedule of the canal operation through involvement of water users groups in whole command area".

Where the WUA itself is the Project Office, it must take account of the usage considerations, but will have to do so using only the water that it receives from the DOI, which again is obliged to make use of the same priorities. In the Bijayapur system, one of the objectives of the WUA is to prepare rules regarding the use of water in times of shortage,[60] but these are unavailable, if they exist at all. As noted above, however, in the absence of such rules, the Branch Committee is by default obliged to distribute water according to equity.[61]

C.v Allocation of water resources to new users

The introduction of new users to irrigation systems raises issues related to the adequacy of the resource (and assessment thereof), the criteria applied to applications, consultation requirements and the degree to which existing rights to water use are protected. A distinction is made in the legislation between applications to join an existing project and applications for water utilization licences: the former are made to the relevant WUA or Project Office, and the latter to the DWRC.

With respect to the introduction of new users to a system, the proper procedure, which anecdotal evidence suggests is applied to varying degrees in practice, is laid out in rule 18 of the IR, and provides that:

1. *"A person desirous of enjoying the Service of Project developed and operated by His Majesty's Government or a project transferred to Users' Association after being developed by His Majesty's Government shall be required to submit an application to the concerned Project Office.*
2. *Upon receipt of the application pursuant to sub-rule (1) the Project Office shall deliver the Service after making an inquiry on the technical and other necessary details as to whether the Service can be provided or not. If the Service cannot be delivered, the applicant shall be notified accordingly".*

The wording above limits the process to those WUAs to which operational control has been transferred following government development. Currently therefore, it does not apply to WUAs controlling systems that have not been developed by HMG.

Conditions consistent with the provisions of the IR may be attached by the Project Office to the use made of the water resources.[62] The implication taken by the author during a visit to a Farmer-managed irrigation system was that the circumstances would be different in every case of prospective new use, depending on the number of current users, current water usage and local hierarchies, among other factors.

Rule 18 of the Irrigation Regulations states that new applicants will have the service provided to them unless the necessary inquiries undertaken by the project office reveal that "it cannot be delivered".[63] Additionally, rule 5(1)(d) of the same regulations, in setting out the duties of the WUAs, includes the following:

> *To distribute water to new User farmers without causing any harm to the previous Users who are receiving the Service*

[60] Constitution of Water Users' Institution 2058 – Lekhnath Municipality (Bijayapur Irrigation System), para.4(f).
[61] See *supra* note 45.
[62] IR, rule 20.
[63] IR, rule 18(2).

This is consistent with rule 18 insofar as the WUA's responsibility is to protect existing users, but to admit new users if resources allow. It may also be the case that the constitution of the relevant WUA has a significant bearing on the restrictions placed on new membership.

It appears that with respect to entirely new projects, s.17 of the WRR demands that an application in the form provided be submitted to the DWRC. The provision does not explicitly relate to new projects alone, but to those persons who desire "*to obtain a license for the utilization of water resources*". However, the language used in those sections detailing the application requirements[64] strongly suggests that this is the case. While this is not directly relevant to WUAs,[65] it has a direct bearing on the way that new users are incorporated into water systems, and therefore has the potential to have a significant impact on the availability of water to WUAs.

In all of the above legislation regarding new users, no criteria are set out against which the relevant authority may measure a new application. In the WRR, rules 18 and 19 require that the licensing authority need only confirm that the relevant documentation has been submitted,[66] and that it has taken account of any objections received, where adverse effects are feared, after public notice of the application has been given.[67] This has two main effects:

- the evaluation of applications by the DWRC may be made more difficult insofar as the licensing authority has no objective method of determining whether an application is reasonable or not; and
- the process of evaluation is obfuscated by the lack of objective standards and characterised by a general lack of transparency. Furthermore, as a consequence of the fact that there is no requirement to publish details of any objections received, there is no way of ascertaining if the conditions attached to a licence match the adverse impacts alleged. It is not possible to objectively determine if the licensing authority has taken account of all objections received.

The licensing authority need not assess the quantity or quality of water available for the licence sought, although some details of environmental effects must be provided in the initial application.[68] It is bound to take account of the priorities listed in s.7 of the WRA in making its decision,[69] but the uncertainties regarding practical application of these priorities make the process more open to interpretation. Moreover, it need not take into consideration the uses made of an inter-district watercourse in other Districts. Instead of assessing water availability at the licensing level, any rights of use endowed by the granting of a licence are subject "*to the extent of water resources of such place and are as specified*" in a particular licence.[70] It is therefore left to the licence holders and users to allocate available resources in the event that the licensing authority issues water use rights beyond a particular watercourse's capacity or when there is a drought.[71]

[64] WRR, rule 17(1)(a)-(e).
[65] Due to the fact that irrigation is not a licensable activity – *supra*, note 20.
[66] WRR, rule 18.
[67] WRR, rule 19(3). Public notice of applications must be given under rule 19(1).
[68] WRR, rule 17(e). The wording of this provision is broader than simply providing environmental information – it also includes details of social and economic impacts, and alleviatory measures taken to reduce adverse effects.
[69] *Supra*, 12. No mention of these priorities is made in the WRR with respect to the licensing procedure.
[70] WRR, rule 22.
[71] See *supra*, para.1.2.2 for further details of the procedures to be followed in times of shortage.

It should also be noted that environmental impact assessments may be required with respect to applications for larger irrigation schemes. Details of this process are set out in para.2.1.1 below.

C.vi Registration:

To finalise the discussion of the allocation of water resources, the separate issue of registration of WUAs must be addressed. As indicated above, the IR demands that WUAs be registered: rule 3 of the IR states that:

> *"The following users of irrigation system constitute an users association … and submit an application to the concerned Irrigation office in the format as prescribed in schedule –1:*
>
> *a. Developed and operated by His Majesty's Government*
> *b. Maintained and rehabilitated by His Majesty's Government*
> *c. Constructed and operated by the farmer groups"*

The WUA is therefore required to register with the local DOI office before it can begin using water resources.[72] There is no centralised database of such registered WUAs as each District Office will retain only its own records, and more fundamentally, there is no basin-wide register of water rights for particular watercourses. As the Districts are based on administrative rather than basin boundaries, this has the further effect of creating difficulties and unwieldiness in the administration of disputes between neighbouring districts and of decreasing the effectiveness of any integrated water resource management practices.

Prior to the introduction of the water resources legislation, registration of societies would be with the Local Development Office (under the auspices of the Association Registration Act[73]). Following the advent of the WRA, at least initially, WUAs were erroneously registered in such a way, largely as a result of lack of knowledge on the part of local officials, and possibly, political manoeuvring at local level.[74] Until recently, registration was permanent, although the former practice of registering with the Chief District Officer required annual renewal. With the advent of the changes to the IR, however, WUAs must now renew their registration annually.[75] Such a renewal process will be a valuable tool for performance

[72] See IR, Sch.1 for details of the form to be submitted to the DOI. Registration is also required in other countries, notably: Armenia (see Law on Water User Associations and Unions of Water User Associations, art.8, on file with author); and Kyrgyzstan (see Law on Unions of Water Users, art.5, on file with author). It has not been possible to confirm what the renewal requirements in these nations are, if any.

[73] Association Registration Act 2034 BS (Nepal Gazette, HMGN, Nepal).

[74] There may be local tension between the resource demands of the DOI and the LDO, where the LDO wishes to continue receiving any revenue related to registration, or there may be issues with respect to status and influence.

[75] Rule 8A of the IR states:

> *"(1) Every users association, registered as per this Regulation, shall submit an application to the concerned Irrigation Office along with audit report as audited by recognized auditor from the Auditor General's Department and annual report for the renewal within the ninety days of fiscal year.*
> *(2) If it is not possible to produce an application due to some reason within the time frame pursuant to sub rule (1) an application with reasons shall be submitted within additional ninety days for renewal including Rs. 100 as late fee*
> *(3) Upon receiving an application pursuant to sub rule (1) and (2) Concerned Irrigation Office shall renew within seven days. Written information shall be given to the concerned user's association if there is any reason for not to renew it."*

monitoring and general monitoring purposes, although the frequency of renewal is arguable. This is especially true in an environment where licensing of collective irrigation does not take place.

Registration has a number of important consequences for WUAs: firstly, a properly constituted[76] WUA will become "*an autonomous and corporate body having perpetual succession*" and will have the right to "*acquire, enjoy, sell"* or otherwise dispose of heritable and moveable property.[77] It will also be capable of suing and being sued.[78] It therefore has the legal capacity to take legal action against other users who misuse water resources within the terms of the relevant legislation.

In addition, it should not be possible for unregistered WUAs to make use of water resources from government-run schemes. In practice, however, the DOI can point to no powers that allow it to take action against any such transgressing WUAs. It is also the case that WUAs will not have access to government funds if they are not registered. Information regarding unregistered WUAs is not available, and it is therefore not possible to determine whether or not this is an issue of concern at present. As regards the consequences for a WUA of non-renewal of registration, the legislation says nothing. If a WUA is no longer registered, it would in theory lose its legal status, which would cause many problems, not least for those seeking to recover debts from them. It could no longer be sued as a separate legal entity and there is nothing in the WUA legislation to indicate that the individual members of the WUA could be sued for those debts. Members of the WUA would also be unable to take action against other persons and there may be consequences with respect to its ability to use its bank account.,[79] It might be better if withdrawal of registration was used only as a means of enforcing compliance where all other measures have failed. A presumption could be introduced such that registered WUAs will continue to operate, unless they repeatedly fail to produce relevant documentation and / or comply with the requirements of the legislation.

C.3 Restrictions on use

C.3.1 Legislative Provisions

The system of unlicensed water utilization created both *de facto* and in effect *de jure* by the WRA and related regulations is subject to a number of legislative restrictions in order to protect other users and the environment. This is augmented by pollution control legislation, enforcement of which falls beyond the remit of the Ministry of Water Resources and the DOI. Like the licensing system, however, the intention behind the restrictions is more noble than the reality, due to the complete lack of a monitoring network in Nepal.

[76] WRA s.5 – this obliges WUAs to be set up under the registration process detailed in the IR..
[77] WRA, s.6(1)-(3).
[78] WRA, s.6(4).
[79] In the Bijayapur context, the constitution states that if the institution "collapses", the assets of the WUA will revert to the government of Nepal – see Constitution of Lekhnath Municipality, Bijayapur Irrigation System, *supra* note 54, para.31. However, legal incapacity is not synonymous with "collapse", so it is not at all certain that this provision would be triggered by the lack of registration. The position is the same in Kamala Uttarbahini – see Kamala Uttarbahini Canal Project: Constitution of the Water Users' Working Committee, Bandipur, Siraha, 2059, para.28.

The Irrigation Policy seeks to address this to some extent: it recognises, for example, that irrigation projects should have minimal adverse environmental effect and that irrigation should leave such quantity of water as will not have a detrimental effect on biodiversity.[80] No timescale is imposed on this objective, although the policy is due to be updated after 5 years.[81]

C.i General Pollution control and environmental protection

The government has the power to set and publish enforceable water quality standards for particular uses, but has not yet determined what these standards are.[82]

Although water quality standards have not yet been formulated, some emission limit values have been established. Primary responsibility for pollution control lies with the Ministry of Population and Environment ("MOPE") which implements the Environment Protection Act 2053 and its related Regulations.[83] Rule 15 of the EPR states that:

> *No person shall emit or cause the emission of noise, heat, radio-active material and waste from any mechanical means, industrial establishment or any other place in contravention of the standards prescribed by the Ministry by notification published in the Gazette.*

General and industry-specific tolerance limits have been set with respect to certain substances,[84] but the level of enforcement seems to be erratic[85] - from the list of fifty five industries indicated in Sch.7 of the EPR, it appears that ELVs have been set for only nine.[86]

Those affected by pollution incidents are entitled to compensation for loss suffered.[87] Additional anti-pollution provisions are contained in the WRA:

> *"1) His Majesty's Government may, by a notification published in the Nepal Gazette, prescribed the pollution tolerance limit for water resources.*
> *2) No one shall pollute water resources by way of using or putting any litter, industrial wastes, poison, chemical or toxicant to the effect that the pollution tolerance limit of the water resources as prescribed pursuant to sub-section(1) is exceeded.*
> *3) The prescribed officer may, as required, examine or cause to examine to determine as to whether or not the water resource has been polluted or the quality standard as prescribed to sub-section(1) of section 18 has been maintained."*[88]

[80] Irrigation Policy 2060, paras.2.11.1 and 2.11.3 respectively.
[81] *Id*., para.2.15.8.
[82] WRA, s.18.
[83] Environment Protection Regulations, 2053 ("EPR").
[84] See the MOPE website at http://www.mope.gov.np/environment/standard.php for further details of these limits. A list of industries requiring Pollution Control Certificates (which are required under rule 16 of the EPR) can be found in Sch.7 of the EPR, at http://www.mope.gov.np/environment/rule97.php. Provisional Certificates must be renewed every year and Permanent Certificates (those relating to industries for which emission standards have been published) every three years – see EPR rule 16. It has not been possible to verify the degree to which these requirements are followed in practice.
[85] Email correspondence between author and Basistha Raj Adhikari, DOI. On file with author.
[86] See the website of the MOPE at http://www.mope.gov.np/environment/industry.php for details of the industries for which effluent standards have been established.
[87] See EPR, rules 17 and 45-47. A number of compensation actions are currently being dealt with by Nepali courts, although the author understands that no prosecutions under the Act have so far been made.
[88] WRA, s.19.

and, with the broader aim of preventing harm to the environment in general:

> *"While utilizing water resources, it shall be done so in such a manner that no substantial adverse effect be made on environment by way of soil erosion, flood, landslide or similar other cause."*[89]

Again, these pollution tolerance limits are as yet undetermined, making the likelihood of successful actions against pollution remote. As emissions of potentially polluting materials are largely unmeasured, such actions as may be raised would also presumably face significant difficulties with respect to proving causality.

Environmental assessments must be undertaken with respect to certain types of project.[90] A distinction is made between projects requiring Initial Environmental Examinations (IEEs) and the large scale projects that require the more onerous Environmental Impact Assessments (EIAs).[91] Unfortunately, it has not been possible to obtain data from the MOPE regarding the degree to which this legislation is enforced and complied with following project implementation. In general, environmental assessments are necessary only for larger projects.[92] Although it is beyond the scope of this report to comment on the levels at which such assessments are required and the industries that are affected, it may be useful to indicate the extent to which a WUA may be involved in the environmental assessment processes. If we take as an example a proposal to develop a new drinking water supply, the level of environmental assessment required will be governed by Schedules 1 and 2 of the Environmental Protection Rules.[93] Proponents of new projects requiring environmental assessments must inform a number of specified local bodies about such proposals to seek their views on the environmental impact of the project. Such consultations take place during the

[89] WRA, s.20.

[90] EPA, ss.3 and 5. Approval of a project may be given under s.6.

[91] For further details regarding the processes to be followed with respect to environmental assessments, please see EPR, rules 3-14 and Schedules 1,3 and 5 (with respect to Initial Environmental Examinations) and 2,4 and 6 (with respect to Environmental Impact Assessments).

[92] The rehabilitation of irrigation systems do not require EIAs, but may require IEEs depending on their size and location. The scale of assessment needed for new schemes will also vary according to size and location, but EIAs may be necessary. Full EIAs will also have to be completed for any project, irrespective of magnitude, if, for example, the affected area contains a main source of public water or is semi-arid or mountainous (EPR, Sch.2.).

[93] Schedules 1 and 2 set out the criteria which will govern whether an IEE or an EIA are required. For example, the criteria with respect to water resources projects are as follows:

Initial Environmental Examination (Sch.1)	**Environmental Impact Assessment (Sch.2)**
New irrigation systems: - *Those irrigating 25 to 2000 hectares in the Tarai* - *Those irrigating 15 to 500 hectares in the hill valleys."* - *Those irrigating 10 to 200 hectares in the hill and mountain areas with a steep gradient.* Rehabilitated irrigation systems: - *Those irrigating more than 500 hectares in the Tarai.* - *Those irrigating more than 200 hectares in the hill valleys.* - *Those irrigating more than 100 hectares in the hill and mountain areas with a steep gradient.* - *Any water resources development activity which displaces from 25 to 100 persons with permanent residence*	New irrigation systems: - *Those irrigating more than 2000 hectares in the Tarai.* - *Those irrigating more than 500 hectares in the hill valleys.* - *Those irrigation more the 200 hectares in the hill and mountain areas with a steep gradient.* - *Any water resources development activity which displaces more than 100 people with permanent residence.* Additionally, any projects that are proposed in certain areas, including the following: - *Historical, cultural and archaeological sites* - *Environmentally "weak and wet" areas* - *National parks* - *Semi-arid, mountainous and Himalayan areas* - *Flood prone areas* - *Areas with main sources of public water supply.*

scoping of the project and during the preparation period of the IEE or EIA.[94] WUAs are not specified organisations in either case, although they may give their views. The body responsible for authorising such projects, for example, the Ministry of Population and Environment, must take account of the representations made by those who responded to the consultations and may give approval to the project if no *substantial* negative or adverse impact on the environment will result.[95] There is no duty placed on the approving body to consult with any other authority or any individual groups or organisations. Schedules 5 and 6 of the EPR set out the information that must be submitted to the approving body, which includes details of the impact on land use and the degradation of cultivable land. The rules, unfortunately, do not contain any indications as to the importance attached to the information provided in these applications, and it is therefore not possible to assess the priority attached to the damage caused to irrigated land by any resultant shortages of water.

In the water resources legislation referred to above, a distinction is made between the regulation of emissions and that of water quality, with different ministries responsible for each. Best practice in the European Union and in South Africa regulates emissions (whether point source or diffuse) according to the capacity of the receiving waters, a practice which is not currently followed in Nepal despite some efforts to this end in the above legislation.[96] During the author's discussions with employees of the DOI and with the FMIS officials, the impression was given that problems associated with pollution were of less concern to WUAs outside the Kathmandu Valley than was lack of water, although as Nepal industrialises to a greater degree this will become more important.

In addition, there is currently no provision compelling the DOI to consult on any matter with the MOPE. Communications between the author and representatives of the DOI suggest that lines of communication between employees of the two ministries may be ill-defined.

Along with the DOI and MOPE, it should also be noted that both VDCs and Municipalities are assigned roles with regard to pollution control, although, again, the extent of their involvement is uncertain.[97] VDCs have a general obligation to formulate plans for environmental protection, and more specifically to prevent pollution in areas used for tourism,[98] while Municipalities have a duty to control water pollution generated within their

[94] See EPR rules 4 and 7 respectively.

[95] EPR rule 9.

[96] See for example, the so-called European Union Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy *Official Journal L 327 , 22/12/2000 P. 0001 – 0073*, available at http://europa.eu.int/eur-lex/en/), preamble para.40; and the South African National Water Act (dual use of Resource Quality Objectives (ch.3) and a licensing system) – available at http://www-dwaf.pwv.gov.za/.

[97] LSGA, s.28 (especially ss. (b), (c), (e), (f), (h) and (j), with respect to VDCs) and s.96 (Municipalities).

[98] LSGA, s.28(h) and (j) respectively. The VDC also has judicial powers with respect to those who dump solid waste – s.70. However, municipalities also have similar powers, the only difference appearing to be the level of fines that may be levied: municipalities can levy fines 150 times as large as VDCs: –

> For VDCs*: "If any person dumps solid wastes at the house, courtyard, or yard of any neighbour or does any act fouling the environment, the Village Development Committee may punish such person with a fine under clause (c) [i.e. 100 Rupees] and require such person to remove such solid wastes" (s.70(g))*
>
> For Municipalities*: "If any one dumps solid wastes at one's own house, the neighbour's house, courtyard, junction, or does any act fouling the environment, the Municipality may punish such person with a fine of up to fifteen thousand rupees, and may recover the amount of such*

respective areas. These municipal areas are designated under Part 3 of the LSGA, and although they imply some degree of urban development, may also include hill areas which have developed to a certain degree.[99] The allocation of responsibilities between the MOPE and these local bodies is uncertain in the legislation.

C.ii Protection of other users

The WRA contains a number of provisions that seek to limit the damage caused by pollution or abuse of water resources. Section 4(3) of the WRA states that

> *"A person or a corporate body making use water resources shall make its beneficial use without causing damage to other." (sic)*[100]

Compensation may be available to those damaged by the water use of others,[101] and this may provide a better foundation for an anti-pollution case than that of the EPA above. In addition, s.14 provides that services may be terminated if a person:

> "*is in default of payment of the charge for the utilization of services or utilizes the services unauthoritatively or misuses the services or acts in contravention of the terms and conditions*".

Those users found to be misusing water resources may have their service terminated, although the exact meaning of "misuse" is not specified.[102] Neither "use" nor "misuse" are defined in the Act, which is unhelpful with respect to both licensing and to dispute avoidance. Use must also take place without "*substantial adverse effect...on environment by way of soil erosion, flood, landslide or similar other cause*"[103] although no measures for enforcement are provided.

A further similar provision appears in the EA, stating that "while carrying out electricity generation, transmission or distribution, it shall be carried out in such a manner that no substantial adverse effect be made on environment by way of soil erosion, flood, landslide, air pollution etc".[104] Although the EA requires that an environmental report be submitted to the Prescribed Officer when a licence related to electricity generation is sought, there is no corresponding obligation on the Prescribed Officer to take such a report into account in making his or her decision and no requirements are set regarding the contents or preparation of environmental reports.[105]

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loss or damage from the concerned person or require such person to render them into original condition" (s.165(f))

[99] LSGA, s.72.

[100] "Beneficial Uses" are defined in s.2 as "*rational uses of the water resources within the available means and resources*". See also the discussion above regarding the protection of existing uses, *supra*, 13.

[101] WRA, s.22(1): "*[t]he prescribed officer may impose a fine up to an amount of five thousand rupees to any person who acts in contravention of this Act or rules made under this act and realize compensation also for such damage from such person if damage is caused to anybody due to such act*".

[102] WRA, s.14.

[103] WRA, s.20.

[104] EA, s.24.

[105] EA, s.4.

C.4 Governance – law, policy and practice

C.4.1 Enforcement and compliance

C.i Legislation

Under the Water Resources legislation, the WUAs have limited powers to penalise their members financially for non-payment of service fees or for unauthorised use of water resources within their respective irrigated areas. They may charge penalty fees with respect to service fees that are paid late,[106] although this relies on the charge having been set by the Service Charge Fixation Committee:[107] so far, this committee does not seem to be established on a general basis.[108] As regards penalties in the form of service withdrawal, the wording of s.14 of the WRA appears to allow recipients of service charges, to terminate supplies to members who are "*in default of payment of the charge for the utilization of services or utilizes the services unauthoritatively or misuses the services or acts in contravention of the terms and conditions*". These 'recipients of service charges' may include WUAs, but the wording and context of the clause make it appear more likely that the provision allows the DOI to stop services to WUAs themselves, rather than enabling WUAs to take action against members.[109] The context deals with the rights and obligations of licensees, and as we have seen, WUAs do not fall into this category.

Despite this, WUAs and the DOI do, however, have power under the IR to suspend water services to members:

- If the User has failed to pay Service Charges due,[110]
- If the user violates the conditions of the agreement with the WUA,
- where the canal structures have been damaged (until necessary repair and maintenance is complete).[111]

In addition, the revised rule 5(1)(h) of the IR specifically allows WUAs to "*exclude those users who fail to pay the service charge*". Experience indicates that instances of WUAs actually terminating supply are very limited at best.[112] Where the social cohesion of farmer

[106] IR, rule 30(1): *"If the Service Charge to be paid by the User to the users association or person or institution entitled to power is not paid within the specified time, The User shall be required to pay late charge in addition to Service Charge and the rate of the late charge to be paid by the User shall be as fixed by the Service Charge Fixation Committee constituted pursuant to rule 25."* Note however, that the reference to rule 25 is incorrect as rule 26 is in fact the relevant provision. The recent changes made to the IR have introduced a new member to the Service Charge Fixation Committee: a representative of the District Irrigation Users' Association. This body is referred to elsewhere in the IR: for example, see rule 4(8) with respect to the dissolution of Executive Committees of user associations, and rule 7 with respect to Users Coordination Associations. It is not further defined, and it is therefore not clear what its role is or where its members are drawn from.

[107] IR, rule 26.

[108] Anecdotal evidence provided to author by Basistha Raj Adhikari, DOI.

[109] It may be that the quality of the translation is complicit if the author's inference is incorrect.

[110] The actual wording of the new rule 23(a) is not entirely clear, and may be less wide than the previous version. There is an implication that the provision refers only to the fees payable by the WUA to the Irrigation Office. If this narrower reading is indeed correct, WUAs may still terminate or suspend service under the revised rule 5(1)(h) below.

[111] IR, rule 23.

[112] Anecdotal reports from Simon Howarth, Mott MacDonald.

managed schemes is missing, WUAs lack the resources or willingness to be able to police cessation of service, so it is difficult to ensure that such action is enforced. The agreement between the WUA and individual users takes the form of the constitution and by-laws of the WUA. In the three examples that have been made available to the author,[113] only one explicitly details the obligations of its members (Bijayapur), and this is limited to requiring that they attend meetings and work in favour of the WUA.[114] The by-laws for the same system, however, provide that membership may be cancelled if service charges are not paid.[115] The constitution of the Sunsari-Morang system requires that one of the committees prevent illegal use of water, but provides no powers for it to do so.[116]

Aside from this, however, penalties may be levied by bodies other than the WUAs, in theory at least and with awards of compensation possible, in instances where:

- the WRA or rules made under it have been contravened;
- water has been used beyond the terms of, or in the absence of, a licence;
- water has been stolen; or
- wilful harm has been done to water-related infrastructure.[117]

The local DOI office has responsibility for enforcing the first three in the list above,[118] and although it is unclear which body is responsible for the punishment of wilful destruction of water-related infrastructure, it seems reasonable to assume that this too would be within the remit of the DOI. From the author's conversations with officials from the DOI it seems that no prosecution has been made for breach of the WRA thus far. As regards the other circumstances listed, active enforcement would be unrealistic: use of water beyond the terms of a licence is not relevant to WUAs as they would fall outside the licensing regime.

The stealing of water and wilful destruction of infrastructure would be more appropriately dealt with by the relevant WUA, at least in situations where individuals are involved.[119] It should also be noted that additional powers with respect to the termination of service are allocated to the DWRCs under the WRR, with respect to licensed user associations.[120] These bodies are authorised to cancel licences in a number of circumstances.[121] The lack of WUA

[113] That of Bijayapur, Kamala Uttarbahini and Sunsari-Morang, all unofficial translations of the official documents.

[114] Bijayapur Irrigation System Constitution, *supra*, note 41, para.19(v).

[115] Bijayapur Irrigation System, By-laws, *supra*, note 41, para.3.3. Cancellation of membership can also occur when ownership or tenancy is ended or if membership fees are unpaid. It is not clear how often such a sanction is imposed: nor is it clear how it is enforced, given the problems of blocking water supplies. The other consequence of non-membership of a WUA is the loss of voting rights with respect to committee membership (*id*., para.9.5).

[116] Constitution of Water Users' Institution, Sitagunj Branch Canal, para.10.1.2(iii).

[117] WRA, s.22.

[118] IR, rule 40 refers only to the "*power to punish in the matter related to irrigation pursuant to sub- section (1), (2) and (3) of the Section 22 of the*" WRA, thereby appearing to exclude subsection (4).

[119] See Ostrom, *infra*, note 122.

[120] See WRR, rule 36(1) and WRA, s.21.

[121] Licences can be cancelled:

1. *If the licensee performs any act contrary to this Act or rules made under this act, the prescribed officer may issue an order to the concerned licensee by prescribing necessary improvements to be made on such activity within the specified period.*
2. *If the licensee makes no improvement within the prescribed period pursuant to sub-section(1), the prescribed officer may cancel the license of such person.*

licences makes this power academic, at least for now.[122] With respect to enforcement of the terms of the WRA, the DOI is also poorly placed: it has no remit beyond irrigation management, and would consequently find it difficult to enforce the broader provisions of the WRA, especially in relation to licensing.

Late fees are chargeable in the event that service fees are not paid on time. The Service Charge Fixation Committee is responsible for setting the late fee,[123] although this does not appear to happen in practice. This is due, in part, to the very low levels of fee collection and also because the rates chargeable do not make pursuit cost-effective. In many cases such committees have simply not been created.[124] The WUAs now have explicit responsibility for collecting both service charge fees and late fees.[125] The proposed allocation of service fees collected has been set out in the most recent Irrigation Policy, although this apportionment does not attempt to establish fee levels.[126]

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3. *Prior to the cancellation of license pursuant to sub-section (2), the prescribed officer shall give the licensee a reasonable opportunity to explain his innocence.* (WRA, s.21).

[122] It does however entail a split between the body capable of revoking licences and that which penalises transgressions.

[123] IR, rule 30(1), although it should be noted that the functions and duties of the Service Charge Fixation Committee, as set out in rule 28, do not explicitly include setting the level of the late fee:

"The function, duties and power of Service Charge Fixation Committee shall be as follows:

(a) To determine the minimum service charge for each crop on the basis of average agricultural production to be increased upon the availability of the Irrigation service.

(b) To make available the particulars and advice as sought by His Majesty's Government from time to time.

(c) To seek advice from His Majesty's Government while making change in the rate of service charge."

The IR unfortunately does not define "late", and this lacuna is also evident in the by-laws of the individual systems seen by the author. The point at which "late fees" become "penalty for non-payment of service fees" is therefore debatable.

[124] Email correspondence between author and Basistha Raj Adhikari, DOI, 20 December and 26 December.

[125] The most recent version of the Irrigation Regulations provides:

"The Functions Duties and Power of the Users' Association shall be as follows:…

(g) To collect service charge from users and deposit it as prescribed by concerned Irrigation office.

(h) To exclude those users who fail to pay the service charge, to collect late charge and to inform the same to the concerned Irrigation office." (rule 5(1)).

[126] Annex 2 of the Irrigation Policy 2060 sets out the following apportionment:

Level of participation in the operation of the system	**Sharing of Irrigation Service Charges Collected from Users (in Percentage)**		
	Central Maintenance Fund, Department of Irrigation	National Treasury of His Majesty's Government	To be retained by the water users association
1. Water course and there under operated by the users association and above than water course managed by His Majesty's Government.	40	40	20
2. Tertiary and there under operated by the users association and above than tertiary managed by His Majesty's Government.	30	30	40
3. Secondary canal and there under operated by the users association and above than secondary canal managed by His Majesty's Government.	20	20	60
4. All canals below than main canal managed by the users association and other canals managed by His Majesty's Government.	10	10	80

At the broader level, the enforcement and implementation of the water resources legislation, as has been indicated, is sporadic at best. The licensing system ostensibly established by the WRA and WRR does not exist in practice. Standards for water quality, and the monitoring network necessary for measuring such limits, have not been established, and service fees are often not charged. This leaves little that can be enforced in practice by any agency.

Without detailing here the powers and obligations of each agency, the allocation of responsibilities with respect to enforcement of the legislation provides further confusion. For example, if WUAs are to be autonomous, it is essential that they be responsible for the use and abuse of water resources within their respective irrigated areas.[127] This would therefore require that WUAs be accountable for policing water theft within their areas, instead of the DOI as is the case currently.[128] The DOI would then only be responsible for punishing those who steal from the larger canals that fall within its remit.

It is probable that the suspension of elected democracy, since the dissolution of parliament and elected VDC membership, exacerbates the lack of enforcement, although it is not directly responsible in itself for the weak enforcement of legislation in this area.

C.ii By laws, Constitutions and Statutes

It is unclear how far the constitutive documents of WUAs are enforced in practice: anecdotal evidence is contradictory. Apart from rules determining the powers and functions of the operating committees, the constituent documents may contain requirements regarding the auditing of annual accounts and the representation of women in the decision-making processes. For example, in the Bijayapur and Sunsari-Morang documents, annual auditing of accounts is required, such accounts to be forwarded to the DOI (and in the case of Sunsari-Morang, to the Chief District Officer, who is given power to challenge irregularities).[129] As regards the representation of women, of the three WUA documents available, only Bijayapur makes specific mention of the issue, stating that it has a target of having 30% of its participants made up of women, although this is acknowledged to be a goal rather than a reflection of the current situation.[130]

5. All the structures including main canal other than head works managed by the user association.	5	5	90
6. In case of complete transfer of the project.	0	5	95

[127] See also, for example, Ostrom, E. Governing the Commons – The Evolution of Institutions for Collective Action,(Cambridge University Press, 1990), 94: in "*robust institutions monitoring and sanctioning are undertaken not by external authorities but by the participants themselves*", quoted in Hodgson, S., Legislation on Water Users' Organizations, *supra* note 47, 89.

[128] While the new IR rule 23 attempts to transfer some responsibility for the enforcement of legislation from the DOI to the relevant WUA, the policing function remains with the DOI. The WUA has a duty to inform the DOI about damage to infrastructure, but responsibility for punishing the breaches set out in s.22 of the WRA remains with the DOI (see. IR, rule 40).

[129] For example, see Constitution of Water Users' Institution, Sitagunj Branch Canal, *supra*, note 90, para.9.1.3(b). See also, *infra*, para.3.2.1 on the broader aspects of auditing.

[130] Bijayapur Irrigation System, By-laws, *supra*, note 41, para 9.3: "[*s]ince there is negligible women's participation in every aspect of life, there shall be at least 30 percent women's participation in days to come*".
See also the attached Annexe showing the differences between the constitutive documents of three WUAs, and comparing these with the requirements made by legislation.

It does not appear that any single body has responsibility for ensuring that WUA documentation is complied with (other than the DOI or Chief District Officer to a very limited extent – please see below for more general legislative obligations regarding compliance and auditing requirements). However, this responsibility should naturally fall on the WUA members themselves, which raises the separate question of the rights, powers and obligations of members in general. This will be addressed below with respect to dispute resolution and the more general detailing of the capacity of the various relevant organisations. It also obliquely raises the issue of those provisions that members will wish to enforce: it may be difficult for gender balance targets to be achieved at the WUA level, for example, if it is left to the WUA members to enforce such provisions. If such targets are not met, those seeking to remedy this will not be able to do so within the administrative structures of the WUAs because they lack the voting power. Such targets must therefore be properly enshrined in legislation.[131]

C.4.2 Compliance Monitoring

As noted above, compliance with respect to general pollution control rules at least, is not monitored, as a result of both the absence of information monitoring networks and the paucity of enforceable standards. In order for compliance to be effected, clear standards must be in place that are measurable and in some cases time-limited. Such standards are in place with respect to some aspects of the WRA regime, but the mere existence of these standards does not guarantee compliance.

With respect to the monitoring of the management of WUAs and their performance, HMG is empowered to create an Evaluation Monitoring Committee under IR rule 43:

> *(1) His Majesty's Government shall constitute Evaluation and Monitoring Committee as per necessity for the evaluation and monitoring of irrigation system on the basis of service provided by irrigation system, quality of water, crop intensity, increase of production, institutional and financial status of the Users' Association and physical changes in the working area.*
>
> *(2) The representation of irrigation Users' Association shall be introduced along with other person while constituting Evaluation and Monitoring Committee pursuant to sub rule (1).* [132]

The author was unable to confirm whether or not such a body, or its predecessor from the previous version of the IR, has ever been constituted or has met. It is also not clear who would constitute its members, other than representatives of the WUAs themselves. In order to ensure that the committee retains an appropriate degree of independence, it is essential that it is not made up primarily of WUA members, who would have a direct interest in ensuring that no fault was ever found. The extent of its remit is significantly wider than it was prior to the revisions of 2004, although the phrase "*institutional and financial status of the Users' Associations*"[133] gives little information regarding the details. The breadth of the new remit is to be welcomed, and it is to be hoped that the new committee will be provided with commensurate resources.

[131] See C4.3 with respect to the degree to which gender balance requirements are protected under the law.
[132] IR, rule 43.
[133] *Id*.

Questions remain regarding the role and effectiveness of such a committee, specifically with respect to procedural aspects of its running and the source of the information it relies on. How often will it meet? Will it be constituted on a district basis or will HMG establish a single committee with jurisdiction over the entire country? Should it use as its basis information provided by the WUAs themselves, or should it depend upon information that it either produces itself or receives from the DOI? The other aspect of the monitoring committee that requires examination is that of the standards it must enforce. The committee's focus is on the physical elements of irrigation: the infrastructure, the quality of water supplied, crop intensity, physical changes to the area and the increase in production. The WUA itself is less directly monitored, although it could be argued that improvements in productivity, for example, are the result of better WUA management. Only the financial and "institutional" status of WUAs is expressly referred to, but this does not appear to incorporate monitoring of the general performance of the WUA.

The functions and duties of WUAs, against which its performance must be measured, are broadly set out in rule 5 of the Irrigation Regulations:

> a. *To repair and maintain; operate and manage the Irrigation System operated by it. Provided that if it requires to change or replace the equipment affecting the Structure prior approval of the concerned Irrigation Office shall be required.*
> b. *To avail water to the User farmers at appropriate time in proper quantity as required by the type of crop and the condition of the land.*
> c. *To keep the record of the land in which service could not be availed and to recommend to exempt the Service Charge to be paid by such Users.*
> d. *To distribute water to new User farmers without causing any harm to the previous Users who are receiving the Service.*
> e. *To mobilize public participation for maintenance of the Irrigation System,*
> f. *To construct additional Structures to increase irrigable area considering the supply of water.*
> g. *To collect service charge from users and deposit it as prescribed by concerned Irrigation office.*
> h. *To exclude those users who fail to pay the service charge, to collect late charge and to inform the same to the concerned Irrigation office.*
> i. *To provide notice to the concerned Irrigation Office of any information pertaining to any demolition or destruction, alteration, obstruction or any knowledge about the possibility of the same activities irrigation system or structure.*[134]

More specific standards apply to account reporting and gender participation, but these will be addressed in greater detail below.[135]

The problem for the Evaluation and Monitoring Committee with respect to the above is that WUAs need only keep records relating to a) income and expenditure, and b) the service provided over the past financial year.[136] This will consequently not include details relating to

[134] IR, rule 5(1). Sub-paras.(g)-(i) are recent additions in the latest version of the regulations.

[135] See *infra*, paras.3.2.1 and 3.3.1 respectively.

[136] IR, rule 6:

> 1. *The Users' Association shall maintain up-to-date record including the record of the Service Charge to be paid by the Users for the use of Service made available by it showing expenditure incurred for the maintenance as well as balance of its fund.*

the quality of water,[137] crop intensity and increase in production, or the "institutional status" of the WUA. Furthermore, it does not include information regarding the output of the irrigated area. The new requirements with respect to monitoring are wider than in the previous incarnation of the IR, and it is a significant step forward for HMG to be able to assess whether or not a particular area is becoming more efficient in its productivity. This will form the basis for determining if the WUA strategy is successful or not.

The Irrigation Policy refers to the formation of a new committee dedicated to monitoring, the Central Irrigation Monitoring and Evaluation committee.[138] No date appears to have been set for the establishment of this committee, and details of its powers and infrastructural capacity are not yet available. As indicated above, the jurisdiction of the new Evaluation and Monitoring Committee is as yet uncertain, and it may be that this is in fact intended to fulfil the Irrigation Policy promise.

Compliance, however, is not simply the enforcement of standards by the regulatory body. It must also include the ability of the WUAs to enforce the standards of service it is entitled to receive under agreements with the DOI. The problem with this is that the IR do not contain comprehensive details of the obligations and duties of the DOI with respect to service provision. In some cases, for example with respect to joint-managed projects, the DOI may have specific duties to adhere to which are set out in the transfer agreement.[139] The problem with having these obligations set out in the transfer agreements alone is that the extent of the obligations will be to some degree dependent on the negotiating power of the relevant WUA, and there may be no means established through which the WUA can enforce them.

The DOI is obliged to provide service to prospective new users if an application is made, unless this is not possible.[140] A refusal to provide service in this context may be challenged, but any decisions taken by the DOI in the event of shortages are not open to challenge, although notification procedures must be followed where service levels are to be terminated or reduced.[141] No standards of performance are established that bind the DOI, unless they are set out in the transfer agreement, the consequence being that the DOI is largely unaccountable to the WUAs it provides water to. If the DOI fails to provide water, whether because of lack of water due to drought or leaking infrastructure, or provides water of unsuitable quality, the WUAs are, *prima facie*, powerless to hold the DOI to account. WUAs are unable to assess whether a decision to reduce service has been made on tenable grounds, even where drought is the reason behind such a reduction, as the DOI is not obliged to hold its decision-making processes in public. The DOI must consult with the relevant local Irrigation Office and other Local Body,[142] but this does not include the WUA itself[143], but these consultations need not be made public and the reasons for making a particular decision remain hidden.

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2. The Users' Association shall, within three months of expiry of fiscal year, submit its report to the concerned Irrigation Office along with the financial statements of the Users' Association and all details of the Service made available to the Users in that fiscal year.

137 Even assuming the monitoring network necessary to determine the quality of the water was in place.

138 Irrigation Policy, 2060, para.2.14.1.

139 See, for example, the SMIP transfer agreement, *supra* note 53.

140 IR, rule 18.

141 IR, rules 22-24.

142 IR, rule 22.

143 If the assumption is made that the term "local body" does not include WUAs. See *supra*, note 39 regarding the definition of Local Bodies.

C.i Auditing

WUAs are obliged to provide records of their finances to the DOI within three months of the end of each financial year.[144] In addition, the new rule 8A of the IR requires that WUAs have their finances audited[145] as part of the registration renewal process. These financial reports must be audited by the Auditor General's Department and submitted to the DOI along with the registration renewal application.[146] User associations may also be bound by their constitutive documents to produce such accounts and to have them audited and presented to the local district officer or DOI, who may or may not be able to challenge questionable accounts. Because the registration renewal process now requires audited financial statements,[147] greater scrutiny of the financial condition of WUAs is permitted. However, although the DOI must give reasons for refusing an application for the renewal of registration, there is no provision allowing a WUA to challenge such decisions. This absence is particularly significant because the grounds on which the DOI may refuse to grant renewal are not explicitly set out, which is detrimental to both transparency and predictability.

Although there is no standard form of accounts that is held to be generally acceptable, even at the district level, only a limited number of auditors may audit the accounts of the WUAs.[148] WUA members, and more especially executive members, are under no obligation to be account-literate, which is not conducive to the production of transparent accounting.[149]

The fact that many WUAs have no involvement with cash, given the likelihood that service use fees are not charged, means that a requirement to submit accounts would not be universally applicable in any case.

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[144] IR, rule 6(2):
"The Users' Association shall, within three months of expire of fiscal year, submit its report to the concerned Irrigation Office along with the financial statement of the Users' Association and all details of the Service made available to the Users in that fiscal year."

[145] IR, rule 8A(1).

[146] *Id*. The capacity of the Auditor General's Office to process all WUA accounts within 90 days of the end of the fiscal year is not certain.

[147] The DOI may refuse an application for the renewal of registration under rule 8A(3). See, *supra*, para.1.2.4 regarding the consequences of non-registration.

[148] Audit requirements in other countries are tied to established standards rather than a particular group of people. For example, Pakistan, require that accounts and audit reports conform to local accounting standards – see for example, the Punjab Irrigation and Drainage Authority (Pilot Farmers Organizations) Rules 1999, rule 20, which demands that the standards of the Pakistan Institute of Chartered Accountants be adhered to.

[149] With regard to the transparency of WUA financial information, Vermillion and Sagardoy (in Transfer of Irrigation Management Service- Guidelines (IWMI / FAO, Rome 1999), 31) recommend:

- Training in agreed financial practices for the treasurer of the WUA and the Chief Financial Officer of the WSP should be provided (if required). Also, training in bookkeeping practices could be given to all WUA directors and WSP administrative staff.
- Financial transactions should only be made with a minimum of two authorized witnesses and a record of the transaction.
- Financial records of the WSP should be available for inspection by farmers.
- There should be a clear basis for how the level of water fees is determined (such as needs-based budgeting).
- Amount of water fees to be collected should be based on a known and measurable level of service, such as volume of water delivered, area served or number of irrigations.
- An independent financial auditor could periodically examine WSP accounts
- Social ties between the WU treasurer and WSP financial officer should be avoided.
- The WUA treasurer should be replaced periodically.

C.4.3 Representation

The most recent version of HMG's Irrigation Policy[150] recognises the importance of participatory management in achieving the goal of increasing agricultural productivity.[151] Participatory management can only be successful if representative participation is in place.

Representation in Nepali WUAs is governed by both the water resources legislation and by the constitution, or statute, of the WUAs concerned. The statutory rules are inconsistent, however, with respect to the degree of representation required for the formation of WUAs and relevant committees. Firstly, the WRR provides that

> *"Persons, who desire to use the water resources on institutionalized basis, may form a consumers' association consisting of at least **seven** persons as officials and members".*[152]

> "*At least **seven** persons, selected from among the concerned consumers desiring to register the consumer's association, shall have to submit an application to the District Water Resources Committee in the format as prescribed in Schedule 1 together with a copy of statute of the consumers' association and a fee of one hundred rupees*" (emphasis added).[153]

The IR, conversely, requires that the Executive Committee of the WUA contain not more than *eleven* members.[154] It also sets out the requirements to be met with respect to the degree of local representation that must be present in order for a WUA to be set up:

> *"While constituting the Users' Association…there should be representation of at least sixty seven percent Users of the irrigated area of such canal, secondary canal, sub-secondary canal, tertiary canal, watercourse distributed water from which canal, secondary canal, sub-secondary canal, tertiary, water course is to be used."*[155]

The WUA therefore needs the support of 67% of potential users before it can be formed, and a document of consent from those users must be submitted with the application form.[156] Similarly, a consensus of two thirds of the general members of a WUA can precipitate the dissolution of its executive committee if the irrigation system has not been properly operated.[157] Previously, the legislation provided that all users of a particular system automatically became members of a particular WUA upon registration.[158] This is no longer the case,[159] and membership is therefore governed entirely by the constitutive documents of the WUA. It is possible that the new rule may consequently be used to exclude tenant farmers, and those without security of tenure, from membership of the WUA, although in practice this

[150] Irrigation Policy, 2060. See also, *supra*, para.2.5.1.
[151] *Id*., 1.
[152] WRR, rule 3.
[153] WRR, rule 4. It should be noted that "Consumers Associations" under the WRR are broader in scope than the "Users Associations" under the IR – those registered under the IR are concerned only with irrigation, whereas Consumers Associations consist of "persons who desire to use the water resources on an institutionalized basis", and may be putting those resources to any licensable use. The WRR wording reflects that used in the primary legislation, the WRA (s.5).
[154] IR, rule 3.
[155] *Id*. Note that under the previous version of the IR, rule 3 also contained a clause stating that "[e]ach, user shall be deemed to have been ipso facto general member of such Association".
[156] IR, Sch.1. 2 copies of the WUA Constitution must also be submitted, *id*.
[157] IR, rule 4(2).
[158] In the previous incarnation of the IR, rule 3(2) required this.
[159] IR, rule 3(2).

would be dependent upon the rules of the WUA itself as regards the admission of new members. Regardless of whether or not this may be possible, the change in the legislation does nothing to strengthen the position of the more disadvantaged farmers and enhances the opportunities for more powerful farmers to pursue their own agenda either inside or outside the WUA system.

C.i Gender Balance

The Irrigation Policy sets out the government's intention to involve women in the decision-making processes related to irrigation management. It states that "*[u]ser association[s] shall be composed of with at least thirty three percent of the women representation*".[160] This requirement is not echoed in the provisions of either the WRA or WRR, which contain no standards of participation by female users. It is however now enshrined in the revised Irrigation Regulations.[161] As regards the monitoring of whether or not this is adhered to, it may be that the DOI has such a power,[162] but this remains ambiguous. In the farmer managed scheme visited by the author, it was pointed out that two women did indeed sit on the committee,[163] but the author was unconvinced that their role amounted to much more than a box-ticking formality.

Aside from the representation of women on WUAs, the legislation generally fails to address the issue of gender balance in other decision-making bodies, with the exception of the Local Self-Governance Act. For example, VDCs members are under an obligation under that Act to chose a list of arbitrators available for dispute resolution procedures,[164] three of whom will be chosen to sit on cases.[165] The list of potential arbitrators must include women and "backward classes"[166], but there is no obligation imposed on the VDCs to ensure that the arbitrators chosen for a particular case include these persons. Although no particular targets regarding representation of women or disadvantaged groups in these lists have to be met, the same is not true with respect to Municipalities under the same legislation – these must consist of at least 40% women.[167] HMG has the power to monitor Local Bodies[168] to assess if they have "*accorded necessary priority to the backward communities, women and children*",[169] but as the standards to be attained are insufficiently rigorous, and HMG is not obligated to carry out such monitoring, the effectiveness of this must be in question, even if the current dormancy of Local Bodies is ignored.

With respect to other bodies, the local Irrigation Office has no standards to adhere to, and the DWRCs, need not contain any women at all. It remains to be seen how successful the government is in attaining the objectives set by the Irrigation Policy on the participation of women. The level set by the policy is not unchallengeable either – presumably Irrigation

[160] Irrigation Policy 2060, para.2.4.3.
[161] IR, rule 3, which requires thirty three percent of the Executive Committee to be women.
[162] See *supra*, para.3.2.
[163] As was required by rule 3 of the IR before the recent revisions.
[164] See *infra*, para.3.5 for further details of dispute resolution processes.
[165] LSGA, s.34.
[166] LSGA, s.35(2): "*The Village Development Committee shall have to include the women and back ward class as well, to the extent possible, in the list of arbitrators referred to in sub-section (1)*".
See also s.103, where similar requirements are made with respect to Municipalities.
[167] LSGA s.76(2).
[168] I.e. VDCs, Municipalities and District Development Committees – see LSGA, s.2.
[169] LSGA, s.234.

Areas are not populated by groups consisting of only one third women, and it is therefore questionable that the standard is in fact set at the correct level in the first place.

C.ii Representation of Other Disadvantaged Groups

The revised IR makes provision for the representation of so-called "backward" parts of Nepali society. Rule 3 requires that Executive Committees of WUAs should contain 2 members drawn from the "*dalit, downtrodden and backward ethnic community*", where this is possible. The last phrase is an important qualification to the rule, however, as the legislation does not detail the factors that will govern the availability, or not, of dalit for these purposes. This might depend upon the demographics of the irrigated area, the willingness of the dalit community to participate, and perhaps most importantly, the willingness of the rest of the community to accept their participation. While the general rule is admirable in its intent,[170] the "availability" qualification serves to render it virtually useless.

A related issue concerns those persons who can be considered to be "users" under the definition in IR rule 3.[171] It appears that the word "user" is sufficiently broad to include not only landowners, but also tenant farmers. It would also seem to encompass sharecroppers, farmers with no security of tenure. In practice such a broad definition is not adhered to at the WUA level. For instance, in the Bijayapur system, an "Ordinary Member" of the WUA is defined as a beneficiary of the system,[172] but para.5 goes on to provide that one male and one female member of each landowning or tenant household shall be accorded membership of the WUA, thereby excluding farmers lacking legal status.[173] The implementation of the broader legislative requirement is therefore limited by the constitutive documents of the WUAs themselves.

The question of membership in this respect is fraught with difficulty. It has been argued that those with only short-term interests in the irrigation systems[174] may have an economic interest in postponing essential infrastructure repair work.[175] If sharecroppers were allowed to participate in the WUAs, and given voting rights, the additional question arises of what voting rights attach to a particular parcel of land – should the sharecropper have rights within the WUA in addition to, or in place of, the respective landowner or tenant i.e. can one area of land be the basis for more than one vote?[176]

[170] It is consistent with the Irrigation Policy which states that "*there shall be representation of dalit, downtrodden and backward ethnic communities*" in WUAs (para.2.4.3), although no mention of the question of availability is made in the policy.

[171] See *supra*, para.3.3.

[172] Bijayapur Irrigation System By-laws (*supra*, note 41), para.2(h).

[173] *Id*., para.5. See Hodgson, *supra* note 47, 32-4 for examples of how other parts of the world legislate on this issue, although it should be noted that no comment is made regarding the effectiveness of these approaches.

[174] I.e. those who do not know if they will be farming the same land in the following year, because they are subject to the demands of the landowner.

[175] For a full discussion of the problems associated with WUA membership, see Hodgson, *supra*, note 47, 33.

[176] This is complicated somewhat by the issue of absentee landlords, who may have voting rights but who take little interest in the day to day operation of the organisation. It seems doubtful that absentee landlords would give up their rights with regards to WUAs in the event that a single vote accrued to a specific piece of land, as this would require that the land user *in situ* would be most likely to hold such a vote.
It could also be argued that giving voting rights to sharecroppers might in fact encourage landowners to take on more sharecroppers on smaller areas of land, as this would increase the voting power of the landlord.

C.4.4 Consultation

The WR legislation contains a small number of instances where decision-making processes must involve an element of consultation, while the Irrigation Policy emphasises the importance of integrating the offices of the DOI and the Department of Agriculture, both horizontally and vertically.[177] The practical application of the consultative ideal is less solid, however. Consultation performs the multiple role of both improving public participation, alleviating the difficulties caused by imprecise allocation of responsibilities and awkward geographical boundaries, and finally of contributing to the integration of all relevant factors in the decision making process.

As noted with respect to the incorporation of the environment into the allocation processes, there is currently no obligation for the DOI to consult with the MOPE to ensure that the two licensing bodies are not issuing mutually incompatible licences.[178] In fact, the DOI, as the nominal registration body, is not obliged to consult with any other organisations or individuals. The practice set out in the WRR with regard to the DWRC is similar in this respect. The Ministry of Water Resources' role as licensor of hydro power projects does not appear to necessitate consultation with any other body either. Licensing and registering authorities of any sort are not required to communicate with their peers in other districts with respect to inter-district watercourses. The delineation of boundaries on a political level instead of a hydrological one, exacerbates the potential problems and increases the need for such consultations.

The degree to which others are involved in decision-making, where it is required, ranges between mere notification to "consultation", the latter implying some level of dialogue. Instances where this involvement is required by the legislation are effectively limited to the following:

- In the event that service is reduced or terminated under rules 22 or 23 of the IR, the DOI must notify the relevant WUA and local body.[179] In addition, where demand for water exceeds supply and the Project Office determines that a reduction in service is required, it must "*consult with the concerned Irrigation Office and the concerned local body*"[180] *and* "*coordinate*" with the affected WUA.[181] If the Project Office is in fact the WUA itself, there is no obligation to consult with all members, except where the constitutive documents and administrative processes of the WUA demand otherwise.
- Rule 19 of the WRR requires that the DWRC publishes a public notice of all applications received for water utilization licences. It can also impose conditions on the licence if necessary to reduce any adverse effects.

[177] Para.2.13.4 of the Policy reads: "*The district, regional and central offices of the Department of Irrigation and Department of Agricultural shall be functionally tied up and coordinated in the process of implementation, follow up and evaluation from the level of identification and selection of the project to implement the irrigation and agricultural development programs*".
[178] See, *supra*, para.1.2.1.
[179] IR, rule 24.
[180] IR, rule 22(2).
[181] IR, rule 22(1).

- The EPR contains provisions requiring that the views of relevant VDCs and Municipalities be sought to ascertain whether the pollution associated with an application for a Pollution Control Certificate will cause an adverse effect on the environment.[182] The licensing body must confirm with such bodies that there is no risk of "substantial adverse impact" on the environment, or that there is at least a possibility that any such effects can be alleviated.[183] The views of WUAs that may be affected are not included within this process.

C.4.5 Dispute resolution and access to justice

It appears that the dispute resolution procedures adopted by WUAs in general are not statutorily based. The legislation is relatively silent on the issue, and detailed processes are lacking. No single body has responsibility for all dispute resolution, although a number of bodies may claim limited jurisdiction in certain circumstances. Logically, there are a number of levels at which conflicts may arise and where dispute resolution or access to justice may be necessary –

- with respect to disputes between individual users in a WUA;
- between conflicting users, whether licensed or not, of a watercourse in a single district;
- between users of a watercourse that straddles two or more districts;
- challenging decisions by WUAs;
- challenging the decisions of the DOI or DWRC; and
- challenging the decisions of HMG in instances where it issues over-riding directives under the IR or WRR.

Formally, WUAs have no role to play in any of the above, as their functions[184] do not include this aspect of irrigation management. During the author's visit to the farmer-managed systems at Dodhikot and Balkot, the impression was given that the WUAs themselves would take care of disputes between individual members, although there is no legislative basis for this and the processes followed in such cases would be peculiar to each WUA.

The WRR, however, provides for the establishment of a Water Resources Utilization Inquiry Committee, responsible for "*any disputes arising on while utilizing the water resources*".[185] This committee, which would appear to operate at the district level, consists of at least three members[186], and it appears from the provision that the intention behind the committee is to address problems arising from conflicts between individual users. In effect, though, the committee's focus is on, and may potentially be limited to, addressing issues that would normally be assessed at the licensing stage i.e. whether a proposed use will be broadly beneficial or detrimental, and whether or not the environment will be affected.[187] Currently,

[182] EPR, rule 16.
[183] *Id*.
[184] See, *supra*, 30-1, for details of the functions of WUAs.
[185] WRR, rule 28.
[186] These members consist of representatives from the following organisations: the Ministry of Water Resources; the relevant District Development Board; and the regional office of the National Planning Commission. Additionally, if the dispute is between two districts, representatives from all concerned district development boards will be members (WRR, rule 28(2)).
[187] WRR, rule 28(3). In fact, there is a suggestion in the provision that it relates primarily to disputes arising out of proposed uses of a watercourse – this is reflected by the presence of the National Planning Commission in the

these issues would not be assessed by the DWRC when licensing a particular water use, and possible conflicts would be identified only if public objections were received.[188] The DWRC may determine, on the basis of a series of factors set out in rule 28(3), and taking into account the priorities set out in s.7 of the WRA,[189] that a particular use of water resources is not beneficial and may either prohibit that use or attach conditions to it. As the DWRC is responsible for approving licensable water uses, there is an implication that it may only prohibit or attach conditions to licensable uses. It would not therefore have the capacity to take any action against WUAs registered under the IR. No appeal against the decisions of the DWRC is permitted under the legislation[190] and further details setting out the working of the inquiry body are absent.

As noted above,[191] the DOI has the role of enforcing certain provisions in the WRA relating to misuse of water. It has no legislative role in administering justice regarding WUAs, and no appeal is available against any of its decisions except with respect to complaints by prospective new users who have been denied service.[192] Appeal in such cases is to the same body that made the original decision, and no further steps can be taken by an aggrieved prospective user as the local Irrigation Office's decision is final. Other decisions by the DOI, for example those relating to the registering of WUAs, reduction or termination of service, or the upholding of standards by the DOI, are not open to review or challenge as users have no right of recourse.

Finally, one other body has ostensible jurisdiction to hear cases at the local level: the VDC, under the LSGA.[193] Interestingly, the LSGA, which is currently in abeyance because of the lack of elected local bodies, contains the most detailed provisions relating to the resolution and avoidance of disputes by VDCs. However, it is regarded as largely unworkable by DOI because of the differences in hydrological and administrative boundaries, and because it is apparently felt that, politically, the WUAs rather than the VDCs should be empowered to collect irrigation service fees. The jurisdiction of the VDCs includes the following:

membership of the Water Resources Utilization Inquiry Committee. Such a representative does not sit on the DWRC itself and would therefore not otherwise be part of the process of licensing water utilization.

[188] WRR, rules 18-19. See *supra*, para.3.4.

[189] WRA s.7 requires that:

1. "*if a dispute arises while utilizing water resources, the prescribed committee* [i.e. the DWRC] *shall, on the basis of priority order as set out in Sub-section (1), the beneficial use or misuse made of the water resources in accordance with sub-section (3) of Section 4* ["A person or a corporate body making use water resources shall make its beneficial use without causing damage to other."] *and also by conducting other necessary enquiries, decide as to whether or not or in what manner such use could be made.*
2. *The decision made by the prescribed committee pursuant to sub-station (2) shall be valid to all concerned.*
3. *The procedure of the committee, as prescribed pursuant to sub-section (2), while deciding on matters mentioned on that sub-section, shall be as prescribed."*

[190] Id., s.7(2) – "*The decision … shall be valid to all concerned.*"

[191] See, *supra*, para.3.1.1.

[192] IR, rule 19:

1. "*If a person not satisfied with the notification server pursuant to sub-rule (2) of Rule 18 of the decision to the effect that the Service could not be made available , such person may submit a complaint against such decision to the concerned Irrigation Office within thirty-five days of such decision.*
2. *The concerned Irrigation Office shall conduct the necessary inquiries on the compliant received pursuant to sub-rule (1) and issue an order. And such order shall be final*."

[193] See LSGA, s.33.

> "*Cases on border/boundary of land, public land, Sandhi Sarpan (inconvenience in respect of boundary or way-outs), Aali Dhur, canals, dams, ditches or allocation of water and encroachment on roads or way-outs*"; and compensation for crop damage.[194]

The VDC must form an arbitration board for the purpose of hearing such cases,[195] with arbitrators for a particular case being three persons drawn from this board and agreed upon by the parties.[196] The LSGA provides the detail that is lacking from the other water resources legislation with respect to the decision-making process to be followed in hearing and administration of cases.[197] Significantly, the LSGA also provides for a right to appeal to the relevant District Court if either party is dissatisfied with the decision of the arbitrators.[198] This process is currently dormant as a result of the lack of VDC membership. Additionally, assessment of the performance of the court system is unfortuntately beyond the scope of this paper: it is therefore not clear if a right of appeal from other tribunals would be rendered impractical by interminable processing of hearings by district courts. Enforcement of arbitration decisions is the responsibility of the VDCs in the first instance, and ultimately, that of the Land Revenue Office.[199]

As has been noted, the decisions of the DOI are largely unchallengeable. This remains the position with respect to decisions by HMG. At one level, decision-making by HMG is not open to public review because democracy has been temporarily suspended in Nepal. At the water resources management level, HMG is empowered to make directives under both the IR and the WRR that must be implemented without question.[200] Again, however, it has not been possible to assess the potential powers of courts to review government decisions through judicial review processes.

C.5 Conclusions and Recommendations

C.5.1 Introduction

As will be evident from the above outline of the legislative framework with respect to water resource management in Nepal, a number of major issues must be addressed before improvements may be made.[201] Unfortunately, however, the political and economic situation

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[194] *Id*. It should be noted that negotiation is encouraged, prior to taking the next step to arbitration (s.37).

[195] LSGA, s.34.

[196] LSGA, s.34(2). Alternative arbitrators may be appointed from outside the Board in the event that the parties cannot agree (s.34(3).

[197] See generally LSGA ss.33-42. See also, *infra*, para.3.3.1 with respect to the requirements imposed on VDCs with respect to the inclusion of women and "backward classes" in the arbitration board.

[198] LSGA, s.40.

[199] LSGA, s. 41(2)-(3).

[200] See IR rule 41 and WRR rule 39 respectively.

[201] In the event that a major effort is made to overhaul the current legislative framework in order to achieve a coherent and comprehensive water code, a number of elements should be considered crucial. Tarlock's view is that a successful water code should possess the following attributes:

1) "*development of a permit system to give the state control of the allocation and reallocation of water used by public and private entities.*
2) *The creation of public rights for the allocation or reallocation of water for the maintenance of aquatic ecosystems services and the restoration of degraded riverine environments.*
3) *Procedures such as regulated markets to reallocate water from marginal agriculture to more efficient uses, both urban and environmental.*

in the country inevitably means that the ideal regulatory environment for irrigation management will not be put in place in the short term. In conclusion, then, recommendations will be made below that seek to derive the maximum improvement from the minimum legislative tinkering. The aim is to imbue the WUA system with the credibility and legitimacy that farmers require before they will participate fully and actively. Without this legitimacy, both in terms of purpose and of governance, farmers will continue to be unwilling to pay for the WUA and the improvement of the irrigation systems. By establishing good governance of the WUAs, it is hoped that it will be possible to break the "*vicious cycle of low O&M expenditure leading to poor performance and increasing reluctance on the part of farmers to pay when they see no benefit*".[202] Following the structure of this paper, a slightly artificial distinction has been made between allocation matters and governance – the latter will be more concerned with procedural administrative issues.

C.5.2 Allocation:

Before making recommendations as to the concrete reforms that should be made to the relevant legislation in the short term, the gaps and flaws in the current framework will be summarised below along with suggested remedial measures that might address these.

C.i Conclusions

No catchment-wide system of water use management is in place. The WRR has not been implemented, and activities that would otherwise be licensable under the WRA are consequently uncontrolled. Integrated Water Resources Management implemented through a comprehensive licensing system would protect WUAs to the extent that water allocation would be more controlled than it is currently in its quantitative and qualitative aspects. A number of bodies are ostensibly responsible for controlling particular types of water use, but there is no single body with the power to oversee all uses, and the mechanisms for facilitating the transfer of relevant information between the existing bodies is inadequate.

4) *Special protections, either water reserves or financial transfers, to protect rural, generally poor, areas that may face the loss of water and livelihood opportunities.*
5) *The creation of rights to protect at-risk minority groups such as indigenous peoples and other people who have developed sustainable customary use practices.*
6) *The limitation of groundwater mining.*
7) *Special procedures to declare river and ground water basins closed to new uses.*
8) *The ground rules for temporary, emergency sharing.*
9) *A recognition that water plans need to factor in possible adaptations to global climate change which threatens to alter rainfall patterns and create more extreme cycles of flood and drought, especially in arid countries.*
10) *The procedure for the enforcement and quantification of rights.*
11) *The development of more inclusive decision making processes.*
12) *The coordination of water quantity and quality regulation.*" (Tarlock, D.A., *National Water Law: The foundation of sustainable water use*, WL 15 [2004] 120, 123).

While not all of the above are directly applicable to Nepal, the conclusions and recommendations made below broadly reflect the priorities identified by Tarlock, but attempt to do so within the context of the available regulatory and institutional environment.

[202] Bosworth, B., Cornish, G., Perry, C. and van Steenbergen, F., eds., *Water Charging in Irrigated Agriculture: Lessons from the literature*, Report OD145, (Wallingford, United Kingdom, December 2002), 44, available, along with a number of other useful reports, from the Water Publications section of the HR Wallingford website at http://www.hrwallingford.co.uk).

In the event that the WRR was put fully into effect in its current condition however, the regime that it purports to establish would not provide an effective system for controlling all uses of particular watercourses for the following reasons:

- The DWRC is not obliged to take account of the following fundamental considerations in allocating water use:
    - environmental and ecosystem requirements
    - quantity and quality of available resources
    - any other uses of a particular watercourse. Although priorities for utilization are set out in s.7 of the WRA, there is no explicit obligation imposed upon the DWRC to take these into consideration in approving applications for licences under rules 18-20 of the WRR.
- There is no statutory maximum duration for water use licences (other than with respect to Hydropower licences), although the WRR does require that licences be renewed within the time frame specified in each licence. This is exacerbated by the DWRCs lack of power to review and if necessary alter the terms of licences, and the allocation regime is therefore not flexible enough to adapt to changing circumstances. In periods of shortage, upstream users are protected by such limitations as licences are issued subject "*to the extent of water resources of such place and are as specified in the licence*".[203]
- Allocation of water use rights (including those obtained by WUAs through the registration process) is done on the basis of political boundaries, not hydrological ones. This means that the uses made of a watercourse in other Districts may have an impact on downstream uses of that watercourse (including irrigation), but unless representations from the public address these other uses, the DWRCs may not be aware of them and need not consider their importance when issuing licences. This could be ameliorated by having open registers of uses available to all district bodies on a particular watercourse and a requirement in the WRR forcing the licensing bodies to take account of all uses on the watercourse.
- Ancillary to the absence of a coordinated approach to water use controls, there is no watercourse-based process for the allocation of water resources during times of shortage. The IR allows the relevant Project Office, whether that is the local DOI, WUA, licensee or otherwise, to allocate water to their users. The DWRC has no role to play in this process.
- Pollution control monitoring is deficient, with the result that WUAs may suffer from problems caused, for example, by industrialisation and municipal waste.
- The incentive for farmers to participate in WUAs, and to engage with the authorities to formally establish such entities, is limited due to the administrative burdens imposed and by the want of necessity to do so.

C.ii Recommendations

If IWRM is sought, the ideal situation would be to have all uses[204] of water resources being allocated and approved under the oversight of a single body.[205] In Nepal, irrigation user groups need only register with the relevant DOI office for the District, and approval for different uses of a watercourse must be submitted to completely separate and independent

[203] WRR, rule 22.

[204] Including consumptive *and* non-consumptive uses.

[205] The Water Resources Strategy sets out plans to incorporate decision-making regarding new irrigation schemes within broader river basin management (para.6.5.3.1).

authorities with no obligation for consultation between them. As the provision setting out those uses of water resources that may be carried out without a licence is contained within the WRA, there is no immediate hope that this can be changed: primary legislation may only be changed with the approval of Parliament while secondary legislation can be modified by the Cabinet. As Parliament is currently suspended, only secondary legislation can realistically be altered. Consequently, the following changes to existing legislation would be helpful in remedying the above problems without undertaking the large-scale reform[206] that would provide the ideal:

- The system of having WUAs register with the local DOI office under the IR should be continued. However, the register of WUAs in a District should be made publicly available to all, necessitating a change to the IR. This might involve utilising the offices of VDCs, as these could be used as places where copies of the register may be viewed at a local level. With respect to inter-district watercourses, this register should be available to the licensing and registration bodies in all other districts on the same watercourse. Although a single licensing body is desirable, this compromise, coupled with recommendation number 2 below, should allow the licensing and registering bodies to take account of all the available information rather than focusing narrowly on a particular aspect of water use.
- Notification procedures need to be established with respect to inter-district watercourses, such that when either the DWRC or the district DOI office receive an application for a licence or registration, the relevant DWRCs, DOI offices and the MOPE are informed and have the opportunity to make representations. This should also be the case with respect to environmental assessments of projects that may affect other uses of affected watercourses.
- The requirements of registration should be enhanced. Currently no information need be provided by prospective WUAs with respect to number of users, crops grown or extent of the irrigated area. If the nature of a WUA's right of use is to be protected, it is imperative that other licensing bodies have as much information as can reasonably be provided. The register should therefore contain this information, along with a map of the irrigated area if possible. The irrigated area indicated should be the *actual* area irrigated rather than its theoretical extent.
- Currently, the IR does not oblige the DOI to take any factors into consideration when deciding whether or not to register a WUA.[207] This could be changed in the IR such that the DOI is obliged to take account of the priorities listed in s.7(1) of the WRA. However, the DOI must also be under an obligation to take account of the following factors in addition to those set out in the WRA:[208]
    - Environment and ecosystem requirements
    - Other uses made of the watercourse that are, or should be, licensed under the WRR or controlled under the EPR.

[206] Such large scale reform would include measures to implement the following: an integrated water resource use allocation programme including pollution control, under the primary control of a single independent body; eradication of corruption; and democratic government. On February 1, 2005, King Gyanendra declared a state of emergency in Nepal, dismissed his government and assumed direct control himself. It remains to be seen how and when democratic government will return to Nepal, but these recommendations must assume that it will.

[207] Other than assessing discrepancies and duplication, under IR, rule 3(3).

[208] It should be noted that although the VDCs and Municipalities have pollution prevention duties under the LSGA, it is presently not clear how their responsibilities interface with those of the MOPE. If such duties are actually carried out by the local bodies, the decision-making processes of the DOI, DWRC and MOPE must also take into consideration the pollution prevention plans of the VDCs and the Municipalities where appropriate.

- Uses made of the relevant watercourse in other Districts, where the watercourse is a transboundary one.[209]
- The availability of the resource, in terms of both the quantity and quality.
- The pollution tolerance levels and water quality standards to be set under the WRA, ss.18-19.[210]
- The National Water Resource Strategy.
- Equity – this might provide some basis for ensuring that WUAs are not established in such a way that certain water users in the irrigated area are patently discriminated against.

- The criteria to be used by the Project Offices in distributing water to its respective users should be also be broadened to include equity. Coupled with the requirements as regards improved transparency in the annual reports detailed below, this might provide a foundation for greater focus on the provision of water to tail farmers especially, and to more disadvantaged farmers in general.
- The licensing process set out in the WRR, subject to the other recommendations herein, should be implemented. Again, however, the considerations that may affect the decision of the DWRC are not sufficient as the regulations currently stand. Therefore, instead of making a judgement based on whether or not the requisite documents have been provided[211], the DWRC should be obliged to adhere to the list of priorities listed in WRA, s.7, and in addition take the following factors into account:
  - Environment and ecosystem requirements.
  - Other uses made of the watercourse that are registered under the IR (i.e. irrigation) or controlled under the EPR.
  - Uses made of the relevant watercourse in other Districts, where the watercourse is a transboundary one.
  - The availability of the resource, in terms of both the quantity and quality.
  - The pollution tolerance levels and water quality standards to be set under the WRA, ss.18-19.
  - The National Water Resource Strategy.

  This should help ensure that the licensing and registration regimes are consistent, as far as is possible, with each other.
- In order to ensure that the decision-making processes are as integrated as possible, the following improvements to the constitution of the registering and licensing bodies should be made:
  - A member of the MOPE, or its licensing arm, should be added to the constitution of the DWRC.[212]
  - The decisions of the DOI with respect to the registration of WUAs should be made in consultation with the DWRC and the MOPE.

[209] Although beyond the immediate scope of this report, the DOI must also take account of the rights, duties and obligations of Nepal under relevant international agreements, where the relevant watercourse is international in nature.

[210] This reflects the practice in, for example, South Africa – see National Water Act 1998, *supra* note 27, s.27.

[211] See WRR, rules 13(1) and 18(1).

[212] Currently a member of the DOI is already required to sit on the DWRC: WRR, rule 8. This should facilitate better communication as regards the relevant irrigation uses made of a watercourse.

  - With regard to the issuing of pollution control certificates, the MOPE should be obliged to seek and take account of the opinions of the relevant DWRC(s) and DOI office(s) in addition to the organisations listed in rule 16 of the EPR.

- The uses licensed by the DWRC should be added to the public register. This will entail amending the WRR.
- The DOI and DWRC, as registering and licensing authorities respectively, must take a pivotal role in the allocation of water resources in times of shortage. The DWRC, as the primary licensing body, would probably be best placed to take on this role, subject to the improvements above being made. Relevant changes therefore need to be made to the WRR, with appropriate cross-reference in the IR, to ensure that water uses registered under those regulations are also subject to the decisions of the DWRC in times of shortage. As a corollary to this, maximum durations must be set with respect to water utilization licences so that perpetual rights are no longer possible. Powers to review licences in the light of water resource changes should also be granted to the DWRC, although the rights of license holders must be protected in order to imbue the licenses with the necessary credibility.[213]
- As a final point, it should be pointed out that the licensing of pollution of watercourses will only be feasible if a pollution monitoring network is in place. To this end, HMG must do three things:
  - establish comprehensive Emission Limit Values for the polluting industries listed in the EPR.
  - set pollution tolerance levels and water quality standards for watercourses, under the powers set out in the WRA.[214]
  - establish a pollution monitoring network capable of supporting the above.

C.5.3 Governance:

C.i Conclusions

The administration of water resources management in Nepal is neither based on clear and comprehensive regulation nor rigorously enforced. The lack of enforcement is partly a result of the insufficiency of regulation, but this is compounded by the paucity of available resources and the unwillingness of WUAs to accept the responsibilities for operation and maintenance imposed upon them by the legislation. Such reluctance is understandable to some extent: the legislation sets out the responsibilities of the WUAs, but neither offers correlative duties to be adhered to by any of the licensing or registering authorities, nor provides the WUA with commensurate rights and powers to carry out these responsibilities. Standards of transparency and accountability are deficient, at all levels, and improvement of these must be regarded as a prerequisite if WUA members are to regard the system as credible and fair. If cost recovery rates and agricultural efficiency are to be improved, this must be regarded as the first step. The recommendations below seek to consolidate the current system to get the maximum benefit from it without imposing a disproportionate administrative burden.

[213] In South Africa, review of licences must take place not less than every five years and only in the context of a wider review of uses in a particular area, although the duration of the licence itself cannot be altered. See National Water Act, *supra* note 27, s.28(1)(f) and s.49 respectively.
[214] WRA, ss.18-19.

C.ii Recommendations

Reporting:

- The annual reports to be provided by WUAs to the DOI include income and expenditure, and details of services provided throughout the fiscal year. This should be extended to include the following:
    - irrigation outputs – there is a need to report on the productivity of an irrigated area so that efficiency can be measured;
    - that part of the irrigated area for which service could not be provided, along with details of location. At present, WUAs are obliged to keep records of "*the land in which service could not be availed and to recommend to exempt the Service Charge to be paid by such Users*".[215] By showing the location of the land that does not receive water, instances where tail farmers are being deprived of water as a result of excess water use by upstream farmers will be highlighted. The performance of the WUA could be measured in part on its ability to provide water equitably and to all members: this will have a corresponding impact on the credibility of the WUA, especially with tail farmers, and cost recovery may then be enhanced along with agricultural efficiency. This has the additional effect of encouraging WUAs to be more efficient with water use.
    - These annual reports should be approved by the General Assembly of the WUA.[216]

- The DOI should produce an annual report detailing progress on a number of indicators with respect to WUAs. These indicators might include
    - information relating to levels of cost recovery; and changes in the efficiency of production by WUAs based on the information provided from them as part of the registration renewal process;
    - reductions in the level of members' land that cannot be served;
    - information regarding the application of the priorities for water provision set out in IR, rule 21.
    - details of levels of WUA compliance with gender balance requirements;
    - levels of DOI compliance with the performance standards established for particular projects;
    - details of WUA registrations and renewals (including conditions attached to renewals);
    - periods where service to WUAs has been reduced, with reasons for reductions; and
    - information regarding appeals and challenges against the decisions of the DOI.

  The new Evaluation and Monitoring Committee could be given responsibility for enforcing and complying with these measures. DOI performance in providing services must also be assessed, and the annual report should form the basis of this.

[215] IR, rule 5(1)(c).

[216] It may be that this is already reflected in the constitutive documents of WUAs, as is the case in Bijayapur (see Bijayapur Irrigation System Constitution, *supra* note 41, para.9), but it entrenches the transparency of the WUAs.

- While the new renewal requirement with respect to registration is to be welcomed, it is deficient in the following ways:

  The information to be included in the required annual report should be set out and directly linked with the data required by the Evaluation and Monitoring Committee. In addition to this monitoring information, details should also be provided to indicate the level of compliance with representation requirements relating to gender and oppressed groups.

  The basis on which the DOI may refuse applications for renewal is not clear. A list of grounds should be set out, and this may include:

  - Outstanding service fees;
  - Inadequate accounts. For example, as a result of being unaudited, unapproved by auditors, fraudulent, or where gross financial mismanagement on the part of the WUA is indicated
  - Late submission of accounts and annual report.

  These measures should not contribute greatly to the administrative burden imposed on WUAs. However, the question of the timing of renewal remains potentially problematic: there is no evidence to suggest that the Auditor General's Office has the capacity to audit all WUA accounts properly within ninety days of the end of the financial year, and this may jeopardise the prospects of a WUA meeting the renewal deadline set out in IR rule 8A. This will depend on whether the term "fiscal year" used in the IR relates to the financial year of the individual WUA or to the general accounting financial year.

  It should also be recognised that the DOI may wish to apply sanctions other than the simple refusal to renew. For example, it might approve an application, but attach conditions, with the threat of de-registration being applied in the event of non-compliance. If the renewal is linked to the flow of water or government funds, it is far more likely that WUAs will continue to maintain their registration.

Miscellaneous

- WUA membership: the gender balance requirements vary across the legislation, and should be harmonised. Under the LSGA, Municipalities must have at least 40% female membership.[217] The Irrigation policy requires that one third of the membership of be female.[218] The harmonised level should reflect one of these at least – ideally of course, the target should be 50%. The harmonised level should be applied to WUAs under the IR and to the DWRC under the WRR. As it does not appear that gender targets have been set at the government level, this should be also be addressed.
- Rather than setting out standard form WUA constitutions and by-laws, a requirement should be inserted into the IR providing that the constitutive documents of WUAs should not be inconsistent with prevailing legislation.[219]

[217] LSGA, s.76.

[218] Irrigation Policy 2060, para.2.4.3.

[219] This should also act towards achieving greater participation of sharecroppers, as WUAs will consequently be unable to limit their membership to landowners and tenants, but will be obliged to include all users. It is acknowledged that this is not an ideal solution in this regard, as it may have unwelcome effects on absentee landlords, but may go some way towards alleviating the current position.

- The DOI must be under an obligation to set out the reasons for its decisions.[220] This enhances the accountability and transparency of the DOI. The DOI should also be obliged to publish the responses of the public to consultation efforts along with reasons why these have not been accepted (if this is the case).

C.iii Dispute Resolution and Enforcement:

- A WUA should be responsible for resolving disputes between its members. The functions and duties of the WUA set out in the IR must therefore be amended accordingly. The arbitration board procedure used by VDCs[221] should be used as the model for WUAs, with appeal to the relevant District Courts being provided for. For disputes between WUA members in different Districts, one arbitrator from each WUA should be appointed along with a mutually acceptable representative from the DOI.
- Disputes between WUAs themselves, a similar approach to the VDC arbitration might be adopted, where the District Irrigation Office draws up a list of possible arbitrators, and the parties choose three panel members who are mutually acceptable to both from this list. Those disputes involving WUAs in separate districts might be presided over by a representative from the lists of both Districts, with a third member potentially coming from a list drawn up at national level.
- The decisions of the District offices of the DOI and the DWRC should be open to challenge such that aggrieved parties may have recourse to, for example, a committee made up of members of the Ministry of Water Resources and MOPE, or alternatively, the District Courts if the dispute is confined to a single District or higher courts if more than one is involved.
- Responsibility for the policing of water theft within irrigated areas should be transferred from the DOI to the relevant WUA. This will entail amendment of rule 40 of the Irrigation Regulations, and should be reflected in the constitutive documents of the WUA. Similarly, as responsibility for repairing damage to canal infrastructure within the irrigated area belongs to the WUA, the WUA should have appropriate powers to recover the costs of any repairs in the event of wilful damage by its members. This requires that constitutive documents clearly set out the duties of members and explicitly state that costs, or indeed penalties, will be recoverable from transgressors.

[220] See also, *supra*, para.3.5, with respect to examples of the decisions that this should apply to.
[221] See, *supra*, para.3.5 for details of the arbitration board system set out in the LSGA.

Annex: Comparison of Selected WUA Constitutive Documentation and Legislative Requirements[222]

	Bijayapur: Lekhnath[223]	Kamala Uttarbahini[224]	SMIP: Sitagunj Branch[225]	Legislative Requirement
1. Membership: Ordinary	One male and one female member (both over 16 years old, or patron if younger) of each household benefiting from irrigation system Annual membership fee payable.	Not explicit, but appears to be users over 16 years old (or patron if younger). Annual membership fee payable.	All farmers aged over 16 (or patron if younger), in irrigated area. Annual membership fee payable.	Unclear, but membership of 67% of potential users from the irrigated area is required for a WUA to be registered.
Obligations / rights of members	Participate in meetings; Work in favour of the WUA	Not specified.	Not specified.	To inform Project Office if someone has misused the Service or caused leakage of water or committed such other acts or has attempted to commit such acts. To provide necessary assistance to the Project Office on works of construction, repair & maintenance and protection of Structures. Pay service charge.
New	Not specified.	Not specified.	Not specified.	Duty to distribute water to new User farmers without causing any harm to existing users.
tenure	Landowner and tenant	Landowner and tenant	Landowner and tenant	Not specified.
Voting rights	Dependent on fee payment, but	Each member has equal rights, so	Unspecified, but General Assembly	Not specified.

[222] It should be noted that the constitutive documents upon which the following comparison is based are not official translations, and in some cases, a number of provisions are missing from the English versions. The missing provisions are as follows: Bijayapur: from and including rule 20(b) to and including rule 22; Kamala Uttarbahini: from and including rule 10(b) to and including rule 13(a).

[223] See By-laws of the Bijayapur Irrigation System; and Constitution of Water Users' Institution 2058 – Lekhnath Municipality.

[224] See Kamala Uttarbahini Canal Project: Constitution of the Water Users' Working Committee, Bandipur, Siraha, 2059.

[225] The constitutive documents of the SMIP system include, in addition to the Constitution, the Transfer Agreement of for Operation and Management of SS9E sub-secondary canal in Sitagunj secondary canal of Sunsari Morang Irrigation Project, 26 March 1996. There are three Water User institutions in this system, all of which have differing responsibilities commensurate with the levels at which they operate: the Water Users' Committee (sub-secondary / tertiary level); the Water Users' Coordinating Committee (secondary and sub-secondary level); and the Water Users' Central Coordination Committee (primary).

	Bijayapur: Lekhnath[223]	Kamala Uttarbahini[224]	SMIP: Sitagunj Branch[225]	Legislative Requirement
	otherwise appears to be one vote per member, not one per household (there are 2 members from each household, but it appears that household fees are only relevant to "share membership" and irrigation service charges).	likely that this applies to voting.	consists of all users of the system.	
Termination / suspension	Termination of ownership / holding; Non-payment of service charge; Non-participation in maintenance work (branch committee may do this).	Non-users or those not farming in irrigation area.	Not specified.	Service can be terminated if a user "*is in default of payment of the charge for the utilization of services or utilizes the services"* without the necessary authority *"or misuses the services or acts in contravention of the terms and conditions"*.
2. Auditing	Annual auditing by "authorized auditor" (income and expenditure to be approved by general assembly and to be submitted annually to the relevant irrigation authority).	Annual auditing by "registered auditor" then submitted to Chief District Officer. (income and expenditure to be approved by general assembly)	Audit from registered auditor, then submitted to Chief District Financial Officer. General Assembly approves annual finances (although translation uses word "accepts" instead of "approves – uncertain if this is a translational problem, or if the General Assembly role is simply to accept the report regardless of content).	Financial reports to be provided annually to the Irrigation Office. Financial reports (audited by a "recognized auditor from the Auditor General's Department")must also be submitted as part of the registration renewal process.
3. Gender balance	30% target	Not specified.	Not specified.	33% of Executive Committee to be female.
4. Objectives / responsibilities	1. Distribute and manage water to farmers. 2. Manage resources and maintain infrastructure. 3. Coordinate with irrigation authority to manage, maintain and operate system. 4. Protect environment and take care	1. Utilise waters for irrigation-related activities. 2. Establish, manage and develop appropriate and reliable irrigation system. 3. Collect membership fees.	1. Manage rotational practice between users (WUC); 2. Update Irrigation Area maps (WUC); *3. Toli* committees responsible for assessing land served, or not, by the system. 4. Maintenance sub-committees	1. To maintain, operate and manage the Irrigation System 2. To avail water to the User farmers at appropriate time in proper quantity 3. To keep the record of the land in which service could not be availed and to recommend to exempt the Service Charge to be paid by such

	Bijayapur: Lekhnath[223]	Kamala Uttarbahini[224]	SMIP: Sitagunj Branch[225]	Legislative Requirement
	of headworks. 5. Manage water sources in irrigated area. 6. Make rules governing situations where water insufficient. 7. Encourage scientific farming and utilise water efficiently. 8. Encourage coordination to achieve optimum yield. 9. Main Committee: monitor performance (based on monthly reports from branch committees). 10. Branch committee: ensuring users' participation. 11. Branch committee to recover fees from users.		responsible for maintaining and improving the canals, and stopping illegal use. 5. Distribute water from authorised channels 6. Coordinate with irrigation authority. 7. Encourage farmers to plant crops commensurate with available water. 8. Collect irrigation fees from users.	Users. 4. To distribute water to new User farmers without causing any harm to existing users. 5. To mobilize public participation for maintenance of the Irrigation System. 6. To construct additional Structures to increase irrigable area considering the supply of water. 7. To collect service charge from users. 8. To exclude those users who fail to pay the service charge, to collect late charge and to inform the same to the concerned Irrigation office. 9. To provide notice to the concerned Irrigation Office regarding any demolition or destruction, alteration, obstruction.
5. Powers	1. Cancellation of membership; 2. Penalise those who destroy infrastructure. 3. Penalise those who put rubbish in canals / damage canals.		General Assembly penalises "misbehaviour" of users.	To exclude those users who fail to pay the service charge, to collect late charge and to inform the same to the concerned Irrigation office.
6. Dispute Resolution	*Toli*, branch, and main committees have dispute resolution capacities, and main committee has ability to forward unresolved cases to other, unspecified, authorities.	Not specified.	Canal Management Sub-coordination Committee (at the level of the Water Users Coordination Committee) has duty to resolve irrigation-related disputes.	None specified.

Bibliography

Primary Sources: Nepal:

- Association Registration Act 2034 BSl, published by Nepal Gazette, His Majesty's Government, Kathmandu, Nepal.
- Electricity Act 2049, available at http://www.doi.gov.np.
- Environment Protection Act 2053, available at http://www.mope.gov.np.
- Environment Protection Rules 2053, available at http://www.mope.gov.np.
- Irrigation Regulations 2056 at http://www.doi.gov.np.
- Irrigation Regulations 2056 (as revised, February 2004 – unofficial translation only)
- Local Self-Governance Act 2059 (Ministry of Law, Justice and Parliamentary Affairs, Kathmandu, 1999)
- Local Self-Governance Regulations 2059 (Ministry of Law, Justice and Parliamentary Affairs, Kathmandu, 1999)
- Water Resources Act 2049, available at http://www.doi.gov.np.
- Water Resources Regulations 2049 (Ministry of Law, Justice and Parliamentary Affairs, Kathmandu, 1992)
- Hydropower Development Policy 2049, available at http://www.doi.gov.np.
- Irrigation Policy 2060, available at http://www.doi.gov.np.
- Water Resource Strategy, Nepal (WECS / Graphic International, Kathmandu, 2002)
- By-laws of the Bijayapur Irrigation System
- Constitution of Water Users' Institution 2058 – Lekhnath Municipality
- Constitution of Water Users' Institution, Sitagunj Branch Canal
- DOI website at http://www.doi.gov.np.
- MOPE website at http://www.mope.gov.np/environment/standard.php.

Primary sources: Foreign

- Punjab Irrigation and Drainage Authority (Pilot Farmers Organizations) Rules 1999 (Pakistan)
- National Water Act 1998– available at http://www-dwaf.pwv.gov.za/ (South Africa)
- European Union Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy *Official Journal L 327 , 22/12/2000 P. 0001 – 0073*, available at http://europa.eu.int/eur-lex/en/) (European Union)

Secondary Sources:

Bishal, S and Santosh, K.C., *Analysis of Supreme Court Cases and Decisions related to Water Rights in Nepal* in Pradhan, Rajendra *et al*, Water Rights, Conflict and Policy (IIMI, Kathmandu, 1997), 47-62

Groenfeldt, D. and Svendsen, M., eds., Case Studies in Participatory Irrigation Management (World Bank Institute, Washington, 2000)

Hodgson, S., Legislation on Water Users' Organizations, (FAO Legislative Study 79, Rome 2003)

Khadka, S.K., *Water Use and Water Rights in Nepal: Legal Perspective* in Pradhan, Rajendra *et al*, Water Rights, Conflict and Policy (IIMI, Kathmandu, 1997)

Pradhan, Rajendra *et al*, Water, Land and Law – Changing Rights to Land and Water in Nepal (Kathmandu – Wageningen - Rotterdam, FREEDEAL, 2000)

Salman, S., The Legal Framework for Water Users' Associations (World Bank Technical Paper no. 360, World Bank, Washington, 1992)

Shrestha, A., *Building Gender-Responsive Water User Associations in Nepal*, in ADB Case Studies, 15, available at http://www.adb.org/Water/Actions/NEP.

Tarlock, D.A., *National Water Law: The foundation of sustainable water use*, WL 15 [2004] 120.

Vermillion, D. and Sagardoy, J., Transfer of Irrigation Management Service – Guidelines (IWMI / FAO, Rome 1999).

Appendix D Water Users Associations in Ningxia Province China[226]

D.1 Introduction

China's government has identified the nation's rising water scarcity as one of the key problems that must be solved if the nation is to meet its national development plan in the coming years. In facing the emerging water crisis, leaders have debated several approaches for solving water scarcity problems, such as developing more water resources to increase water supply, promoting water saving technology and using a water pricing policy. None have been fully successful yet: developing water resources has been limited by financial constraints and accelerating cost of exploitation; most of its efforts in trying to encourage the use of sophisticated water saving technologies, such as drip and sprinkler irrigation, have failed in recent years due to budgetary, technological and knowledge constraints; and political considerations are likely to keep leaders from moving too agressively on raising prices, at least in the agricultural sector.

With the failure of some methods of combating water shortages and the increasing political and financial difficulties in implementing others, leaders in recent years have turned to water management reform as a key part of their strategy to combat China's water problems. Since the 1980s, and with a greater emphasis since the late 1990s, China policy makers have promoted reform of agricultural water management (Nian, 2001). However, the results seems to be mixed although most evaluations are anecdotal and based on case studies (e.g., Huang, 2001; China Irrigation Association, 2002). Even in those areas in which management reform has been well-designed, effective implementation of the reform has been difficult (Ma, 2001; Management Authority of Shaoshan Irrigation District, 2002). Collective action, information problems and a failure to get the incentives right are some of the reasons for ineffective implementation of these reforms. In addition, there could be local resistance since one of the bases of reform is to provide incentives to individuals to manage water more efficiently: there are many ways that water management reform could negatively affect farmer income and the poverty status of certain individuals. Surprisingly, however, despite the high stakes of the reforms little or no empirical work has been conducted to understand and judge the effectiveness of water management reform.

The purpose of this appendix is to understand better water management reform in China's water-short rural communities, especially focusing on the evolution, governance and effect of Water User Associations (WUAs) - one the important new management patterns promoted by the government.

The report is organized as follows:

- Section D.2: sampling procedures and charateristics of study sites.
- Section D.3: description of the evolution and determinants of WUAs during the 1990s and 2000s.
- Section D.4: analysis of infrastructure, governance, water fee and finances of WUAs.
- Section D.5: analysis of the effect of water management reform on crop water use, agricultural output and income.
- Section D.6: conclusions.

[226] This appendix has been prepared from a study undertaken for this project by Dr Wang Jinxia and Dr Huang Jikun of the Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Beijing.

D.2 The Study Sites

D.2.1 The Sampling Procedures

We selected Ningxia Province because of the relatively good progress with water management reform, including establishment of village-level WUAs. Within the province we selected two irrigation districts - Weining Irrigation District (WID) and Qingtongxia Irrigation District (QID), located downstream of WID – both taking water from the Yellow river. These are large-scale, gravity irrigation IDs, with a wide range of water management patterns, water availability, physical condition and socio-economic charateristics. The two districts differ in their size[227]: QID covers 304,000 ha in nine counties, from which we chose one county from the upper, middle and lower reaches of the district; WID serves 54,000 ha in two counties which were both sampled. In each county, two townships were randomly selected, and then we selected the sample villages and households for primary survey work. In each township, the survey team selected two villages and an average of four households per village. We then conducted community, irrigation system, and household interviews in 5 counties, 34 villages and 130 households. The data resulting from this survey is summarised in Annex D.1

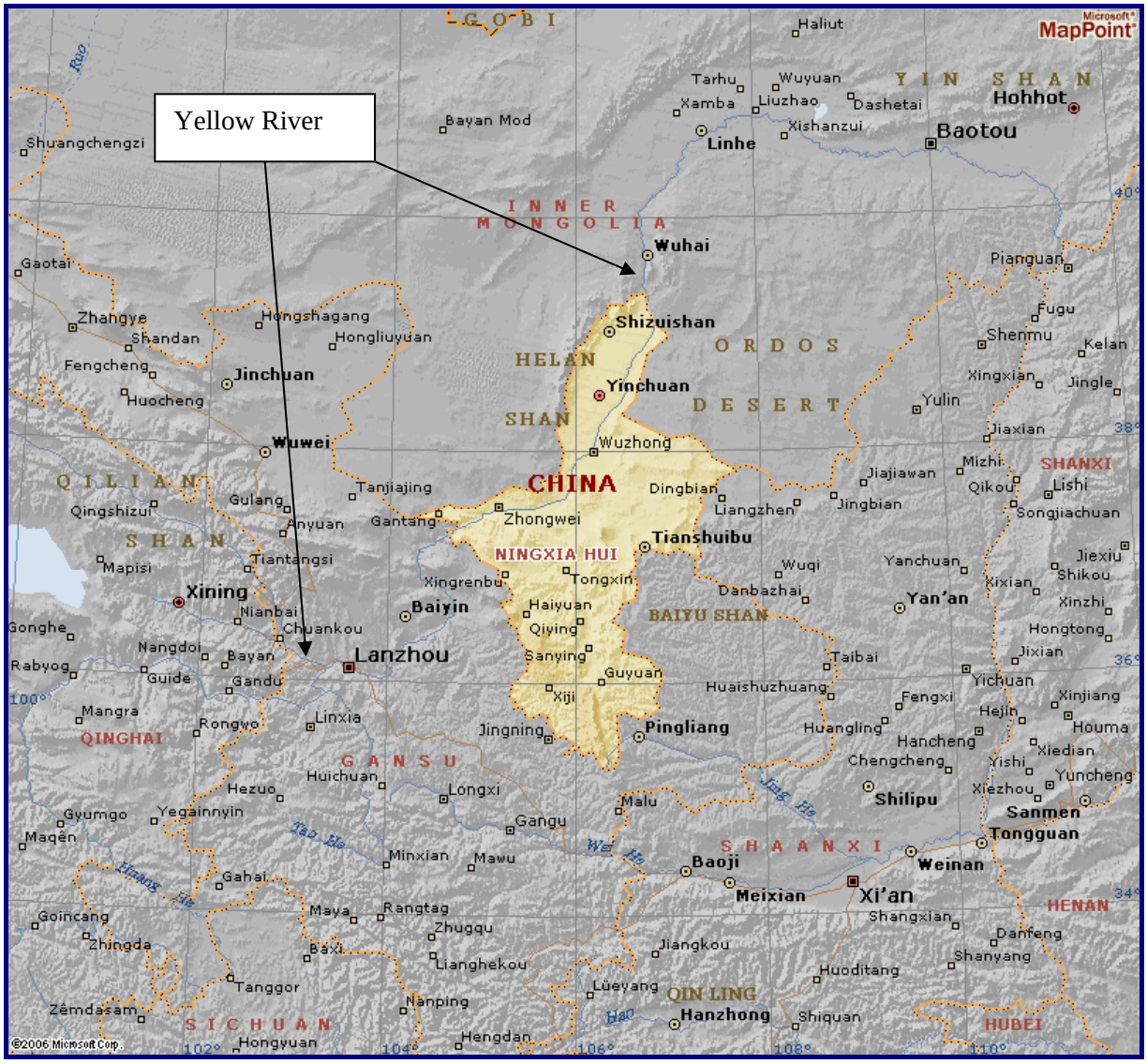
D.2.2 The Study Sites

D.i Ningxia Province

Ningxia Province is located in the north-west of China, in the upper part of the Yellow River Basin. The Yellow River flows for 397 kilometers through the province and irrigates about 350,000 ha which is 27% of the cultivated area (in 1999). The total area of the Province is 51,800 km^2 , but more than 70% of this is in mountainous areas. With more than 5 million of total population, 71 percent of population are engaged in agricultural industry, the most important sector in socio-economic terms. Irrigation here has a history of more than 2000 years and it has played an important role in promoting local rural and economic development. There are three large irrgation systems - Weining, Qingtongxia and Yanghuang – taking water from the Yellow River water by gravity or pumping, and there are many medium and small irrigation systems.

Despite the Yellow River flowing through it, Ningxia Province is still a water short region. Per capita water availability in is only about 300 cubic meters, barely 15% of the national average. It is a very dry area, with average annual rainfall varying from 200mm in the north to 5mm in the south, and more than 60% of rainfall in June to September (Ningxia Statistical Bureau, 2000).

[227] gross areas



Surface water is the major source of water and agriculture is the largest consumer. There is a much larger groundwater resource (3.7 times that of surface water), but it has barely been developed and 90 percent of water used comes from the surface water (Ningxia Statistical Bureau, 2000). One reason for the lower development of groundwater is the relatively high exploitation cost in the mountainous regions, and another reason is that farmers in the plain regions have a relatively abundant and cheap surface water supply and lack the incentive to use groundwater. As an agriculture-oriented development region, as much as 93 percent of water resources has been allocated to agriculture and the shares of industry and domestic water use are only 5 and 2 percent respectively.

Despite the water shortage, water resources in the irrigation districts of Ningxia Province are not efficiently used. For example, in 2000, average agricultural water use was 25,000 m^3/ha in Ningxia, a level about 3.4 times of the national average. In contrast, Henan farmers in the downstream of the YRB used about 3,810 m^3/ha, one-sixth of that of Ningxia. Faced with increasing water shortage and water-induced conflict in the overall river basin, central and local governments have given much emphasis to improving water use efficiency.

Given such differences in water uses between up and downstream reaches, it is clear that existing

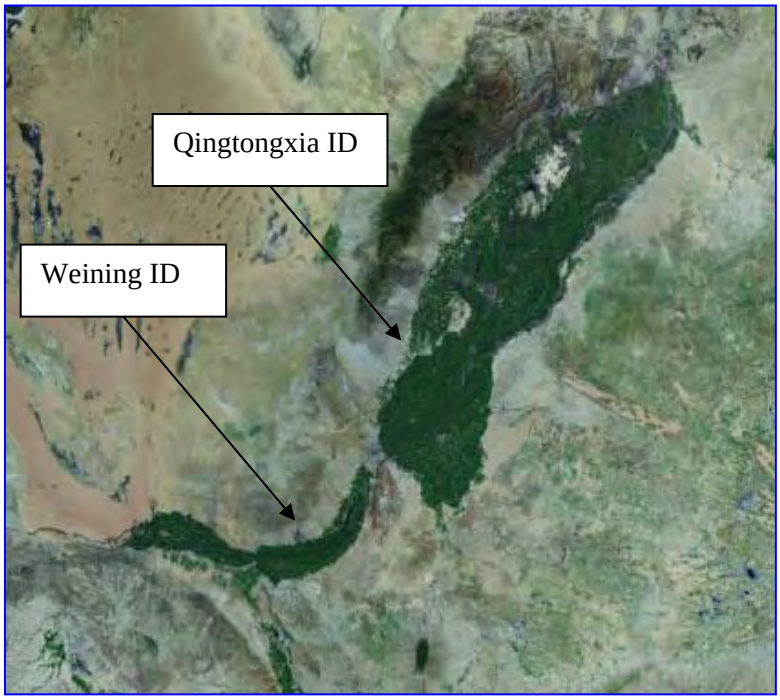
water rights and the current allocation system are critical policy issues. It can be expected that an alternative water allocation scheme could generate large welfare gains for the whole YRB. However, the key issue for reallocating water resources is how to reduce the water use in the upstream while having no adverse effect on production and farmers' welfare. Increasing irrigation investment for maintaining and updating the irrigation facilities is important, but this will be insufficient to improve water use efficiency without reforming water management. Water management reform especially the establishment of WUAs will be examined in detail in the following sections.

Ningxia is a relatively poor region and average per capita annual income in rural Ningxia was only 75 percent of the national average for rural China in 2000 (1,724 yuan versus 2,253 yuan)[228]. The lower average income levels mean that Ningxia also suffers from higher incidences of poverty. According to the most recently available secondary data on poverty (using the national poverty line from the State Statistical Bureau, 1996), the incidences of poverty in Ningxia (18.5 percent) were about three times the national average (6.3 percent). The situation has improved since then at a national level, where the rate declined to 3.4 percent in 2000. Based on this national trend and the growth of rural income in Ningxia in the late 1990s, it is likely that that the incidence of poverty was about 10 percent in 2000.

The main crops in Ningxia are wheat, maize, paddy, oil crops, potato, soybean and some vegetables (Ningxia Statistical Bureau, 2000), with 30% of the sown area being wheat, 16% maize, 12% oil crops, 12% potato, and 4% vegetable in 1999. The total grain production in 1999 was 3 million tons and oil crop production was 100 thousand tons. The average wheat yield is low (2.9Mt/ha) because it is mainly grown under rainfed conditions, whereas the maize yield is 6.6 Mt/ha. Cropping intensity in this province is very low, only 0.81 in 1999, lower than the average national level of 1.2, because of the under-irrigated and mountainous areas. Yields and intensities are higher in the main IDs, where they exceed 5Mt/ha for wheat.

D.ii Weining and Qingtongxia Irrigation District

The two sample IDs have some similarities, but also some fundamental differences. Both WID and QID are "large scale" irrigation districts, and both have a long history - several of their canals have been in operation for more than 2000 years, although there has been enormous investment into fundamental renovations of the original system and expansion into adjacent areas during the past 50 years,. They both suffer from poor physical condition and low water delivery efficiency – the water conveyence efficiency in each ID is reported by ID officials to be 40 to 50%.



[228] 1 US$ = 8.3 yuan

In such a dry, seasonally variable climate and being far from the nation's booming coastal areas, irrigation has played an important role in the economy of the area. Without access to the transportation and other locational advantages of the provinces in the eastern part of the nation, agriculture is still an important sector here and contributes more to GDP than the national average (32% in WID and 27 % in QID as compared to the national average of 16 % (NSBC, 2001).

The cropping pattern is typical of the province and indeed of much of China's northern and northwestern irrigated areas (Table D.1). Wheat, a crop that is grown almost exclusively in the winter season, is dominant. In terms of cultivated area, maize is second, and is mostly a crop that is grown in rotation with wheat (typically being planted in early June—sometimes between the rows of the wheat that is almost ready to be harvested—and harvested in late September or October). Rice is an important crop with a special significance in north China. The diversification of cropping systems in these IDs, makes it difficult to assess the water productivity for the whole agricultural sector precisely. Therefore, our analyses on water productivity concentrate on wheat, maize, and rice (Table D.1).

Based on our survey data, water productivity (that is unit of output per unit of water input) differs by major crop and between IDs. Farmers produced almost 0.6 kilograms of wheat and rice in WID per cubic meter of water. In contrast, maize farmers produced 1.3 kilograms in the same ID. However, the productivity of water of wheat and maize farmers varied between IDs. Farmers in QID produced more wheat and maize but less rice per cubic meter of water than that in WID. Such large difference among crops and between regions is an indication of the potential opportunities to increase water productivity through water re-allocation within and between IDs., although there are many other factors which influence crop choice.

The water price and related O&M cost recovery cost rates are similar in these two IDs, although there is great deal of heterogeneity in the way villages managed water between the four sample IDs (Table D.11). Villages in the two IDs in Ningxia manage their water through WUAs, contracting with individuals, and collective management. However, the importance of each form of water management and their development greatly differ between two IDs. A more detailed discussion of water institution and management issues is included in the following sections.

Table D.1: Characteristics of the four sample irrigation districts, 2000.

	Irrigation District[a]	
	WID	**QID**
Effective irrigated area (000 ha)	56	304
Water use efficiency (%)	40-45	40-45
Rainfall (mm)	200	195
Proportion of area which is irrigated (%)	82	90
Proportion of population dependent on agriculture(%)	82	72
Proportion of GDP from agriculture (%)	32	27
Water productivity - wheat (kg/m^3)	0.58	0.8
Water productivity - rice (kg/m^3)	0.58	0.53
Water productivity - maize (kg/m^3)	1.29	1.4
Water price ($yuan/m^3$)	0.012	0.012
O&M cost recovery rate (%)	61	61

Statistical Bureau of Ningxia (2001)

D.iii The Sampled Villages and Households

The average village size presents an increasing trend since 1990. The total population living in the villages increased from 1,414 in 1990 to 1,606 in 2001 (Table D.2, column 2), but with a more rapid increase in WID. In both cases the household size is about 4 persons..

Land endownment in WID sample villages is not only lower (by about 33% per capita) than that in QID but also is decreasing over time in response to increasing population pressure: it declined from 0.13 ha/capita in 1990 to 0.12 ha/capita in 2001 (Table D.2, column 3). By contrast, cultivated land per capita in QID increased from 0.15 hectare in 1990 to 0.16 hectare in 2001. The impact of population growth is offset in both cases by exploitation of land which was previously uncultivated.

Table D.2: Population, household, arable land and irrigation condition in the sampled villages, 1990-2001[229]

	Year	Population (person)	Household (number)	Cultivated land per capita (ha)	Share of land irrigated (%)
All samples	1990	1,414	337	0.14	100
	1995	1,510	365	0.14	100
	2001	1,606	393	0.15	99.7
WID	1990	1,327	307	0.13	100
	1995	1,530	342	0.13	100
	2001	1,644	398	0.12	99
QID	1990	1,443	347	0.15	100
	1995	1,504	373	0.15	100
	2001	1,593	391	0.16	100

Cultivated land per capita in Ningxia Province in 2001 was 0.33 ha (Ningxia Statistical Bureau, 2002), nearly three times that in our sampled IDs but this is offset by their advantage in irrigation conditions.. Since our sampled villages are randomly selected in the irrigation districts that have good access to the Yellow River water, almost 100 percent of land of these villages are irrigated while less than 30% of agricultural land in Ningxia Province can be irrigated in 2001 (Table D.2 column 5 and Ningxia Statistical Bureau, 2002).

Since 1990, farmers' income in all the sampled villages has increased with some differences between two IDs. The average annual income of farmers increased from 1,223 yuan in 1990 to 1,940 yuan in 2000 (Table D.3). Incomes are lower in WID than in QID, despite increasing more rapidly. In 2001, farmers' income in WID was lower than the provincial average level of 1,823 yuan while farmers' income in QID was higher than the provincial average level. Agriculture forms a declining proportion of household income (dropping from 80% to 65% over the past decade), and agricultural income has grown by just 30% (2.5% per annum) as compared to non-agricultural income which has almost doubled (11% per annum). This rapid trend away from agriculture can be expected to have an impact on attitudes to irrigation management.

[229] All data in this annex is derived from our field survey, unless otherwise stated

Table D.3: Farmers' income and village revenue in the sampled villages, 1990-2001

	Year	Farmers' income		Per capita village revenue (yuan)
		Per capita annual income (yuan)	Share of agric. income (%)	
All samples	1990	1,223	81	21
	1995	1,565	74	35
	2001	1,963	65	40
WID	1990	979	78	18
	1995	1,356	72	26
	2001	1,631	63	21
QID	1990	1,304	81	22
	1995	1,635	75	38
	2001	2,065	66	46

With the improvement in farmers' incomes, villages' economic power has also improved (although there has been some decline in WID since 1995) and has almost doubled from 21 yuan to 40 yuan in 2001 (Table D.3, column 4). Village revenue is mainly derived from land contract fee from farmers together with income from some operating entities – these vary greatly between villages.

Table D.4: Farmers' education in the sampled villages, 1990-2001

	Year	Illiterate rate (%)	Share of educated farmers (%)		
			Primary	Middle	Upper Mid
Ningxia Province	1990	37	30	32	1
	1995	27	32	40	1
	2001	18	30	50	2
WID	1990	21	45	29	6
	1995	15	45	33	8
	2001	8	42	43	8
QID	1990	18	44	32	7
	1995	12	38	40	10
	2001	8	31	45	16

Compared with provincial average education level, our sampled farmers have been educated better and education level has improved over time. In all three years, illiterate rates in the sampled villages were lower than provincial average level. For example, the illiteracy rates in two IDs were lower by 125 percent than the provincial average level in 2001 (Table D.4, column 2). The education level in the two IDs are similar, with increasing numbers of farmers educated in middle or even higher school.

Cropping structure in the sampled villages has not changed greatly since 1990. Grains are always the dominant crops covering almost 90% of the land (Table D.5, column 2). Curiously farmers in WID grow more cash crops, despite having a lower income.

Table D.5: Cropping structure in the sampled villages, 1990-2001

	Year	Proportion of area under cash crops (%)	Proportion of total grain areas under each of the major grain crops (%)		
			Wheat	Maize	Paddy
All samples	1990	11	41	30	23
	1995	12	39	31	24
	2001	13	36	32	21
WID	1990	15	40	27	24
	1995	18	37	27	27
	2001	17	37	30	21
QID	1990	10	43	33	21
	1995	10	40	36	21
	2001	11	37	34	21

Table D.6: Grain yield in the sampled villages, 1990-2001

	Year	Grain yield (kg/ha)		
		Wheat	Maize	Paddy
Ningxia province	1990	2,540	4,980	9,004
	1995	2,340	6,404	7,432
	2001	2,793	6,414	8,330
WID	1990	4,650	6,855	6,960
	1995	4,815	6,585	7,320
	2001	5,115	7,065	8,160
QID	1990	4,680	5,085	8,055
	1995	4,965	5,730	8,895
	2001	5,205	5,760	9,720

Table D.7: Water sources of irrigation in the sampled villages, 1990-2001

	Year	Share of irrigated area (%)		
		Surface water	Groundwater	Conjuctive use
All samples	1990	98.3	0.95	0.75
	1995	98.5	0.95	0.55
	2001	99.25	0.15	0.6
WID	1990	100	0	0
	1995	100	0	0
	2001	100	0	0
QID	1990	97.75	1.25	1
	1995	97.95	1.3	0.75
	2001	99.01	0.21	0.78

Yield of major crops in our sampled villages are generally higher than the provincial average (apart from maize at QID and paddy yield at WID), but there are large differences between IDs (although

given the sample size this may also reflect differences *within* the IDs). Maize, yields are higher in WID and this offsets the impact of the smaller farm sizes on their incomes.

Table D.8: Water scarcity degree in the sampled villages, 1990-2001

	Share of villages facing with severe water shortage (%)		
	1990	1995	2001
All samples	9	16	25
WID	25	13	13
QID	4	17	29

The dominance of surface water is clear from Table D.7 (column 2), but there is still a shortage of water in many villages. Maybe due to its upstream location, water access situation in WID has improved with half the number of villages reporting a scarcity, as compared to1990 (Table D.8 row 2). The situation is the reverse in QID, where from only 4 percent of villages in 1990 now 29 percent in report a shortage. It should be noted that these figures may reflect the changing allocations from the Yellow river by the WRB to these IDs as much as internal differences.

Water quality has changed little since 1990 in the sampled villages, but is worse in QID than WID, as might be expected as it is further downstream. 38 percent of villagers reported problems with water salinity in 2001 – corresponding to those reporting poor water quality, as would be expected since salinity is the most important indicator of water quality.

Table D.9: Water quality in the sampled villages, 1990-2001

	Year	Villagers' perception of water quality (%)		
		Good	Average	Bad
All samples	1990	31	38	31
	1995	28	38	34
	2001	31	31	38
WID	1990	50	25	25
	1995	50	13	38
	2001	50	25	25
QID	1990	25	42	33
	1995	21	46	33
	2001	25	33	42

Table D.10: Water salinity in the sampled villages, 1990-2001

	Proportion of villagers perceiving problems due to water salinity (%)		
	1990	1995	2001
All samples	38	38	38
WID	25	25	25
QID	42	42	42

D.3 Evolution and Determinants of Water Management Institution

D.3.1 Evolution of Water Management Institution

Based on our field survey, after reform villages manage surface water in three general ways: collectively, by contracting to individuals, and through WUAs. If the village leadership through the village committee takes responsibility for water allocation, canal operation and maintenance (O&M) and fee collection, it is thought of as *collective management*, the system that essentially has been allocating water in most villages during the People's Republic period. *Contract management* is a system in which the village leadership creates a contract with an individual to manage the village's water. The *WUA management* system is one that, in theory, is a farmer-based organization that is set up to manage the village's water.

Table D.11: Surface water management in the sample villages, in 4 selected irrigation districts, 1990 – 2001

		Percentage			Numbers		
		WID	QID	All samples	WID	QID	All samples
1990	Collective	100	81	91	8	19	29
	WUA	0	5	3	0	1	1
	Contract	0	14	7	0	3	2
1995	Collective	100	72	86	8	17	28
	WUA	0	10	5	0	2	2
	Contract	0	18	9	0	4	3
2001	Collective	27	51	39	2	12	12
	WUA	50	14	32	4	3	10
	Contract	23	35	29	2	8	9

According to our data, since the early 1990s, and especially after 1995, reform has successively established WUA management in the place of collective management, although contract management is also emerging as a popular alternative to both (Table D.11). The share of WUAs increased from 3% in 1990 to 32% in 2001 (column 3). While there has been a shift from collective management to WUAs during the past 10 years, the water management reform varies across the two sample IDs. For example, in 1995, 100 percent of the water management institutions in WID were of the collective model (column 1). By 2001, however, the collective managed water in only 27 percent of the sample villages and 50 percent of villages were managed by WUAs. However, in another ID of Ningxia Province, QID, some WUAs were even formed in 1990, but there are still fewer WUAs than areas controlled by collective and contract water management (column 2). Under the same central and provincial water policy influences, the differences of water management reform in these two IDs reflect some local political, physical, socio-economic and environmental factors that determine the evolution of water management.

D.3.2 Reasons for Establishing Water User Associations

Table D.12: Reasons for establishing Water User Associations

ID	Nos WUA	Percentage of villages reporting reasons for establishing WUAs				
		Water scarcity	Conflict in water use	Reducing water fee	Government intervention	Earning money
WID	4		25%	25%	100%	50%
QID	4	25%			75%	25%
All	8	12.5%	12.5%	12.5%	87.5%	37.5%

There are several reaons that are considered as important factors in promoting the development of WUAs by village leaders (and hence the totals exceed 100% in the table above).

Increasing water scarcity and conflict in water use are two important reasons that led to the establishment of WUA. 25 percent of villages regarded either increasing water scarcity or conflict in water use as the most important reasons to reform water management (Table D.12, column 1 and 2), suggesting that they did not think that the collective water management model can deal effectively with water scarcity issues, especially in the context of improving water use efficiency. Therefore, they feel that an innovative pattern of water management institution, such as WUA that can potentially induce the improvement of water use efficiency is urgently needed. Increasing water scarcity and water conflict can be treated as pressure from farmers that local leaders have to face since farmers' production will be negatively influenced if water scarcity continues.

Probably more importantly, local leaders received much pressure from higher levels in the government, which are taking steps to encourage water management reform. Our sample data indicates the dominant role of government intervention in the management reform (Table D.12, column 4). Since Ningxia Province is located in the upstream of the Yellow River Basin, it has always been criticized for over-consuming water resources and causing water scarcity in the river basin as a whole: the central government issued some policies since 1999 to constrain water use in the upper reach of provinces, like Ningxia Province. Under such political conditions, governors in Ningxia Province have to explore potential measures to reduce water use while keeping sustainable development of local economy.

Innovative water management also has been highly stressed by the local government as an alternative to increasing water price or introducing water saving technologies to realize the policy objectives.

Table D.13: Government intervention approaches in the establishment of WUA

ID	Declaring documents	Discussing
WID	67%	33%
QID	50%	50%

In order to promote the management reform, Ningxia Provincial government issued several related policy documents to guide and encourage local water management reform in 2000. It seems that such policy has been well delivered to the local leaders since 100 percent of villages in WID and 75 percent of villages in QID reported that government intervention is one of important reason for reforming (Table D.12, column 4). Local government has also organized discussions, mainly with the village leaders to promote the reform (Table D.13).

The approach adopted in Ningxia for reducing water use is to provide an incentive to managers that links their remuneration with the quality of water management. Ningxia's government understands this very well and has designed an incentive mechanism for WUA: managers earn the difference between the fixed revenues that are associated with a village's land (the total area times a per hectare water fee, which is set by upper-level officials) and the amount of money that that has to be remitted to the irrigation district. The remittance from the water manager to the ID is based on the actual volume of water used. Hence, managers earn more income if they can reduce the volume of water that farmers use.

This is of course subject to ensuring the village's cropping activities are not adversely affected in any major way. This is not formally monitored or controlled, but it relies on farmers complaining to village leaders if they are getting an inadequate water supply. It seems that such policy design has played an important role in persuading local leaders to reform water management (50 percent of village leaders in WID and 25 percent in QID indicated that earning money by saving water is one of reasons of establishing WUA (Table D.12, column 5). This differs from collective management, where there are no incentives. The incentive structure is different in contract management, but there are still incentives making this a popular management model also.

As well as support from local leaders and canal managers, support from farmers is important for promoting reform smoothly and successfully. In some villages the village leader will hold a large workshop before the reform including most farmers to decide if they want to reform water management. It is apparent that enhancing farmers' welfare has been addressed in the process of establishing WUAs since 25% of village leaders in WID indicated that reducing farmers' economic burden by reducing water charges is one of reasons for reforming water management (Table D.12, column 3). The water fee per hectare will be decided every year before irrigation. For the reformed villages, higher authorities will allocate one target water use volume to each village - this is lower than the average level of previous three years. Officials will then decide the water fee per hectare for the target water use. Since target water use is lower than before, water fee per hectare will also be lower than before.

Table D.14: Final decision makers of establishing Water User Associations

	Government	Negotiated beween village and government	Discussed with village leaders
WID	25%	50%	25%
QID	50%	0%	50%
All	37.5%	25%	37.5%

To sum up, the introduction of WUAs is promoted through the influence of many stakeholders, including policy makers, village leaders, canal managers and farmers. However, when we further explore who are the most important decision makers in setting up the WUAs, the results reveal the importance of the local government (especially township and county government) and confirm that to a large extent, water management reform in Ningxia province is a top-down activity (Table D.14, column 1), but negotiations between village and government are also important for WUA establishment (column 2) although a large minority of village leaders decided on WUA establishment by themselves (column 3).

D.4 Infrastructure, Governance and Revenue of Water User Associations

D.4.1 Physical Condition and Serviced Size

Generally, canal facility conditions in WUA controlled villages are little different from those controlled by collective committees. There are some differences in the infrastructure: none have much canal lining (19% in collective managed villages and 9% in WUA managed villages - Table D.15, row 1). There are slightly better control structures in villages managed by WUAs (row 2) – possibly suggesting that good water control is a condition for implementing WUA management. Silt is a serious problem for both WUA and collective managed canals with half or more facing severe problems (Table D.15, row 4). Annual cleaning of canals is a very labour intensive work and generally all the households irrigated by the canals are required to contribute certain number of days for canal cleaning – or if they have no labour available, they have to pay money so that canal managers can hire other farmers to do this.

Table D.15: Facility and canal conditions of water management, 2001

	WUA	Collective
Share of lined canals (%)	9	19
Share of canals with good gate (%)	100	88
Share of canals with silt (%)	88	94
Share of canals with serious silt (%)	50	56
Average actual irrigated areas (ha)	201	141
Average actual irrigated households (hh)	382	310
Average irrigated area per 1000 meter canals (ha)	19	30
Average irrigated household per 1000 meter canals (hh)	38	65

The average irrigated areas of a WUA is 201 hectare covering 382 households – 30% more than for collective management (Table D.15, rows 5 to 6). Comparing their total irrigated area and canal lengths, WUAs have to manage almost twice as much canal per household. This gives them a greater maintenance burden but is unlikely to have been a factor influencing the decision to form a WUA.

D.4.2 Selection and Characteristics of Managers

WUA is composed by chairman and board members; theoretically, both chairman and board members should be elected by farmers to ensure they represent the farmers' interest. However, only half of chairmans were elected by farmers, another half were directly appointed by village leaders – however, even this just meant ratification of village leaders' nominees rather than direct competition (Table D.16, columns 1 and 2). Similarly, 63 percent of board members were directly appointed by village leaders, only 37 percent of board members are elected by farmers (Table D.17, columns 1 to 2). However, in this case there was some competition – 12% were elected by competition (column 3).

Table D.16: Chairman' selection of Water User Associations in Ningxia, 2001

	Share of selection (%)	
	Appointed by village leaders	Elected by farmers, ie nominated by leaders and ratified by farmers
WID	25	75
QID	75	25
All	50	50

Table D.17: Selection of board members of Water User Associations, 2001

	Share of selection (%)		
	Appointed by village collective	Elected by farmers, ie nominated by leaders and ratified by farmers	Elected by competition
WID	50%	25%	25%
QID	75%	25%	
WUA	62.5%	25%	12.5%

Traditionally, the collective managers who are responsible for water related issues are also village leaders. In theory WUA managers should not also be village leaders, but our sample data shows that 88% of WUA's managers are village leaders (Table D.18 row 1). Given the appointment process for WUA managers, it is evident that village leaders still controlled the water management in most WUA, at least in short term. When we asked local leaders why village leaders are also WUA leaders, the response is that village leaders are more experienced in water management than common farmers. It seems a necessary period shifting from village leader to farmers. Many leaders told us that in the long term, farmers will finally become the WUA managers as their technical ability improves. There is no specific programme for involving the farmers, but they are expected to learn from their experience.

The managers of WUAs and collectives are similar in many respects – they are about 44 to 45 year old, they all have 9 years' education and 7 years' experience on water management. They are mostly engaged in non-agricultural activities – a slightly higher proportion of collective have an off-farm income, but the WUA's leaders earn more money (Table D.18 row 6). The average farmers' annual income in the sample areas is 800-3000 yuan, but managers of both WUA and collective's have a non-agricultural income alone of more than 3000 yuan, so it seems clear that their income level is higher than common farmers.

Table D.18: Water managers' characteristics

	WUA	Collective
Share of managers being village leaders (%)	88	100
Share of managers being farmers (%)	100	100
Age of managers (year)	45	44
Education of managers (year)	9	9
Year of water management (year)	7	7
Share of managers with non-agricultural job (%)	75	94
Non-agricultural income of managers (yuan)	3,525	3,070

As well as the key manager, both WUA and collective have a management commettee or board. On average, the board of a WUA is composed of 10 members, which is more than the number of members of collective (Table D.19, row 1). More board members of WUAs may suggest that water management has been more paid attention after reform. Since fewer village leaders are included in water management of WUAs than collective, there are fewer board members with water management experience in WUA than in the collective: 56% of members have water management experience versus 71% in collective (rows 2 to 4).

Table D.19: Characteristics of board members of water management, 2001

	WUA	Collective
Average number of management committee	10	6
Share of management committee with canal management experience (%)	56	71
Share of management committee being village leaders before (%)	47	64
Share of management committee being village leaders now (%)	54	100
Share of management committee being educated (%)	100	97

D.4.3 Incentive, Governance and Farmers' participation

Based on the composition of the management team of the WUA, there are many aspects of WUA that make them difficult to distinguish from collectively managed water management systems. The main difference between the WUA managed system and a collective managed system in the short run appears to be the nature of the incentives faced by the village leadership. In both collectively managed systems and (most) WUA managed systems, village leaders carry out the day to day and the longer term management responsibilities for water allocation. In most WUAs, however, there is a clearly defined compensation system that often is performance-based. By contrast in a collectively managed system, village leaders and those they hired to do the work, were paid (at most) a fixed wage. In the WUA system, compensation schemes are set up to elicit better incentives and to achieve certain goals (often water saving or efficiency raising).

Although policy makers designed the incentive mechanism, not all the WUA can effectively implement this policy. Our survey shows that only 25 percent of WUA managers understand the incentive system to earn money by saving water (Table D.20, column 1). Even if they understand the incentive system they might not be able to take advantage of it, if they were faced by an inability to save water without compromising farmers, as they could not change water management practicies. Elsewhere, although there was a nominal shift in institution, managers of WUAs with poor or no incentive are very similar to village leaders in the traditional, collectively-managed systems.

Another difference between WUA and collective is the system of rules and regulations. Unlike in collective management, 38 percent of WUAs made their water management regulations to guide their management, such as regulation of each member's responsibility in water management, water fee collection, water allocation among farmers (Table D.20, column 2). These regulations are generally modified from those provided by the upper governments' guidance regulation. Although we are not sure how much role these regulations have played in improving water management, at least from the point of view of a management framework, it is an advance to have some formal regulations covering water-related issues.

Having a complete and independent financial system is an important requirement for WUAs. However, based our survey showed that few WUAs have such a system and indicated that their

financial systems are combined with village's financial system. Under such system, it is hard to differentiate the responsibilities between village and WUAs, and managers of WUAs have insufficient incentive to improve water management under such financial conditions. Until now, only 25 percent of WUAs indicate that they have independent financial system (Table D.20, column 3).

Table D.20: Financial incentives and governance of Water User Associations

	Having good incentive (%)	Having regulations (%)	Having independent financial system (%)
WID	25	0	25
QID	25	75	25
WUA	25	37.5	25

Traditionally, the implementation of many government services in China is carried out from the top down with little consultation with or participation of farmers – even though collectively-managed services (such as those provided by collectively run water organizations) are supposed to be determined by the entire collective. In fact, village leaders manage their villages largely on the basis of authority derived from above. We found that farmers participated little in collectively-run water management organizations.

Table D.21: Farmers' participation in water management

	Proportion of WUAs which hold regular meetings (%)	Proportion of WUAs that hold meetings which farmers are invited to (%)	Proportion of farmers participating in the meeting (%)
WID	50	0	
QID	100	50	12
WUA	75	25	6

In part because of a perception that traditional organizations had failed to deliver water in a timely and efficient fashion, the government instituted the process of reform that led to the emergence of the WUAs as an alternative way to manage water,. The reforms that led to the creation of WUA's explicitly attempted to make farmer participation part of the system. The idea was to make every farmer a member of a *bonafide* organization over which they would have the power to appoint the managers and set up the rules. However, there is little evidence that true farmer participation is occurring yet. Based on our field survey data, 75% of WUAs hold regular meetings and 25% will invite farmers' representatives to participate. However, only 6% of farmers in these 25% of WUAs actually participate (Table D.21).

D.4.4 Water Allocation to the village

The total volume of water used in the sample villages is presented in Table D.22. This also shows the location of the village in the canal system and cropping intensity as well as the management system as these are key factors influencing water use per unit area. The amount supplied to the village is controlled by the water management station, although this is negotiated and agreed with village/WUA. We will discuss later (in section D.5.2) the incentives that are needed to ensure that the WUA agrees to reduce the amount allocated and delivered to the village.

The highest water use per unit area is in a village at the tail of each system – this is rather surprising but is possibly because there is uncontrolled excess water. Both cases are managed by collectives. Rice is not grown at the tail of QID and with the exception of one village, these villages used less water than those where rice is grown as would be expected on average the non rice-growing villages used 70% of the water per unit area sown, as compared to rice-growing villages.

Rice is more widely grown in WID (which is further upstream along the Yellow River) so it is less valid to compare rice and non rice-growing villages with this limited data – only one village does not grow rice and interestingly it is located at the head of the system but it does have a low water consumption (60% of the rice-growing villages). Location is the most striking determinant of water use here – at the head they use 13-15,000 m^3/ha, whereas at the tail they use 25-29,000 m^3/ha

Table D.22: Management system, crop intensity and water use in sample village

Irrigation District	**Village**	Management type	Area cultivated	Crop intensity	Location in system	rice intensity	**water use**	
		WUA/Col/Cntr			hd/mid/tail		village (m3)	m3/ha crop
WID-N	V313	W	110	136%	h	33%	2,015,100	13,434
WID-N	V321	W	147	154%	t	39%	6,094,749	26,857
WID-N	V322	W	200	115%	t	53%	5,762,650	25,055
WID-N	V324	W	195	175%	t	18%	9,829,628	28,736
WID-N	V314	Cl	167	120%	h	0%	3,041,200	15,206
WID-N	V323	Cl	221	287%	t	19%	19,016,793	30,074
WID-N	V311	Ct	81	229%	h	35%		
WID-N	V312	Ct	180	163%	h	26%		
total - WID			1,301	174%		27%	45,760,119	
average - WID			163					25,689
total - WID/wua			652	145%		36%	23,702,126	
average - WID/wua			163					24,976
total - WID/collective			388	215%		11%	22,057,993	
average - WID/collective			194					26,501
total - WID/contract			261	183%		29%		
average - WID/contract			130					
QID-N	V333	W	266	150%	h	26%	7,328,000	18,320
QID-N	V335	W	95	154%	h	30%	3,310,888	22,668
QID-N	V351	W	168	134%	t	0%	1,799,173	8,007
QID-N	V358	W	400	119%	t	0%	5,511,735	11,555
QID-N	V332	Cl	247	163%	h	32%	8,576,243	21,281
QID-N	V336	Cl	136	170%	h	39%	3,364,053	14,563
QID-N	V337	Cl	90	134%	h	50%	1,826,011	15,091
QID-N	V338	Cl	87	175%	h	27%	2,440,503	15,951
QID-N	V342	Cl	385	171%	m	10%	16,681,616	25,352
QID-N	V347	Cl	152	148%	m	0%	2,834,944	12,656
QID-N	V352	Cl	188	170%	t	0%	3,144,603	9,868
QID-N	V353	Cl	200	150%	t	0%	2,131,055	7,113
QID-N	V354	Cl	143	148%	t	0%	6,859,096	32,559
QID-N	V331	Ct	197	197%	h	27%		
QID-N	V334	Ct	76	117%	h	70%		
QID-N	V335	Ct	141	154%	h	30%		
QID-N	V341	Ct	305	150%	m	58%		
QID-N	V343	Ct	287	146%	m	43%		
QID-N	V344	Ct	553	113%	m	27%		
QID-N	V345	Ct	300	125%	m	22%		

Irrigation District	Village	Management type	Area cultivated	Crop intensity	Location in system	rice intensity	water use	
		WUA/Col/Cntr			hd/mid/tail		village (m3)	m3/ha crop
QID-N	V346	Ct	297	173%	m	65%		
QID-N	V348	Ct	347	160%	m	12%		
QID-N	V351	Ct	267	134%	t	5%		
QID-N	V355	Ct	281	129%	t	71%		
QID-N	V356	Ct	330	172%	t	97%		
QID-N	V357	Ct	155	101%	t	6%		
total - QID			6,092	147%		29%	65,807,919	
average - QID			234					17,019
total - QID/wua			929	134%		11%	17,949,796	
average - QID/wua			232					14,386
total - QID/collective			1,628	161%		15%	47,858,123	
average - QID/collective			181					18,274
total - QID/contract			3,536			41%		
average - QID/contract			272					
Total - all villages			7,393					
Total - WUA			1,581					
Total - collective			2,016					
Total - contract			3,797					

D.4.5 Water allocation and use within the village/WUA

WUAs are responsible for water allocation at the tertiary canal level, within the village or WUA. During our survey, we identified four kinds of water allocation approaches, which we term equity, efficiency, payment capacity, and *ad hoc* (no rule). The way by which each village decides to allocate water has evolved due to a complex set of characteristics of the village, the nature of its water resources and the local cropping patterns. Explaining why a certain village allocates water in a certain way is beyond the scope of this report. Instead, what we are able to do is to describe the fundamental characteristics of the allocation rules and examine how many villages have adopted the different approaches.

Equity allocation means that water resources are equally allocated to all water users along the canal. The implication of such a rule is that it allows the poor and other vulnerable groups to get access to water. In practice, rules are often promulgated to provide water to those farmers at the end of the canals first, and those nearest last. In our sample, we find that 13 percent of villages use this method of water allocation.

In contrast, the efficiency criterion is adopted in other villages. According to this criterion, village water managers irrigate as the water flows into the canal. When the nearest fields are irrigated first, it is the physically most efficient way to allocate water. Despite the emphasis of IDs on equity, a much greater number of villages (70 percent) claim they use the efficiency method of water allocation (it may, however, still be equitable if there is sufficient water to reach the tail farmers).

According to the first come / first serve method, villages are supposed to provide water to those that ask for it first. We found no villages operate this way, but we did find that 2% provide water on a first pay, first serve basis. Farmers (in all cases) need to pay part of water fee before irrigation, but in these villages they will be given priority if they pay the entire water fee before irrigation.

In the remaining villages (15%), there are no established rules.

D.4.6 Agricultural Water Pricing and Collection

Under the central government influence on water pricing policy, agricultural water prices in Ningxia (as in most regions) have risen over time, and this trend in prices has accelerated since 1990. For example, volumetric water price in Ningxia Province increased from 0.002 yuan per cubic meter in 1989 to 0.012 yuan per cubic meter in 2001 – by a factor of six (Table D.23, column 1). Clearly as leaders have begun to better understand markets and farmer response to price signals, their willingness to raise prices to encourage the more efficient use of water has risen. However, price is probably still a small factor in total water use since the actual change in water use has been small comared to the increase in unit cost of water (see table D.23).

Table D.23: Water prices in gravity irrigation systems in Ningxia, 1981 to 2000.

Year	In current prices			In real prices (2000 prices)		
	Volumetric price (yuan/m^3)		Basic fee (yuan/ha)	Volumetric price (yuan/m^3)		Basic fee (yuan/ha)
	Within quota	>30% over quota		Within quota	>30% over quota	
1981	0.0005	\	15	0.002	\	56.4
1983	0.001	NA	15	0.004	NA	54.2
1989	0.002	NA	21	0.004	NA	41.7
1994	0.006	0.010	37.5	0.008	0.013	47.5
2000	0.012	0.017	60	0.012	0.017	60.0

Data source: Ningxia Water Resources Bureau (2000)

Measuring water use by a large number of small farmers is a problem in all countries. Early in the 1980s, in order to improve the water use efficiency, China's government has begun to encourage local governments to adopt the volumetric water pricing approaches (Ministry of Water Resources,2002). However, due to high transaction costs and rigorous requirement on the measurement facilities, this policy has not been implemented in most provinces, especially at the farmgate.

With the inherent difficulties involved with pricing water volumetrically, a number of ways have emerged in the Yellow River Basin to price agricultural water. For example, since 1983, in both the Ningxia IDs, officials implemented a volumetric water pricing policy and set up a two-tier water pricing system. The first part is volumetric water price measured at outlets of the main or branch canals and is set at a level that is supposed to cover the variable costs associated with the supply of water. The second part, the basic water fee, is set at a level that is equal to the value of the labor required for canal maintenance. The first part of water fee is mainly used to cover the salaries of the ID staff and for other expenses associated with the operation and maintenance of the main and branch canals; the second part is mainly used to pay the wages of those hired to maintain the canals.

When setting water fees before 2000, Ningxia provincial level officials did not include a part to cover the maintenance of the system's tertiary canals. At that time tertiary canal O&M expenditures mainly came from the budgetary allocations of local governments and from the water fees collected by the leaders of the collectives directly from the farmers. However, this part of the maintenance fees depended on the financial strength of local governments. In the case of many poor areas that were chronically in deficit, such work was often delayed or completely ignored. As a result, the canals were not always well-maintained.

In 2000, however, the structure of water pricing was changed to address the problem of China's deteriorating infrastructure, especially in tertiary canals. To do so, officials allowed local government officials to raise the basic water fee to include an additional part (albeit with some limits placed on the magnitude of the fee increase - maintenance and water management fees could not exceed 90 yuan per hectare). This new fee was shared between the County Water Resources Bureaus (40%) and the Township Water Management Stations (60% of which 6 percent is to be returned to WUAs) The collection of the additional fees was designed not only to improve the O&M of the tertiary canals (from that part collected by the township water management station), but also was supposed to be used to promote the water management reforms that were scheduled to be implemented in 2001.

In order to reduce the waste of water resources, Ningxia provincial officials also have gradually adopted a progressively priced water pricing structure since 1983. Under this system, when water is used in excess of a certain amount for a certain type of crop or in a certain area, a higher price in charged for the water used in excess of the standard. Initially, however, the use of progressive pricing was scattered and not implemented regularly. In 1994, however, a series of policy measures clarified the policy and the government began to encourage its use. Regulations stipulated that if water use exceeded the quota by more than 30 percent, the volumetric water price would increase by 67 percent, from 0.006 yuan/m^3 to 0.01 yuan/m^3. The quota and above quota prices were raised to 0.012 yuan/m^3 and 0.017 yuan/m^3 in 2000 - the above quota prices are thus 42 percent more than quota prices (Table D.23).

At the farm level, water is most frequently priced on the basis of total area irrigated. In our sample all WUAs calculated fees on an area basis, without distinguishing between the types of crop grown. The fee per unit area is however calculated on the basis of historic water use by the village/WUA and thus it does vary between villages. Villages where there is a large area of high water-demand crops, such as rice, will pay a higher fee than those villages where there is less rice grown. Within the village/WUA farmers all pay at the same rate per unit area, regardless of crop type. Our survey showed that on the average, WUAs will collect 38 yuan per mu or 576 yuan per hectare, although this is rather more than the data in Table D.23 and Table D.29 would indicate is required (Y60+Y0.012/m^3 x 15-25,000 m^3/ha = 240-360 yuan / ha). The data appears to be a little inconsistent, with some villages apparently collecting more than the amount due.

Table D.24: Failure of water fee collection

Manage-ment type	Nos	Villages coll-ecting 100% of fees (%)	Worst collection rate (%)	Approaches to deal with (%)			
				Stop delivery	Do nothing	Go to court	Village pay
WUA	8	62.5%	71%	14	57	29	0
Collective	11	45%	59%	7	79	7	7

One of the major problems facing water management in China's villages is the difficulty of collecting water fees – even though the majority of villages collect all (or even more than) the assessed fee. As tax and fee collection regulations have become stricter (in essence, limiting the amount and way that village leaders collect fees from farmers), collecting water fee has become an increasing burden of village leaders, especially when they manage water collectively.

Despite the figures given in Table D.23, the aggregate collection rate is very similar between WUAs and collective management (as can be deduced from the figures in Table D.26) even though it is thought WUA should improve water fee collection. The aggregates suggest that both types of

managers collect more than 100% of assessed fees, but this may be due to surprising data for two villages which apparently collect very much more than the assessed. If these are excluded, then the total amount collected is about 92%. This maybe suggests that management of WUAs is not much more efficient than in collectives. Although the water fee collection rate has not been changed much with reform, the approaches adopted to deal with failure of water fee collection have changed in certain degree. 79% of collective leader do not take any actions to deal with non-payment, but WUAs are much more likely to take punitive action (stopping water or going to court) (Table D.24).

When villagers do not pay, some villages draw on their general funds, borrow from local enterprises or individuals or take a loan from the bank or local rural credit cooperative in order to meet the village's obligation to the ID (which is required if the village wants to get water deliveries in the next period). To service the interest on the loan, however, leaders frequently must add the interest payments onto the farmer's water charge, an action that invariably leads to higher water fees and more complaints by farmers. Our field survey shows that 7 percent of collectively-managed villages will pay for water fee by this approach when they cannot collect water fee successfully. We did not find any cases where the WUA will pay water fee for those farmers that cannot pay for them.

WUAs would like to take stronger action than collectives to ensure that farmers do pay. Based on our survey, 14 percent of WUAs' managers reported that if farmers cannot pay water fee, they would stop their water delivery, and 29 percent of WUAs said that they would go to court. We did not find specific evidence of actually going to court, but they do stop water delivery. The different attitude between WUAs and collective managers on this issue may reflect the different incentives for them to collect water fee.

Conversations with farmers and leaders in the field survey show that the problem is complicated. From the farmers' point of view, their unwillingness to pay is mostly due to financial inability, low agricultural returns and poor water delivery services. The canal managers recognise the farmers' low returns, but they do not feel that farmers deserve any special service since they are so reluctant to pay for water (and require great amount of effort on the part of the managers – who get little compensation for this effort).

D.4.7 Income, Expenditure and Profit of Water User Associations

The size of the sample and the large variability in income, expenditure and profit makes it difficult to draw general conclusions, we can draw some inferences from the data but these should be treated with caution.

The WUAs in our sample collected more funds than the collectives, but this is because of their larger area. Both depended entirely on water fee collection and do not have any income from other sources. The fee collected per unit area is 576 yuan per hectare for WUAs, marginally higher than the figure for collectives (562 yuan per hectare) – this is not a significant difference, given the very large range (250 to 510 yuan/ha for WUAs and 190 to 800 yuan/ha for collectives).

Since WUA managers can earn more money by saving water and thus they may invest in O&M in order to reduce water use and improve overall water management – and thereby benefit more as a result of the incentive structure. Analyzing the component of expenditure of WUA reveals that the WUA puts 22 percent of the water fee into the O&M activities, such as hiring labor, buying some materials for maintenance, administration and others (Table D.25), leaving 6% as profit – including the incentive for the managers (Table D.26). It is interesting to find, there is little difference in

maintence expenditure per hectare between WUA and collective, but the operating cost for WUA is more than three times of that for collective. It suggests that hiring workers to improve operation is an important measure that WUA can take to improve water management. Collective managers need to submit higher share of their income (90% rather than 70% for WUAs) to the irrigation district which limits the resources available for O&M, although the reason for this is not clear[230]. Although receiving little financial incentive and in face of farmers' pressure, collective leaders will have to borrow or transfer some money from other sources to keep the daily operation going.

Table D.25: Income, expenditure for water managers, 2001

Type	ID	Nos	Avg area (ha)	Fees recd. (yuan/ha)	Expenditure (yuan/ha)			Profit (yuan/ha)
					To ID	Operation	Maint.	
WUA	WID	4	163	647	538	32	39	38
	QID	4	232	526	307	167	17	35
	All	**8**	**198**	**576**	**402**	**111**	**26**	**36**
Collective	WID	2	194	864	797	91	106	-130
	QID	9	181	490	428	25	6	31
	All	**11**	**183**	**562**	**499**	**38**	**25**	**0**
All	All	19	189	568	456	70	26	16

Despite the fact that WUAs have spent more on O&M (with the exception of one collective in WID – see Table D.26), they still can earn more than 7,000 yuan per year; while collective make a negligible profit. Among the profit of WUAs, 42 percent was allocated to managers, 20 percent was submitted to village collective; the rest of 39 percent of profit was kept for future O&M requirement. There is a very small profit in the case of collective management, but this is kept by collective for future O&M. The village leaders do not get any of this benefit, giving them no incentive to improve water management. There is a very large range in profits (from -197 to +131 Y/ha for collectives and from -69 to +155 Y/ha for WUAs). We do not have sufficient information on the details of the income and expenditure to identify the reasons for this. Curiously, the maximum (+155 Y/ha) and minimum (-197 Y/ha) profits were achieved by villages/WUAs with the two highest expenditures on O&M.

Table D.26: Profit for water managers, 2001

	Total (yuan/ha)	Allocation of profit (%)		
		Managers	Village collective	Keep for future maintenance
WUA	36	42	20	39
Collective	0.3	-	100	-

Seven of 13 collectives and three of the 8 WUAs made a loss. There is a large variation in all items which can result in a profit or loss, as can be seen in Table D.26. The profit expressed as percent of fee ranges from +25% to -25%. The amount spent on maintenance ranged from 0 to 20% of fees, with all but four spending less than 5% – there does not appear to be any relationship between expenditure and length of canals. Operation costs are generally higher, and range up to 55% of fees. Curiously the one with the highest operation costs also had highest profit, but this was because they made the lowest payment to ID. There is no correlation between profit and water use (see Tables D22 and D27).

[230] the figures for amounts paid to ID are given in Table D.26, from which it can be seen that these figures are very variable and the averages are strongly influenced by a small number of villages.

Table D.27: Financial status of WUAs and Collectives

ID	Village	Type	Land Area (ha)	Fee due (Y/ha)	Fee recd. (Y/ha)	Paid to ID (Y/ha)	Operation costs (Y/ha)	Maintenance costs (Y/ha)	Profit (Y/ha)
WID	V313	WUA	110	345	345	270	35	0	40
WID	V321	WUA	147	747	869	764	88	37	-21
WID	V322	WUA	200	747	550	495	20	16	19
WID	V324	WUA	195	750	750	563	0	87	100
WID	V314	Coll	167	128	956	937	24	36	-41
WID	V323	Coll	221	750	795	692	143	159	-197
QID	V333	WUA	266	593	421	421	68	0	-68
QID	V335	WUA	95	525	671	662	8	0	0
QID	V351	WUA	168	446	402	447	12	13	-69
QID	V358	WUA	400	135	613	88	335	34	155
QID	V332	Coll	247	633	546	543	39	12	-48
QID	V336	Coll	136	556	555	555	36	16	-53
QID	V337	Coll	90	435	255	255	0	40	-40
QID	V338	Coll	87	495	411	382	35	0	-5
QID	V342	Coll	385	570	585	403	51	0	131
QID	V347	Coll	152	525	501	501	5	0	-5
QID	V352	Coll	188	540	318	239	8	7	64
QID	V353	Coll	200	491	499	472	0	0	27
QID	V354	Coll	143	491	472	419	5	0	48

D.5 Impact of Water User Associations on Water Use, Output and Income

D.5.1 Comparison of opinions on WUA and Collective Management

Compared with collective, farmers consider that WUAs have several advantages in improving water use efficiency and irrigation service and in reducing farmers' burden (Table D.28). These opinions are slightly at odds with the data presented elsewhere (water use in Table D.29 and Table D.31 and fee collection in Section D.4.7 and Table D.24). In addition, 75% of farmers believed that WUA were able to improve irrigation timing.

Table D.28: Advantage comparison of Water User Associations with collective, 2001

Benefit	% of farmers reporting benefit
Save water	100
Reduce water fee	88
Irrigate in time	75
High rate of water fee collection	50

D.5.2 Crop Water Use and WUAs

Although the main objective of water management reform is to save water, our data show that while water use in some areas that have established WUAs is lower than those areas still under collective management, it is not always true (Table D.29). For example, in QID, the water use per hectare in WUA areas is lower than in collective-managed areas but the opposite is true in WID. However, the changes are fairly small and probably less than inaccuracies in flow measurement (which are perhaps within 10%). The sample size is also small and there many other factors which influence water use, particularly crop type as the difference in water use between rice and other grains is very large.

Table D.29: Relationship between surface water management and crop water use in the sample irrigation districts, 2001

		Nos	Water use (m^3/ha)
WID	Collective	2	26,501
	WUA	4	24,976
QID	Collective	9	18,274
	WUA	4	14,385

Table D.30: Relationship between surface water management and crop water use in rice growing areas in the sample irrigation districts, 2001

		Nos	Water use (m^3/ha)
WID	Collective	1	30,074
	WUA	4	24,976
QID	Collective	5	21,002
	WUA	2	19,483

These gross figures of water use underline the importance of good implemention of policy. WUAs at WID in this sample were all able to use less water than the very large quantities used by collectives. The performance of WUAs and collectives at QID reveals a neglible difference on average. We need to examine further the incentives that the WUA has to reduce water use. Good incentives enable the WUAs at QID to reduce water use by 30% and thereby maximise the profit they can earn for themselves. The importance of incentives in making reform work is shown clearly when examining water use in those villages that provided their water managers with strong incentives versus those in which managers faced poorer or no incentives (Table D.31).

The variable water use reflects the variable management ability of village leaders and canal managers, and the condition of canals which all affect whether the village will take advantage of the incentives. It should be noted that this is a small sample of WUAs with only one WUA with good incentives and three with poor incentives in both cases. There is a large variation and many factors influence water use. The two WUAs with good incentives are larger and have a lower cropping intensity (115-120%) than those with poor incentives (134-175%), but the one in WID has the highest intensity of rice cultivation which may be reflected in the higher water use than the poor incentive WUAs. One WUA with poor incentives in WID is able to collect high fees and make a good profit despite high water use. This WUA apparently spends nothing on operation costs suggesting that it is either a very simple system to operate, farmers are particularly active or the WUA account for operating expenses in a slightly different way.

Table D.31: Relationship between incentive mechanism and crop water use in the sample irrigation districts, 2001

WUA	Crop water use (m^3/ha crop)	
	Good incentives	Poor incentives
WID	25,055	24,951
QID	11,555	16,137
Whole sample	15,947	20,391

The profit that a WUA is able to make is not easy to relate to the incentives – partly because the sample is small, but there are many factors influencing profit as well as water use and it is very variable. The profit is 10% of revenue on average, but with a range of (-24% to +30%). Comparative figures are presented in Table D.32. The very high profit achieved in QID is partly due to the very low fee paid to the ID, although this is offset by high operating costs – the reasons for these unusual figures are not entirely clear.

Table D.32: Relationship between incentive mechanism and WUA profit in the sample irrigation districts, 2001

WUA	WUA profit (yuan/ha land)	
	Good incentives	Poor incentives
WID	19	50
QID	155	-56
Whole sample	110	-5

D.5.3 Output, Income and WUAs

Although water management reform, at least when implemented as designed, should lead to water saving and meet the primary goal of water sector officials, it is possible that the success from such a policy would only come at a cost, in terms of falling production, lower income or increased poverty. In this section, we first examine how water management affects agricultural production and then we relate this to income.

There appears to be little relationship between yield and management type at WID, except for maize which has a 10% lower yield in the WUAs. Yields at QID are generally higher for areas under WUA management rather than under collective management. (Table D.33).

Table D.33: Relationship between water management and crop yield in the sampled irrigation districts, 2001

		Crop yield (Kg/ha)		
		Wheat	Maize	Paddy
WID	Collective	4,547	5,750	6,750
	WUA	4,590	5,141	6,798
QID	Collective	4,623	5,415	7,480
	WUA	4,738	6,667	8,125

Comparison of the data on farm and total income under the two types of management (Table D.34) shows a slightly different picture – despite the lower yields in WID WUAs their crop income is higher than in collectives. The higher yields in QID WUAs are, however, not reflected in higher incomes. This could be due to differences in input use and other production costs. This data confirms the importance of non-farm income which accounts for about 40% of total income in these villages.

Table D.34: Relationship between water management, income and poverty in the sample irrigation districts, 2001

		Income	Cropping income
		(yuan)	(yuan)
WID	Collective	1,660	996
	WUA	1,883	1,139
QID	Collective	2,178	1,225
	WUA	2,490	1,215

D.6 Conclusions

In this appendix, we have sought to understand the evolution, governance and impacts of the reform of surface water management systems, through the introduction of WUAs since 1990. We have shown that traditional collective management has been replaced by WUAs and other forms of management since 1990. In some regions, WUAs have become the dominant pattern, reflecting many stakeholders' interests, including upper and local governments as well as village leaders. The reform has been well-designed, but implementation of the reform needs further emphasis.

A major difference between WUAs and collectives is in the incentives faced by managers. Under similar physical conditions, managers will try to improve water management and reduce crop water use if they are provided with a strong incentive to earn money by saving water, This can be achieved by establishing WUAs – but if they are set up in an appropriate way. If, however, the WUA is formed in a way which gives the manager a poor financial incentive, the difference between WUAs and collective is not significant.

Our study showed that WUAs set up with good incentives can reduce crop water use, by managing water actively according to meet the crop needs. If the incentives are not right, water may be delivered even when the land does not need water.

This is a preliminary study, but it does confirm that WUAs can have significant beneficial impact on water management and water use. The study also highlights areas which need particular attention when setting up WUAs. These include:

- Ensuring that WUA managers have a good financial incentive to improve management
- Recruitment of strong leaders, committed to the reform programme
- Ensuring that sound operating procedures are developed and implemented, with sufficient staff, so that water is distributed as planned

References:

China Irrigation District Association, 2002. Participatory Irrigation Management: Management Pattern Reform of State-owned Irrigation District. http//www.hwcc.com.cn.

Huang, Weibing, 2001. Reform Irrigation Management System, Realizing Economic Independency of Irrigation District, Participatory Irrigation Management: Innovation and Development of Irrigation System, Edited by Lixin Nian, China Water Resources and Hydropower Publishing House, Beijing, China.

Ningxia Statistical Bureau,2000. Ningxia Statistical Yearbook, Publishing House of Ningxia Statistical Bureau, Yincuan.

Ma, Zurong, 2001. Deepening Reform of Farmer Managed Irrigation System, Promoting Sustainable Development of Irrigation District, Participatory Irrigation Management: Innovation and Development of Irrigation System, Edited by Lixin Nian, China Water Resources and Hydropower Publishing House, Beijing, China.

Management Authority of Shaoshan Irrigation District, 2002. Positively Promoting Reform Based on Practices of Irrigation District, Obtaining Achievement of Both Management and Efficiency, http//www.hwcc.com.cn

Annex D.1

No.	Irrigation District	Village	Basic Data					Agriculture										Average income (Y/capita)		Total income		Physical condition				Water			
			Management type	Area cultivated	Sown area	Population	Location in canal system	Crop area (ha)						Yields (kg/ha)								canal density (m/ha)	Gate condition	Silt	Weed	water shortage	water use		water quality
			WUA/ Collect/ Contract				head / mid / tail	wheat	maize	rice	other grain	cash	total	wheat	maize	rice	other	Agric.	Non-agric.				good / poor	none/some/serious	none/some/serious		village	per ha	good / common / bad
			W / Cl / Ct	ha	ha		h / m / t																g / p	n / so / sr	n / so / sr	y / n	m3	m3/ha	g/c/b
1	WID-N	V313	W	110	150	1,174	h	32	29	37	23	30	150	6,000	7,500	10,500		1,046	1,134		1,228,474	1,330,846	47	g	sr	so	n	2,015,100	13,434	b
2	WID-N	V321	W	147	227	847	t	74	40	58	3	53	227	5,250	6,000	6,750		1,320	330		1,118,040	279,510	16	g	so	so	n	6,094,749	26,857	g
3	WID-N	V322	W	200	230	1,069	t	53	47	107	0	23	230	3,000	6,000	6,750		1,190	510		1,272,110	545,190	7	g	so	sr	n	5,762,650	25,055	b
4	WID-N	V324	W	195	342	2,900	t	147	147	35	0	13	342	4,875	6,750	9,000		1,000	1,000		2,900,000	2,900,000	6	g	n	n	n	9,829,628	28,736	g
5	WID-N	V314	Cl	167	200	1,005	h	43	36	0	58	63	200	5,250	6,000			492	328		494,460	329,640	32	g	so	n	y	3,041,200	15,206	g
6	WID-N	V323	Cl	221	632	2,620	t	153	153	43	96	187	632	6,000	7,500	8,250		1,500	1,000		3,930,000	2,620,000	5	p	sr	sr	n	19,016,793	30,074	g
7	WID-N	V311	Ct	81	184	558	h	81	41	29	17	17	184	5,250	6,750	5,250		980	20		546,840	11,160					n			c
8	WID-N	V312	Ct	180	293	2,980	h	113	113	47	-	20	293	5,250	6,300	7,500		480	720		1,430,400	2,145,600					n			c
																		1,001	630	61%									
	total - WID			1,301	2,259	13,153		696	605	354	197	406	2259								12,920,324	10,161,946						45,760,119		
	average - WID			163	282	1,644		87	76	44	25	51	282	5,109	6,600	7,714		982	773	56%	982	773	16						25,689	
								31%	27%	16%	9%	18%																		
	total - WID/wua			652	949	5,990		306	262	236	26	119	949								6,518,624	5,055,546						23,702,126		
	average - WID/wua			163	237	1,498		76	65	59	7	30	237	4,781	6,563	8,250		1,088	844		1,088	844	15						24,976	
								32%	28%	25%	3%	13%																		
	total - WID/collective			388	832	3,625		197	189	43	154	250	833								4,424,460	2,949,640						22,057,993		
	average - WID/collective			194	416	1,813		98	95	21	77	125	416	5,625	6,750	8,250		1,221	814		1,221	814	16						26,501	
								24%	23%	5%	18%	30%																		
	total - WID/contract			261	478	3,538		194	154	75	17	37	477								1,977,240	2,156,760								
	average - WID/contract			130	239	1,769		97	77	38	9	19	239	5,250	6,525	6,375		559	610		559	610								
								41%	18%	9%	2%	4%																		
9	QID-N	V333	W	266	400	1,885	h	128	126	70	8	68	400	5,250	7,500	9,000		1,206	804		2,273,310	1,515,540	13	g	so	sr	y	7,328,000	18,320	c
10	QID-N	V335	W	95	146	793	h	54	29	29	23	13	146	4,500	6,750	7,500		2,100	700		1,664,481	554,827	21	g	sr	sr	n	3,310,888	22,668	c
11	QID-N	V351	W	168	225	1,466	t	101	63	0	11	50	225	4,500	6,000			1,018	833		1,491,665	1,220,453	43	g	so	so	n	1,799,173	8,007	b
12	QID-N	V358	W	400	477	2,680	t	200	133	0	61	83	477	3,900	6,750			660	2,640		1,768,800	7,075,200	8	g	sr	so	n	5,511,735	11,555	g
13	QID-N	V332	Cl	247	403	1,758	h	120	117	80	0	86	403	5,250	6,000	9,000		1,400	1,400		2,461,200	2,461,200	26	g	n	n	n	8,576,243	21,281	g
14	QID-N	V336	Cl	136	231	829	h	53	65	53	57	3	231	8,250	6,000	7,500		945	405		783,405	335,745	12	g	so	so	y	3,364,053	14,563	c
15	QID-N	V337	Cl	90	121	2,076	h	33	30	45	1	12	121	6,750	6,000	7,650		1,296	1,404		2,690,496	2,914,704	20	g	so	so	n	1,826,011	15,091	b
16	QID-N	V338	Cl	87	153	1,538	h	23	52	23	43	11	153	6,000	6,000	6,000		512	2,048		787,456	3,149,824	27	g	sr	sr	n	2,440,503	15,951	b
17	QID-N	V342	Cl	385	658	2,448	m	200	200	38	69	151	658	5,250	9,000	7,500		2,682	298		6,565,536	729,504	12	g	sr	so	n	16,681,616	25,352	g
18	QID-N	V347	Cl	152	224	1,081	m	110	73	0	20	21	224	4,500	5,250			798	415		862,804	448,449	20	g	sr	n	n	2,834,944	12,656	c
19	QID-N	V352	Cl	188	319	1,246	t	112	110	0	47	50	319	5,625	8,250			1,170	330		1,457,820	411,180	37	g	sr	so	n	3,144,603	9,868	c
20	QID-N	V353	Cl	200	300	1,426	t	123	113	0	21	43	300	6,030	6,000			1,625	875		2,317,250	1,247,750	33	g	so	n	y	2,131,055	7,113	c
21	QID-N	V354	Cl	143	211	1,267	t	97	83	0	16	15	211	4,125	4,500			600	1,400		760,200	1,773,800	37	g	sr	so	n	6,859,096	32,559	b
22	QID-N	V331	Ct	197	387	1,206	h	140	120	53	67	7	387	4,125	4,500	6,375		1,647	1,193		1,986,523	1,438,517					n			g
23	QID-N	V334	Ct	76	88	1,938	h	13	13	53		8	88	4,500	6,000	7,500		850	850		1,647,300	1,647,300					n			b
24	QID-N	V335	Ct	141	218	1,183	h	80	43	43	34	19	218	4,500	7,500	6,750		2,100	700		2,484,300	828,100					n			c
25	QID-N	V341	Ct	305	456	1,701	m	61	173	177	5	40	456	7,500	3,750	6,000		1,600	400		2,721,600	680,400					n			g
26	QID-N	V343	Ct	287	419	1,266	m	147	147	125	1	-	419	4,500	5,250	7,200		1,120	280		1,417,920	354,480					y			c
27	QID-N	V344	Ct	553	624	1,861	m	267	200	147	7	4	624	4,875	3,750	4,500		1,360	240		2,530,960	446,640					y			b
28	QID-N	V345	Ct	300	375	1,456	m	133	133	67	41	1	375	6,000	4,500	5,250		1,000	-		1,456,000	-					n			b
29	QID-N	V346	Ct	297	513	1,924	m	20	213	193	-	86	513	6,000	3,750	6,000		1,440	160		2,770,560	307,840					n			b
30	QID-N	V348	Ct	347	556	1,597	m	200	200	40	1	115	556	4,500	7,500	7,500		1,278	522		2,040,966	833,634					n			c
31	QID-N	V351	Ct	267	357	2,327	t	160	100	13	4	80	357	4,500	6,000	5,625		1,018	833		2,367,723	1,937,228					n			b
32	QID-N	V355	Ct	281	362	1,656	t	81	67	200	13	1	362	4,500	4,875	6,750		2,024	506		3,351,744	837,936					y			g
33	QID-N	V356	Ct	330	569	1,153	t	116	113	320	11	9	569	3,750	3,000	6,000		1,120	280		1,291,360	322,840					y			b
34	QID-N	V357	Ct	155	157	723	t	57	33	10	18	39	157	4,650	9,750	9,375		1,424	176		1,029,552	127,248					n			b
	total - QID			6,092	8,948	40,484		2,829	2,749	1,779	578	1,015	8,951								52,980,931	33,600,338						65,807,919		
	average - QID			234	344	1,557		109	106	68	23	39	344	5,147	5,928	6,949		1,309	830	61%	1,309	830	21						17,019	
								32%	31%	20%	7%	11%																		
	total - QID/wua			929	1,248	6,824		482	351	99	102	214	1,249								7,198,256	10,366,020						17,949,796		
	average - QID/wua			232	312	1,706		121	88	25	26	54	312	4,538	6,750	8,250		1,055	1,519		1,055	1,519	17						14,386	
								39%	28%	8%	8%	17%																		
	total - QID/collective			1,628	2,619	13,669		872	843	239	274	392	2,620								18,686,167	13,472,156						47,858,123		
	average - QID/collective			181	291	1,519		97	94	27	30	44	291	5,753	6,333	7,530		1,367	986		1,367	986	24						18,274	
								33%	32%	9%	10%	15%																		
	total - QID/contract			3,536	5,082	19,991		1,475	1,555	1,441	202	409	5,082								27,096,508	9,762,162								
	average - QID/contract			272	391	1,538		113	120	111	17	31	391	4,915	5,394	6,525		1,355	488		1,355	488								
								29%	31%	28%	4%	8%																		
	Total - Ningxia			7,393	11,207	53,637		3,525	3,354	2,134	775	1,421	11,210																	
	WUA- Ningxia			1,581	2,197	12,814		788	613	335	128	333	2,198																	
	Collective - Ningxia			2,016	3,451	17,294		1,069	1,032	282	428	642	3,453																	
	contract - Ningxia			3,797	5,559	23,529		1,668	1,709	1,516	219	446	5,559																	

No.	Irrigation District	Village	WUA												Finance													
			Formation				Chairman		board members	incentive	regulations	indep. finance	records	Meetings			Total water charges collected			Combined charge		Total expenditure				Expenditure / ha cultivated			
			When formed	Why formed	How formed	Legal Status									Fee due from farmers	Total due from farmers	basic	volumetric	when	total	Y/ha crop	ID	Operation	Maintenance	Profit	ID	Operation	Maintenance	Profit
			year	1=shortage of water 2=conflict over water use 3=poort timing of water supply 4=to reduce farmers' payment 5=govt. encouragement 6=having profit by saving water	1=govt. or ID 2=coordinated b/w village and govt. 3=discussed w/in village	y / n	Appointed/ elected	Village leader	Appointed/ elected	good/poor	y / n	y / n	water/fees/area/members	any ?	who attends	Y / ha	Y	Y	Y	before / after irrigation	Y	Y/ha	Y	Y	Y	Y	Y/ha	Y/ha	Y/ha	Y/ha
							a / e	y / n	a / e	g /p	y / n	y / n	w / f / a / m	y / n	board / farmers					b / a										
1	WID-N	V313	2001	4,5	3	n	e	y	e	p	n	n	w / f / a / m	y	board	345	37,927	2,276	35,651	b	37,927	345	29,682	3,800	-	4,445	270	34.6	0	40
2	WID-N	V321	2001	5,6	2	n	e	y	a	p	n	y	w / f / a / m	n	board	747	109,809	7,661	120,026	b	127,687	563	112,307	13,000	5,400	-3,020	764	88	37	-21
3	WID-N	V322	2001	2,5	2	n	e	n	e	g	n	n	w / f / a / m	y	board	747	149,400	6,600	103,400	b	110,000	478	99,000	4,000	3,200	3,800	495	20	16	19
4	WID-N	V324	2001	5,6	1	n	a	y	a	p	n	n	w / f / a / m	n	board	750	146,550	8,793	137,757	b	146,550	428	110,000	-	17,000	19,550	563	0	87	100
5	WID-N	V314														128	21,335	9,600	150,400	b	160,000	800	156,800	4,000	6,000	-6,800	937	24	36	-41
6	WID-N	V323														750	165,500	10,532	165,008	b	175,540	278	152,609	31,450	35,000	-43,519	692	143	159	-197
7	WID-N	V311																												
8	WID-N	V312																												
	total - WID															578	630,521	45,462	712,242		757,704	425	660,398	56,250	66,600	-25,544	635	54	64	-25
	average - WID																						635	54	64	-25				
	total - WID/wua															647	443,686	25,330	396,834		422,164	445	350,989	20,800	25,600	24,775	538	32	39	38
	average - WID/wua																						538	32	39	38				
	total - WID/collective															439	186,835	20,132	315,408		335,540	403	309,409	35,450	41,000	-50,319	797	91	106	-130
	average - WID/collective																						797	91	106	-130				
	total - WID/contract																													
	average - WID/contract																													
9	QID-N	V333	2001	1,5	1	n	a	y	a	p	n	n	w / f / a / m	y	board	593	157,724	6,720	105,280	b	112,000	280	112,000	18,140	-	-18,140	421	68	0	-68
10	QID-N	V335	1999	5	3	y	e	n	e	p	y	n	w / f / a / m	y	board + farmers	525	49,714	3,810	59,690	b	63,500	435	62,700	800	-	0	662	8	0	0
11	QID-N	V351	2001	5	1	y	a	n	a	p	y	n	w / f / a / m	y	board + farmers	446	74,844	4,051	63,469	b	67,520	300	75,022	1,950	2,150	-11,602	447	12	13	-69
12	QID-N	V358	1993	6	3	n	a	y	a	g	y	y	w / f / a / m	y	board	135	54,000	14,700	230,300	a	245,000	514	35,063	134,116	13,716	62,105	88	335	34	155
13	QID-N	V332														633	156,646	8,102	126,938	b	135,040	335	134,400	9,600	3,000	-11,960	543	39	12	-48
14	QID-N	V336														556	75,655	4,538	71,098	b	75,636	327	75,636	4,967	2,184	-7,151	555	36	16	-53
15	QID-N	V337														435	39,179	1,380	21,620	b	23,000	190	23,000	-	3,600	-3,600	255	0	40	-40
16	QID-N	V338														495	43,230	2,156	33,781	b	35,937	235	33,330	3,030	-	-423	382	35	0	-5
17	QID-N	V342														570	219,184	13,504	211,570	b	225,074	342	155,000	19,612	-	50,462	403	51	0	131
18	QID-N	V347														525	79,667	4,563	71,488	b	76,051	340	76,051	800	-	-800	501	5	0	-5
19	QID-N	V352														540	101,520	3,592	56,276	b	59,868	188	45,000	1,500	1,250	12,118	239	8	7	64
20	QID-N	V353														491	97,934	5,974	93,595	b	99,569	332	94,205	-	-	5,364	472	0	0	27
21	QID-N	V354														491	70,021	4,040	63,288	b	67,328	320	59,756	700	-	6,872	419	5	0	48
22	QID-N	V331																												
23	QID-N	V334																	0.59											
24	QID-N	V335																												
25	QID-N	V341																												
26	QID-N	V343																												
27	QID-N	V344																												
28	QID-N	V345																												
29	QID-N	V346																												
30	QID-N	V348																												
31	QID-N	V351																												
32	QID-N	V355																												
33	QID-N	V356																												
34	QID-N	V357																												
	total - QID																1,219,317	77,131	1,208,391		1,285,522		981,163	195,215	25,900	83,245				
	average - QID															495	93,794	5,933	82,703		1,285,522	332	384	76	10	33	384	76	10	33
	total - QID/wua																336,281	29,281	458,739		488,020	391	284,785	155,006	15,866	32,363				
	average - QID/wua															425	84,070	7,320	108,232				307	167	17	35	307	167	17	35
	total - QID/collective																883,036	47,850	749,652		797,502	305	696,377	40,209	10,034	50,882				
	average - QID/collective															526	98,115	5,317	31,644				428	25	6	31	428	25	6	31
	total - QID/contract																													
	average - QID/contract																													
	Total - Ningxia																1,849,838	122,594	1,920,633		2,043,227		1,641,561	251,465	92,500	57,701				
	WUA- Ningxia																779,967	54,611	855,573		910,184		635,775	175,806	41,466	57,138				
	Collective - Ningxia																1,069,871	67,983	1,065,060		1,133,042		1,005,786	75,659	51,034	563				
	contract - Ningxia																													
																		Total	Y/ha			568	456.4	69.9	25.7	16.0				
																		WUA	Y/ha			576	402.1	111.2	26.2	36.1				
																		Collective	Y/ha			562	499.0	37.5	25.3	0.3				

Appendix E Quantitative data on water distribution: Nepal and Kyrgyz Study sites

E.1 Khageri Irrigation System (Nepal)

E.1.1 Introduction

Water distribution is a complex process of delivering water to users or group of users, to meet a planned allocation of water. It is managed through the interaction of the physical infrastructure, its hydraulic parameters and operational practices. It is first necessary to understand these three components in order to understand water distribution.

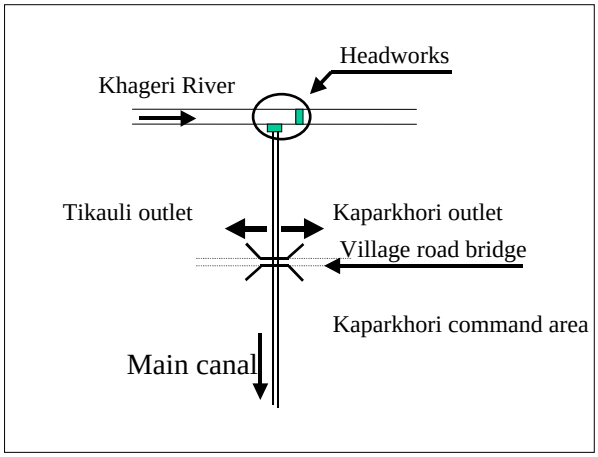
The layout of the system was briefly described earlier in Chapter 4 and existing water management performance in Chapter 8 of the main report The following sections describe first the infrastructure and water distribution practices for the upper main canal (UMC), the lower main canal (LMC), the branch canals, and finally to outlets. In each case, we first describe the physical components and its associated water control system, and then the operational practises - this indicates how well the performs. The flow data recorded at key points of the system and some further interpretation of this data is provided in a separate case study report.

E.1.2 The upper main canal (UMC):

E.i Layout and control system at Kaparkhori

The main canal between the headwork and the first cross regulator constitutes the upper main canal (UMC). The UMC conveys water through 9 km of forest to the LMC, but it also supplies water to about 100 ha of land in Kaparkhori Village area through two direct outlets located at about 400 meters downstream of the headwork (Figure E.1), which is far from the main irrigated area.

Figure E.1: Layout of the main canal, Kaparkhori area and direct outlets



Both the Tikauli and Kaparkhori outlets are located at a much higher elevation than the canal bed. These supply water to paddy fields in Kaparkhori and to a few paddy fields and fishponds in the Tikauli camp[231].

As both these direct outlets are located at higher levels above the canal bed, stop log grooves have been built in the piers/abutments of the village road bridge for placing stop logs across the canal and raising the canal water level.

[231] The Tikauli camp belongs to DOI, which has been built on over 2 ha of land. The camp has a few fishponds and a few paddy fields. The fish pond is managed by WUA through a management contract.

E.ii Operation of the UMC at Kaparkhori

There is no systematic linkage between the operation of the UMC at the Kaparkhori Village and other control points located further down stream in the LMC. Until the present, operation at the Kaparkhori check structure is done in isolation. This practice, however, affects flow availability in the downstream areas. Although this is necessary in order to irrigate Kaparkhori, it is planned and implemented without regard to the downstream system: indeed there is not even any institutional linkage between the Kaparkhori area and the rest of the system.

During the spring season, flow available in the Khageri River is much less than the design capacity of the main canal and there is no cross-regulator (CR), apart from one so far downstream that it has no influence here. The water level in the UMC at Kaparkhori would remain at a much lower level in the spring season than its full supply level (FSL), so the farmers put stop logs across the canal to allow flow into their outlet. By diverting the flow into Kaparkhori, less water is available to flow to the LMC, although it does not influence the total amount of water available to the system since no water is left to flow downstream of the headwork. However, the amount diverted is such that downstream farmers soon come to remove the stop logs making the Kaparkhori outlets dry. After some time, the Kaparkhori farmers replace the logs across the UMC to raise its water level again. So, the cycle of adding and removing stop logs at the Kaparkhori control point has long been normal practice without any systematic communication between them, or co-ordination of their requirements.

It is accepted that stop logs must be placed across UMC at the bridge. But, the basic question is - up to what level should the Kaparkhori farmers be permitted to raise water in the UMC and for how long? Thus, there is a need to develop rules and monitoring indicators defining to what extent Kaparkhori farmers should raise water in the UMC (both level and duration) at different flow conditions. Further, there is a need to develop institutional linkage between Kaparkhori and the rest of the system area. In this context, the Kaparkhori farmers recently formed a committee (after the completion of fieldwork for this study), which is now recognized by the main committee.

The UMC passes through the buffer zone of the Chitwan National Park where it crosses several natural depressions to form wetlands which support wildlife habitats for one-horn Rhinos and several kinds of endangered birds. Thus, the UMC needs to be operated with an objective of meeting both the irrigation and wildlife needs, with a systematic communication and close co-ordination between the authority of the National Park, WUA, and DOI. Failures of coordination frequently result in conflict.

E.1.3 Lower main canal (LMC)

E.i Physical components and system of water control

The portion of the main canal between the chainage 28500 and 38000 RD is termed as lower main canal (LMC). A cross regulator and a bottom escape located at its head end (at chainage 28500 RD) regulates flow to the LMC. In total, LMC has the following control structures.

- Escape at chainage 28,500 RD
- Main canal cross regulators at chainage 28500, 32000, 34000 and 38000 RD
- Gated branch canals : BC-0, BC-1, BC-2 and BC-3
- Ungated pipe outlets : 15 at various locations

Figure E.2: : Layout of control structures and bifurcating canals of the LMC

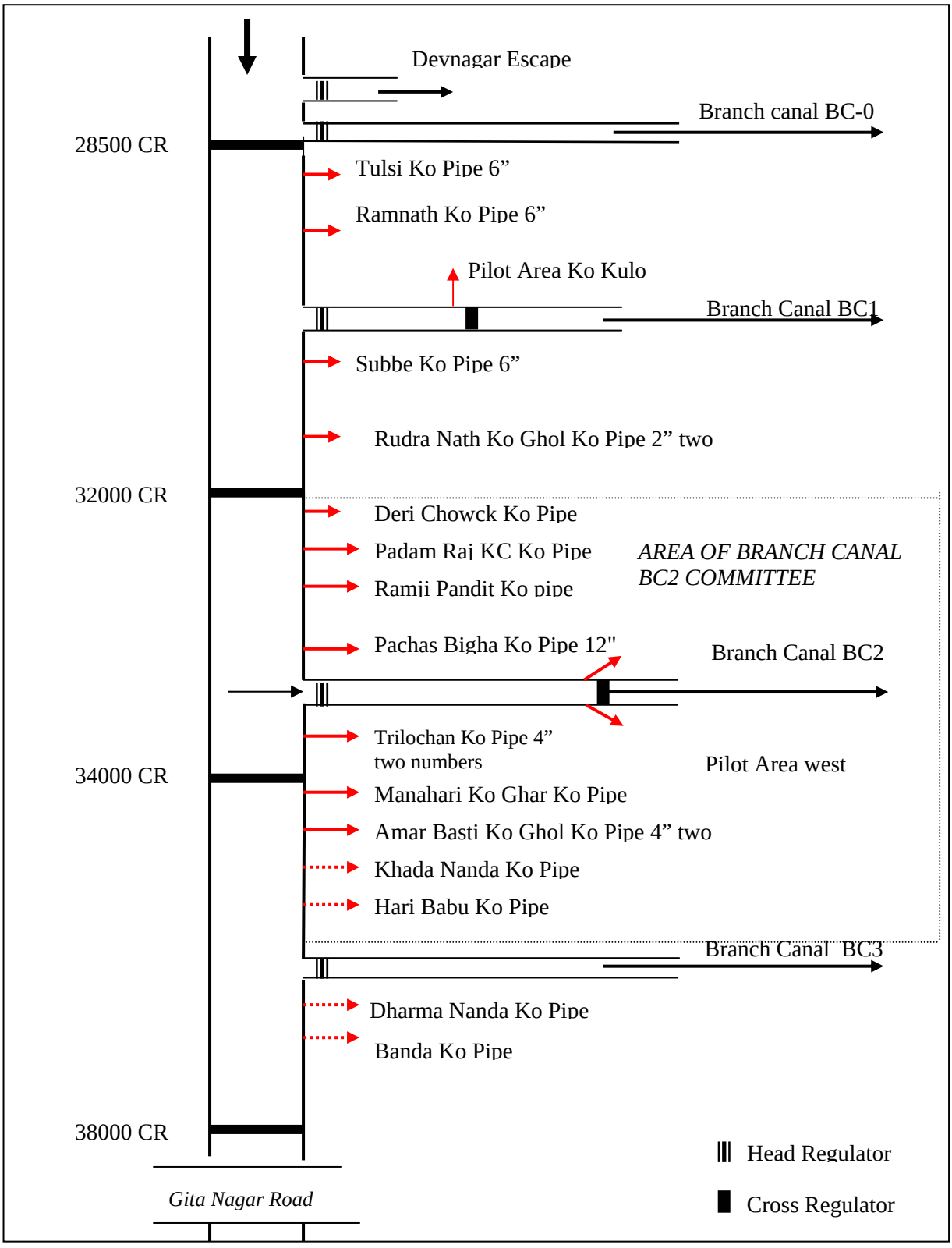


Figure E.2 shows the layout of the control structures and the direct pipe outlets of the LMC. Local names are given to these pipe outlets for their easy identification. Of the fifteen direct outlets, the last four outlets namely the Khada Nanda Ko Pipe, Hari Babu Ko Pipe, Dharma Nanda Ko Pipe and Banda Ko Pipe do not operate for cultivating spring rice. This is because the land areas belonging to these outlets are located at high elevation and cannot be irrigated during the spring season. Of the four branch canals, BC-0 and BC-1 are fully open for spring paddy, the head end reach of BC-2 is operated (up to the first cross regulator), and BC-3 is totally closed. Table E.1 presents details of irrigated area of these branch canals and direct outlets. Although the system was built long ago, people continue to add pipes or increase the size of pipe outlets in the LMC without any formal authorization. There is no logical basis for adding such additional pipes, in terms of size, location or level of pipes, but this is done at individual discretion with tacit (but usually unstated) approval by the WUA.[232]

The total irrigated area under LMC is divided into two groups for management. The areas that are associated with the branch canal BC-1, which include area under BC-0, BC-1 itself, and all direct outlets located between the chainage 28500 and 32000 RD, forms the first group. This area is termed as 'BC-1 command area' and remains within the administrative jurisdiction of BC-1 branch canal committee. The rest of the area, which include area under BC-2 and all direct outlets located between 32000 CR and BC-3, forms the second group. The area under the second group is termed here as 'BC-2 command area' and remains within the administrative jurisdiction of BC-2 branch canal committee.

Table E.1: Irrigated areas of branch canals and outlets from LMC

SN	Bifurcating canal	Irrigated area (ha)		Remarks
		Total	Spring paddy	
A	**Branching canals under the administrative jurisdiction of BC-1:**			
1	BC-0	28.0	28.0	
2	Tulsi ko pipe (6"dia)	2.5	2.5	
3	Ramnath ko pipe (6' dia)	5.0	5.0	
4	BC-1	195.3	143.7	See outlet details of BC-1
5	Subbe ko pipe (6" dia)	1.4	1.4	
6	Rudra nath ko ghol ko pipe (2"-2 number)	1.3	1.3	
	Total area under BC-1	**234**	**182**	
B	**Branching canals under the administrative jurisdiction of BC-2**			
1	Deri chowk ko pipe (4" dia)	1.2	1.2	
2	Padam Raj ko pipe (6" dia)	1.5	1.5	
3	Ramji Pandit ko pipe (4" dia)	1.0	1.0	
4	*Pachas Bigha ko* pipe (12" dia)	60.0	60.0	
5	BC-2	505.0	24.4	
6	Trilochan ko pipe (4"-2 numbers)	6.5	6.5	
7	Manahari ko ghar ko pipe (12" dia)	Incl. in [5]	*[40.0]*	Low lands (*Ghol* area)
8	Amarbasti Ghole ko pipe (4"- 2 numbers)	Incl. in [5]		
	Total area under BC-2	**575**	**95**	***Ghol*** area not counted
Total spring rice area in BC-1 and BC-2 (including ghol)			**317**	
Total area under spring rice including Kaparkhori			**417**	

[232] See field trip report of Umesh Nath Parajuli dated 28 February to 04 March 2004 for a detail case.

E.ii Operation of the lower main canal (LMC)

The LMC starts operating with the start of paddy seedbed preparation in early February, when wheat and pulses approach the harvesting stage. Not all the lower order canals operate since then due to fear of water seepage to adjacent fields containing standing crops[233] In such areas, either the paddy seedbeds are irrigated with alternative sources of irrigation (hand pump, dug well, drain water) or dry seedbed is prepared. By early March, when harvesting of wheat and pulses starts, all the lower order canals start operating and paddy transplantation starts.

Operation of the LMC is guided by the agreement of water rights between BC-1 and BC-2 command areas. The BC-1 command area (including BC-0 and direct outlets upstream of 32000 CR) has been granted the right to receive seventy five per cent of the incoming flow, while the remaining twenty five per cent is allocated to the BC-2 command area, including direct outlets between 32000 and 34000 CR[234]. This is not a formal right, but was granted by the WUA, and is increasingly being contested by downstream branch canals as the demand for water in the spring season grows[235]. This is gradually leading to a shortage of water and conflict.

The arrangement to share water on a 75:25 basis between BC-1 and BC-2 was probably based on the following considerations:

- Land area under each canal
- Topography and land type under each canal (note that most of the area under BC-1 is *tandi*)
- Prior use right (BC-1 started first)
- Geographical location (BC-1 is at head)
- Proximity to forest (BC-1 is adjacent to forest, making it difficult to cultivate crops other than paddy mainly due to wild animals).

The LMC has unusual operational characteristics in the spring season, compared to other run-off-the-river type of irrigation system. The LMC acts as series of balancing reservoirs as well as for conveyance. Four cross regulators (CR) located at chainage 28500, 32000, 34000, and 38000 RD divide the LMC into four sections and regulate flow from one section to another, each of which act as a balancing reservoir (known as tanks) with significant storage capacity relative to the size of the outlets[236].

The operation of the LMC is controlled by these four cross regulators, which are operated to meet the socially agreed sharing of water (75:25) between the command areas of BC-1 and BC-2, as described in the following paragraphs.

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233 During the study period, the pilot gate west ko kulo operated much later compared to the pachas bigha ko kulo. As a result, in the command area of the pilot west ko kulo, paddy seed bed were grown with alternative source of water

234 This also includes head end areas of BC2

235 Until recently, only the farmers of BC1 and BC2 claimed the sole use right of canal water for cultivating spring paddy. However, in recent years, farmers of the downstream area also started claiming use right of water. As a result, during the study period, the stored water in canal was released for more than 48 hours for irrigating spring maize in the BC4 area.

236 A very crude estimate suggests that the storage volume available in the last three reservoirs is about 190,000 m^3, which corresponds to about 50 l/sec of flow for about 24 hours – almost 10% of daily requirements.

Table E.2: Segment of LMC performing as balancing reservoir

Segment of LMC	Tank
Upstream of 28500 CR	First
Between 28500 and 32000 CR	Second
Between 32000 and 34000 CR	Third
Between 34000 and 38000 CR	Fourth

The first control: Operation of 28500 CR

Operation of this CR[237] is determined by the incoming flow, upstream and downstream water level, and the flow required in the downstream. For example, the higher the upstream water level, lesser will be the opening of the CR gate from the canal bed. Actual opening of the gate from the canal bed is measured by counting the number of threads exposed on the vertical spindle.

During most of the study period, the gate opening varied between 15 and 30 cm, and the range of the incoming flow was 230 to 1185 l/sec (with an average of 630 l/sec), as shown in the Khageri case study report (Mott MacDonald, 2006).

The water level in canal upstream of 28500 CR may fall below a critical level at some times in the dry season. In such a situation, the CR is completely closed for a few days to store the incoming water in the canal (balancing reservoir) upstream in order to increase the water depth[238]. Once the water depth is sufficient, the regulator is opened again. Such situation however never occurred during the study period.

The second control: Operation of 32000 CR

Operation of the 32000 CR[239] is guided by two requirements:

- to raise upstream water level in the canal (in the second balancing reservoir) sufficiently to allow irrigation of the high level land alongside the LMC and head reach of BC-1[240];, and
- to meet the water sharing arrangement of 75:25 between BC-1 and BC-2 command areas.

Usually, it is difficult to satisfy both the requirements simultaneously. As a result, these requirements are met separately, but so that both are met in aggregate over the season.

In order to irrigate the high land, the water level in the LMC upstream of 32000 CR needs to be raised by closing both the 32000 CR and the pilot area CR of BC-1. In the agreed operational practice, these CR are to be closed for 36 hours a week. This was observed for most weeks during the study period.

[237] The 28,500 CR has three gated panels. Of the three panels, two of them remain closed throughout the spring rice cultivation period and only one panel operates.

[238] The farmers of the KIS may request farmers of the Panchakanya Irrigation System to release additional water in the Khageri River, since the source rivers of these systems are linked upstream of the Khageri head works. Such situation however did not occur during the study period.

[239] The 32000 CR has three gated panels. Of the three panels, two of them remain close throughout the spring rice cultivation period, and only one panel operates.

[240] These includes areas irrigated by BC-0, *Tulsi ko pipe* and *Ranmath ko pipe* of LMC, and *Pilot ko kulo* of BC-1

For rest of the time, operation of the 32000 CR is shaped to meet the 75:25 water-sharing arrangements between BC-1 and BC-2 command areas. Although this water sharing arrangement was agreed long ago, farmers find it difficult to monitor such division of water with the existing infrastructure. As a result, farmers adopted a proxy indicator, which compares the opening of the 32000 CR gate with respect to the 28500 CR gate. This is done by opening of the 32000 CR gate to a height of 25 per cent of the opening of the 28500 CR gate: for example, by opening of the 28,500 and 32,000 CR gates to 20 and 5 cm respectively. The hydraulic calculation to verify this is quite complex as most of these gates operate under submerged conditions and they also leak a small amount. The farmers were not surprisingly unsure whether this gate opening indicator truly ensures the agreed water-sharing ratio.

Most of the time during the study period the 32000 CR gate was usually opened to between 5 and 9 cm, with minimum and maximum flow through the CR of 54 and 349 l/sec respectively, while the average flow was 178 l/sec.

It should be noted that closing the 32000 CR gate would normally be expected to stop flows into the BC-2. This was not the case, partly due to the leaking gates of the 32000 CR, but also due to the volume stored in balancing reservoir, which continues to supply water to the branching canals even without incoming flow.

The third control: Operation of 34000 CR

Operation of the 34000 CR[241] is also guided by two requirements:

- to maintain water level in its upstream (third balancing reservoir) and
- to release water downstream in the forth balancing reservoir.

For most of the spring season, this CR remains closed for maintaining water level upstream. BC-2 and all direct outlets between chainage 32000 and 34000 RD are left open all the time, except that the outlet may be plugged temporarily when there is no water demand using local material from its upstream side. The discharge through these outlets varies according to the water level in the parent canal (third balancing reservoir).

One of the gates of the 34000 CR is partly opened for about 12 hours once in every 5-10 days to allow water flow into the fourth balancing reservoir created between 34000 and 38000 CR. This action raises water level in the reservoir, which in turn continues to supply water to the *ghol* area for a few days through two direct pipe outlets namely "*Manahari ko ghar ko pipe*" and "*Amar basti ko ghol ko pipe*"

The branch canal BC3 and the remaining other direct outlets located between 34000 and 38000 CR remain closed during the entire paddy cultivation season. The cross regulator located at chainage 38000 RD remained closed throughout the spring rice cultivation to maintain the fourth balancing reservoir.

Summary: Operation of LMC

Three types of water distribution arrangements for operating LMC are followed:

- Water distribution based on time-share (ie gates opened or closed to a fixed schedule)

[241] This CR has two gates, of which one gate remain closed throughout the spring rice cultivation season and only one gate operates.

- Water distribution based on percentage of incoming flow (ie gates opened to pass a specified percentage of the flow continuously)
- Water distribution based on physical setting/configuration of canal (ie no adjustments made, but flows are determined by the nature of the infrastructure).

Opening and closing of the cross regulators gates for a fixed time is an example of the first type of water distribution arrangements. For example, the 32000 CR gate is closed completely for a fixed duration (36 hours a week) to allow delivery of water to outlets located at higher elevations. Similarly, 34000 CR gate is opened for 12 hours a week to allow delivery of water to downstream area. These are simple indicators used by many irrigation systems and are known to farmers. So, they are usually followed in actual practice.

Water distribution to the command area of BC-1 and BC-2 as per the fixed percentage of incoming flow (75:25) represents the second type of water distribution arrangements. This works well in practise, but is not as transparent as the fixed time-share rule as concepts of flow volume and methods of measurement are not so easily understood.

After dividing the incoming water to BC-1 and BC-2 command area based on the fixed percentage, the next level of water distribution (from LMC to its ungated outlets) is guided by the physical configuration of these direct outlets. The fixed settings include the diameter of the pipe outlet, and the level of the outlet relative to upstream and downstream channels. The flow will depend on the water level at LMC and the downstream flow conditions. It is the responsibility of end users to maintain the suitable downstream flow condition, but they have no control over the upstream water level in the LMC – which is thus critical for deciding flow through outlets.

The operator puts effort into maintaining a constant water level in the LMC by adjusting cross regulators, but the means adopted for ensuring the 75:25 share between BC-1 and BC-2 results in a varying water level, and there are no indicators for judging whether these water levels are appropriate for supplying water to outlets. As a result, flows through the ungated outlets and also to pilot gate of BC-1[242] are varying in terms of both the time and quantity. This lack of a suitable, agreed indicator could be one of the reasons for the WUA and branch committees to allocate more time to outlets (BC-0, pilot gate of BC-1, and direct outlets) than the authorised 36 hours – they believe that they receive less water than they actually do. This situation certainly has impact on equitable water distribution, as less reaches the downstream users than it should. So, an indicator specifying elevation of FSL and duration of supply would be helpful.

E.1.4 Branch canal BC-1

E.i Physical components and system of water control

The branch canal BC-1 is the second branch canal bifurcating from LMC. It is 4.1 km long and commands about 195 ha of cultivated land. During the spring season, about 145 ha is cultivated with spring paddy, but there is insufficient water to cultivate the remainder. Most of the canal section is lined with cement concrete or brick masonry. The canal system is in fairly good condition. A gated head regulator built at its intake regulates flow through this canal.

[242] Although the Pilot gate outlet receives water through BC-1, hydraulically it resembles a direct outlet of LMC and the flow to this canal is also controlled by the water level in LMC.

The canal has only one cross regulator at chainage 0+027 meters built to divert water to the first offtake, known as the pilot area[243]. Other than this cross regulator, the canal has 34 direct concrete pipe outlets, 19 polythene pipe outlets, and three drop structures.

Locations of the pipe outlets in the canal vary from place to place. At some places, outlets are close to the canal bed, while in other places they are at higher elevation with respect to the canal bed. Some of these elevated outlets may not flow when the discharge in the parent canal reduces to certain level. Further, in some outlets, conditions of free flow prevail. As a result, flows through such outlets are determined only by upstream flow conditions. However, in some other outlets, condition of submerged flow prevails. In such cases, flows through these outlets are determined by both the upstream and downstream flow conditions. Thus, the canal needs to be actively managed for equitable distribution of water.

Flow into BC-1 is essentially controlled by the following operational activities:

- Operation of the 28500 and 32000 cross regulators, which are managed to meet the 75:25 water sharing agreements between BC-1 and BC-2 command areas.
- Operation of BC-1 CR located at chainage 0+027 meters

When the CR of BC-1 is closed, the CR at 32000 in LMC is also closed, and the water level at LMC and BC-1 remain almost at same level, which in turn reduces the head loss across the BC-1 HR and hence the flow entering BC-1. When the CR is opened, the water level in BC-1 drops so the head loss across the regulator increases and flow into BC-1 also increases. The water level upstream of the HR will also drop, which would tend to reduce the flow slowly, but this is a slower process due to the storage in the LMC.

During the study period, BC-1 started operating with its full share of water from mid March. Since then the incoming flow into BC-1 varied between 124 and 849 l/sec, with an average flow of about 478 l/sec. This was much later than BC-2, largely because the winter crops in BC-2 were more advanced – the reasons for this are only partly related to water management, as they are also influenced by other aspects of farmers' livelihoods.

E.ii Operation of BC-1

The branch canal BC-1 operates continuously throughout the spring paddy cultivation season. Presently, for the purpose of operation, BC-1 is divided into two segments, and water is rotated among them on time-share basis.

The pilot area (8.3 ha) falls on the first segment and is entitled to receive entire incoming flow for 36 hours a week (in practise, the duration may be increased or decreased depending on the field conditions). The gate operator has considerable influence over these adjustments – a fact which benefits his social status - and individual farmers may lobby him for this, but the formal responsibilities do not appear to be clearly defined. As the area under this segment is high, both the 32000 CR of LMC and the pilot area CR of BC-1 are closed for this period and the entire incoming water is diverted to the *pilot area ko kulo* as well as BC-0 and the direct outlets in BCC-1 area of responsibility – these total 20% of the area. This is equitable since 36 hours per week is water for 21% of the time – a close match with the 20% of area which needs to be irrigated.

[243] Although the pilot area was developed long ago to ensure efficient management of water, it never operated as designed.

Once the irrigation turn of the first segment of BC-1 is complete, both the 32000 CR of LMC and the pilot area CR of BC-1 are opened simultaneously. Consequently, water level in the BC-1 draws down immediately and no flow enters into the *pilot area ko kulo*. Thus, all the flow in BC-1 is automatically directed towards the second segment of BC-1.

During the field study, farmers presented different opinions regarding the operational practices of the second segment of BC-1. Some said that the second segment is further divided into two sub-segments and the incoming flow is divided between these two for rest of the week. Others disagreed and said that the available flow is distributed directly to all outlets in the second segment. It was apparent that it was operated as a single segment during this season, but that it used to be sub-divided in the recent past and farmers say that in case of real scarcity of water this will need to be followed again. The subdivision into two sub-segments is thus a loosely accepted principle to be applied under certain circumstances which have not applied in recent years. This can be seen by examining the past operational practice of BC-1.

Cultivation of spring rice in the area started some 30 years ago. In those days, there were no systematic practices for operating BC-1. 'Might is right' was the only prevailing rule. During the early days of spring rice cultivation, the BC-1 had 4-5 drop structures (which no longer exist) which were built to control water. However, the politically powerful farmers of those days who were located at the tail end broke all the drop structures in order to drain the flow towards the tail end. There were frequent conflicts in distributing water during the period of spring rice cultivation between head end and tail end farmers. Finally, farmers agreed to divide the canal into three segments for sharing water as described in Table E.3.

Table E.3: Past rotational schedule of BC-1

SN	Canal segment	Rotational Stage	Time (Hr.)	Description	Nos. outlet	Area (ha)
1	Head	One	36	All the incoming waters is to be diverted to pilot area ko kulo by closing the cross regulator located in its downstream	1	8.3
2	Middle	Two	72	Temporary check structure is to be built D/S of Balram's outlet (6" pipe, concrete outlet number 19). All outlets located between Balram's outlet and pilot area ko kulo should flow continuously.	29	138.6
3	Tail	Three	60	All outlets up to the Balram's outlet are to be closed. All outlets located downstream of the Balram's outlet should flow continuously.	23	48.4

During the Irrigation Management Transfer Project (IMTP) intervention, which started in 1995 and was completed in about 1999, substantial stretches of the BC-1 were lined; the damaged drop structures were no longer required; and the conveyance efficiency of the canal increased. Further, after the management transfer, the agency staff (*dhalpa* or water guard) who used to manage water in BC-1 was no longer available. As a result, the rotational schedule adopted earlier was no longer implemented. Since then the two-segment rotation has been practiced (for 36 hrs and then 132 hours per week). But farmers suggest that during the period of real scarcity of water, the earlier three-stage rotational schedule should be introduced again.

In the present situation, all outlets located downstream of the *pilot area ko kulo* flow continuously after the first 36 hours. However, there are no systematic practices in distributing water to these outlets from BC-1. As long as water level in the BC-1 remains above the level of outlets, they draw water. Flows to these outlets are determined by their size (pipe diameter), upstream/downstream flow conditions, and their location with respect to canal bed. There is no procedure or person (operator) identified for distributing water to outlets (as they are all meant to flow continuously). The variable flow conditions mean that some adjustments are done in practice, and farmers sometimes obstruct flow in the BC-1 to increase the flow through their outlet. This is done on an *ad hoc* basis, without any attempt at consultation or reaching an agreement and clearly influences other outlets significantly. Nevertheless, no major conflicts were observed. However, it could be seen that about 25% of the BC-1 area was not transplanted with spring rice due to the lack of water (exacerbated by the problems of managing BC-1 which meant that water could not easily be used in an efficient manner).

Operation of the branch canal BC-1 is also related to operation of the Ganganagar canal, which is an independent system in the low land area which draws from the major drain located between BC-1 and BC-2. This area has a highly undulating topography, with alternate high lands (*tandi*) and low lands (*ghol)* on both sides of BC-1 - the difference between adjacent *tandi* and *ghol* is about 25 meters. When irrigation is applied by flooding the higher land, there is surface and sub-surface runoff to the *ghol,* which in turn hel/sec in triggering local springs in the depressions. Because of these hydrological phenomena, the *ghol* in the right side of BC-1 starts flowing when the canal starts operating, which in turn supplies water to a Ganganagar canal. Despite the fact that Khageri Canal is the primary source of water, the Ganganagar Canal is considered as an independent system. The area of about 100 ha irrigated by the Ganganagar canal can be regarded as the indirect irrigated area of BC-1. Although it is dependent on seepage water from BC-1, performance of Ganganagar is not greatly affected by the details of operation of BC-1 since large-scale sub-surface flow is much larger than the changes in surface runoff that might result from local changes in operating practices in BC-1. Paddy in this area is grown later still than in BC-1, but this is due to late cultivation of the preceding wheat crop which is deliberate in order to maximise yields.

In sum, operation of BC-1 is not managed systematically. There are many reasons for this, but we focus here on the technical reasons, which include:

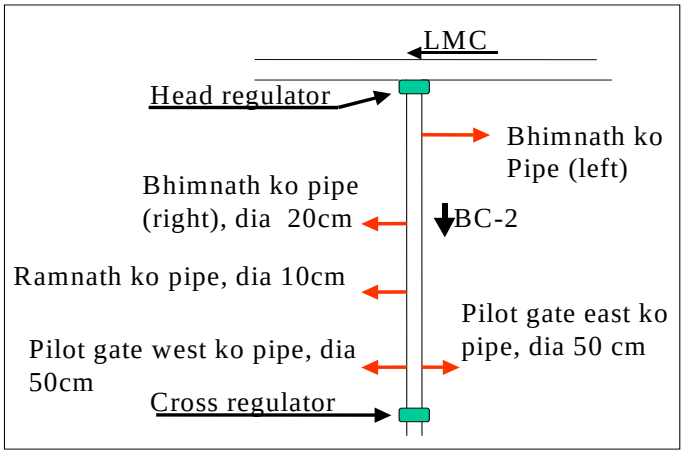
- Improvements under IMTP resulted in removal of drop structures and extensive canal lining. These measures reduced losses and made the canal better able to provide water to the tail of the branch canal but they did not solve the problem of controlling flows into outlets. Further, after the management transfer, the service of agency staff for managing water within BC-1 was no longer available. The combined effect of these two changes reduced the need for (and hence motivation to establish) a rotational system, but did not remove it completely.
- The inconsistent level of outlets and lack of means for controlling water in the branch canal, which make it difficult to operate the canal and has resulted in water shortage in part of each outlet command area.
- The undulating topography with highland (*tandi*) alternating with lowland (*ghol*), where the differences in elevation exceed 25 metres. The *tandi* land depends entirely on direct irrigation, but a substantial amount of excess water flows from *tandi* to adjacent *ghol* land through both surface runoff and subsurface flow. The branch canal is aligned along the ridge and irrigates on both sides, but most of the *tandi* land is on the left bank, and it is this side which suffers from most severe water shortage. Irrigation losses from the *tandi* area on the right hand side of the canal (which is a long narrow strip of land) flow to *ghol* land, both within the same outlets, and other land further downstream at Ganganagar, which is not part of KIS. The need for and inability to control informal excess irrigation of this land leads to water scarcity further downstream within the official command area of BC-1.

E.1.5 Branch canal BC-2

E.i Physical components and system of water control

Branch canal BC-2 is 4.98 Km long and has a total command area of about 505 ha, but only supplies water to about 24 ha of land for spring rice.

Figure E.3: Layout of BC-2 and its pipe outlets



As in the case of BC-1, a gated head regulator at the intake regulates flow to this canal and a cross-regulator controls flow to the so-called pilot area (which never operated as designed). This cross regulator remained closed throughout the spring rice cultivation season in 2004, and no water flowed beyond this point, although the gate remained opened in the year 2003 and spring rice was cultivated in some area in its downstream. Figure E.3 presents the layout of BC-2 and the outlets between the intake and the cross regulator.

Of these pipe outlets, the *Bhimnath ko pipe* (left bank) remained closed throughout the spring rice cropping season because the lands irrigated by this outlet are at high elevation and can only be irrigated during the monsoon season. Table E.4 presents salient features of other pipe outlets of BC-2

Table E.4: Salient features of pipe outlets in BC-2

SN	Outlets	Outlet dia (cm)	Irrigated area (ha)
1	*Bhimnath ko pipe* (RB)	20	1.5
2	*Ramnath Koirala ko pipe*	10	1.0
3	Pilot gate west	50	9.4
4	Pilot gate east	50	12.5
	Total area		**24.4**

E.ii Operation of BC-2

Flow into BC-2 is essentially controlled by operation of its head regulator and 34000 CR. During the spring rice cultivation season, the head regulator gate of BC-2 remained almost closed (2 to 4 cm open from its bed). As a result, there was only a low flow passing underneath the gate, varying between 53 and 182 l/sec, with an average flow of about 108 l/sec. Downstream of the intake, BC-2 operated continuously as far as the cross regulator downstream of Pilot gate east and west outlets (Figure E.3). This is only a short stretch of BC-2 (about 500 m) and all its outlets flow continuously.

E.1.6 *Pachas bigha kulo*

E.i Physical components and system of water control

The *pachas bigha kulo* is a direct outlet from LMC just upstream of the 34000 CR. A 30 cm diameter ungated pipe supplies water from LMC to this canal. The canal is about 2 km long and irrigates about 60 ha of land. Its irrigated area also lies on the hydrologic boundary of BC-2. Physical condition of this canal is good enough to delivery water up to the tail end of the command area. Initially this canal was set for irrigating *pachas bigha* (33 ha) of land, and hence canal was named as *pachas bigha ko kulo*[244].

The *pachas bigha kulo* is a simple earthen canal and it does not have any permanent water division or water control structures. It supplies water directly to several fields through open cuts made in its canal banks. At many places, temporary check structures are placed in the channels to raise its water level whenever needed. It has two branching canals, where earthen temporary structures are made to divide water into them on equitable basis. During a period of water scarcity, such temporary structures usually become a source of conflict.

Flow through this ungated intake is determined by both the upstream (in LMC) and downstream (in the canal) water levels. The upstream water level is shaped by the way the LMC cross regulators are operated, while the downstream water level in the canal is determined by its physical condition and the temporary check structure (if any) placed at the *pachas bigha kulo* canal head reach[245]. Such check structures obstruct the flow, which in turn raises water level downstream of the direct outlet and thus flow through it is reduced.

E.ii Operation of the Pachas bigha ko kulo

The intake is ungated, but the amount entering the canal is affected by operation of the canal as described above. No systematic practices or schedules were observed for deciding when and how long for these temporary check structures should be in place: farmers fix them as and when needed at their individual discretion. Flows entering the *pachas bigha kulo* thus varied between 10 and 160 l/sec depending on the status of such check structures and the upstream water level. The average flow is about 53 l/sec during the days when it is flowing.

[244] In Nepali, *pachas* means 50.

[245] The head reach area of the *pachas bigha ko kulo* constitute high land with respect to canal. As a result, check structures are placed across the canal for raising its FSL.

The irrigated area of *pachas bigha kulo* falls into three segments: head, middle and tail. Although there have been various attempts in the past in establishing a rotational water distribution practice to these three areas, such practice could not become sustainable. Some say that such practice was adopted in the previous two years, but was not applied during the study period apparently because the main canal supply or supply to this canal was too erratic. Irrespective of the reasons, during the study period farmers relied on individual efforts in distributing water from the *pachas bigha kulo* to its three segments and then to their fields. Even then, the area had a reasonably good water supply[246] except at the extreme tail, despite only operating for 57 out of 79 days with an average flow into this canal of 38 l/sec, which is equivalent to a duty averaged over the season of 0.6 l/sec per ha. This irrigation duty is the lowest of the three study areas. Flows are constrained by the size of the outlet, but they are able to cope with this low supply. There seem to be two main reasons for this achievement:

- The favourable location means that they can cultivate crops earlier than others, which meant that there was little competition for water at the start of the spring paddy season so that transplantation could be completed very efficiently;
- The topography of the area is favourable for economical use of water: the land is relatively flat with a mild slope from north to south along the canal.

They started irrigation earlier than BC-1 since they harvested their wheat crop earlier - presumably their favourable situation next to the main canal meant that they could complete their monsoon crop earlier and hence sow wheat earlier. During these early days of canal operation (9 to 17 March), BC-1 did not require its full allocation of water. Farmers of the *Pachas bigha kulo* took advantage of this situation and diverted the maximum flow possible (90 -160 l/sec) to their area and transplanted more than 90 per cent of their land within 10 days. Many farmers used the high flow to prepare land and then store water in the field for transplanting paddy after a few days. This strategy proved to be very effective in completing paddy transplantation in time, which is locally considered to be the most critical period in terms of water management: they believe that once transplanted, the crop can be managed even with small amount of water. The same applied to the pilot gate west, where farmers completed paddy transplantation in a similar timeframe. By contrast, only a few farmers in the BC-1 area were in a position to start paddy transplantation at that time, and most farmers did not complete this till much later.

The topography and soils of the area are favourable for economical use of water: the land is relatively flat with a mild slope along the canal. As a result, when irrigation by flooding is applied at the head end of the command area, the excess water automatically flows towards its tail end area rather that draining off into natural drains (*ghol*) to the side of the command area. There is also a substantial amount of subsurface flow and small springs at the tail end. Drainage and seepage flows are thus reused within the command area.

[246] ie it was adequate to meet the needs of the crops, and most water users did not feel they needed to agree to an organised schedule of water distribution. This was satisfactory for most users, but those at the extreme tail were unable to get water and did not expect to do so.

E.1.7 The field level channels and study blocks

E.i Location of study blocks

Locally, field level channels are known as *kulo*. These *kulos* take off either directly from the main canal or from the branch canals through ungated pipe outlets[247]. Irrigated areas of these *kulos* vary from around one hectare to about 20-25 ha. Three blocks were selected in this study in order to examine water distribution at field level:

- 18 number *ko kulo* of BC-1,
- tail end of the *Pachas bigha kulo*, and
- 'Pilot gate west *kulo'* of BC-2.

Table E.5 presents salient features of these study plots.

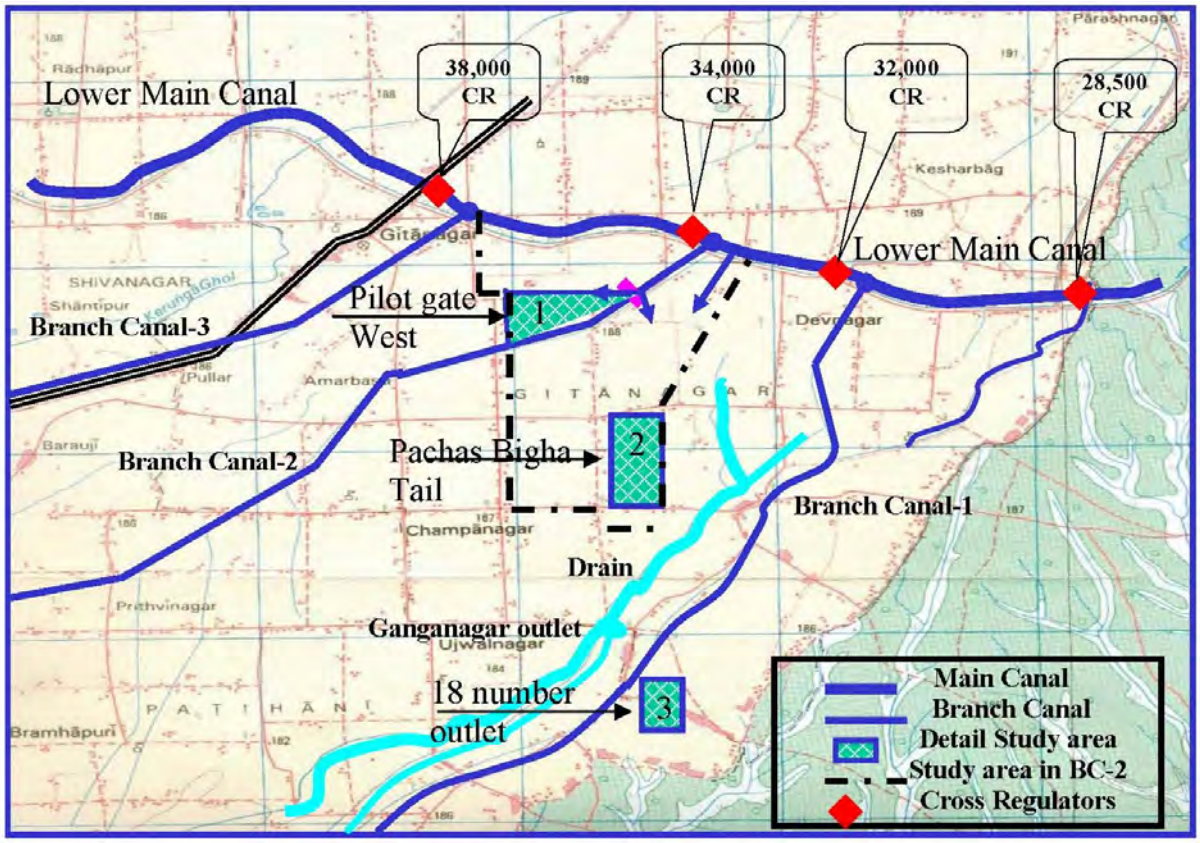
Table E.5: Details of study plots

Study plot	Name of Kulo	Inlet pipe dia. (cm)	Parent canal	Irrigated area (ha)	
				Total	spring rice
1	BC-1 Outlet 18	22.5	BC-1	10.1[248]	4.08
2	*Pachas bigha* tail	30.0	LMC	21.8	21.8
3	Pilot gate west	50.0	BC-2	9.4	9.4

[247] In total, the study area has about 57 number of ungated pipe outlets (2 in UMC, 11 in LMC, 42 in BC1 and 4 in BC2)

[248] Administrative command area of the outlet committee nine (OC-9) is 15.6 ha. Outlet 18 (C-18) commands 10.1 ha and there areis the main outlet)which receives water also from a few polythene pipes other than 18 number outlet. But, the hydraulic command area of 18 number ko kulo (C-18) is about 10.1 ha (Figure 5.7)

Figure E.4: Location of Study Areas



E.ii Physical components and system of water control

These *kulos* are simple earthen canals and they do not have any permanent water division or water control structures. They are constructed simply by excavating the normal ground and irrigate their both banks. In many cases, temporary check structures are placed in these channels to raise the FSL whenever needed. There are subdivisions of these *kulos*, also referred to as *kulos*, to irrigate individual fields.

There are two categories of these subsidiary *kulos*: permanent and temporary. Permanent *kulos* are those channels that exist round the year and are shown in the cadastral map. Such permanent *kulos* may be sufficient for the cultivation of the monsoon paddy as water can flow field to field to irrigate land which is far from the *kulo*. But field to field irrigation is not possible for cultivation of the spring paddy due to scarcity of water, and farmers construct temporary *kulos* through their neighbours land, which are abandoned after the cultivation of the spring paddy.

Outlet 18 of BC-1

Flow through Outlet 18 is determined by both the upstream and downstream water levels, which varied considerably throughout the season. The upstream water level (water level in BC-1) is shaped by the incoming flow and the way water is distributed to upstream outlets from the parent canal. The downstream water level in the outlet channel is determined by its physical condition and the check

structure (if any) placed at the head reach. Because of these varying upstream and downstream conditions, flows entering this *kulo* varied between 10 and 38 l/sec, with an average flow of 27 l/sec[248].

Farmers say that the outlet is defective, as it is set slightly inclined at its inlet. This, however, does not seem to be the real problem; which is that the level of the outlet channel is slightly higher than the BC-1 canal bed[249]. As a result, whenever water depth in BC-1 at the outlet remains less that 20 cm, water does not flow into the outlet channel. Thus it is difficult to achieve equitable distribution of water between outlets along BC-1 since upstream abstractions cause a situation of low flow and low water depth in the branch canal towards its tail. This problem would be avoided if there was a three segment rotation in the branch canal since a situation of flow less than 20 cm would be less likely to occur.

It is instructive to compare flows entering Outlet 18 with the incoming flow to BC-1. This suggests that, during the study period, the irrigation duty in Outlet 18 and BC-1 was 4.8 and 3.3 l/sec/ha respectively when they were flowing – ie. Outlet 18 received a relatively larger flow per unit area irrigated but this was for a smaller number of operating days. This suggests that Outlet 18 operated only for about 75 per cent of time (31 out of 42 days) for which the BC-1 was operating, and that the seasonal discharge per unit area actually irrigated in Outlet 18 is the same as for BC-1 as a whole. However, the area actually irrigated in Outlet 18 was only 4.08 ha (out of the total area of 10.1 ha) in the outlet. The whole outlet has an equal entitlement to water, but only 4.08 ha can receive this in practice.

Tail end of *Pachas bigha kulo*

Unlike Outlet 18, this study area is not self contained in terms of its intake - it is located at the tail end of *pachas bigha kulo*, and water users in the upstream part of the command area directly determine the availability of water to the study area. Because there is no systematic water distribution practice in the upstream area of the *pachas bigha kulo*, availability of water in the tail end area varied between 3 and 62 l/sec with an average flow of 14 l/sec. However, these data do not fully represent flow entering the study blocks, because there is substantial surface runoff from several upstream locations into the study area through road culverts. As a result, there is no direct correlation between flow entering this area with the flow entering into the *Pachas bigha kulo*. Further, this area also has some shallow tubewells which are used as an alternative source of irrigation. Some of these can discharge into the canal system.

BC-2: Pilot gate west

The pilot gate west outlet receives water through a 50 cm diameter pipe from branch canal BC-2, immediately upstream of the cross-regulator. This pipe is large and never flows full: the flow into this *kulo* is determined by the incoming flow into BC-2 and the operation of the pilot gate east, since the entire flow in BC-2 at this point flows into these two outlets[250]. For these reasons the flow into this canal varied between 9 and 72 l/sec, with an average of about 35 l/sec.

[248] This figure corresponds to the average of operating days when canal is flowing.

[249] Farmers of outlet 18 say that during IMTP intervention, one farmer leader from tail end influenced the technician and lowered the canal bed of BC-1 in several stretches. Because of this their outlet is now located at a higher elevation than the BC-1 canal bed.

[250] Sometimes pilot gate east is closed, especially during the monsoon season, resulting more flow to pilot gate west.

E.iii Water distribution at field level

Water distribution practices at field level changes within the cropping season. During the period of paddy transplantation, farmers do not all transplant paddy simultaneously (for a variety of reasons, such as the previous crops, availability of machinery/animals for ploughing, ability to purchase inputs etc, as well as water). It is not considered possible to develop a formal rotation or order of delivery, and water is distributed to users through mutual consultation to suit their individual needs. There are no defined rules to distribute water for paddy transplantation, except that once someone has started land preparation and transplantation no one is permitted to disrupt his supply until he has completed it.

During the planning stage of this study, farmers reported that they would introduce rotational water distribution after completion of paddy transplantation. In practice, such rotations were not observed in any of the study plots. Reasons for which are described below.

- In Pilot gate west and the tail of *Pachas bigha ko kulo*, farmers say that they could not adopt rotations because the supply to their area was too erratic
- In Outlet 18, farmers tried to adopt water distribution by turn, but they failed to do so for several reasons as explained below.

Pilot gate west and *Pachas bigha kulo,*

Farmers say that they could not adopt rotational water distribution system within the canal mainly because the flow entering into the canal from the LMC/BC-2 was too erratic. As a result, in both the study blocks, water distribution management at field level relied on individual efforts. This explanation is not entirely convincing, but the resulting water distribution was adequate for most of the area, and it would be difficult to improve on this for most of the area with a fixed rotation. There is a small area at the extreme tail which did get an inadequate canal supply, but they were able to make alternative arrangements[251] which were probably easier to implement than more systematic management of *Pachas bigha kulo* as a whole. This clearly has implications for improving equity of management, and will be discussed further later

Water distribution within Outlet 18 of BC-1

The 18 number ko kulo operated intermittently with 2 to 6 days ‘on’ and 1 to 2 days ‘off’ in between. At field level, irrigation by turn is the preferred method of water distribution: water from one farmer’s field needs to be diverted to another farmer’s field once the former completes irrigation in his land. Depth of water in the paddy field is the indicator to judge whether the irrigation is complete or not. In this study block, farmers say that attainment of a shallow depth of water (2 inches) in most part of the field indicates sufficiency of irrigation in that field.

As the duration of each turn is not fixed the total time needed to irrigate the outlet is not related to the schedule for operation of the outlet and (particularly in the case of large outlets such as No 18) part of the land area may remain unirrigated at the end of the time allocated to the outlet channel. In this case, as per the rule, irrigation in the next turn should start from the point where it stopped earlier.

In practice these rules (which are informal) are not followed conscientiously: most of the time, the field is irrigated to greater than a shallow depth of water, and irrigation starts from the head in every rotational turn. This creates water scarcity in the tail end of the outlet. As a result, many farmers in the tail of Outlet 18 did not cultivate spring paddy. Note that of the total hydraulic command area of 10.1

[251] These included use of private tubewells and occasional unscheduled deliveries from the main canal

ha, only 4.08 ha of land in the head end area are transplanted with spring paddy with an available flow of 19.6 l/sec[252]. Further, this flow rate of 19.6 l/sec for an area of 4.08 ha is highest among the three study plots. Certainly, with this canal flow, more area could have been irrigated, and even if the entire command area had been irrigated the duty would have been more than double that in *pachas bigha kulo*.

This situation raises two questions:

- why is the flow per unit area is highest in this study plot; and
- why farmers do not irrigate by turn - why does irrigation always starts from the head in every new irrigation turn (of the outlet) rather than starting it from the point where it was stopped earlier?

This issue was raised in the farmers meeting[253] held at the level of the branch canal BC-1 on 12 July, 2004. Farmers believed that the available stream size is the primary reason for not following irrigation by turn – that means not starting irrigation from that point where it was stopped earlier. This is mainly because, in this area, farmers think that the interval between irrigations to any plot should be no longer than one week[254]. This cannot be achieved with the available stream size (which is also frequently interrupted) if irrigation is done strictly in turn[255]. Thus, a larger stream size is pre-requisite for maintaining the said frequency and thus adapting irrigation by turn, especially during the period of water scarcity. This is mainly because, a large stream size advances faster and thereby minimizes the deep percolation in both the field channel and in the field. If a small stream is applied at one corner of a field, water may never reach to the other corner Therefore, for higher water use efficiency, a larger stream size for a short period is a preferable compared to a small stream size for longer period.

The issue of stream size was really a constraint, especially during the period of long dry spell. Please note that for the 18 number outlet 5-15 May was a critical period of irrigation. In this period, there was an intermittent supply of water to the said canal with varying 'on' and 'off' periods (presumably due to variable operation upstream in BC-1). Further, as noted above, the stream size varied between 10 and 21 l/sec. So, the question here is – what should be the average stream size for efficient irrigation of paddy field? Certainly, this is a question which needs to be answered depending on the local conditions. However, in general, for intermittent irrigation to paddy field, a stream size of about 30 l/sec (or one cusec) is considered ideal for efficient irrigation for small farmers[256].

This discussion raises a further question – how can the stream size in Outlet 18 be increased, which is discussed in conjunction with the management of water in BC-1 in the main report and case study report.

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252 19.6 l/sec is seasonal average. Average of the time when canal is flowing is about 26.5 l/sec (see Table D1.1 in Appendix D1)

253 On 12 July 2004, a concluding meeting was organized at the level of branch canal BC-1 to discuss the issues identified and to share findings of the study. In total, there were 24 participants in the meetings. These include KFOs of the study block (18 number outlet), all outlet representative of BC-1, all executive members of BCC, main canal representative of BC-1, and representative of women awareness committee of BC-1

254 Failure to do so may reduce the yield of paddy substantially

255 For example, in Outlet 18, 5 to 16 May was a period of water scarcity and this outlet was closed for 5 days, and the flow when it was flowing varied between 10 and 21 l/sec, which is said to be too small a flow. In such a situation, maintaining the required irrigation frequency is difficult

256 See the design of Structured Irrigation System.

E.1.8 Analysis of water distribution

E.i Introduction

The focus of this study is equity in water distribution. It is thus necessary to quantify delivery of water to different levels of the irrigation system (from main system down to farmer's fields). There are no flow-measuring structures at these locations, and so a flow monitoring system was set up so that time series flows could be computed at the followings key control points.

- At all cross regulators (CR) of LMC
- At head regulators (HR) of Branch canal BC-1 and BC-2
- At all direct outlets of LMC
- At the inlets to the detail study blocks

While doing so, field water conditions were also observed. The methods and full data are presented in the case study report (Mott MacDonald, 2006).

E.1.9 Flow measurements

E.i Method of measurement

Canal flows were measured by a variety of methods

- Water level records and calibration of control structures
- Water level records and calibration of canal sections
- Spot measurements of flow

Water level gauges were installed at appropriate locations so that water depths could be monitored on a daily basis and flows computed. These are approximate methods, but sufficiently accurate for the present purpose: the reliability of the data and the implications of this are discussed in the main report and case study report.

Flows within the study blocks could not be measured directly but we recorded the dates and durations of irrigations, and observed the field water conditions (ie depth of standing water in the field).

E.ii Summary of data

The results of these measurements are briefly summarised in Table E.6.

Table E.6: Summary of average flows through key control points of the KIS

Canal	Irrigated area	Duration of irrigation	Nos days canal flowing	Flow (l/sec)		Average flow when canal in operation	Unit flow (l/sec/ha)
				Min	Max		
Whole Area							
BC-1	143.7	79	79	124	849	478	3.3
pachas bigha ko kulo	60	79	57	10	160	53	0.6
BC-2	24.4	79	78	53	182	108	4.4
Detailed Study Area							
18 number outlet	4.08	42	31	10	38	27	4.8
pachas bigha tail	21.8	77	51	3	62	14	0.4
Pilot gate west	9.4	74	69	9	72	35	3.5

E.iii Interpretation of flow data

The time series flow data are analyzed here at two levels:

- in the main system (LMC); and
- into the study plots.

As the study focus is on equity in water distribution, most of the flow analyses are geared towards understanding this. This is considered in three sections:

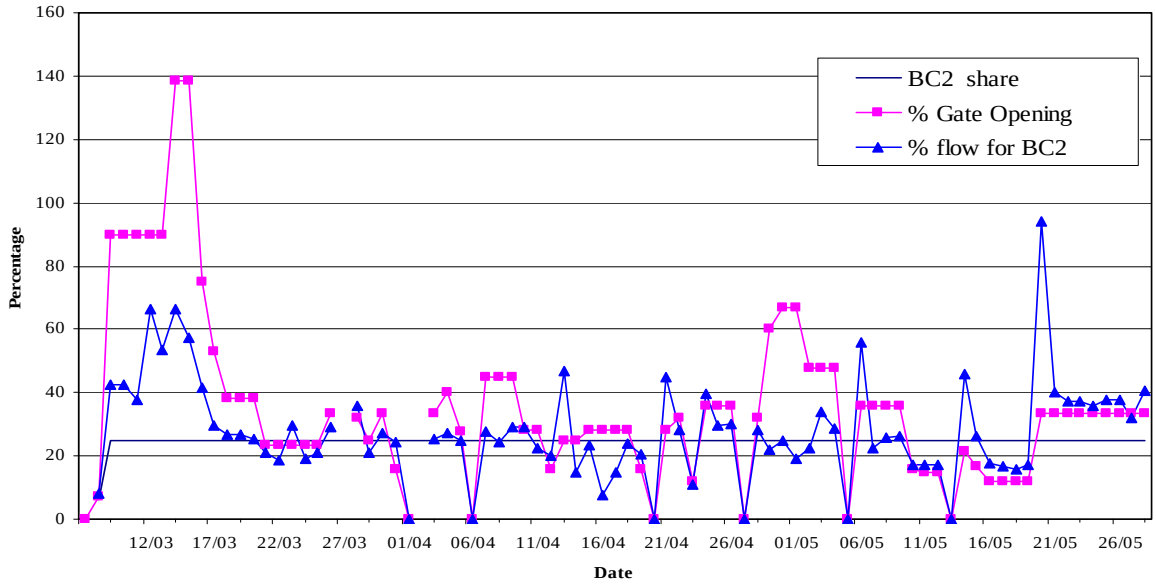
- sharing of water between BC-1 and BC-2 command area,
- sharing of water between outlets along LMC.
- Comparison of flows to three study blocks

Water sharing between BC-1 and BC-2 command areas

As noted earlier, there is a 75:25 water-sharing agreement between BC-1 and BC-2, for which farmers have adopted a proxy indicator for monitoring water division. The proxy indicator compares the opening of the CR gates. Farmers, however, were not sure whether this indicator is a reliable way to monitor the sharing of water. As the hydraulics of these cross regulators is not easily understandable, mistrust was increasing between farmers of BC-1 and BC-2, the gate operators and committee members about the actual division of flows.

This was checked in this study by recording the opening of the gates of the 28500 and 32000 CR and by measuring the flow passing through them. Figure E.5 presents share of BC-2 in terms of percentage gate opening and flow at 32000 CR with respect to 28,500 CR. This figure suggests that except during the initial period, the percentage gate opening of the 32000 CR and the flow passing through it match quite well with the actual water allocation ratio of BC-2 (25 %).

Figure E.5: Share of BC-2 and BC-1



This suggests that gate operator and the farmers are knowledgeable and what they have done was fairly right, but it does appear that some farmers have their doubts – they were anxious for confirmation of the sharing through this study. Although the proxy monitoring indicator, as designed and used by farmers to judge the percentage of water delivery, is a crude one and may not be highly accurate but it is still a wonderful invention that enabled them to match the water sharing closely to the allocation rules. This represents an effective basis for sharing between the areas of responsibility of the BC-1 and BC-2 branch canal committees, excluding area under BC-0.

Water sharing between outlets along LMC

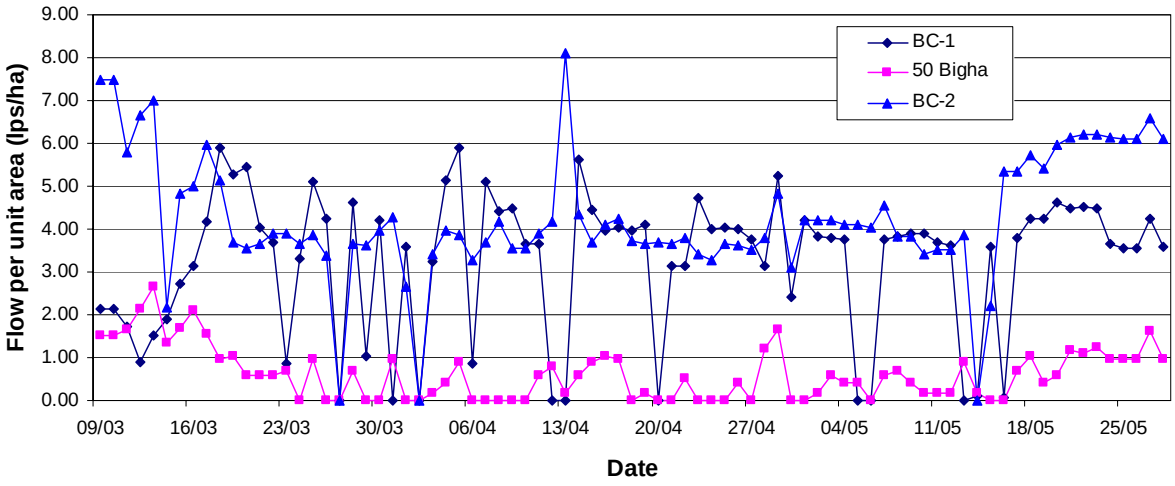
In addition to overall sharing between BC-1 and BC-2, it is necessary to compare flows through all the direct outlets and branch canals along LMC. This reach of LMC has eleven branching canals: two branch canals (BC-1 and BC-2), and nine direct outlets.

BC-1, BC-2 and the *Pachas bigha kulo* together irrigate 95% of the area during spring rice cultivation season. In the operational schedule for these canals, BC-2 and *Pachas bigha kulo* were supposed to operate 6 days a week, while BC-1 is supposed to operate continuously. But, in practice, BC-2 also operated almost continuously, while *Pachas bigha kulo* only operated for 57 days out of total 79 days – this is a consequence of the water level in the LMC since the outlet to *Pachas bigha kulo* is at a higher level than BC-2.

The flow per unit area through these outlets is presented in Figure E.6 the flow per unit area is highest in BC-2 with an average value of about 4.4 l/sec per ha irrigated, which is followed by BC-1 (average flow 3.3 l/sec per ha). The flow per unit area is lowest in the *Pachas bigha kulo* (with an average of about 0.6 l/sec per ha) (Table E.6)

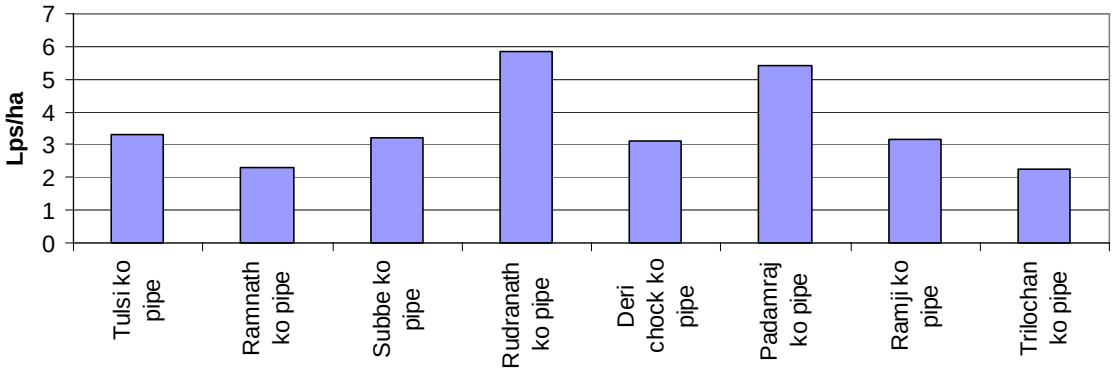
Figure E.6: Flow per unit area through major branching canals

(BC-1, BC-2, and *Pachas bigha ko kulo*)



The average flow per unit area in the remaining eight direct outlets indicates a range of flows per unit area of 2.3 l/sec/ha (Trilochan *ko* pipe) to 5.9 l/sec/ha (Rudranath *ko* pipe) (Figure E.7)

Figure E.7: Flow per unit area in direct outlets of LMC



These are striking differences, but the figures need to be interpreted in the context of local water requirements in order to understand their implications for equity in water distribution. This is examined further through comparison of flows into the study blocks.

Comparison of flows to three study blocks

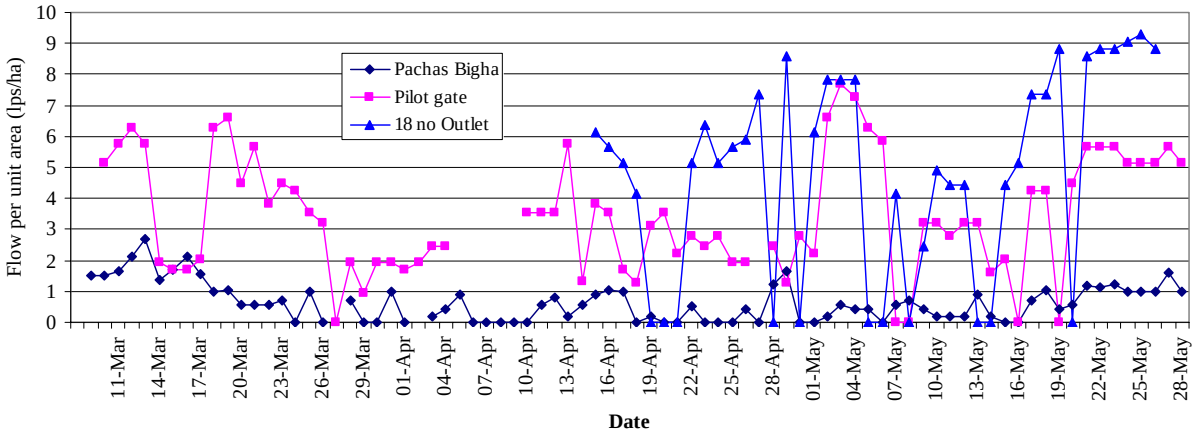
Flows into three study blocks provide an indication of the distribution at field level (Table E.7). These indicate differences from the flow pattern from the main canal.

Table E.7: Comparison of flows to three study blocks

	BC1-O18	50-bigha-tail	BC2-pilot gate W
Outlet			
Time flowing	70%	70%	94%
Flow (l/sec/ha)	4.8	0.4	3.4
Parent channel			
Days flowing	100%	95%	94%
Flow (l/sec/ha)	3.3	0.6	4.4

There are considerable daily fluctuations of flow, as shown in Figure E.8, and it is clear that delivery of water to the three areas is not equitable from the perspective of land area. However, despite the very low flow to the tail of the *Pachas bigha kulo*, few farmers felt water scarcity in this area. As this is a lowland area the water requirements are lower than BC-1, and direct irrigation from the canal was also supplemented by surface runoff from upper blocks which is captured and diverted into the study area through road culverts directly to fields. It should also be noted that this canal acted as a drain and flowed even on some days when there was no flow from the LMC: surface runoff from upstream areas which had been irrigated earlier flowed back into the canal further downstream. Such events are indicated on the field data sheets.

Figure E.8: Flow per unit area in the study blocks



E.1.10 Conclusions

Further analysis of the water distribution data is presented in the main report. We note here that the

- sharing of water between BC-1 and BC-2 command area complies with the 75:25 agreement,

- sharing of water between outlets along LMC is very variable, with flows ranging from 0.6 (PBK) to 5.9 (Rudranath ko pipe) l/sec/ha on average through the season. Despite the very low duty, PBK farmers expressed little problem with water supply apart from a very small area at the extreme tail. As this is largely *ghol* land and needs less water than BC-1 which suffered from severe shortages despite a duty of 3.3 l/sec/ha. These large variations in local requirements makes it difficult to design rational and yet fair rules for water distribution
- Comparison of flows to three study blocks reveals that these are also very variable (ranging from 0.4 l/sec/ha for PBK to 4.4 l/sec/ha for O18). Most of PBK tail had sufficient water although there were some shortages, suggesting that there is some scope for improving management to ensure that a fair share of water entering PBK (0.6 l/sec/ha) reaches the tail. O18 received a higher duty than BC1 as a whole and yet this insufficient to irrigate the whole area.

We conclude that water management is fairly equitable within the area that is irrigated, but there are areas excluded from irrigation. The choice of which land is left unirrigated is not decided on an equitable basis. Imprved water management could increase the area irrigated with the same amount of water.

E.2 Sunsari Morang Irrigation Project, Nepal

E.2.1 Introduction

The layout of the system was briefly described in Chapter 4 and existing water management performance in Chapter 8 of the main report. The following sections describe the infrastructure and the operating rules before the start of the study for the main canals (CMC and Sitaganj), the sub-secondary canal (SS9E), the tertiary canals (T5 and T6), and finally the watercourses. Further data and analysis of the flows at various levels in the system are presented in the main report.

E.2.2 The Chatra Main Canal (CMC)

The Chatra Main Canal (CMC) receives water from the Koshi River through a side intake built on the left bank of the river, and is 53 kilometres long. It conveys about 45 m3/sec of water in monsoon season and 20-25 m3/sec in winter season. There are eight cross-regulators and it supplies water to 46 bifurcating canals, which are categorized as below depending on their discharging capacity and area covered.

- Secondary (or Branch) canal - 6 numbers, which irrigate more that 1,000 ha of land,
- Sub-secondary canals - 13 numbers
- Tertiary canal – 2 numbers
- Direct outlets - 25 numbers

The CMC and secondary canals are designed to be operated on a continuous basis from the intake down to its tail, but the other bifurcating canals are designed for intermittent operation.

A change was introduced in 2004 when each secondary canal was closed in turn for one day in a week, in order to ensure sufficient water reached the tail of CMC for newly developed areas. However, many farmers were unaware of the new operational schedule.

E.2.3 Sitagunj Secondary Canal (S9)

The Sitagunj Secondary Canal (S9) bifurcates from the CMC at chainage 80 RD (24.4 km). It is 14.34 km long and commands an area of about 7,920 ha. It is one of the largest secondary canals of SMIP, with 14 bifurcating canals. Figure E.9 presents the schematic diagram of S9 and its bifurcating canals. It was designed to operate continuously, but with varied flow that depends on the flow available in the CMC. With the variation in the CMC discharge, discharge into this canal also varies – although not in a consistent or proportional manner unless the cross and head regulators are operated carefully. The maximum design duty of this canal is 0.7 l/sec/ha, which amounts to a maximum design discharge of 5.592 m3/sec (including losses).

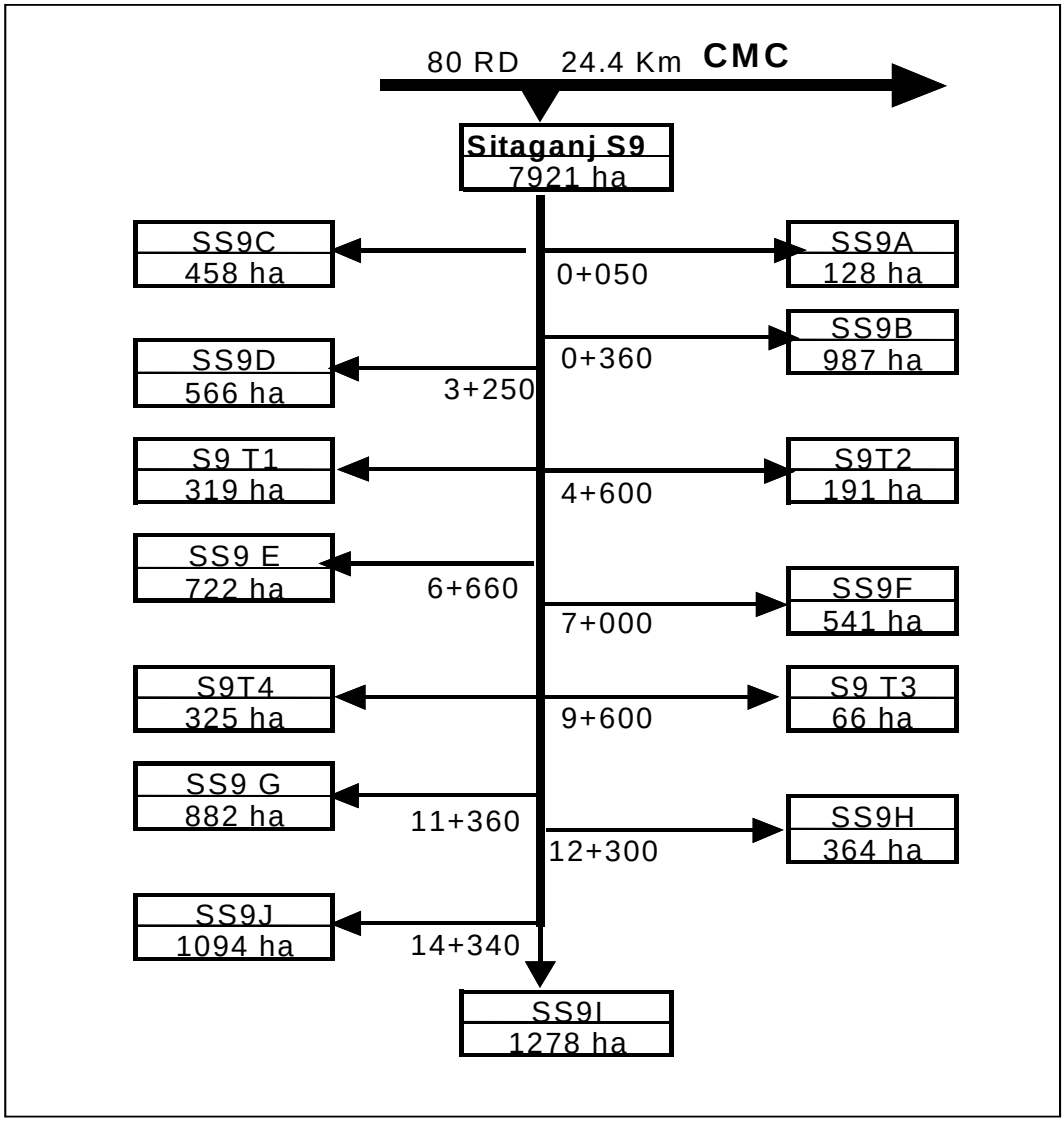
The lower order bifurcating canals from S9 (sub-secondary, tertiary and watercourses) were designed in such a way that they operate either at full supply level at fixed discharge with a design duty of 1.2 l/sec/ha or they are closed. This means that the number of bifurcating canal that can be operated simultaneously depends on the flow available in S9 and thus in CMC. Depending on the available discharge in S9, the bifurcating canals would be divided into 2, 3 or 4 groups with each group having almost equal area (Table E.8). During the monsoon season, flow in CMC remains within a range of 36 to 45 m3/sec, so the bifurcating canals of S9 are divided into 2 groups each of which should receive water for half of the time.

With the rehabilitation and command area development in the stage III (downstream) part of SMIP, which was completed in 2004, there was insufficient water to operate all secondary canals simulatenously and thus a system of closing each secondary canal for one day per week was introduced. This made the rotations at sub-secondary canal more complex.

Table E.8: Grouping of the bifurcating canals of S9 for ranges of available supply.

Ranges of discharge in CMC	Corresponding flow ranges in S9	Number of groups of offtaking canals
36.4 – 45.4	4.5 – 5.6	2
25.7 – 36.3	3.19 – 4.47	3
18.2 – 25.6	2.23 – 3.11	4

Figure E.9: Schematic diagram of S9 and its bifurcating canals

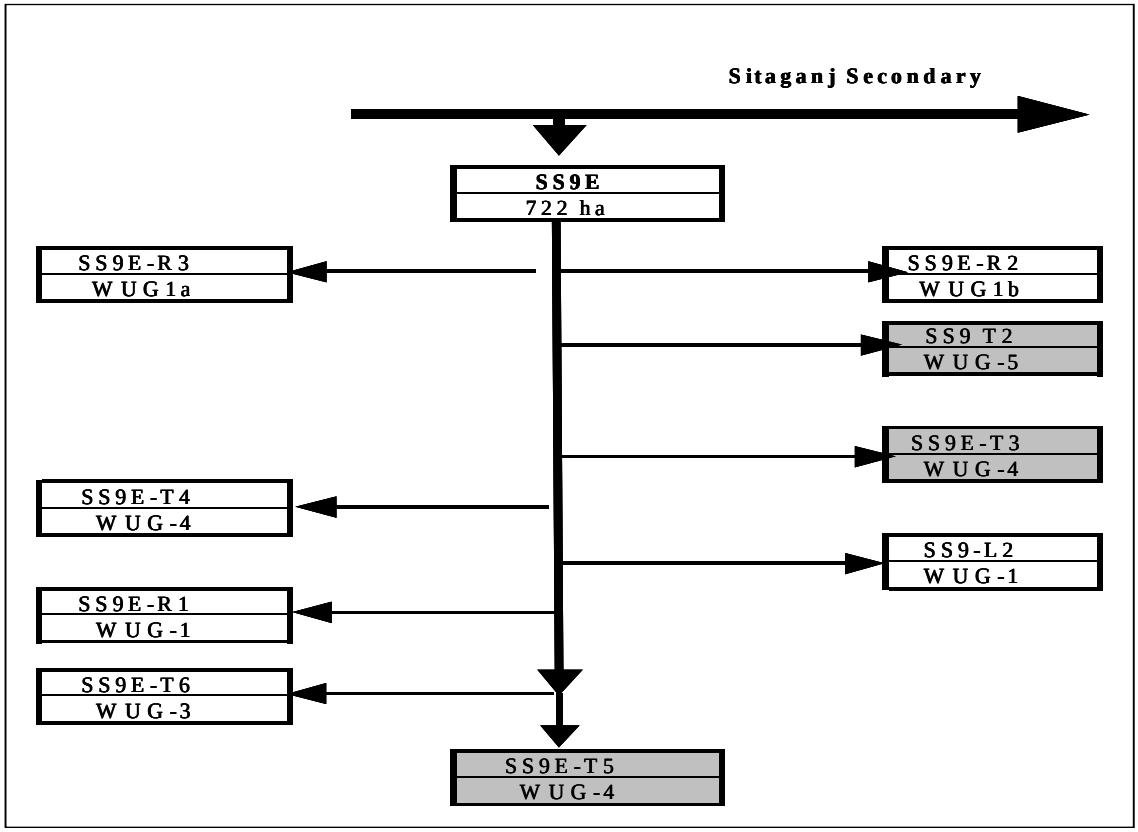


E.2.4 Sub-Secondary Canal SS9E

The sub secondary canal SS9E is about 5.05 km long and takes water from the Sitaganj Secondary Canal (S9) at Aurabani Village with a gated head regulator at its intake; it irrigates 722 ha of cultivated land via five tertiary canals and four direct watercourses. Prior to the EIP study, the canal had 22 number unauthorized direct outlets. There are no gates within the canal system, and proportioning flow divider[257] (PD) are provided at all bifurcation points of tertiary canals. Adjustable Proportional Modules (APM) are provided for each direct watercourse. Figure E.10 presents the schematic diagram of SS9E and its bifurcating canals (apart from the unauthorized outlets), highlighting the tertiary canals covered in this study and in GGG.

[257] Hydraulically, these are broad crested proportioning weirs

Figure E.10: Schematic diagram of SS9E as designed



Originally, SS9E was designed to operate intermittently with 7 days 'on' and 7 days 'off, with all subsidiary canals down to watercourse level operated simultaneously and continuously. Each watercourse was designed to have 7 outlets, and thus each outlet would operate with the entire watercourse discharge for one day (24 hours). This was changed a few years ago to 4 days 'on' and 4 days 'off' because the 7 days cycle was considered too long by the farmers. This, however, was again changed to 6 days 'on' and 8 days 'off' in 2004 since the secondary canal was scheduled to be closed every wednesday (for the reasons given above) and it was found to be impossible to irrigate an entire watercourse within 4 days

The design assumptions are not followed closely in practise, particularly at times of shortage: the system was designed to provide supplementary irrigation but this is very difficult to operationalize. Many farmers are either unaware of the design assumptions or disagree with them, and were not involved in developing them [258]

Delivery of water to branching canals had became *ad hoc*, with many unauthorized obstructions of flow in the sub-secondary canal, resulting in scarcity at the tail end of SS9E, especially in the tertiary

[258] It is to be noted that SMIS is designed for supplementary irrigation. The extent of area that can be irrigated under the monsoon paddy depends greatly on the rainfall. In SMIP, with the typical rainfall pattern of the area and the incoming flow of 45 m3/sec, the CMC can irrigate only 50 percent of area (out of 58,000 ha), especially during the period of peak water demand (SMIP, 1995). In this situation, the designed operational plan aims to distribute the irrigation water to the entire irrigated area with the assumptions that each individual farmer get assured irrigation for 50 per cent of his land, and in the remaining 50 per cent, farmers take the risk of paddy cultivation.

canal T5 and T6 prior to the start of these studies. Figure E.11 compares the flow delivered to SS9E with that of the flows delivered to T5 (tail end of SS9E) in 2002. Even though the flows delivered to SS9E remained above the designed value, the flows delivered to T5 were well below the design value and the pattern of flow fluctuation in SS9E and T5 does not match.

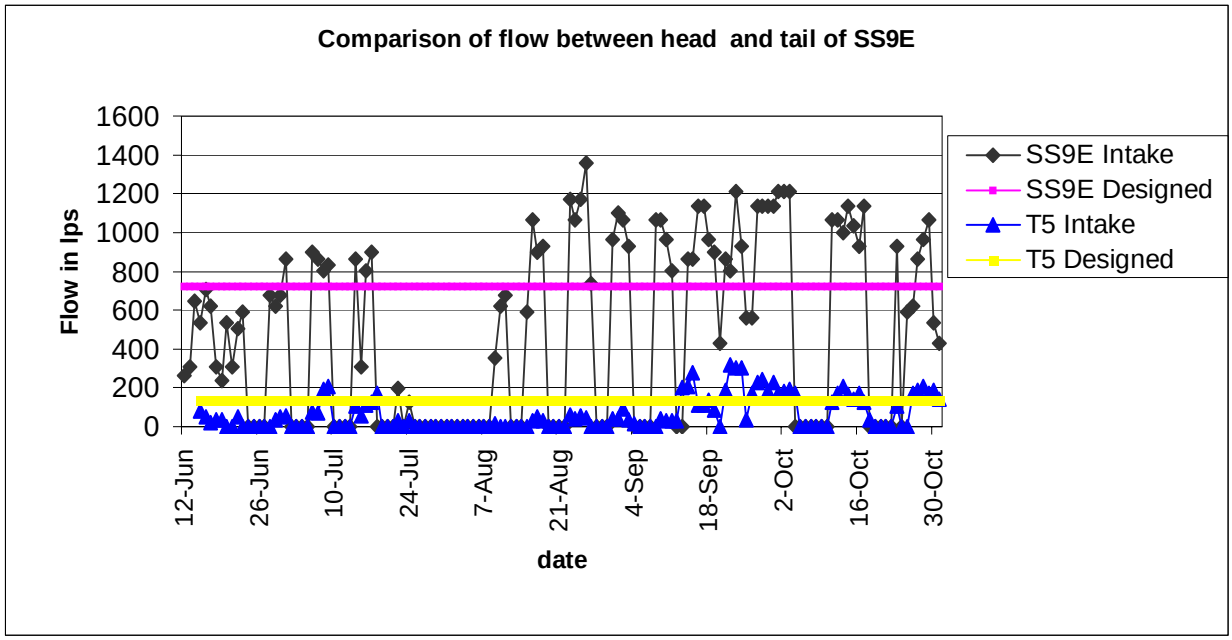


Figure E.11: Comparison of flow between head end of SS9E and T5 (tail end of SS9E)

At the start of EIP study (the monsoon paddy cultivation season of 2004), a 6/8 days rotational scheduled was in place – meaning 6 days 'on' and 8 days 'off' – as described above. However, in reality, even this rotational schedule was not fully followed as influential farmers lobbied the WUCC and SMIP to deviate from it to ensure that they got sufficient water

E.2.5 Tertiary Canal T5

The tertiary canal T5 takes off from a PD located at the tail end of SS9E. This canal irrigates about 104 ha[259] of cultivated land, and it is about 1.36 km long. It has four WCs and two illegal outlets[260] (Figure E.12).

Since there was a very unreliable supply to T5 prior to this project, it had not been possible to agree a mechanism for distributing available water from T5 to its watercourses: there were disagreements over the relative hydraulic performance of the outlets, and many farmers cut the canal embankments or put unauthorized obstructions in the canal. The tertiary canal T5 was operated on an *ad hoc* basis, and 'might is right' was the principle for its operation. As a result, the watercourses WC3 and WC4 operated only for about 62 per cent of time for which T5 was flowing, while the watercourse WC1 operated for 96 per cent of the same time duration (Figure E.13).

259 The designed irrigated area of T5 is about 116 ha (Table E.9)

260 Prior to EIP it had altogether five illegal outlets

Figure E.12: Layout of the tertiary canal T5

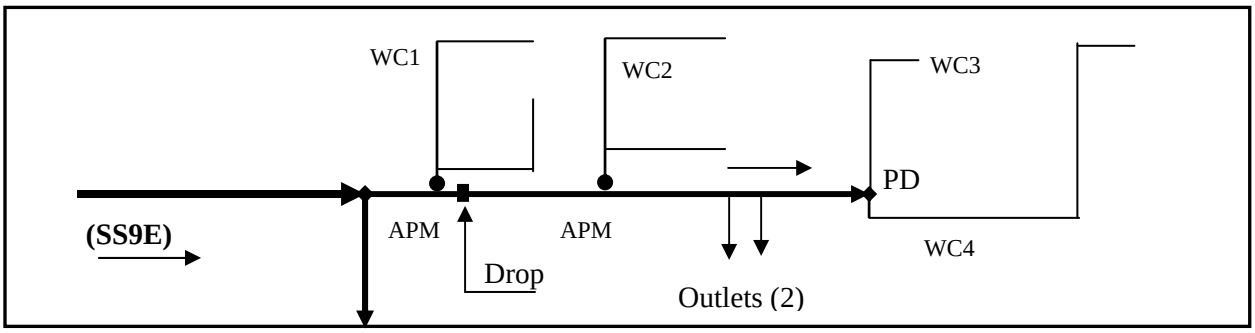
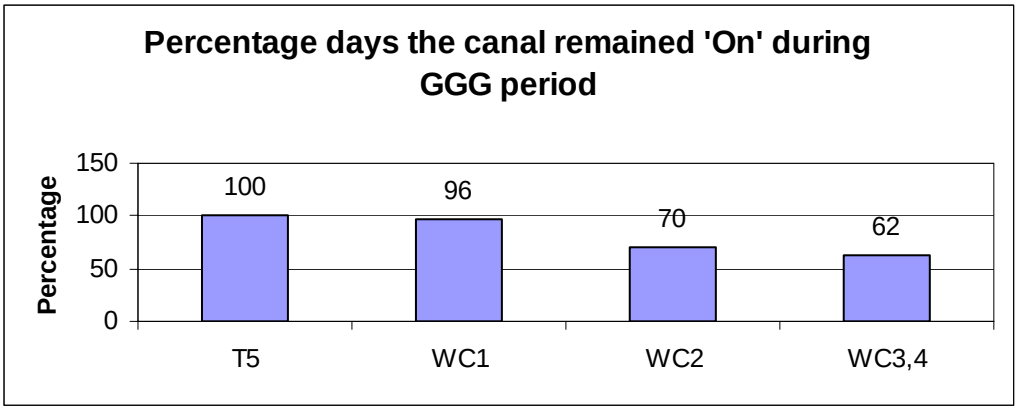


Figure E.13: Percentage days the watercourses remained 'on' during GGG period



E.2.6 Watercourses (WCs)

A watercourse is the lowest order canal and irrigates about 30 ha of cultivated land. These watercourses are simple earthen canal with occasional lined sections, and they do not have many formal water control structures. Although, theoretically, each of these watercourses is supposed to have 7 outlets[261], at present there are quite a large number of unauthorized open cut outlets in them. Temporary check structures are commonly found in these channels to raise water level wherever needed. Table E.9 presents command areas of these watercourses. These areas were obtained from various sources, and were not finally confirmed until new irrigation rosters were prepared towards the end of the study. As we note elsewhere in the report, it is difficult to obtain reliable data on areas.

In general, the watercourses were operated more or less on an *ad hoc* basis before this study. A farmer who finds water in the watercourse diverts it to his field. So, at one time, even four to five farmers divert water to their fields simultaneously - with too small stream size for irrigation for each of them.

[261] WC1 is an exception, which has 9 designed outlets

E.9: Command areas of watercourses

Watercourses		Length (m)	Command area (ha)	
Main	Branch		Designed	Actual
Tertiary Canal T5				
WC1	WC1A	792	23	24.52
	WC1B	694		
WC2	WC2A	550	26	21.36
	WC2B	480		
WC3		1100	32	27.07
WC4		1500	35	29.32
Illegal outlets (two numbers)				2.0
Sub-Total			116	104.27
Tertiary Canal T6				
WC1		900		20.41
WC2		1200		34.01
WC3		1300		28.57
Sub-Total		3400	NA	83.00

Source: GGG asset survey.

E.2.7 Conclusions

This section provides background information regarding the layout of the system and the operation before the start of the study. The layout is carefully defined and well-built to a coherent design. Operation is, however, not in accordance with the design principles resulting in significant differences in flows as compared to the design. This leads to illicit interventions and an approach to management often described as 'might is right'. Water supplies to the tail of canals at each level is consistently below the design.

E.3 Overview of the Study in Kyrgyz Republic

E.3.1 Selection of study sites in Kyrgyzstan

A key criterion for selecting our study sites was that they should have well-established WUAs capable of managing irrigation in accordance with a rule-based system. The three study countries were selected because their history of WUA development made it likely that we could identify irrigation schemes which meet this requirement. Within the Kyrgyz Republic, Osh *oblast* (province) was selected because of the relatively good progress with WUAs in this area and ease of access, and the following criteria were used for selection of WUAs for the study:

- WUA and users willing and able to participate in study (i.e. they should recognise the need for improvement in water distribution).

- Canal system in operable condition so that after routine maintenance (by *ashar*) during the spring, water can be distributed. (some shortcomings are expected, but the WUA must be able to control flows even if just by informal means). The layout should also not be too complicated, so that rational water distribution planning and its implementation is within the capacity of the WUA
- Water available to be distributed until August (some small systems only provide water for the early part of the season, which limits the ability of the WUA to provide active management). June, July and August are the most important months for irrigation. In some of the river systems, fed by melting snow, there may be severe water shortages during the month of August. It would be difficult to implement the study if there is no water to distribute.
- Scheme located close to Osh (within one hours drive) – to facilitate logistics.

- Good relations and communications with *Raivodkhoz*, (the bulk water supplier), so that the WUA is confident in the total supply that it will receive. The bulk water supplier and the WUA have to be in regular contact. A disturbed relation will not benefit the study because it will harm the water delivery to the WUA.
  - Rehabilitation status such that it does not influence the study, since many schemes are in the process of rehabilitation. A large number of WUAs are in the process of or starting on-farm rehabilitation. An ongoing rehabilitation will draw away the attention of the WUA and therefore less interest or attention will be given to the study.
  - Main system rehabilitation complete, so that the water supply to the study areas can be controlled. The water supply to the study areas should be controllable. Many diversion and control structures are broken or absent in some systems. For this study it is important that the water supply can be regulated in some way.

There are about 60 WUAs in Osh *oblast*, located in four *raions* (districts) All WUAs are supported by the Osh Oblast support unit from the OIP. More details on the area are in the project reports, in this paragraph only the most important matters are summarised. By a process of literature review, discussions and field reconnaissance two WUAs were chosen: Jany Aryk and Obi Haet.

Application of these criteria resulted in the following shortlist of WUA to be visited:

Aravan Raion: WUA Obu Haet

Kara Suu Raion: WUA Kerme-Too

WUA Jany Aryk

The site visits were conducted as semi-structured interviews with representatives from the WUA, Raivodkhoz and farmers. The objective of the visits was to obtain a “feeling” of the issues important for those locations and to identify if there would be a potential for improvements in water management. Before the site visits, information from the WUA database, maps, operational schemes were obtained for these systems.

The team made an assessment of suitability of each WUA visited against original selection criteria. The result is in the table underneath.

Criteria		Obu Haet	Kerme Too	Jany Aryk
1	WUA and users willing and able to participate in study	✓	✓	✓
2	Manageable system in operable condition (to tail	✓	×	✓
3	Water available to distribute until August	✓	✓	✓
4	Close to Osh	✓ (30km)	✓ (15km)	✓ (5km)
5	Good communications with *Raivodkhoz*	✓	? new agency (previously problems)	✓
6	Rehabilitation status such that it does not influence study	✓ planned	✓ no plan	✓ planned
7	Main system rehabilitation preferably complete	✓	×	✓

To create a better view of the potential for improvements within the scope of this study, three additional criteria were suggested:

Criteria		Obi Hayat	Kerme Too	Jany Arik
8	Perceived need for improved management at farm level	✓	× (some signs of vandalism of infrastructure)	✓
9	Ease of working (complexity of relations with village, languages)	✓	×	✓
10	Good farming background	✓	×	✓

Comments

- All WUAs have participated in OIP training so they are confident that the study will be beneficial;
- Infrastructure will be in better condition by the start of the season, because of maintenance by ashar;
- There is evidence of problems in distribution between 'farmers', according to some farmers met;
- The need for measurement structures was stressed by all WUAs, but the study team confirmed that under the study there are no plans to install these. Although there may be scope for testing the appropriateness of low cost portable devices, in general there is no budget for infrastructure.

On this basis, Kerme-Too appeared to be the least suitable of the three sites, but the other two were considered equally suitable. So the team decided that the study would concentrate on Obi Hayat and Jany Aryk.

As these are still quite large areas, a secondary canal was selected in each WUA for the purposes of this study, using the following criteria:

- Shortage of water
- Problems with water distribution (due to e.g. physical problems and social conflicts)
- Canal in operational condition
- Relatively simple physical system
- Command area of roughly 100-250 ha
- Between 100 – 200 farm management units
- WUA recommendations.

On this basis Khatta Khaz I canal in Jany Aryk WUA, and Buvakul canal in Obi Haet WUA were selected. An overview of these sites is given in the following sections.

E.3.2 Study observations

Observations were carried out at three levels of the system throughout the season:

- Level 01: Study canal (ie the total volume into the study area and to the main reaches of the study canal)
- Level 02: Field Outlet (ie the way water is shared between outlets along the study canal)
- Level 03: Selected Irrigation Blocks below the field outlets, 3 per study canal – Head, Middle, and Tail

At each level of observation both physical and social/institutional observations were made. The physical water monitoring was recorded on water monitoring forms. The social and institutional information was obtained through discussions in groups, using checklists as a guide for the discussion. Farmers/irrigators were actively involved in the water monitoring, as well as in the discussion sessions.

In addition, further detailed observations were made within a single large outlet in each WUA in order to understand the mechanisms for water sharing between the relatively large numbers of farmers in these outlets. These are referred to as level 05 observations. At the end of the study we undertook a questionnaire survey of individual farmers and of informal networks of collaborating farmers.

This appendix concentrates on the physical measurements, in support of the data in the main report. The social and institutional studies are reported in full in the main report.

E.i Level 01: Water distributed along study canal

Objective	Observe approximate volume of water conveyed into study canal Observe how the water is distributed to different sections along the study canal
Method	**Physical**: Stick gauge in canal or marks on the side of the canal that will be calibrated with area / velocity method. If flows are in the right range, calibration can also be done using a portable Chipoletti Weir that will be supplied by the project. **Social and institutional monitoring**: Discussions with Farmer Observers about water distribution every 10 day period.
Measurement interval	**Physical**: Two times per day, 08:00 and 20:00 **Social & institutional**: every 10 day period (approximately day 10, 20, 30 of each month).
Who measures and records	**Physical**: *Murab* WUA canal, with backstopping from EIP Engineer Team **Social and institutional**: EIP Team (one engineer plus Aidai)
Who verifies	Farmer Observer (FO) near measurement point (estimated time requirement per Farmer Observer: 15 minutes morning, 15 minutes evening).
Location	Indicate on map (to be finalised in the field)
Reporting	**Form 01**: by *Murab* and Farmer Observer **Questionnaire 01**: by EIP Study Team based on group discussion with *Murab* and FOs.
Support material	Method of measurement (WB-OIP-training material)
Material supplies	Tape measures, stakes, stop watch (as appropriate), pocket calculators (1 each for *Murab*, and 4 FOs in each study area), forms in suitable binding for field work. EIP Study Team to specify, prepare, and distribute supplies to *Murab*s and FOs. Tea and snacks will be provided by the EIP team to those attending group discussion meetings. **Note**: the EIP team will be supplied with a camera and film so that they can initiate some photographic recording of what is happening in the field. They should consider the usefulness of issuing water users with a small, inexpensive, camera at a later stage, so that water users can record observations relevant to water distribution in their canal (structures [illegal or legal], water flows, problem areas, etc.).

E.ii Level 02: Water distributed to field outlets

Objective

Observe approximate volume of water supplied from each field outlet to DMU/farmers below the outlet.

Method

Physical water monitoring: Registration of date, time, duration and approximate flow from each field outlet to each DMU/farmer receiving water from that outlet.

The discharge is to be measured using the eye method. The eye method needs to be calibrated weekly by the *Murab* using a portable Chipoletti or Thomson Weir. The weir will be supplied by the project to the *Murab*.

Social & institutional monitoring: Group discussions with farmer irrigators about their experiences of water distribution during the previous irrigation period, once a month. The discussion will take place in three separate groups; one each for water users from Head, Middle and Tail from each study area. For each group, 20 DMU/farmers, will be selected so that all three wellbeing groups are represented. They will be invited to attend a 2 hour discussion meeting. The discussion will be led by EIP staff (1 Engineer and Aidai).

Measurement interval

Physical: At the start and finish of the irrigation turn to each water receiver.

Social & institutional: At the end of April, and at the end of May.

Who measures and records

Physical: *Murab* WUA canal, with backstopping from EIP Engineering Team

Who verifies

Each DMU/farmer receiving water from the outlet at the time of water delivery to his/her parcel(s)

Location

At each field outlet indicated on map

Reporting

Form 02: by *Murab* and DMU/farmer receiving water

Questionnaire 02: EIP Study Team based on group discussion with farmer irrigators.

Support material

-

Material supplies

Weir, forms in suitable binding for field work. EIP Study Team to specify, prepare, and distribute supplies to *Murab*s.

Tea and snacks will be provided by the EIP team to those attending group discussion meetings.

E.iii Level 03: Water distributed downstream of field outlets, for selected Observation Blocks below the field outlet

Objective

Observe how water is approximately distributed within 3 selected blocks: one each at head, middle and tail of the secondary canal command area.

Register additional information regarding water distribution within the selected area

Method

Physical water monitoring: Recording of date, time, duration and approximate proportion of total flow to the block that is allocated to each parcel within the block.

To estimate the proportion of the total field outlet discharge that is allocated to the block, and to each parcel within the block, the eye method should be used.

Social and institutional monitoring: Group discussion with Block Elder and block member farmers about water distribution within the block, for approximately 2 hours [possibly only 1 hour needed? GAN], once per month.

Measurement interval

Physical: At the start and finish of the irrigation turns to each parcel.

Social and institutional: at the end of April and end of May.

Who measures

Physical: Block Elder, with water receiver for each parcel

Who verifies

Farmer that receives the water

Location

At selected blocks. Names of Block Elders and block farmers are in Appendix L. The location of each block, and detailed information about each parcel, needs to be noted on a map, as described in section 4, below.

Reporting

Form 03: by Block Elder and water receiver/farmer

Questionnaire 03: by EIP Research Team based on group discussion with Block Elder and block members/farmer irrigators.

Support material

-

Material supplies

Forms in suitable binding for field work. EIP Study Team to specify, prepare, and distribute to Block Elders.

Tea and snacks will be provided by the EIP team to those attending group discussion meetings.

E.4 Obi Haet, Kyrgyzstan

E.4.1 Layout and type of system

Aravan *Raivodkhoz* receives water from several systems, Aravan Sai river, Aravan Ak-Bura Canal, Nayman reservoir, Isfara river (inter Oblast) and the South Ferghana canal (international). The most important water sources are the Aravan Sai River and the Aravan Ak Bura canal. Most of the years there is adequate water supply. In case needed, additional water can be requested from the *Oblovodkhoz*. The Chief Engineer of the *Raivodkhoz* is responsible for planning of water allocation to the WUA. He is working on the system for many years and knows well the situation, and is a capable and pleasant person.

Some water measurement devices are present in the system, but more are needed. Water supply is adequate but fluctuates during the day. These predictable fluctuations (due to snowmelt) are taken into account during the implementation of the watering schedule.

The WUA location in the Raion and the layout of the Buvakul canal are given in the main report, showing the layout of the study canal, all the outlets and the irrigated areas for each field. The command area of this canal is 164.6 ha and there is no village area included in this command area.

The canal is constructed in earth. The maintenance status is quite reasonable and the farmers and WUA clean the canal on regular intervals. There are no working hydraulic structures in the canal. The *mirab* creates temporary cross regulators using brushwood and stones.

The offtakes to the fields are also in earth. These are opened and closed using a shovel. The system depends on these small in-field hand-made structures to ensure a reasonable management of the system. It is difficult to manage, however, as there are 57 offtakes to farmers and groups of farmers. It is difficult for one *mirab* to control this as the distance from the beginning to the end of the system is about 4 km.

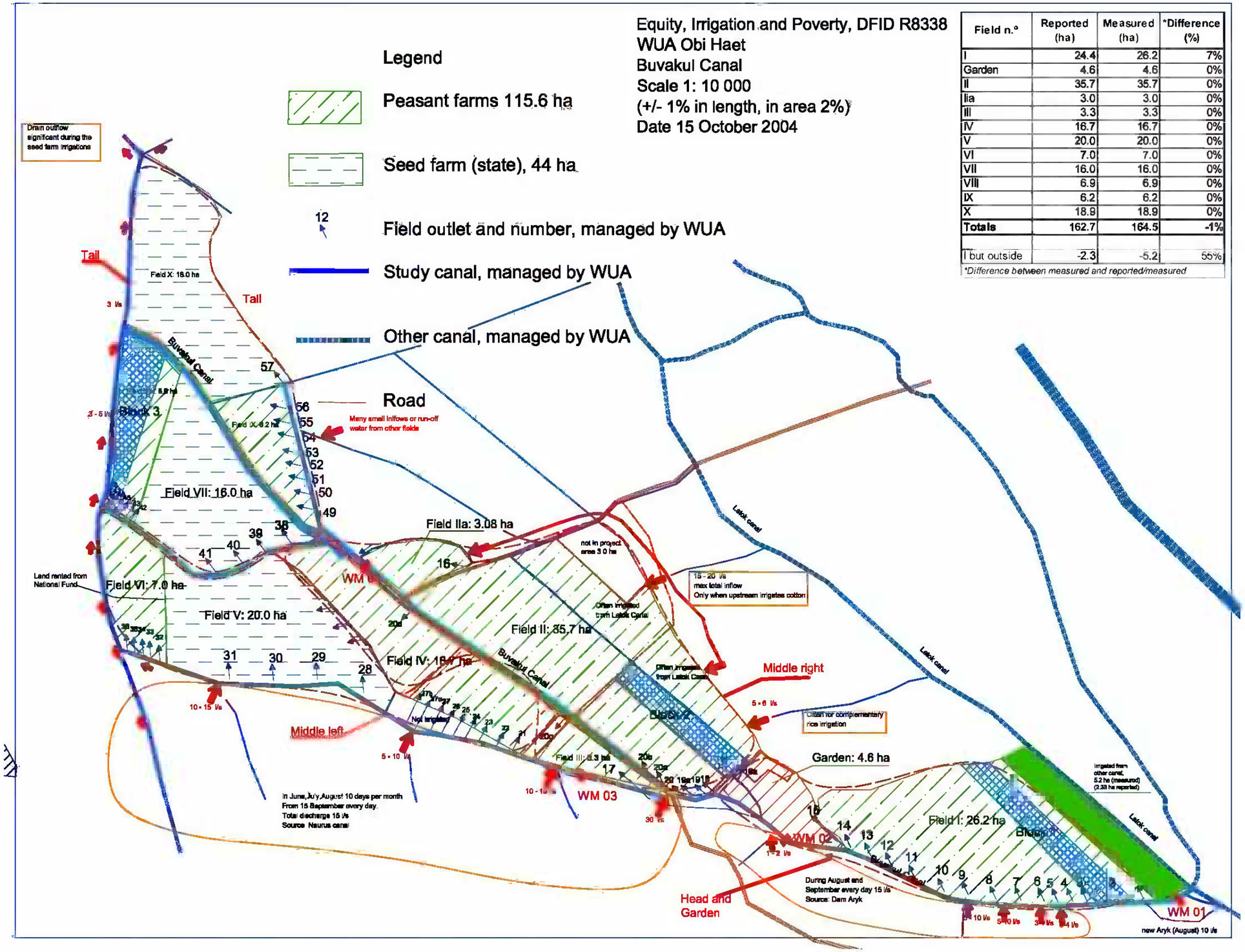
The OIP has developed a rehabilitation plan for this canal, including a reduction in the number of outlets and construction of regulation and water measurement structures.

E.4.2 Quantitative data on water distribution

E.i Level 01 Buvakul Canal

Along the Buvakul canal four stick gauges were installed. The canal sections were calibrated several times during the irrigation season. The gauges were distributed in a way so that volumes of water supplied into head-middle and tail parts of the system would be quantified, as shown in Figure E.14, to give an indication of distribution of irrigation water into different parts of the system.

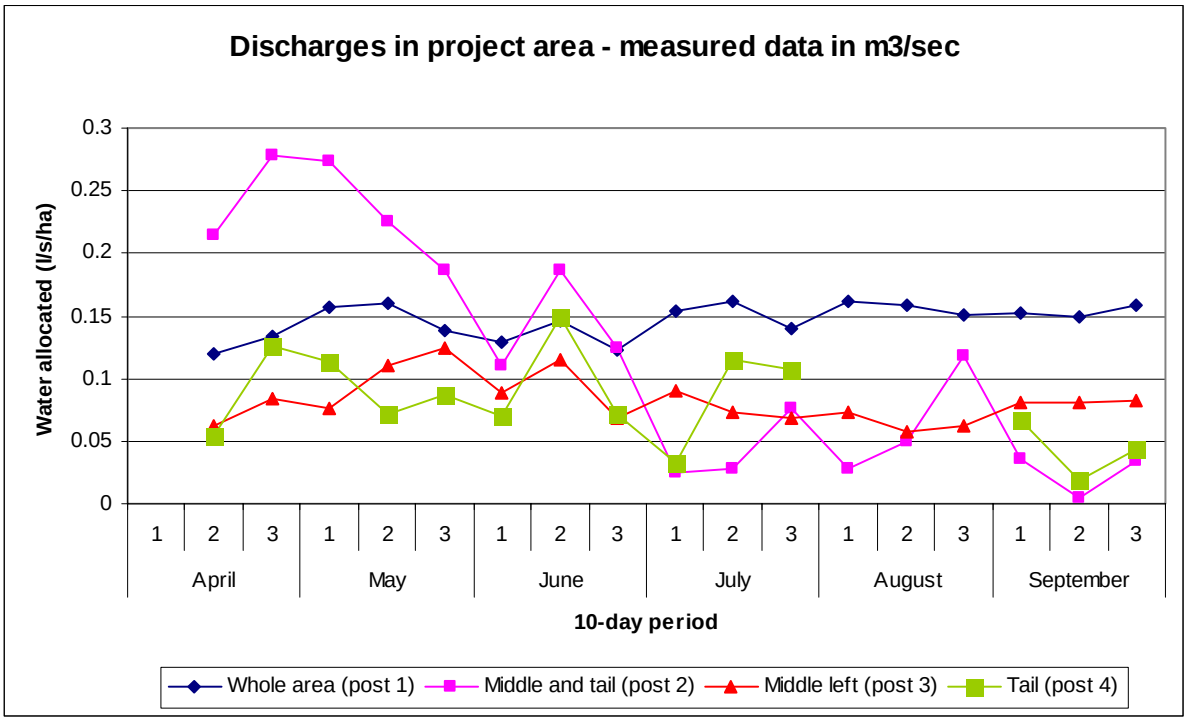
Layout of Buvakul canal: Obu Haet WUA



Field n.°	Reported (ha)	Measured (ha)	*Difference (%)
I	24.4	26.2	7%
Garden	4.6	4.6	0%
II	35.7	35.7	0%
IIa	3.0	3.0	0%
III	3.3	3.3	0%
IV	16.7	16.7	0%
V	20.0	20.0	0%
VI	7.0	7.0	0%
VII	16.0	16.0	0%
VIII	6.9	6.9	0%
IX	6.2	6.2	0%
X	18.9	18.9	0%
Totals	162.7	164.5	-1%
I but outside	-2.3	-5.2	55%

*Difference between measured and reported/measured

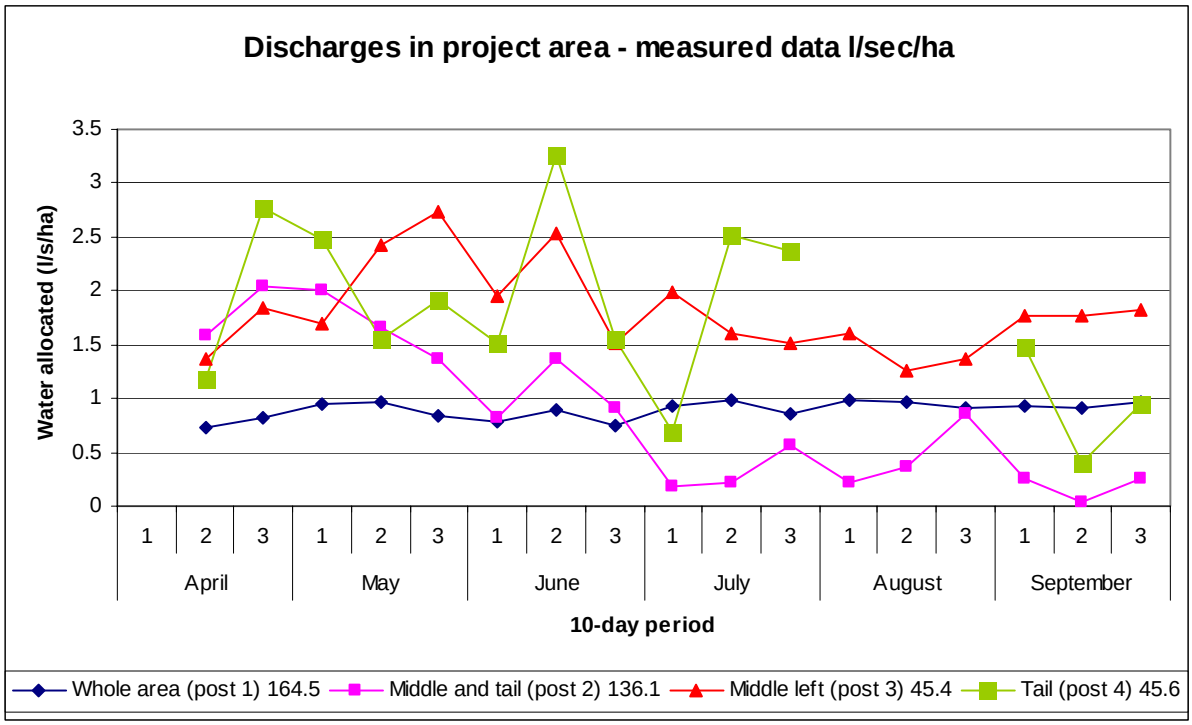
Figure E.14: Water distributed to Buvakul m3/sec



It can be seen that during the months of April, May and June, the discharge measured at post 2 is larger than the one measured at post 1. From July until September, the discharge into the area (post1) is generally smaller than the sum of the flows downstream. Assuming that the measurements are correct, this means that the Buvakul canal is not the only source of irrigation water, and that there are some other inflows from other canals or drains.

Transforming the data in discharge per unit area (Figure E.15), it can be seen that the lower one gets into the system the more water is being diverted per hectare.

Figure E.15: Water distributed to Buvakul l/sec/ha



There are several reasons why the water balance does not fit very well:

Measurement

- Even though the staff gauges were calibrated several times during the irrigation season, and the canal sections appeared to be quite stable, it is possible that the staff gauges were not indicating the right discharge;
- The land areas that were measured are not correct, but this is not believed to be the case since a very good match has been obtained between measured and reported irrigated areas.

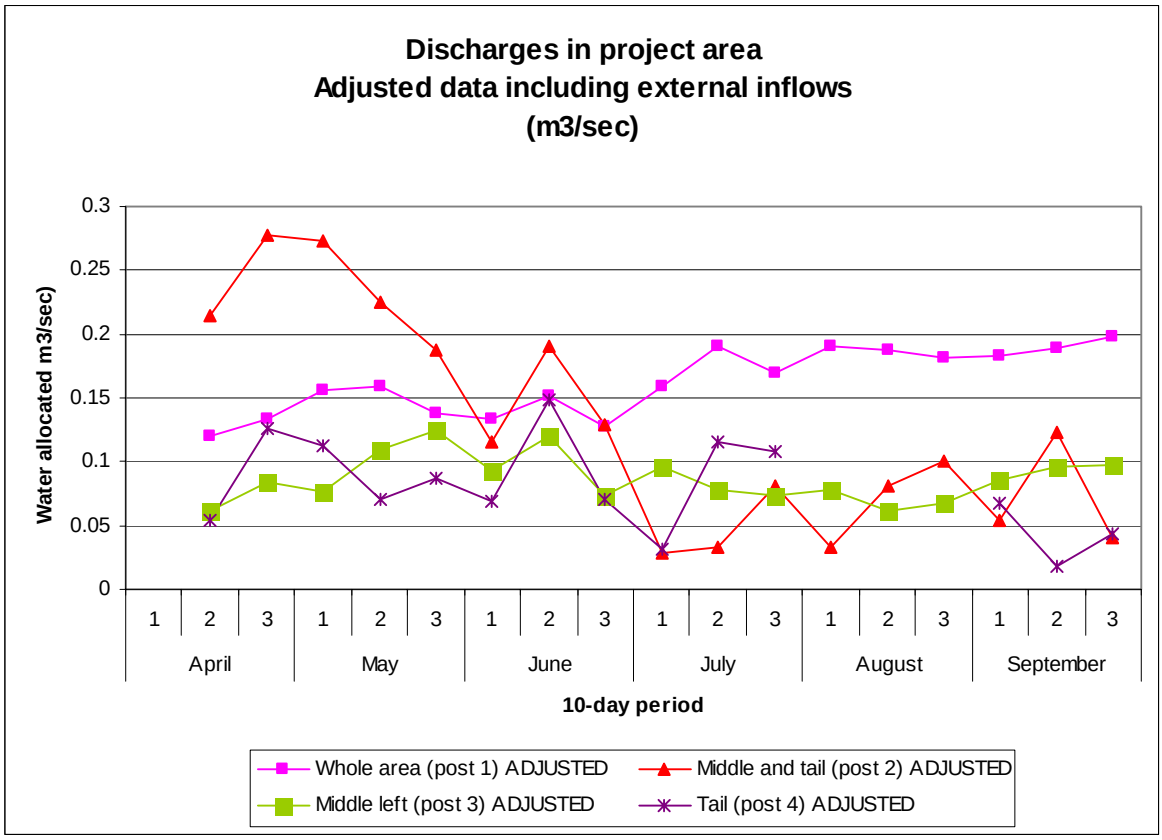
Other reasons

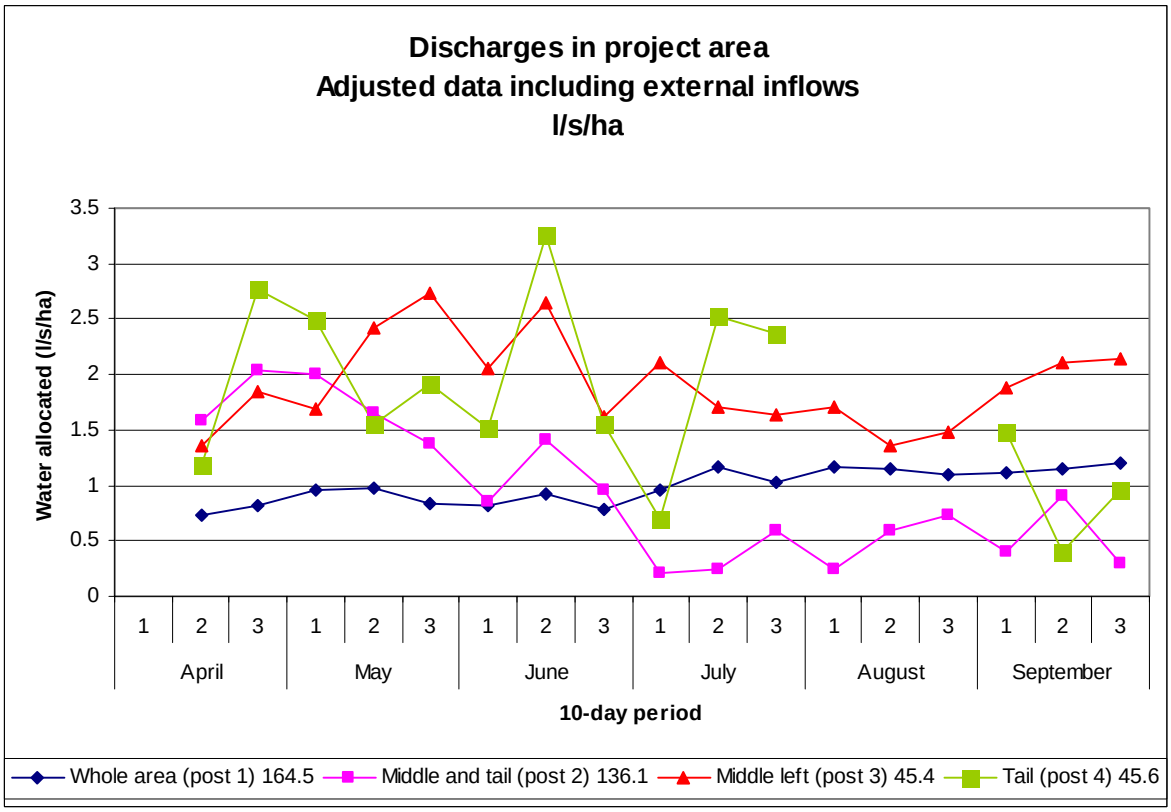
- There are significant inflows into the irrigated area that bypass the measurement gauges. This seems to be the case, and a tentative quantification has been made which will be discussed below;
- There are significant outflows from the area meaning that the water retained in the area is less than measured.

As long as the additional inflow and outflows from the area are evenly distributed throughout the study area there would be not much significance. But the case is that there are considerable differences between the gauging stations, meaning that the external in and outflow is not evenly distributed along the area and that therefore they need to be considered in a different way for each irrigation area.

Additional information was collected regarding the additional in and outflows and an evaluation was made to take into account these changes. We then made adjustments for additional inflows into the area, as in the following graphs.

Figure E.16: Adjusted data on water distribution in Buvakul, allowing for inflows

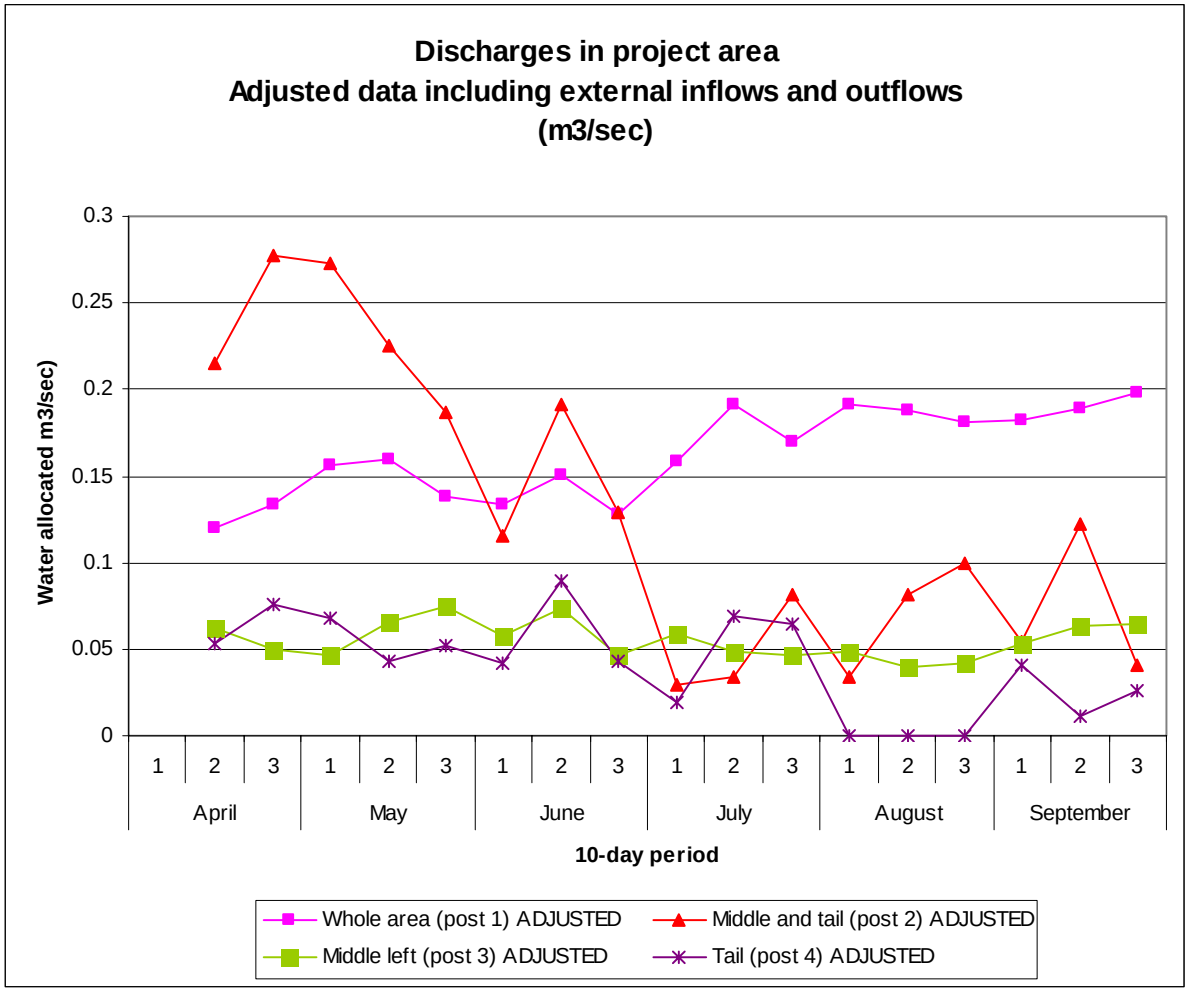


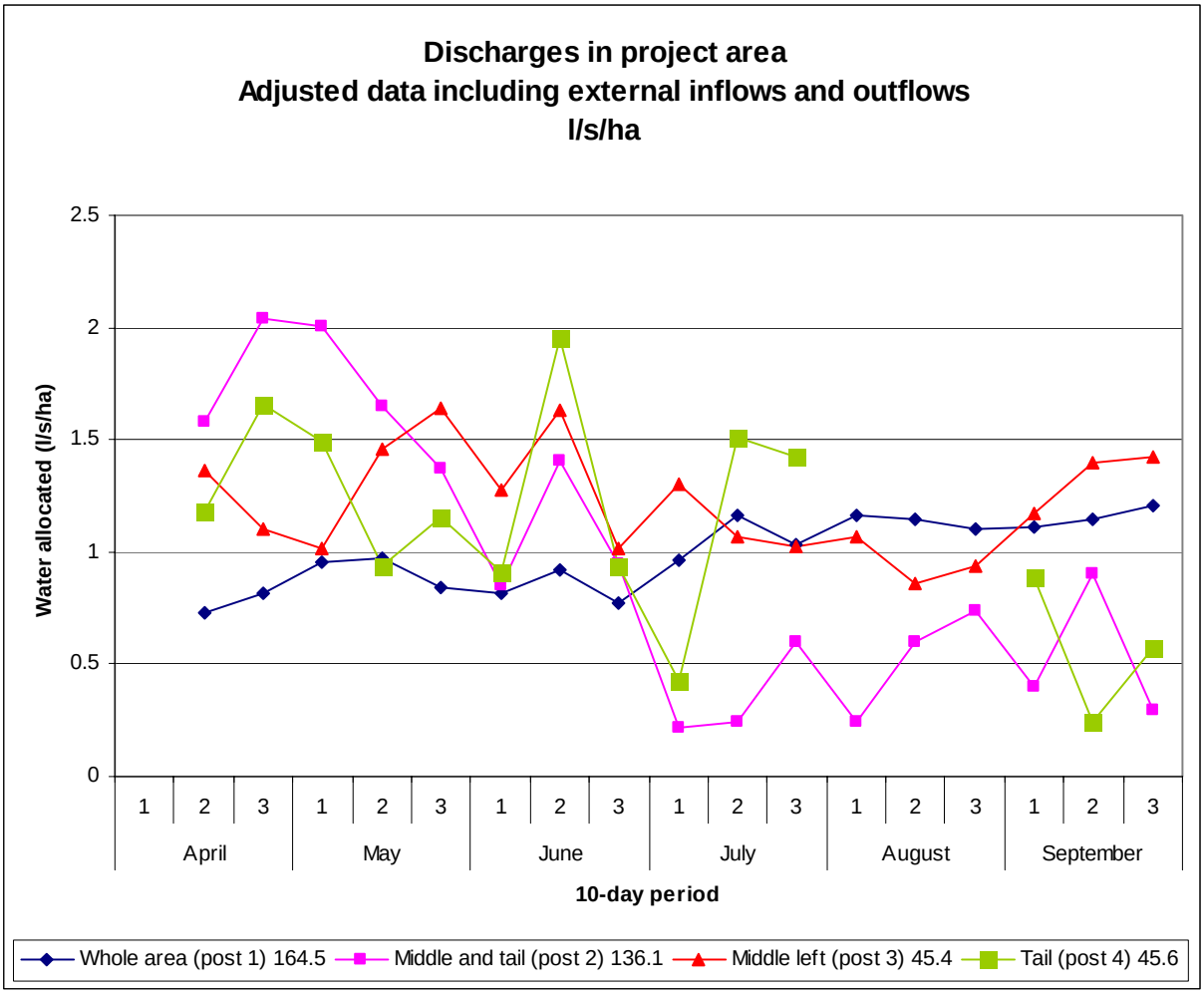


The result is more promising, but still not good enough. It is believed that there must be significant drain flows out of the area that are not accounted for on the values regarding post 3 and 4.

Taking into account a 40% drain flow at these hydro posts, the allocations become as presented in Figure E17. This is an improvement, but it can still be seens that there are discrepancies in the measurements. It means that it is difficult to measure discharges in this system because there are significant external inflows and drainage outflows. These can of course all be measured, but it is questionable if the result will be satisfactory for the day-to-day management of the system. This highlights the difficulty in using flow measurement as a basis for management and undetlines the need for a simpler system.

Figure E.17: Adjusted data on water distribution in Buvakul, allowing for additional inflows and outflows





The total seasonal water distribution to the head, middle and tail parts in the system can be calculated from the measured and adjusted flow data as presented in Table E.10.

Table E.10: Seasonal water distribution to head middle and tail of system

	Head	Middle	Tail
Measured data	12,601 m^3/ha *(gauge 01 / whole area*		
		11,751 m^3/ha *(Gauge 02 / mid+tail*	
			18,789 m^3/ha *(Gauge 04)*

	Head	Middle	Tail
Data adjusted for external inflow	14,071 m^3/ha *(gauge 01 / whole area*		
		12,259 m^3/ha *(Gauge 02 / mid+tail*	
			18,789 m^3/ha *(Gauge 04)*

	Head	Middle	Tail
Adjusted external inflow and drain out flow	14,071 m^3/ha *(gauge 01 / whole area)*		
	-	12,259 m^3/ha *(Gauge 02 / mid+tail)*	
	-	-	10,675 m^3/ha *(Gauge 04)*

This actual distribution can be compared with the planned amount, as in Table E.11

Table E.11: Seasonal water distribution to head middle and tail of system

	Planned (*1000 m3)	Distributed
March	8	0
April	282	146
May	299	391
June	393	342
July	518	385
August	448	405
September	337	395
October	53	0
November	6	0
Total	**2,344**	**2,064**

The results show that in reality 88% of the planned amount of water has been distributed. The actual figures for water delivery are the ones that are measured at measurement post 1, the amount that will be paid by the water users. It does not include the return flows from other areas and the values are therefore below the real amount of water that was directed into the area. Even measuring flows to relatively large groups of farmers is thus difficult, let alone to individual farmers.

E.ii Level 02 : Outlets to study blocks - Obu Haet

Data indicating the time that each outlet received irrigation water during the irrigation season is summarised in Table E.12. These recordings do not include the fields V,VII, and X which are under state management and grow cotton seed. The numbers also do not include irrigation for rice.

Table E.12: Duration of irrigation to study blocks

Zone	Field	Irrigation hours	Number of irrigation events	Hours per irrigation event		Command area	Irrigation hours per ha	Irrigatio events per ha	Hours per irrigation per ha
Summary									
H	Average I	8,476	256	33		35.6	238	7.2	0.9
M	Average II	8,475	263	32		44.0	193	6.0	0.7
M	Average III	776	23	34		3.3	237	7.0	10.3
M	Average IV	1,537	45	34		21.3	72	2.1	1.6
M	Average VI	420	11	38		9.0	47	1.2	4.2
T	Average VIII	1,064	32	33		7.7	138	4.1	4.3
T	Average IX	416	11	38		7.2	58	1.5	5.3
	Average H,M,T	3,023	92	35		18.3	140	4	4
H	Average H	8,476	256	33		35.6	238	7.2	0.9
M	Average M	2,802	86	35		19.4	137	4.1	4.2
T	Average T	740	22	36		7.5	98	2.8	4.8

Main observations are the following:

- The head of the system receives about two and half times more irrigation events per hectare as compared with the tail of the system;
- The total irrigation time per hectare (h/ha) is about two and half times more at the head than at the tail of the system; and
- The average duration per irrigation per hectare (hours per irrigation/hectare) at the tail end of the system is about five times longer than at the head of the system

This could mean that:

- The farmers at the head of the system have much better access to irrigation water than at the tail of the system
- The irrigations at the tail of the system are better organised so that they can cope with infrequent irrigation

Farmers report that the crop yields of cotton are better than at the tail end of the system than at the head of the system. This could indicate, assuming that the other production factors are more or less the same, over-irrigation at the head of the system harms the cotton crop yield.

A summary of the perception of the quality of irrigation service delivered by the WUA to these outlets is presented in Table E.13.

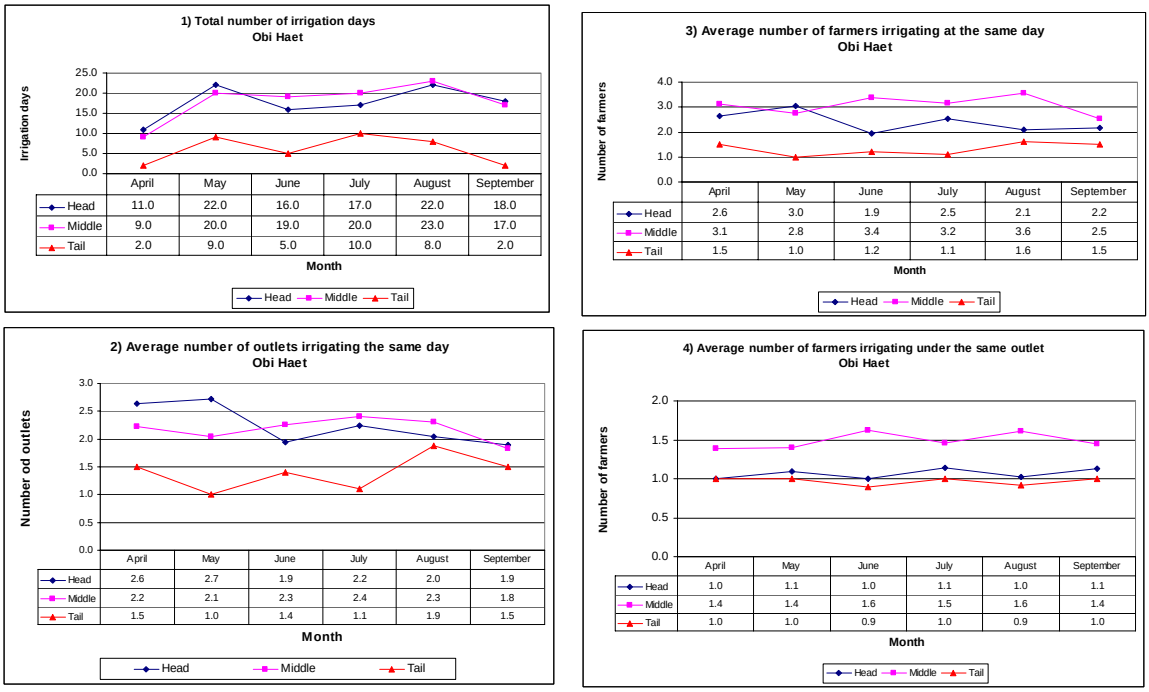
Table E.13: Farmer perceptions of irrigation performance

Analysis and summary form 02 Obi Haet	Head		Middle		Tail		Total	
	n.°	%	n.°	%	n.°	%	n.°	%
1) General								
Number of registered irrigation events (un)	263	41%	341	53%	44	7%	648	100%
2) Duration of Irrigation								
Average duration of each registered irrigation (h)	33		33		35		34	
3) Timing of irrigation								
Number of irrigations on time (A)	125	76%	244	95%	32	97%	401	88%
Number of irrigations late (B)	0	0%	3	1%	1	3%	4	1%
Number of irrigations early (Z)	40	24%	9	4%	0	0%	49	11%
Total	165	100%	256	100%	33	100%	454	100%
4) Sufficiency of irrigation								
Number of irrigations too much (0)	1	1%	2	1%	0	0%	3	1%
Number of irrigations enough (1)	164	99%	231	90%	24	73%	419	92%
Number of irrigations not enough (2)	0	0%	23	9%	9	27%	32	7%
Total	**165**	100%	**256**	100%	**33**	100%	**454**	100%

- Most of the irrigation events (53%) occurred in the middle of the system (which covered just 31% of the area);
- The duration of each irrigation, irrespective of the area, is the same in each part of the system – although 57% of the area is in the head, 31% in the tail and only 12% in the tail;
- The farmers at the tail end perceive that 97% of the irrigations are received on time and that 3% of the irrigations were delivered late;
- The farmers at the head of the system perceive that 76% pf the irrigation events occurred on time and that 24% of the irrigations were receives early;
- The farmers in the middle of the system perceive that 95% of the irrigation occurred on time, 1% too late and 4% early;
- The sufficiency of irrigation shows that the farmers at the head of the system believe they received enough and some even too much. In the middle of the system about 90% believes the irrigation is enough and 9% not enough. At the tail end of the system 73% of the irrigations were considered enough and 27% not enough.

The number of irrigation days, and the numbers of farmers and outlets irrigating on the same days are presented in Figure E.18.

Figure E.18: Number of irrigation days, and farmers and outlets irrigating



These graphs illustrate some aspects of the complexity of the system.

- There are about 20 irrigation days per month in the head and middle of the system, but only about 10 days per month at the tail end;
- In the head and middle of the system a bit more than two outlets irrigate at the same time, in the tail of the system less than two outlets irrigate at the same time;
- In the head of the system between two and three farmers irrigate the same day, in the middle this is between 2.5 and 3.6, in the tail end of the system this is between one and one and a half farmer per day; and
- In the head and tail about one farmer irrigates under one outlet per irrigation, in the middle more than one farmer irrigates under the same outlet on the same day.

It means that the *mirab* allows only a certain number of outlets and farmers to irrigate on the same day. This is based on his understanding of the limits of the distribution system.

Cropping pattern Obu Haet

Where in the system	Land area (ha)	Cropping pattern										
		Cropped area (ha)		Cotton (ha)	Wheat (ha)	Onion (ha)	Potato (ha)	Carrot (ha)	Rice (ha)	Maize (ha)	Sunflower (ha)	left empty
HEAD	29.03	35.57		20.29	4.54	3.13	0.19	0.13	2.35	0.70	2.72	1.52
		100%		***57%***	***13%***	***9%***	***1%***	***0%***	***7%***	***2%***	***8%***	***4%***
MIDDLE	85.67	94.54		64.29	6.63	5.86	0.90	0.37	3.93	2.16	5.04	2.08
		97%		***68%***	***7%***	***6%***	***1%***	***0%***	***4%***	***2%***	***5%***	***2%***
TAIL	48.00	49.81		44.55	2.51	0.50	0.00	0.20	0.32	0.00	1.53	0.20
		100%		***89%***	***5%***	***1%***	***0%***	***0%***	***1%***	***0%***	***3%***	***0%***
TOTAL	162.70	179.92		129.13	13.68	9.49	1.09	0.70	6.60	2.86	9.29	3.80

				Cotton (ha)	Wheat (ha)	Onion (ha)	Potato (ha)	Carrot (ha)	Rice (ha)	Maize (ha)	Sunflower (ha)	left empty
HEAD				57.0%	12.8%	8.8%	0.5%	0.4%	6.6%	2.0%	7.6%	4.3%
MIDDLE				68.0%	7.0%	6.2%	1.0%	0.4%	4.2%	2.3%	5.3%	2.2%
TAIL				89.4%	5.0%	1.0%	0.0%	0.4%	0.6%	0.0%	3.1%	0.4%
TOTAL				71.8%	7.6%	5.3%	0.6%	0.4%	3.7%	1.6%	5.2%	2.1%

The following tendencies can be observed in the cropping pattern:

- In the tail end about 90% is under cotton cultivation, in the middle this is 68% and in the head of the system 57%;
- There is significantly more land under rice cultivation at the head and middle of the system than in the tail end;
- Significantly more onions, potatoes and maize are grown in the head and middle of the system; and
- Significantly more wheat is grown in the head of the system.

It can be concluded that the best option for the tail end of the system is to grow cotton, as it is less affected by water shortages during the cropping season.

An area under cotton of almost 90% means that there is no possibility for crop rotation. In the head and middle of the system crop rotation can be possible.

E.iii Level 03 : within study blocks - Obu Haet

Three blocks were selected within a single outlet so that the water distribution could be anlaysed. The results are summarised in Table E.14.

Table E.14: Water distribution within outlets

Data summary Block 1-3								
Parcel ID	**Crop**	**Area (ha)**	**Irrigation hours**	**Irrigation events**	**Hours per irrigation**	**Irrigation hours per ha**	**Irrigation events per ha**	**Hours per irrigation per hectare**
Block 1		0.45	73	3.6	21	521	37	135
Block 2		0.47	133	4.8	27	806	35	190
Block 3		0.44	121	3.4	35	332	10	112
Average		**0.46**	**109**	**3.9**	**28**	**553**	**27**	**146**

The following can be concluded:

- Block 1 is in the head of the system, so the numbers of irrigation events and hours of irrigation were expected to be higher in this block. The reason for this not having occurred can be justified by the fact that there is no rice grown in this block. In the rest of the head reach of the system rice is grown. So in this aspect block 1 is not fully representative for the head of the system.

- Block 2 in the middle section of the canal, the largest average area, highest average irrigation hours and number of irrigation events.

- Block 3 at the tail end of the system is clearly under irrigated as compared with block 1 and block 2

Carrots and onion are grown in very small areas in these blocks but they receive proportionally significantly more hours of irrigation as well as number of irrigations per hectare. The actual number of irrigation events are also above the ones from the other crops.

E.iv Level 05: Distribution within outlet 16 of Obu Haet

This part of the study was undertaken for outlet number 16 that is located in the middle part of the system. The total command area of this bock is 32.87 ha. There are 53 farmers and so an average area per farmer of 0.62 ha.

To irrigate this area it took 5,311 hours for 164 irrigations and each irrigation took around 31 hours to be completed. To quantify the water distributed to each farmer, without having discharge data, other indicators were developed. The main indicator is water distribution in hours of irrigation per hectare.

The following classification was made to distinguish between water allocations:

- No irrigation
- Below average < 75% (<145 hr/ha)
- Average 75% - 125% (145 – 242 hr/ha)
- Above average 125%-175% (242 – 339 hr/ha)
- Very much above average > 175% (>339 hr/ha)

The results are presented in Table E.15.

Table E.15: Adequacy of irrigation in outlet 16, according to well being groups[262]

Classification of irrigation gifts	No irrigation	Below average	Average	Above average	Very much above average	Total
		<75% of average	75% - 125% of average	125%-175% of average	>175% of average	
n.º of farms	2	22	12	13	4	53
Average area / field (ha)	0.59	0.71	0.73	0.47	0.29	0.62
Total area (ha)	1.17	15.71	8.71	6.13	1.15	32.87
% of farms	4%	42%	23%	25%	8%	100%
% of area	4%	48%	26%	19%	3%	100%

% of farms in well being groups	No irrigation	Below average	Average	Above average	Very much above average	Total
Group 1		8%		2%		9%
Group 2	2%	15%	17%	9%	8%	51%
Group 3	2%	19%	6%	13%		40%
Total farms	4%	42%	23%	25%	8%	100.0%

% of area in well being groups	No irrigation	Below average	Average	Above average	Very much above average	Total
Group 1		15%		1%		16%
Group 2	2%	13%	19%	7%	3%	45%
Group 3	1%	20%	7%	11%		39%
Total area	4%	48%	26%	19%	3%	100%

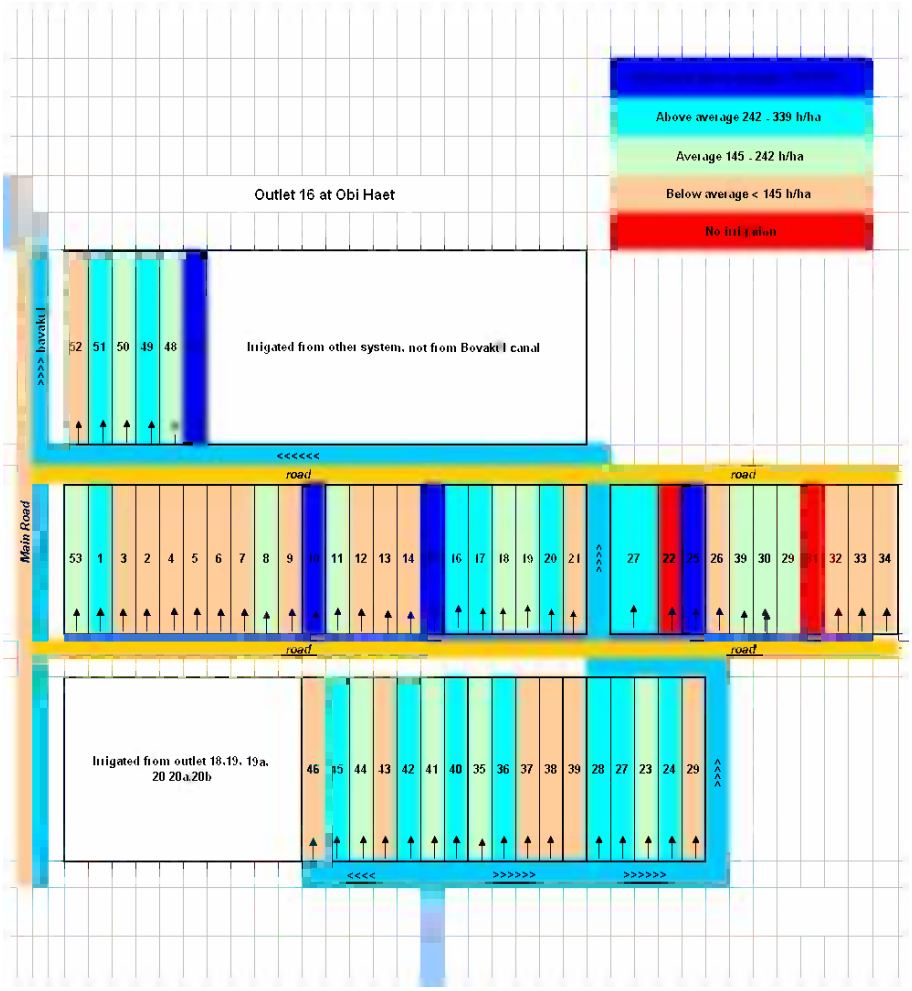
From the above data, it can be seen that

- Most farms and most of the area received below average supplies,
- Around 25% of the number of farms and area received average water application,
- 25% of the farms and 19% of the area received above average, and
- 8% of the farms and 3% of the area received very much above the average supply

A graphical display is presented of the final result in Figure E.19

[262] Group 1 = well-off; group 2 = medium; group 3 = poor

Figure E.19: Distribution of water within outlet 16



E.4.3 Conclusions - equity of water supply

The study area has a complex irrigation and drainage system, which makes it difficult to analyse water distribution systematically - there is a large amount of water flowing into the area from surrounding areas. This really benefits the middle and tail reaches of the system, and there are also uncontrolled drainage outflows from the area. It is therefore very difficult to relate water use by outlets, let alone individual farmers to the inflow to the Buvakul canal

Nevertheless the data show that the head of the system receives more than double the number of irrigation events and irrigation time per hectare than the tail of the system. So the farmers at the head of the system have much better access to irrigation water. The farmers at the tail of the system, have a less reliable supply but some are able to make better use of this limited supply – due to the greater agricultural skills. Such farmers mainly grow cotton which is more water stress resistant than other crops, they are better organised, make better use of the irrigation water and have a higher productivity of cotton than other farmers.

There are few if any clear patterns to the distribution of irrigation water, although are clearly considerable variations. These are largely related to individual skills and access to the *mirab* , rather than systematic bias against specific locations or well-being groups. This is a consequence of the lack of formal rules and the limted role played by the WUA.

E.5 Jany Aryk, Kyrgyzstan

E.5.1 Layout and type of system

WUA Jany Aryk receives water from the Aravan-Ak-Bura Irrigation System Authority that was established in August 2003. The authority was established because the canal was previously under the management of two *Raivodkhoz*, making canal management difficult. The Agency has an experienced director who used to work on the OIP project and has had considerable exposure to WUAs and their issues. The Authority is strengthening existing relationships with the WUAs and intends to improve the water planning and distribution.

Jany Aryk WUA irrigation system as a whole and the study canal is illustrated in the main report. It is a complex system that flows through five villages. There are not many water measurement devices in the system, and these are mainly located at the offtakes coming from the Aravan Ak Bura Canal. The water supply to the study canal (Khatta Khaz 1) is reliable and sufficient in quantity. The Khatta Khaz-1 canal is also a complex system without water control and measurement structures, and in average physical condition. The tail section is in bad condition and tail-end farmers mainly receive water from the Selpo Canal (also from Aravan-Akbuura system).

There are no operational drinking water systems present in the villages, so the irrigation water is used for domestic purposes and hence the canal system needs to be always running. The base flow to the villages is about 1 l/s/ha of village area.

The total command area of this canal is 199.3 ha of which 151.9 ha is agricultural land and 47.4 ha is village territory. Water offtakes are often culverts but without a gate. Opening and closing of the offtakes is difficult, because the velocity of flow is considerable and earthen plugs will not work. This also means that management of the system in not easy. The distance from the start to the end of the system is around 3 km, which makes it difficult for one *mirab* to manage it.

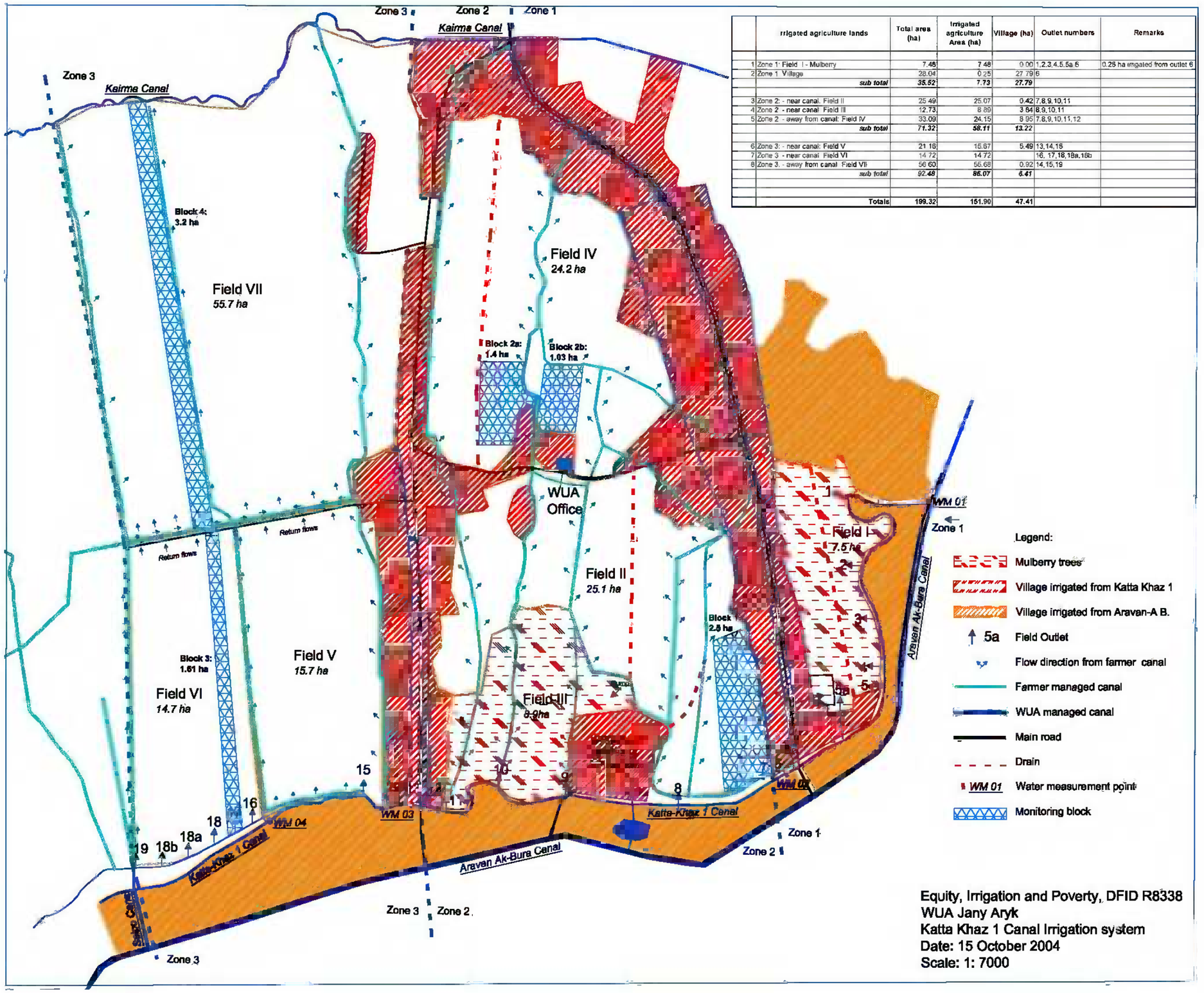
E.5.2 Quantitative data on water distribution

E.i Level 01 Katta-Khaz canal

Along the Katta-Khaz canal 3 measurement posts[263] were installed with the objective to calculate the water allocation to the sections in the system. The results are given in table E.16.

[263] We attempted to measure flows in a fourth location, at the tail of the canal, but this proved to be impracticable because of heavy vegetation growth which made it impossible to calibrate the gauge.

Layout of Khatta Khaz 1 Canal: Jany Aryk WUA



	Irrigated agriculture lands	Total area (ha)	Irrigated agriculture Area (ha)	Village (ha)	Outlet numbers	Remarks
1	Zone 1: Field I - Mulberry	7.48	7.48	0.00	1,2,3,4,5,5a,6	0.25 ha irrigated from outlet 6
2	Zone 1: Village	28.04	0.25	27.79	6	
	sub total	*35.52*	*7.73*	*27.79*		
3	Zone 2: - near canal: Field II	25.49	25.07	0.42	7,8,9,10,11	
4	Zone 2 - near canal: Field III	12.73	8.89	3.84	8,9,10,11	
5	Zone 2 - away from canal: Field IV	33.09	24.15	8.95	7,8,9,10,11,12	
	sub total	*71.32*	*58.11*	*13.22*		
6	Zone 3: - near canal: Field V	21.16	15.67	5.49	13,14,15	
7	Zone 3 - near canal: Field VI	14.72	14.72		16, 17,18,18a,18b	
8	Zone 3. - away from canal: Field VII	56.60	56.68	0.92	14,15,19	
	sub total	*92.48*	*86.07*	*6.41*		
	Totals	199.32	151.90	47.41		

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WUA Jany Aryk
Katta Khaz 1 Canal Irrigation system
Date: 15 October 2004
Scale: 1: 7000

Table E.16: Seasonal water distribution to head middle and tail of system

Way of computation	Zone 1	Zone 2	Zone 3
Cumulative water distributed directly based on readings from gauges	15,475 m^3/ha *(gauge 01 readings)*		
	-	13,686 m^3/ha *(Gauge 02 readings)*	
	-	-	10,385 m^3/ha *(Gauge 03readingsl)*
Water distributed to each zone, calculated by subtracting gauge values from each other	31,355 m^3/ha *(Gauge 1-2)*	19,263 m^3/ha *(Gauge 2-3)*	10,385 m^3/ha *(Gauge 3)*

It can be observed that there are large differences in the amount of water distributed to the different zones along the canal.

The flow data is summarised in Figure E.20 and the resulting calculated water distribution practices are presented graphically in Figure E.21. The most important difference can be observed in the period from end of April until the end of June, where Zone 1 is receiving between 5-6 l/s/ha and the other areas between 1 and 3 l/s/ha.

The WUA reports to allocate about 50 l/s for domestic water supply (in the canal command as a whole). This corresponds with about 1 l/s/ha for the village area. This water is used for consumptive use in the household, the house plot kitchen garden and the trees along the water ways in the village. The 50 l/s can be considered as the base flow of the system.

Figure E.20: Discharge measurements averaged over each 10-day period

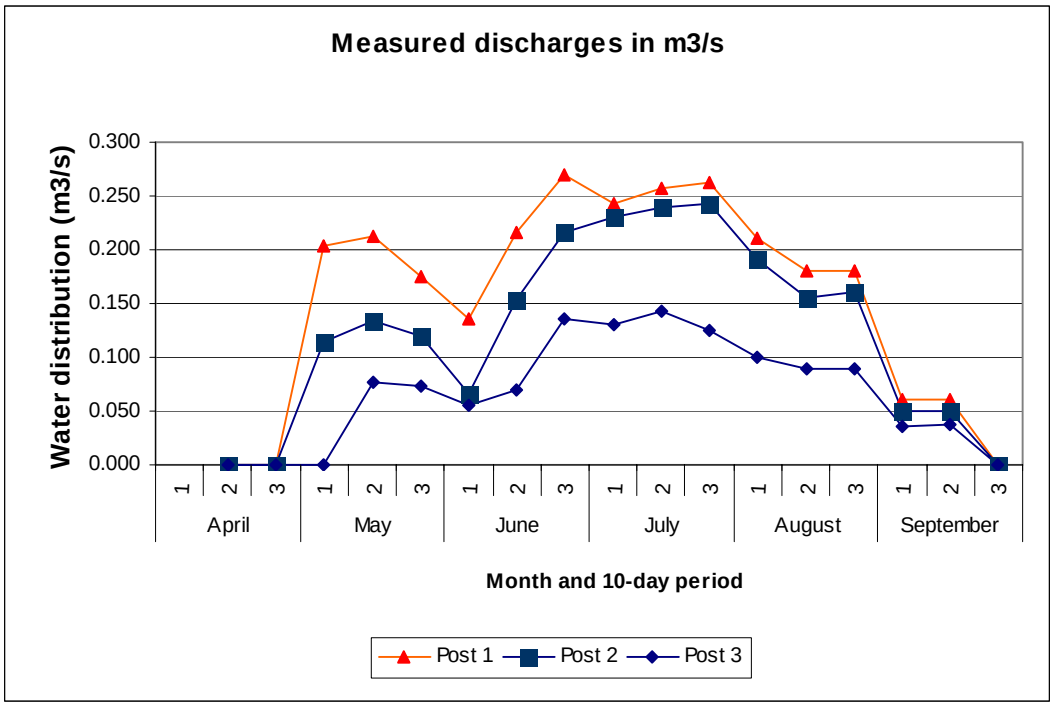
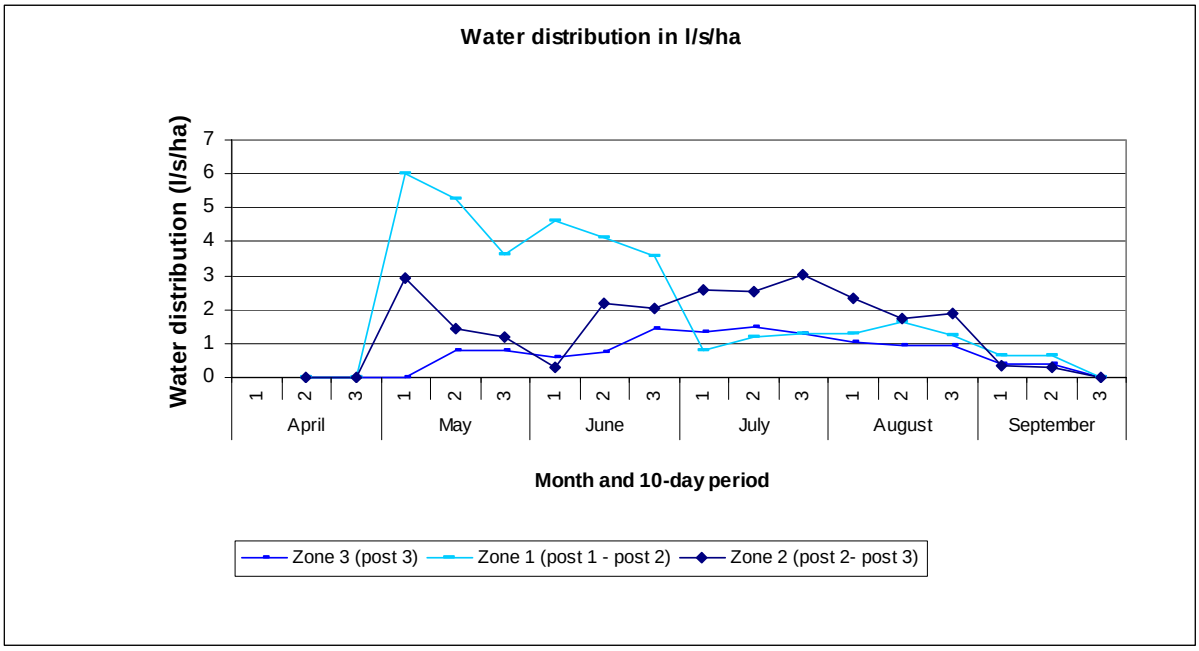


Figure E.21: Calculated unit area flows (l/s/ha) per 10 day period



E.ii Level 02: Outlet to study blocks

Data giving the time that each outlet in Zones 2 and 3 received irrigation water during the irrigation season is summarised in Table E.17. The times were not recorded for Zone 1 since these outlets were flowing for so much of the time that it was not practicable to record actual numbers and duration of events.

Table E.17: Duration of irrigation to outlets

Summary Data Form 02 - Katta-Khaz Canal

Outlet	Zone	Field	Irrigation hours	Number of irrigation events	Hours per irrigation event		Command area	Irrigation hours per ha	Irrigation events per ha	Hours per irrigation per ha
7	2	II	399	10	40		2.78	143.5	3.6	14.4
8	2	II	720	17	42		7.00	102.9	2.4	6.1
9	2	II	794	22	36		4.13	192.3	5.3	8.7
10	2	II & III	2417	54	45		13.56	178.2	4.0	3.3
11	2	II&III	1569	27	58		8.72	179.9	3.1	6.7
Averages Zone 2			**1180**	**26**	**44**		**36.19**	**159.4**	**3.7**	**7.8**
14	3	V & VII	2553	50	51		19.77	129.1	2.5	2.6
15	3	V & VII	5168	266	19		27.14	190.4	9.8	0.7
16	3	VI	2234	33	68		10.79	207.0	3.1	6.3
17	3	VI	649	6	108		1.60	405.6	3.8	67.6
18	3	VI	566	11	51		15.11	37.5	0.7	3.4
19	3	VII	3416	67	51		19.24	177.5	3.5	2.6
Averages Zone 3			**2431**	**72**	**58**		**93.65**	**191.2**	**3.9**	**13.9**

Zone 3 (tail end) received more irrigations and each irrigation for a longer time duration than Zone 2, but the variation within zones was considerable. There are several factors of relevance:

- Outlets 8-14 are in deeply incised sections of the Khatta-Khaz canal, makling access difficult and there is little scope for controlling the flows into these outlets – flows are mainly determined by the discharge in the main canal and the configuration of the outlet – rather than the way the outlet is managed
- Outlets 16-19 (but most importantly outlet 19) augment their supplies by water from the Selpo canal which takes water from the AABC. These outlets are thus effectively head outlets from Selpo as well as tail outlets from Khatta Khaz – this is most important for the large field VII.
- The aree irrigated per outlet is also significant – outlets serving small areas tend to take more water per unit area

The perception of irrigation service quality is summarised in table E.18

Table E.18: Farmer perceptions of irrigation performance

Analysis and summary form 02 Jany Aryk	Zone 2		Zone 3		Total	
	n.º	%	n.º	%	n.º	%
1) General						
Number of registered irrigation events (un)	130	23%	433	77%	563	100%
2) Duration of Irrigation						
Average duration of each registered irrigation (h)	44		48		46	
3) Timing of irrigation						
Number of irrigations on time (A)	75	95%	156	95%	231	95%
Number of irrigations late (B)	4	5%	8	5%	12	5%
Number of irrigations early (Z)	0	0%	0	0%	0	0%
Total	79	100%	164	100%	243	100%
4) Sufficiency of irrigation						
Number of irrigations too much (0)	4	5%	2	1%	6	3%
Number of irrigations enough (1)	32	41%	48	30%	80	34%
Number of irrigations not enough (2)	42	54%	109	69%	151	64%
Total	**78**	100%	**159**	100%	**237**	100%

Important observations are:

- 77% of the irrigation events occurred in Zone 3, which covers 72% of the irrigated area
- Average duration of each irrigation is also very similar in both zones,
- 95% of the irrigation deliveries were on time and 5% of the irrigations were late in both zones, and
- 54% of the irrigations in Zone 2 and 69% in Zone 3 were considered not enough.

E.iii Level 03 : within study block/outlet

Water distribution was studied within four study blocks, as summarised in Table E.19. The data show little differentiation. What is relevant to observe is that the smaller the plot area, the more irrigation hours/ha can be observed.

Table E.19: Water distribution within blocks

Data summary Block 1-4								
Parcel ID	Crop	Average area (ha)	Average irrigation hours	Average irrigation events	Average hours per irrigation	Average irrigation hours per ha	Irrigation events per ha	Hours per irrigation per hectare
Block 1		0.23	117	2.9	37	720	13	165
Block 2		0.19	152	2.9	54	1,334	15	282
Block 3		0.20	178	3.0	59	935	15	300
Block 4		0.29	202	5.2	38	1,368	18	131
Average		**0.23**	**162**	**3.5**	**47**	**1,089**	**15**	**219**

Block 4 is farthest away from the main water source and has:

- Largest plot size
- Low irrigation hours for each irrigation
- Highest number of irrigation events
- Largest number of irrigation hours per hectare
- Most diversified cropping pattern

This block receives additional water from Selpo, but it is slightl remote from this source as it receives water via an outlet irrigating other parts of the Selpo command. It appears that the farmers do have a lower access to water, but are more systematic in the way that they manage their irrigation.

E.iv Level 05 Jany Aryk

Water distribution within case study outlet 14 is summarised in Table E.20. The command area in this block is 4.81 ha, there are 18 farmers giving an average area of 0.27 ha per farmer. It took 1156 hours in 35 irrigation events to irrigate this area – giving an average time of ±34 hours.

The indicator used to quantify the water allocation per unit area is hours/irrigation per hectare. The following classification was made to distinguish between water allocations:

- Below average < 75% (<92 hr/ha)
- Average 75% - 125% (92 – 155 hr/ha)
- Above average 125%-175% (155 – 217 hr/ha)
- Very much above average > 175% (>217 hr/ha)

Table E.20: Adequacy of irrigation in outlet 14, according to well-being groups

Classification of irrigation gifts	No irrigation	Below average	Average	Above average	Very much above average	Total
		<75% of average	75% - 125% of average	125%-175% of average	>175% of average	
n.º of farms	0	8	6	1	3	18
Average area / field (ha)	0.00	0.28	0.25	0.30	0.27	0.27
Total area (ha)	0.00	2.23	1.47	0.30	0.81	4.81
% of farms		44%	33%	6%	17%	100%
% of area		46%	31%	6%	17%	100%

% of farms in well being groups	No irrigation	Below average	Average	Above average	Very much above average	Total
Group 1		17%	6%			22%
Group 2		28%	28%	6%	17%	78%
Group 3						0%
Total farms		44%	33%	6%	17%	100.0%

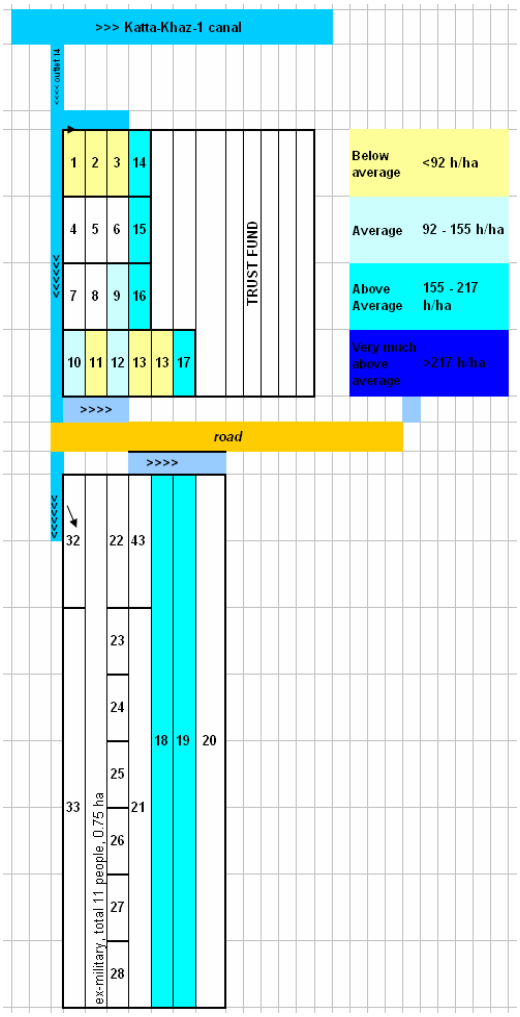
% of area in well being groups	No irrigation	Below average	Average	Above average	Very much above average	Total
Group 1		16%	4%	0%		20%
Group 2		30%	26%	6%	17%	80%
Group 3						0%
Total area		46%	31%	6%	17%	100%

The results are discussed underneath:

- There has been no registration of no irrigation
- 33% of the farms and 31% of the area received average irrigation
- 44% of the farms and 46% of the area received below average water allocation
- 17% of the farms and area received very much above average water allocation

Most of the farmers reported two irrigations with duration of 24 hours each. Three farmers reported having received only one irrigation.

Table E.21: Distribution of water within outlet 14:



It was not possible to collect complete data as some farmers could not be identified, but with the data available it can be seen that there is little correlation between location and adequacy of supply. Even at the end of this sub system it is possible to receive water above average quantities and at the beginning of the sub system farmers receive below average quantities. Well-off farmers appear to have a worse supply than the medium well-being farmers, presumably due to their greater off-farm activities

E.5.3 Conclusions - equity of water supply

The WUA is not very active, and thus farmers have to rely largely on informal actions to ensure that they receive water. This results in very variable supplies, but like in the case of Obu haet, they cannot easily be related to well-being or location in the system

The head of the system is reported to receive about three times as much water than the tail. The perception of the water users with regard to sufficiency of water delivery is clear - in the tail end 69% consider the quantity of irrigation not sufficient.

Supplies to the middle outlets are mainly determined by the discharge in the main canal and the configuration of the outlet – rather than the way the outlet is managed as these are uncontrolled and difficult to reach

The tail outlets can augment their supplies by water from the Selpo canal which takes water from the AABC. These outlets are thus effectively head outlets from Selpo as well as tail outlets from Khatta Khaz.

The area irrigated per outlet is also significant – outlets serving small areas tend to take more water per unit area

There are marked temporal variations in the supply of water to the study areas as a whole. In the beginning of the irrigation season a rapid increase in the water intake took place, reaching just over 200 l/sec by the middle of May. Water supply then dropped by over 25%, before rising again to over 250 l/sec by the end of June. It remained at this level for around one month before declining to zero by the end of September. Similar patterns can be seen in the overall distribution to each zone.

Appendix F Livelihoods Tables

F.1 Livelihoods Data Collection Method and Sampling

F.1.1 General Approach

F.i Objectives of well-being classification and livelihood data collection

We had two objectives for these activities:

- To guide us in recruiting irrigators from different well-being categories for our participatory study of irrigation management. We wanted to ensure that our panels of observers and our focus group discussions reflected the views and experience of all categories of irrigators. We were particularly concerned to find ways to involve poor and vulnerable farmers who might otherwise be left out.
- To provide data for our analysis of the interaction between livelihood assets and strategies, and water distribution.

F.ii Listing of landholder/irrigators

Our first step was to prepare a list of all landholder/irrigators in our study sites. 'Landholder' is defined as the manager of land within our study command area during the study season. This could be either the landowner, or some other person or management unit (e.g. a household) having management control of the land under some form of tenancy (formal or informal, e.g. contract, sharecropping, etc.). In our study sites the landholders are, at least potentially, all irrigators; although their access to irrigation, ability, and interest in irrigation varies.

We used a similar, though slightly different procedure to prepare this list in each study site. These listings were verified in the field over the course of the study period by our study teams (dates of completion in brackets):

- **Kyrgyzstan**: the *mirabs* keep small handwritten notebooks with a list of landshare holders in the WUA. We used these lists as a basis for identifying both the landshare holders and the actual landholder/cultivators in our study sites. Our team then related this listing to detailed maps of the study areas based on maps available from the On-Farm Irrigation Project, and verified in the field and updated by our study team. To prepare the list in each study site:
    - **Jany Aryk** – our key informants were the *mirab* and the WUA accountant consulting together (April 2004).
    - **Obu Haet** - our key informant was the *mirab* on his own (April 2004).
- Nepal:
    - **KIS** - our team worked with the Branch Canal Chairman and Secretary, using their registers, and cross checked this with cadastral maps obtained from the Land Revenue Office/Irrigation Office. This information was verified in the field by our team with the assistance of local informants (February 2004).
    - **SMIP** –our study team included the Team Leader and the Water User School Manager from Guidelines for Good Governance (conducted in Monsoon, 2003). These two members of the team live locally and are very familiar with the study area. They, together with team members who had been working in KIS (as well as in SMIP on Guidelines for Good Governance), and local informants, updated and made field

verification of the list of water users prepared in April-May 2003 for Guidelines for Good Governance (GGG). There were two source of information from GGG -- the findings from the Diagnostic Learning/Action Planning Study and the list of Water User School participants. Detailed field layout maps for T-5 were prepared by our EIP study team with the help of local informants (June 2004).

- **India:, SRSP:** our team used a variety of secondary documents to prepare a pipe-wise list of landholder/farmers to interview for the Baseline Survey. The secondary documents included: the list of WUA members and the WUA voters list, pipe wise field position of farmers along with cadastral maps, TC wise list of farmers obtained from the Irrigation Department Sultanabad. (August 2004).

Limitations of our listings

Only in Kyrgyzstan did the WUA have a complete list of the owners of land in the command areas. In our other study sites the listing of owners and tenants was both incomplete and inaccurate.

In our India, SRSP site our team used its own field observations and enquiries to arrive at the baseline listing of all landholders. In our Kygyzstan and Nepal sites we relied on the knowledge and recollection of our key informants to get the names and livelihood information for the actual landholders during the study season. In all cases it was difficult to get a complete and correct listing because our informants tended to be more familiar with the landowner than with the tenant. The poorest landholders, particularly those holding the land on an informal short-term tenancy, were the most likely to be overlooked. Our teams tried to compensate for this lack of information or oversight through field verification. But despite sincere efforts, we realise that there are some landholders for whom we do not have data.

As it is likely that it is particularly the very poorest landholders who have been left out, the data for the poor category in our analysis may well be biased -- their situation as summarised under the 'poor' category in our tables may appear, on average, to be better than it is.

Nevertheless, despite the shortcomings in the data, we feel the general patterns and conclusions in the comparison of the situation for the poor, medium and well-off category of landholders are valid.

F.iii Well-being classification

Our procedure for well-being classification was based on the work of Barbara Grandin (1988) and usefully summarised by Guijt (1992)[265]. The advantage of this method of classification is that it uses local criteria for well-being to determine the grouping of households, and it combines a range of socio-economic attributes in the classification of landholders according to well-being.

We asked the key informants in our sites in Nepal and Kyrgyzstan to classify landholders according to level of well-being, using a simplified procedure as follows:

- Explain the purpose of the exercise. We wish to understand relative (not absolute) well-being in the community, and we wish to ensure that we are able to involve landholders/irrigators from all well-being categories in our research.

[265] This article by Irene Guijt "A User's Note: wealth ranking by cards", is particularly useful. A copy of this note is included as an attachment to this appendix The full issue of PLA notes no 15 - dedicated to Well-being/Wealth Ranking is available on the internet at http://www.iied.org/NR/agbioliv/pla_notes/pla_backissues/15.html.

- Discuss the informants' views of the general difference between the well-off, the poor, and those in the medium category of irrigator/landholders in our study sites.
- Ask informants to list the general characteristics of landholder/irrigators in each well-being category.
- Keeping the characteristics listed above in mind, go through the list of landholder/irrigators and indicate which category each landholder belongs to: poor, medium or well-off.

We were only able to follow this procedure in our Nepal and Kyrgyzstan sites. In India, SRSP this procedure was not followed by the team, and it was not practical to apply this classification to the baseline survey data. Therefore in our analysis of the SRSP data the following groupings by size of total landholding (including land NOT in the study command area) are used:

Table F.1: India – Size classes used to classify landholders by total area of land held

Sub-Marginal:	Marginal:	Small:	Medium+:
0 – 0.2 ha	0.21 – 1.0 ha	1.1 – 2.0 ha	2.1 ha and larger.

These categories are comparable to those used in the India Agricultural Census (MoA, India, 1998): Marginal: below 1 ha; Small: 1-2 ha; Semi-medium: 2–4 ha; Medium: 4–10 ha; Large: 10 ha and over.

This mode of classification has the disadvantage of using only land held as a proxy indicator for well-being. In some cases, such as a marginal landholder who has returned from Dubai and operates a business as a contract tractor operator, this is misleading. But we believe that the analysis we were able to do using size classes still allows useful observations to be made.

The general characteristics used for classifying landholder/irrigator households in Nepal and Kyrgyzstan were as follows:

Table F.2: Kyrgyzstan and Nepal - General criteria used by key informants to classify landholders in study sites by well-being category

Study Area	Poor	Medium	Well-Off
Kyrgyzstan: Jany Aryk and Obu Haet.	Very small land share insufficient to feed family. No member of household has stable off-farm employment; cow (1); house in poor condition or not owning house.	Some member of family has off-farm employment; may also include a pension income; cattle (2) and sheep (3-4); nicely furnished house in good condition.	Engaged in business/trading. Owning cattle (3-4) and sheep (20-30) [particularly in Jany Aryk]; 2-3 houses; car.
Nepal, KIS	Very small land-holding; may be share-croppers. Some, particularly the *Dalit* households in BC-1, are dependent on being able to rent land to cultivate spring rice. Also have off-farm activities, but mostly in the village. Sell forest products in nearby markets (especially true of landholders in BC-1)	Main cultivators of the area, on both their own land and as share-croppers. Active in irrigation matters. Also involved in dairy business and small shops, mills and other income generating activities	Mostly engaged in off-farm activities: own business within or outside the village; government or private job; pensioners; and source of remittance. Many cultivate their own land in the monsoon but rent their land to sharecroppers for spring rice. Little interest in being actively involved in collaboration for management of irrigated agriculture because of their alternative income sources.
Nepal, SMIP	Holding very little land; may be sharecropper or contract tenant on poor land; may have	Own up to 1 ha (some variations by WC) and may sharecrop more land, produce	Own more than 2 ha (very well-off have more than 5ha), may have more land elsewhere;

Study Area	Poor	Medium	Well-Off
	cattle.	sufficient food for home consumption; may have other skills and employment within family (eg teacher, technician), may have shop.	may own heavy machinery (tractor, thresher etc), and also have family members with off-farm income (professional, business).

Source: EIP field study teams

F.iv Livelihoods information gathering

Information on the livelihood assets of each landholder household was obtained in two stages.

- When conducting the well-being classification, basic information for each landholder on the list was obtained from key informants (in our Kyrgyzstan and Nepal sites only).
- More detailed information for individual landholders was obtained in one of two ways:
    - Through focus group discussions and key informant interviews in the course of the study season (Nepal: KIS – Spring 2004, SMIP – Monsoon 2004); and
    - Through individual interviews of landholders using semi-structured questionnaires (Kyrgyzstan: October-November 2004, and India: August and November-December 2004).

F.v Cropping information

Cropping patterns, and related crop planning, are different in each of our study countries, and we used a different method to obtain crop data in each site:

- **Kyrgyzstan**: under the On-Farm Irrigation Project, WUAs have been helped to prepare pre-season cropping and watering plans. These are used as a basis for agreeing a water delivery contract with the Rayon Irrigation Department (*Raivodkhoz*) and are often indicative only, as actual cropping may vary according to actual spring rainfall. Our team worked with the WUA to prepare a listing of the actual crops grown by each landholder in our study season. The team, working with farmer observers, monitored how water was distributed to fields and crops in the course of the study season.
- Nepal:
    - **KIS** - spring paddy was the only crop cultivated in our study area. The team, working with Farmer Observers, monitored nursery preparation, area transplanted, and crop development during its various stages (vegetative growth and flowering stages), and the way that the water was managed in the course of the study season.
    - **SMIP** – monsoon paddy was the only crop cultivated in our study area. The team, working with farmer observers, monitored the area cultivated in each watercourse, and the percent of the area that was irrigated in the course of the study season.
- **India:, SRSP:** information on area under different crops in *Kharif* 2003, *Rabi* 2003/2004 and *Kharif* 2004 was obtained through the Baseline Survey questionnaire. Additional information on water distribution was obtained through a Water Management Survey. The sampling and procedures used for these surveys are described in section F.1.2 (iv).

F.vi Social groups, relationships and collaboration

Qualitative information on landholders' membership of social groups and their relationships and collaboration for irrigation management were obtained in two ways:

- Participant observation and focus group interviews (Nepal and Kyrgyzstan)
- Individual interviews of landholders using semi-structured questionnaires (Kyrgyzstan and India)

F.vii Tabulation and data analysis

We used a combination of Excel spreadsheets and Access databases for data entry and analysis:

- Basic livelihoods data was entered in a database either on Excel spreadsheets (Nepal and India) or Access (Kyrgyzstan). Data was extracted from these databases and tabulated using the Excel Pivot Table facility.
- Our teams used pre-structured formats in Microsoft Word to record qualitative observations on landholders' collaboration, attitudes toward the WUA, and irrigation management outcomes. These took the form of Field Trip Reports (Nepal), Minutes of Meetings with focus groups from different well-being categories and Farmer Observer meetings (Kyrgyzstan), and Case Studies for individual irrigators interviewed as part of the Livelihoods Survey (India). A combination of Word tables and Excel spreadsheets were used to code and synthesise these qualitative observations.

F.viii Summary of data sources used in Appendix F

In the following tables, unless otherwise noted with the relevant table, our sources of data are as listed in the following table. The tables use the reference code noted in (brackets below).

Table F.3: Sources of data used in tables in Appendix F

Kyrgyzstan, Jany Aryk and Obu Haet	(a1) EIP – Livelihoods Sample Survey using WUA revised landshare list from WUA key informants – landholders only (n = 428) [Oct – Nov, 2004] (a2) EIP – WUA Landshare list and WUA key informant information. Landholders listed here slightly different from those in (a1) (n = 427) [Apr, 2004] (a3) EIP – Collaborating Neighbours Network (CNN) Survey (n = 8) [October – November, 2004]
Nepal, KIS	(b1) EIP – Livelihoods data for all landholders with tenancy information who are included in the database – information from key informants (n = 125) [Feb, 2004] (b2) EIP – Livelihoods data, plus ethnicity data – information from key informants (n = 146) [February, 2004]
Nepal, SMIP	(c) GGG - edited livelihoods data collected under Guidelines for Good Governance Diagnostic Learning/Action Plan, edited under EIP– from key informants (n = 157) [April/May, 2003, updated June, 2004]
India, SRSP	(d1) EIP – Baseline Survey (n = 99) [August, 2004] (d2) EIP – Livelihoods Survey (n = 44) [December, 2004] (d3) EIP – Water Management Survey (n = 30) [Dec, 2004]

The specific procedures used to obtain these data in each site are described below.

F.1.2 Site-specific procedures

F.i Kyrgyz Republic, Jany Aryk and Obu Haet

Landholders in livelihoods database

For our sites in the Kyrgyz Republic we went through the following steps to obtain livelihoods information:

(a) Working with key informants[266] who drew on WUA landshare holder registers, in February 2004 we prepared a complete listing of landholders in our study sites. Our key informants provided us with the following information for each landholder household. The information on 'access to water' was the *mirab's* subjective assessment of the quantity and reliability of the landholder's access to irrigation water supply:

Table F.4: Kyrgyz Republic - Landholder information obtained from key informants

Name of Landshare owner and Name of Landholder for 2004
Landshare Area (ha) (by outlet)
For each landholder
Wellbeing Status (1 = Better Off; 2 = Medium ; 3 = Poor)
Access to water (Good, Medium or Poor)
Number of Persons In Household of Landholder (M,F & Total)
Single Parent Household? (F/M/No)
Literacy (number literate aged between 7 and 69)
Activity (employment)
Hires '*mirab*' (yes/no)

[266] The *mirab* in Obu Haet, the accountant and the *mirab* in Jany Aryk

(b) The initial list was verified in the field by our team, to arrive at a final listing. The distribution of landholders by well-being category and access to irrigation was as follows:

Table F.5: Kyrgyz Republic - Total landholders in study areas by well-being category and access to irrigation water

WUA		Total Population			
Jany Aryk	Well-being Category	access to water			
		good	average	poor	total
	Poor	4	30	3	37
	Medium	42	143	20	205
	Well-off	7	34	7	48
					290
Obi Haet	**Well-being Category**	**access to water**			
		good	**average**	**poor**	**total**
	Poor	22	11	6	39
	Medium	50	23	10	83
	Well-off	9	5	2	16
					138
Total					**428**

(c) In order to get detailed information about the livelihood assets, experience with irrigation management, and attitudes toward the WUA, in October/November 2004 a stratified random sample of landholders was interviewed. The procedure used to select the sample landholders is included in section F1.2.v. For various practical reasons, as well as to ensure that we had at least one respondent for each of the categories of landholder, our sampling fraction was not uniform across the strata. Our sample size and sampling fraction for each stratum is in the table below.

Table F.6: Kyrgyz Republic - Sample size used in livelihoods survey of landholders

WUA		Sample Size				Sample as Percent of Total Population/Sampling Fraction			
Jany Aryk	**Well-being Category**	**access to water**				**access to water**			
		good	**average**	**poor**	**total**	**good**	**average**	**poor**	**total**
	Poor	2	6	1	9	50%	20%	33%	24%
	Medium	5	10	2	17	12%	7%	10%	8%
	Well-off	3	2	2	7	43%	6%	29%	15%
					33				11%
Obi Haet	**Well-being Category**	**access to water**				**access to water**			
		good	**average**	**poor**	**total**	**good**	**average**	**poor**	**total**
	Poor	4	3	3	10	18%	27%	50%	26%
	Medium	10	4	2	16	20%	17%	20%	19%
	Well-off	2	2	2	6	22%	40%	100%	38%
					32				23%

In view of the variable sampling fraction, in order to arrive at our findings for our study population as a whole we had to weight the sample results for each stratum by the total number of landholders in the the stratum. We used the following formula:

For each survey attribute:

Table F.7: Kyrgyz Republic - Weighting formula used to calculate figures for study population as a whole, based on survey findings

% of survey respondents in the stratum with the attribute	X	number of landholders in the total population belonging to the stratum	=	total number of landholders in stratum with the attribute

The tables below illustrate how this calculation was used to estimate the percent of landholders in our study sites who rent land in.

Table F.8: Kyrgyz Republic - Illustration of application of weighting formula - Estimated percent of landholders in study sites who rent land in

(A) % of sample respondents renting land in (from Livelihoods Survey)

Name of Water User Association	Wellbeing Category	Access To Irrigation		
		Good	Moderate	Poor
Jany Aryk	1	33%	0%	100%
	2	0%	60%	50%
	3	0%	17%	0%
Obi Haet	1	50%	100%	100%
	2	30%	50%	100%
	3	0%	33%	33%

(B) Total landholders in study areas

Name of Water User Association	Wellbeing Category	No of households by access to irrigation			Total HH
		Good	Moderate	Poor	
Jany Aryk	1 well-off	7	34	7	48
	2 medium	42	143	20	205
	3 poor	4	30	3	37
Obi Haet	1 well-off	9	5	2	16
	2 medium	50	23	10	83
	3 poor	22	11	6	39
Jany Aryk	TOTAL	53	207	30	290
Obi Haet		81	39	18	138
GRAND TOTAL		134	246	48	428

(C) Estimated number total landholders in study areas renting land in (A x B)

Name of Water User Association	Wellbeing Category	No of households by access to irrigation			Total HH
		Good	Moderate	Poor	
Jany Aryk	1 well-off	2	0	7	9
	2 medium	0	86	10	96
	3 poor	0	5	0	5
Obi Haet	1 well-off	5	5	2	12
	2 medium	15	12	10	37
	3 poor	0	4	2	6
Jany Aryk	TOTAL	2	91	17	110
Obi Haet		20	20	14	54
GRAND TOTAL		22	111	31	164

(D) Estimated % of landholders renting land in (weighted)

Name of Water User Association	Wellbeing Category	Total HH	HH renting land in (weighted estimate)	%HH renting land out
Jany Aryk	1 well-off	48	9	19%
	2 medium	205	96	47%
	3 poor	37	5	14%
Obi Haet	1 well-off	16	12	72%
	2 medium	83	37	44%
	3 poor	39	6	15%
Jany Aryk	TOTAL	290	110	38%
Obi Haet		138	54	39%
TOTAL		428	164	38%
GRAND TOTAL	1 well-off	64	21	33%
	2 medium	288	132	46%
	3 poor	76	11	14%

Collaborating Neighbours Network (CNN) Survey

In each of our study sites there were 4 or 5 small informal groups of landholders who collaborated to manage irrigation to their fields, as well as for a range of other agricultural activities. We wanted to understand the background to their formation, the size of the groups, and the types of activities they engaged in. For this purpose we administered a semi-structured questionnaire to one member in each of four groups in Jany Aryk, and four groups in Obu Haet. The groups were identified for our team by the *mirab* in each study site.

F.ii KIS, Nepal

Landholders in livelihoods database

The listing of landholders was obtained from the Chairman and Secretary of the Branch Canal Committee in BC -1 and BC- 2. In our livelihoods database we have 176 households listed.

However this list includes those households about whom our key informants had information. As a result the listing includes absentee landowners who were not cultivating in spring 2004 as well as cultivating landowners and tenants. As discussed in section F.1.1 (ii), it was difficult to get complete and accurate information, particularly for poor and marginal landholders. Consequently this listing does not include most of the non-resident *Tharu* sharecroppers, mostly in *Pachas Bigha Kulo*, and *Dalit* sharecroppers, mostly in BC-1 Outlet 18.

Our listing for BC-1 Outliet 18 only includes information for the 24 landholders who were able to cultivate and irrigate a crop in spring 2004. This is less than the number holding land in the command area of the outlet, and does not cover those who did not cultivate because they could not access irrigation.

In our tabulations we do not include 41 landowners who are renting out all the land they own in the study command area – they do not fulfil our definition of 'landholder' (see section F.1 (ii)). We also do not include the 10 households in the database for whom tenancy information is not available. Thus most of our tabulations (except for those on ethnicity, as discussed below) cover 125 landholding households[267] as follows:

Table F.9: KIS, Nepal – Basis for count of landholders in study area

(A) Total Households in KIS Database, by well-being category (including non-landholders)

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	30	27	7	24	88
PGW	13	29	18	5	65
O18	13	8	2		23
Grand Total	56	64	27	29	**176**

(B) Households who do not hold land - Give land to tenants only

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	1	4	4	15	24
PGW	1	6	5	5	17
O18	n/a	n/a	n/a	n/a	n/a
Grand Total	2	10	9	20	**41**

[267] Landholding households are defined as households identified as holding land under one of the following conditions: (1) "self" cultivator (i.e. holding own land), (2) "self and take" (i.e. hold own land and take land in under some form of tenancy), or (3) "self and give" (i.e. hold own land and give some land to others under some form of tenacy), or (4) "take only" (i.e. only holding land under some form of tenancy). We **exclude** all households identified as "give only".

(C) Households in KIS Database for Whom Tenancy Information is Missing

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	1	1	1	5	8
PGW	1		1		2
O18	n/a	n/a	n/a	n/a	n/a
Grand Total	2	1	2	5	**10**

(D) Total landholders in study area for whom tenancy information is available

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	28	22	2	3	55
PGW	11	23	12	0	46
O18	13	8	2	1	24
Grand Total	52	53	16	4	**125**

With the exception of our ethnicity tables, as discussed below, the data in our analysis is based on the 125 landholders for whom we have tenancy information in our livelihoods database. Although *Dalit* and *Tharu* landholders are under-recorded in these tables, we were able to get qualitative information and case studies on the experience of these landholders, and this is included in our discussion in Chapter 5.

Ethnicity Data

Ethnicity data was not recorded in the Livelihoods Database. However, after completing the livelihoods listing discussed above, our team completed a separate exercise to quantify the ethnicity of landholders in our study areas. Unfortunately it is difficult to make a direct link between the ethnicity data and the households listed in the livelihoods database. Therefore we assumed the following in order to estimate the ethnic composition of landholders in the study area: There are 125 landholding households for whom livelihoods information is available, as discussed above. There are 146 Brahmin/Chettri (B/C), 2 Newar and 21 Janajit/Dalit households in the ethnicity listing. If we assume that none of the 21 Janajati/Dalit landholding households were included in the livelihoods database, then all of the 125 landholder/cultivators are either B/C or Newar. If we assume that the 2 Newar households listed are landholder/cultivators, we have a balance of 123 landholders who could be B/C. Subtracting the 2 'Medium' well-being Newar landholders from the 125 households gives the distribution of B/C landholders. However, this calculation results in 28 poor B/C landholders in PBK, whereas our ethnicity listing indicates that there are only 23 poor B/C landholders in PBK. We guess that these 5 landholders could be Tharu because there were no Tharu included in the ethnicity listing, even though we know that Tharu are sharecropping in PBK.

We arrive at the ethnic composition of our landholder households as follows:

Table F.10: KIS, Nepal – Ethnicity data available for landholders in study area

(A) Janajati and Dalit Households - not included in Landholder Database

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	7	0	0	0	7
PGW	0	0	0	0	0
O18	14	0	0	0	14
Grand Total	21	0	0	0	**21**

(B) Newar Households - included in Landholder Database

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	0	2	0	0	2
PGW	0	0	0	0	0
O18	0	0	0	0	0
Grand Total	0	2	0	0	**2**

(C) Brahmin/Chettri Households - included in Landholder Database

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	23	20	2	3	48
PGW	11	23	12	0	46
O18	13	8	2	1	24
Grand Total	47	51	16	4	**118**

(D) Tharu Households – assumed to be included in Landholder Database – but not included in Ethnicity Listing

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	5	0	0	0	5
PGW	0	0	0	0	0
O18	0	0	0	0	0
Grand Total	5	0	0	0	**5**

(E) Total Landholders for Whom Ethnicity Information is Available

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	35	22	2	3	62
PGW	11	23	12	0	46
O18	27	8	2	1	38
Grand Total	73	53	16	4	**146**

Land area data

When calculating the average area held within the study command area, we have only included the 114 landholders for whom we have area information available, as follows:

Table F.11: KIS, Nepal – Number of landholders for whom data on land area held in study command is available

(A) Total Landholders for Whom Area Information is Available

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	27	22	2	3	54
PGW	11	23	12		46
O18	5	7	2		14
Grand Total	43	52	16	3	114

(B) Total Landholders for Whom Area Information is Missing

	Wellbeing				
Study Area	Poor	Medium	Well-off	Non-Resident	Grand Total
PBK	1				1
PGW					
O18	8	2			10
Grand Total	9	2			11

F.iii SMIP, Nepal

Landholders in livelihoods database

For our SMIP site we drew on the livelihoods information collected during the Diagnostic Learning/Action Planning activity completed in April/May 2003 under Guidelines for Good Governance (GGG). During this activity a complete listing of all water users in T-5 was prepared. The well-being ranking procedure described in section F.1 was used to classify each water user according to well-being category. This included not only landholders and landowners, but also landless residents who were considered to rely on the irrigation water resource in one way or another.

Our EIP study team revised the GGG listing to include only landholders (under whatever form of tenancy). The following groups were not included in the EIP listing:

- Absentee landlords who are completely non-resident. They mostly fall into the well-off category.
- Landless people, both local and non-resident, who work as agricultural labourers. They can benefit from irrigation, but are not directly affected by the distribution of water which is the focus of this study.
- Local landless people who work locally in sectors other than agriculture.

In the course of the study, our team reviewed and verified the list, and the associated livelihoods information. The number of landholders listed for the command area of T-5, by watercourse, is as follows:

Table F.12: SMIP, Nepal, T-5 - Total landholders in study area, by well-being category

Watercourse	Wellbeing			
	Poor	Medium	Well-off	Grand Total
WC -1	8	17	12	37
WC -2	20	17	6	43
WC -3	8	21	11	40
WC -4	12	17	8	37
Grand Total	48	72	37	157

F.iv SRSP, Andhra Pradesh, India: sample selection procedure for 'Baseline Survey', 'Livelihoods Survey' and 'Water Management Survey'

Landholders in 'Baseline Survey'

In August 2004 the study team conducted a Baseline Survey covering all landholding households in the command areas of three pipes served by Minor 30 R in the Kadambapur WUA: P2 in the head reach, P5 in the middle reach and P9 at the tail. The purpose of the Baseline Survey was to get basic livelihoods information on all landholder/cultivators including, e.g. caste, landholding status, irrigation status, occupation, livelihood assets, cropping, crop production, etc. The intention was for this survey to provide a sampling frame for subsequent selection of farmers for intensive field observation. The landholders were identified using the following sources:

- List of WUA members from the Irrigation Department Sultanabad
- Voters list of WUA members from the Revenue Department
- Field-verified list of landholder/cultivators based on in-field mapping by the study team

The team was not able to complete a well-being classification exercise with key informants. Consequently the analysis of this data had to be based on classification according to landholding size categories as follows:

Table F.13: SRSP, Andhra Pradesh, India - Landholder size class codes

	Total Holding Size (ha)
Sub-Marginal	0.0- 0.2
Marginal	0.21 - 1.0
Small	1.1 - 2.0
Medium+	2.1 +

The number of landholders interviewed based on the field-verified listing, using a semi-structured questionnaire was as follows:

Table F.14: SRSP, Andhra Pradesh, India - Number of landholders in baseline survey by pipe and size class

Pipe Number	Size-Class				Grand Total
	Sub-Marginal	Marginal	Small	Medium+	
P2	1	13	6	5	25
P5		14	13	6	33
P9	21	11	3	6	41
Grand Total	22	38	22	17	99

The 'Livelihoods Survey' and 'Water Management Survey'

Subsequently, in December 2004, two further surveys were carried out in the study area. The purpose of these surveys was to make more detailed enquiries into the relationship between irrigation and livelihoods.

The 'Livelihoods Survey', using a semi-structured questionnaire, covered 44 farmers. This survey included questions related to livelihood assets, as in the Baseline Survey, plus additional questions regarding memberships in the WUA and other local organisations and methods for coping with water problems and conflicts related to water distribution.

The interviewees were purposively selected on the basis of approximately 15 from each pipe – P2, P5 and P9, with a view to including cultivators from the head, middle and tail of the pipe, and a range of holding sizes. The intention was also to be sure to include some women and tenant farmers. The distribution of respondents by size-class was as follows:

Table F.15: SRSP, Andhra Pradesh, India - Sample size for livelihoods survey

Pipe Number	Size Class				Grand Total
	Sub-marginal	Marginal	Small	Medium	
P2	1	4	6	3	14
P5	2	4	4	7	17
P9	2	4	2	5	13
Grand Total	5	12	12	15	44

Associated with the 'Livelihoods Survey' a further survey was conducted focussing specifically on relations with the WUA and water management issues. This was administered to a sub-sample of respondents to the Livelihoods Survey.

Table F.16: SRSP, Andhra Pradesh, India - Sample size for water management survey

PipeNo	Size Class				Grand Total
	Sub-marginal	Marginal	Small	Medium +	
P2	1	3	2	2	8
P5		4	2	4	10
P9	2	2	3	5	12
Grand Total	3	9	7	11	30

The selection procedure for identifying respondents for these two surveys was opportunistic, and it was not consistently possible to relate the respondents and data from these surveys to the respondents

to the Baseline Survey[268]. Some of the questions related to livelihood assets overlapped with information collected with the Baseline Survey. We chose to use the Baseline Survey data as it was more comprehensive and for a larger and better controlled sample.

However, we did make use of the information from the Livelihoods Survey to get a sense of the extent of landholder membership in the WUA and other local organisations. We also used the case studies prepared as part of this exercise to 'flesh out' our descriptions of landholder/irrigator experiences in our analysis in Chapter 5. We drew on the Water Management survey for insights into attitudes toward the WUA and the way that water users collaborate for water distribution.

F.v Kyrgyz Republic: sample selection procedure for Livelihoods Survey and Collaborating Neighbours Network (CNN) survey

Activities

- Finalise questionnaires for livelihoods and CNN surveys (and translate), and prepare spreadsheets for analysis of data.
- Where DM (farmer/irrigator) is not the same as shareholder, identify whether the land is farmed by another member of the household or is rented out, and determine well-being classification for DM (farmer/irrigator).
- Confirm inventory of CNNs in Obi Haet (Block 2, with weaker networks in Block 1 and 3). Assuming that there are only three identified, interview one farmer from each. First fill in information in the CNN questionnaire as far as possible from previous interviews and then interview farmer to complete the questionnaire. (Note: this activity may be combined with implementing the Livelihoods Survey).
- Prepare matrix of number of DM (farmer/irrigators) in good/medium/poor access and good/medium/poor well-being categories (Note: the wellbeing classification of the DMs[farmer/irrigators] should be used for this classification) in order to identify sample size for livelihoods survey. See section below for the matrix to be used.
- Confirm survey assistant and finalise financial/contractual arrangements with TES.
- Select sample for livelihoods survey on a random basis (see below).
- Implement survey (Livelihoods and CNN interviews).
- Enter data into database, and prepare summary tables.

Sample selection for livelihoods survey

Note: The general procedure presented below was used as guidance to arrive at the sample for the Livelihoods Survey. However, in practice, and in order to ensure that there was at least one landholder interviewed for each stratum in the survey population, the total sample size was 33 for Jany Aryk and 32 for Obu Haet. The sampling fraction was variable.

- Ensure HH list is complete up-to-date and includes well-being ranking and access to water for Decision Makers (DM [farmer/irrigators] rather than shareholders).

[268] Names of respondents could not always be correlated, and data for households whose names could be correlated was not always consistent.

- Tabulate DM in each well-being and access to water category, ensuring that each person is only entered once. If a user has land in more than one category of access to water, enter them in the category for their largest plot of land.
- Prepare a matrix of DM in each well-being/access combination as follows

Well-being / Access to water	Good	Medium	Poor
Good			
Medium			
Poor			

- Determine the sample size in each well-being/access combination. The total sample size for the Livelihoods survey should be 27. This will be approximately 20% of the number of DMs in each cell [the correct percentage should be calculated according to the total sample size of 27 as a percent of the total number of DM in each study canal command area., The same percentage should be applied to each cell]. Fractions should be rounded to the nearest whole number. [NOTE: This procedure could not be followed as proposed. The actual sample size for each cell is noted in Table F.6].
- A random sample of the appropriate size should then be selected from each stratum, using the Excel random number generator according to the following procedure:
    - For each of the 9 categories (i.e. cells in the matrix), list all of the DMs by ID number and Name, in order of ID number.
    - Note the smallest ID number and the largest ID number.
    - Use the Excel RANDBETWEEN function to generate a random number between the lowest and the highest ID number in the list. (the Excel “help” for the RANDBETWEEN function is copied below).
    - Select the DM with the ID number that matches the random number generated by RANDBETWEEN.
    - If no DM has an ID number that matches, re-calculate a random number (press the F9 key). Repeat until the random number can be matched to an ID number on the list.
    - Repeat the process until you have identified as many DMs as are required to be interviewed for that category. This will provide you with your First Selection List for that category.
    - Repeat steps (c) to (f) to prepare a Reserve List for each of the 9 categories.
- When conducting the survey, if after three attempts it is impossible to interview a DM on the first selection list, then replace the DM with the first person in the Reserve List.
- Repeat step 7 as required, going on to the second person on the Reserve List, etc.
- When interviewing people review well-being ranking against the original criteria for classifying them to ensure that the respondent has been appropriately assigned.

F.2 Landholder Numbers and Ethnic Composition

F.2.1 Number of landholders [5.1]

Note: The number in [brackets] after each heading refers to the table number in the main text

Table F-17: Number of landholders included in livelihoods analysis, by well-being category and study sub-area

Study Area (*data source)*	Sub-Area	Poor	Medium	Well-off		**Total**
Kyrgyzstan (a1)	Jany Aryk	37	205	48		**290**
	Obi Haet	39	83	16		**138**
	Total	76	288	64		428
				Resident	Non-Res	
KIS (b2)	PBK	35	22	2	3	62
	PGW	11	23	12	0	46
	OL 18	27	8	2	1	38
	Total [1]	73	53	16	4	**146**
SMIP *[2]* (c)	WC-1	8	17	12		37
	WC-2	20	17	6		43
	WC-3	8	21	11		40
	WC-4	12	17	8		37
	Total	48	72	37		**157**
		Sub-Marginal	**Marginal**	**Small**	**Medium +**	
SRSP (d1)	P-2	1	13	6	5	25
	P-5		14	13	6	33
	P-9	21	11	3	6	41
	Total	22	38	22	17	**99**

[1] This includes the landholders for whom livelihoods tenancy information is available, plus Janajit/Dalit landholders counted in our ethnicity data, but not included in the livelihoods database. See discussion in section F.1 for the limitations of this data.
[2] Excludes 1 household for which well-being classification not available.

F.2.2 % of landholders by well-being category and study sub-area [5.3]

Table F-18: Per cent of landholders by well being category and study sub-area

Study Area	Sub-Area	Poor	Medium	Well-off		Total
Kyrgyzstan	**Jany Aryk**	**13%**	**71%**	**17%**		**100%**
	Obi Haet	**28%**	**60%**	**12%**		**100%**
	Total	18%	67%	15%		100%
				Resident	Non-Resident	
KIS	PBK	56%	35%	3%	5%	100%

	PGW	24%	50%	26%	0%	100%
	OL 18	71%	21%	5%	3%	100%
	Total	**50%**	**36%**	**11%**	**3%**	**100%**
SMIP	WC-1	22%	46%	32%		100%
	WC-2	47%	40%	14%		100%
	WC-3	20%	53%	28%		100%
	WC-4	32%	46%	22%		100%
	Total	**31%**	**46%**	**24%**		**100%**
		Sub-Marginal	**Marginal**	**Small**	**Medium +**	
SRSP	P-2	4%	52%	24%	20%	100%
	P-5	0%	42%	39%	18%	100%
	P-9	51%	27%	7%	15%	100%
	Total	**22%**	**38%**	**22%**	**17%**	**100%**

Source: Table F-17: Number of landholders included in livelihoods analysis, by well-being category and study sub-area

F.2.3 Ethnic/caste Composition – per cent in each study area [5.4, 5.5]

Table F-19: Ethnic/caste composition - Number of landholders by ethnic group or caste in each study area

Study Area ***(data source in brackets)***	**Ethnic/Caste Group**	**Poor**	**Medium**	**Well-off**		**Total**
Kyrgyzstan (a2)	Jany Aryk – (Uchar village) - 100% Kyrgyz	37	205	48		290
	Obi Haet – (Birlik Village) (97% Uzbek, 3% Other	39	83	16		138
	Total	76	288	64		428
				Resident	Non-Resident	
KIS (b2)	B/C	47	51	16	4	118
	Newar	0	2	0	0	2
	Janajati	4	0	0	0	4
	Dalit	17	0	0	0	17
	Unidentified (Tharu?)	5	0	0	0	5
	Total	73	53	16	4	146
SMIP (c)	Yadav	9	22	20		51
	Sah	20	22	20		62
	Chhetri etc	2	7	3		12
	Dalit	10	5	1		16
	Other	10	3	1		14
	Total	51	59	45		155

Study Area *(data source in brackets)*	Ethnic/Caste Group	Poor	Medium	Well-off		Total
SRSP (d1)		**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	**Total**
	Other Caste	0	0	1	3	4
	Backward Caste	1	33	21	14	69
	Muslim	20	1	0	0	21
	Scheduled Caste	1	3	0	0	4
	N/A	0	1	0	0	1
	Total	22	38	22	17	99

Table F-20: Ethnic/caste composition – Per cent of landholders by ethnic group or caste in each study area

Study Area (data source in brackets)	Ethnic/Caste Group	Poor	Medium	Well-off		Total
Kyrgyzstan	**Jany Aryk**	**(Uchar village) - 100% Kyrgyz**				
	Obi Haet –	**(Birlik Village) (97% Uzbek, 3% Other)**				
				Resident	Non-Res	
KIS [excluding absentees]	**Brahmin/Chhetri**	64%	96%	100%	100%	**81%**
	Newar	0%	4%	0%	0%	**1%**
	Janajati	5%	0%	0%	0%	**3%**
	Dalit	23%	0%	0%	0%	**12%**
	Unidentified (Tharu?)	7%	0%	0%	0%	**3%**
	Total	100%	100%	100%	100%	100%
SMIP	**Yadav**	18%	37%	44%		**33%**
	Sah	39%	37%	44%		**40%**
	Chhetri etc	4%	12%	7%		**8%**
	Dalit	20%	8%	2%		**10%**
	Other	20%	5%	2%		**9%**
	Total	100%	100%	100%		100%
SRSP		**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	**Total**
	Other Caste	0%	0%	5%	18%	**4%**
	Backward Caste	5%	87%	95%	82%	**70%**
	Muslim	91%	3%	0%	0%	**21%**
	Scheduled Caste	5%	8%	0%	0%	**4%**
	N/A	0%	3%	0%	0%	1%
	Total	100%	100%	100%	100%	100%

Source: Table F-19: Ethnic/caste composition - Number of landholders by ethnic group or caste in each study area

F.3 Natural and physical assets

F.3.1 Average area of land held [5.6], [footnote 14]+ land tenure table by sub-area [5.7]

Table F-21: Average area of land held within study command area

Study Area *(data source in brackets)*	Sub-Area	Poor	Medium	Well-off		Total	**Range**
Kyrgyzstan (a1)	Jany Aryk	0.25	0.31	0.27		0.30	0.09 – 5.00
	Obi Haet	0.57	0.52	0.81		0.57	0.26 – 5.31
	Total	0.42	0.37	0.41		0.39	
KIS (b1) [1]				Resident	Non-Resident		
	PBK	0.38	0.62	1.93	3.71	0.72	
	PGW	0.18	0.49	1.61		0.71	
	OL 18	0.54	0.32	0.79		0.46	
	Total	0.35	0.52	1.55	3.71	0.69	0.02 – 8.80
SMIP (c)	WC-1	0.38	0.63	1.22		0.77	
	WC-2	0.32	0.56	0.82		0.48	
	WC-3	0.58	0.52	0.84		0.62	
	WC-4	0.74	0.41	1.32		0.71	
	Total	0.48	0.53	1.07		0.64	0.03 – 5.42
		Sub-Marginal	Marginal	Small	Medium +		
SRSP (d1)	P-2	0.10	0.51	1.16	1.52	0.85	
	P-5		0.68	0.90	1.14	0.85	
	P-9	0.08	0.50	1.14	1.46	0.47	
	Total	0.08	0.57	1.00	1.36	0.69	0.03 – 3.05

[1] Nepal, KIS: EIP – Livelihoods data – from key informants, area data available for 114 out of 125 landholders as follows:

Study Area	**Sub-Area**	**Poor**	**Medium**	**Well-off**		**Total**
				Resident	**Non-res**	
KIS	PBK	27	22	2	3	54
	PGW	11	23	12		46
	OL 18	5	7	2		14
	Total	43	52	16	3	114

Table F-22: Kyrgyzstan - Landholders holding land under more than one outlet

In Obi Haet all landholders have only one parcel within the study command area.

Number of Parcels by Well-being Group

	Number of Holdings - Jany Aryk			
Number of Parcels	Poor	Medium	Well-off	Total
1	32	159	36	227
2	7	48	12	67
3	3	15	0	18
4	0	2	0	2
Total	42	224	48	314
Number with >parcel in same outlet	1	11	3	
	% of Holdings - Jany Aryk			
Number of Parcels	Poor	Medium	Well-off	Total
1	76%	71%	75%	72%
2	17%	21%	25%	21%
3	7%	7%	0%	6%
4	0%	1%	0%	1%
Total	100%	100%	100%	100%

Excluding 4 holdings where well-being not known

Source: Kyrgyzstan (a2): WUA Landshare list from WUA key informants, and Stage II Report. Note that this listing is not entirely consistent with the final landholder number used for our livelihoods analysis because of some possible double counting of the same parcel against landshare owners and landholders for the study period. However, this gives an indication of the likely incidence of landowners with more that one parcel in the Jany Aryk.

Table F-23: Number of landholders practicing different forms of land tenure in the study area during the study season

Study Area *(data source)*	**Form of tenure**	**Poor**	**Medium**	**Well-off**	**Total**
Kyrgyzstan (a1)	**Total landholders**	76	288	64	428
	Cultivating own land	76	288	64	428
	Renting land in	11	132	21	164
	Renting land out	11	8	0	19
	Owning land outside study command area	**0**	**65**	**25**	**90**
KIS (b1)	**Total landholders**	52	53	20	125
	Cultivating own land	41	47	17	105
	Renting/share/contract/ mortgage land in	23	7	3	33
	Renting land out	2	6	0	8
	Landholders in PBK and PGW [1]	**39**	**45**	**17**	**101**
	Owning land outside study command area [landholders in *Pachas Bigha Kulo* and Pilot Gate West only**] [1]**	**12**	**12**	**7**	**31**

Study Area *(data source)*	Form of tenure	Poor	Medium	Well-off	Total
SMIP (c)	**Total landholders**	48	72	37	157
	Cultivating own land	17	52	31	100
	Renting land in	31	20	6	57
	Renting land out	n/a	n/a	n/a	n/a
	Cultivating land outside study command area (T5)	**35**	**65**	**37**	**137**
	Cultivating land outside T5 and T6	**19**	**26**	**14**	**59**

		Sub-Marginal	*Marginal*	*Small*	*Medium +*	
SRSP (d1)	**Total landholders**	22	38	22	17	99
	Cultivating own land	22	30	16	15	83
	Relative of owner	0	5	3	0	8
	Renting land in		3	3	2	8
	Renting land out	n/a	n/a	n/a	n/a	n/a
	Cultivating land outside study command area	**1**	**14**	**15**	**13**	**43**

[1] For KIS we only have information regarding landownership outside the study command area for landholders with land irrigated by Pachas Bigha Kulo and Pilot Gate West; not for BC-1 Outlet 18. Though the data for our study site are incomplete, this figure indicates that a significant proportion of landholders have land interests across multiple command areas. Note that assets outside the study command area refers also to residential land/building in Bharatpur/Sita Nagar/ Kathmandu and so on.

Table F-24: Per cent of landholders practicing different forms of land tenure in the study area during the study season

Study Area (data source in brackets)	Form of tenure	Poor	Medium	Well-off	Total
Kyrgyzstan	Cultivating own land	100%	100%	100%	100%
	Renting land in	14%	46%	33%	38%
	Renting land out	14%	3%	0%	4%
	Owning land outside study command area	**0%**	**23%**	**40%**	**21%**
KIS	Cultivating own land	79%	89%	85%	84%
	Renting/share/contract/mortgage land in	44%	13%	15%	26%
	Renting land out	4%	11%	0%	6%
	Owning land outside study command area [landholders in *Pachas Bigha Kulo* and Pilot Gate West only]	**31%**	**27%**	**41%**	**31%**
SMIP	Cultivating own land	35%	72%	84%	64%
	Renting land in	65%	28%	16%	36%
	Renting land out	n/a	n/a	n/a	n/a
	Cultivating land outside study command area (T5)	**73%**	**90%**	**100%**	**87%**
	Cultivating land outside T5 and T6	**40%**	**36%**	**38%**	**38%**

Study Area (data source in brackets)	Form of tenure	Poor	Medium		Well-off	Total
		Sub-Marginal	*Marginal*	*Small*	*Medium +*	
SRSP	Cultivating own land	100%	79%	73%	88%	84%
	Relative of owner	0%	13%	14%	0%	8%
	Renting land in	0%	8%	14%	12%	8%
	Renting land out	n/a	n/a	n/a	n/a	n/a
	Cultivating land outside study command area	**5%**	**37%**	**68%**	**76%**	**43%**

n/a – Data Not Available

Source: Table F-23: Number of landholders practicing different forms of land tenure in the study area during the study season

F.3.2 Percent of landholders owning livestock [5.8, 5.9]

Table F-25: Kyrgyzstan - Livestock ownership - per cent of landholders owning

Kyrgyzstan Summary Tables: Percent of Households with Livestock				
	Wellbeing Category			
Name of Water User Association	Poor	Medium	Well-off	Grand Total
Cattle				
Jany Aryk	100%	55%	98%	68%
Obi Haet	64%	79%	71%	75%
Grand Total	91%	62%	84%	70%
Sheep				
Jany Aryk	65%	0%	61%	18%
Obi Haet	6%	5%	5%	5%
Grand Total	50%	1%	32%	14%
Goats				
Jany Aryk	12%	0%	18%	4%
Obi Haet	0%	5%	0%	3%
Grand Total	9%	1%	9%	4%
Poultry				
Jany Aryk	100%	15%	76%	37%
Obi Haet	29%	69%	57%	61%
Grand Total	82%	31%	66%	45%
Horses				
Jany Aryk	5%	0%	8%	2%
Obi Haet	0%	5%	0%	3%
Grand Total	4%	1%	4%	2%

Source: Kyrgyzstan (a1): EIP Livelihoods sample survey

Table F-26: KIS – Livestock income - landholders with Income from livestock

(A) Number of landholders with income from livestock

	Well-being Category			
Livestock activity	Poor	Medium	Well-off	Grand Total
Some Income from Livestock (any source)	31	34	11	76
Milk	25	31	9	65
Meat	9	12	7	28
Ploughing	7	2	1	10
Total Landholders	52	54	19	125

(B) % of landholders with income from livestock

	Well-being Category			
Livestock activity	Poor	Medium	Well-off	Grand Total
Some Income from Livestock (any source)	60%	63%	58%	61%
Milk	48%	57%	47%	52%
Meat	17%	22%	37%	22%
Ploughing	13%	4%	5%	8%
Total Landholders	100%	100%	100%	100%

Source: Nepal, KIS (b1): EIP – Livelihoods data – from key informants

Table F-27: SMIP – per cent of landholders with Income from livestock

SMIP	% HH with income from livestock	100.0%	100.0%	100.0%	100.0%

Sources: Nepal, SMIP (c) : EIP – Livelihoods data – from key informants – all households for which data was available reported income from livestock (n= 146; Data missing for 11 land holders).

Table F-28: SRSP - per cent of landholders owning livestock

SRSP		Sub-Marginal	Marginal	Small	Medium +	Total
	Buffalo/Cattle	5%	32%	45%	71%	35%
	Sheep/Goats	0%	5%	9%	0%	4%

Sources: India, SRSP (d1): EIP – Baseline Survey

Table F-29: Kyrgyzstan: Livestock ownership - average number owned per landholder household by type of animal and well-being category

Kyrgyzstan Summary Tables: average number of livestock per household - overall				
Name of WUA	Poor	Medium	Well-off	TOTAL
Av no of cattle per HH				
Jany Aryk	1.2	2.3	3.3	2.3
Obi Haet	1.4	1.2	1.8	1.3
GRAND TOTAL	1.3	2.0	2.9	2.0
Av no of sheep per HH				
Jany Aryk	0.9	5.0	4.7	4.4
Obi Haet	0.1	0.2	0.0	0.1
GRAND TOTAL	0.5	3.6	3.5	3.1
Av no of goats per HH				
Jany Aryk	0.3	0.6	5.0	1.3
Obi Haet	0.0	0.0	0.0	0.0
GRAND TOTAL	0.1	0.4	3.8	0.9
Av no of poultry per HH				
Jany Aryk	1.9	9.7	10.6	8.9
Obi Haet	3.1	1.9	3.0	2.4
GRAND TOTAL	2.5	7.5	8.7	6.8
Av no of horses per HH				
Jany Aryk	0.0	0.1	0.1	0.1
Obi Haet	0.0	0.0		0.0
GRAND TOTAL	0.0	0.0	0.1	0.0

Source: Kyrgyzstan (a1): EIP Livelihoods sample survey

Table F-30: SRSP - Livestock ownership - number of households by number of livestock owned

Project	**Number of Animals Owned**	**Number of Households Owning – by Holding Size Class**				
	Buffaloes/ Cows	**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	**Total**
SRSP	0	21	26	12	5	64
	1	1	9	6	4	20
	2		3	1	3	7
	3			2	4	6
	4			1	1	2
	Grand Total	22	38	22	17	99

Number of Animals Owned	Number of Households Owning – by Holding Size Class				
Goats	**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	**Total**
0	22	36	20	17	95
4		1			1
20		1			1
30			2		2
Grand Total	22	38	22	17	99

Sources: India, SRSP (d1): EIP – Baseline Survey

F.3.3 Other physical assets [5.10]

Table F-31: Other physical assets - landholders owning traction

A: % of landholders owning traction

Study Area *(data source in brackets)*	Sub-Area	Poor	Medium	Well-off	Total
Kyrgyzstan (a1)		n/a	n/a	n/a	n/a
KIS (b1)		n/a	n/a	n/a	n/a
SMIP (c)		n/a	n/a	n/a	n/a

SRSP (d1**)**		**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	
	Tractor	0%	3%	0%	29%	6%
	Bullocks	0%	61%	73%	65%	51%

B: Number of bullocks tractors owned per landholder

Study Area *(data source in brackets)*	Sub-Area	Poor	Medium	Well-off	Total
Kyrgyzstan (a1)		n/a	n/a	n/a	n/a
KIS (b1)		n/a	n/a	n/a	n/a
SMIP (c)		n/a	n/a	n/a	n/a

SRSP (d1**)**	**Number of Bullocks/ Tractors Owned**	**Number of landholders 0wning Bullocks or Tractor – by Holding Size Class**				
	Bullocks	**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	**Total**
	0	22	15	6	6	49
	2		22	16	11	49
	4		1			1
	Grand Total	22	38	22	17	99
	Tractors	**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	**Total**
	0	22	37	22	12	93
	1		1		5	6
	Grand Total	22	38	22	17	99

F.3.4 Cropping pattern [5.11], [5.12], [5.13]

Table F-32: Cropping pattern during study season – per cent of farmers growing each crop

Crop		Study Area *(data source in brackets)*					
		Jany Aryk (a1)	Obi Haet (a1)	KIS (b1)	SMIP (c)	SRSP - Kharif/ 2003 (d1)	SRSP - Kharif/ 2004 (d1)
Main Crop	Paddy			100%	100%	65%	44%
	Maize	66%				2%	2%
	Cotton		82%				
	Wheat	8%	21%				
	Sunflower	12%					
	Potato	9%	5%				
	Vegetables	8%					
	Onion		32%				
	Legumes & misc. [1]					2%	3%
	Trees, perennials	4%					
Second Crop	Rice		27%				
	Maize		29%			5%	7%
	Legumes & misc. [1]						3%
	Sunflower		9%				
	Carrot		4%				
	Fallow/Not cultivating	n/a	n/a	n/a	n/a	31%	51%
	Total Farmers	100%	100%	100%	100%	100%	100%

[1] Green Gram, Groundnut, "Babarlu", Groundnut & Maize

Table F-33: Cropping pattern during study season – per cent of total area under each crop

		Study Area *(data source in brackets)*					
Crop		Jany Aryk (a1)	Obi Haet (a1)	KIS (b1)	SMIP (c)	SRSP - Kharif/ 2003 (d1)	SRSP - Kharif/ 2004 (d1)
Main Crop	Rice			100%	100%	74%	24%
	Maize	62%				2%	1%
	Cotton		66%				
	Wheat	12%	13%				
	Sunflower	8%					
	Potato	8%	1%				
	Vegetables	3%					
	Onion		9%				
	Legumes & misc. [1]					1%	1%
	Trees, perennials	6%					
Second Crop	Rice		6%				
	Maize		3%			2%	4%
	Legumes & misc. [1]						2%
	Sunflower		9%				
	Carrot		1%				
	Fallow			n/a	n/a	1%	17%
	Not cultivated					4%	4%
	Unaccounted for [2]					16%	46%
	Total Area	100%	100%	100%	100%	100%	100%

[1] Green Gram, Groundnut, "Babarlu", Groundnut & Maize
[2] Area not classified as either under a named crop or fallow. It is likely that this land was left uncultivated or the crop was abandoned during this drought year.

Table F-34: Jany Aryk - cropping pattern during study season, by well-being

A: Jany Aryk - Per cent of farmers growing crop, by well-being [1]

Study Area *(data source in brackets)*	Crop	Poor	Medium	Well-off	Total
Jany Aryk	Maize	60%	66%	73%	66%
	Sunflower	16%	11%	12%	12%
	Wheat	18%	7%	5%	8%
	Potato	2%	10%	10%	9%
	Vegetables	7%	7%	10%	8%
	Trees, perennials	5%	4%	3%	4%
	TOTAL – farmers	100%	100%	100%	100%

[1] **Source**: WUA listing of land holders in study command areas, and cropping plans

B: Jany Aryk - Per cent of total land share area under each crop, by well-being [1]

Study Area	Crop	Poor	Medium	Well-off	Total
Jany Aryk	Maize	57%	61%	71%	62%
	Sunflower	16%	8%	7%	8%
	Wheat	20%	13%	4%	12%
	Potato	1%	9%	9%	8%
	Vegetables	3%	4%	3%	3%
	Trees, perennials	4%	6%	6%	6%
	TOTAL Land share Area	100%	100%	100%	100%

[1] **Source**: WUA listing of land holders in study command areas, and cropping plans

Table F-35: Obi Haet - Cropping pattern during study season, by well-being

A: Obi Haet - Per cent of farmers growing crop, by well-being [1]

Study Area	Crop	Poor	Medium	Well-off	Total
Obi Haet	1 - Cotton	94%	78%	75%	82%
	1 - Wheat	20%	22%	21%	21%
	1 - Onion	40%	31%	21%	32%
	1 - Potato	6%	4%	4%	5%
	2 - Carrot	8%	3%	0%	4%
	2 - Rice	22%	31%	21%	27%
	2 - Maize	32%	30%	21%	29%
	2 - Sunflower	8%	10%	8%	9%
	TOTAL- farmers	100%	100%	100%	100%

[1] Source: WUA listing of land holders in study command areas, and cropping plans

B: Obi Haet - Per cent of total land share area under each crop, by well-being [1]

Study Area	Crop	Poor	Medium	Well-off	Total
Obi Haet	1 - Cotton	74%	62%	67%	66%
	1 - Wheat	12%	13%	15%	13%
	1 - Onion	9%	10%	6%	9%
	1 - Potato	1%	1%	1%	1%
	2 - Carrot	1%	1%	0%	1%
	2 - Rice	5%	7%	4%	6%
	2 - Maize	2%	3%	1%	3%
	2 - Sunflower	8%	9%	9%	9%
	Total Land share Area	100%	100%	100%	100%
	Total of Crops - 1	95%	86%	89%	89%
	Total of Crops - 2	17%	20%	14%	18%
	Total of Crops 1+2	111%	106%	104%	107%

[1] Source: WUA listing of land holders in study command areas, and cropping plans
Note: Sum of column is greater than 100% because some farmers grow more than one crop

Table F-36: SRSP - Comparison of crops Kharif 2003 and 2004, by size class

(A) SRSP –number of landholders and land area under each crop, by size class, *kharif* 2003

Main Crop	Number of landholders growing crop					Area Under Each Crop (ha) [1]				
	Sub-Marginal	Marginal	Small	Medium +	Grand Total	Sub-Marginal	Marginal	Small	Medium +	Grand Total
Rice	1	28	19	16	64	0.10	16.47	15.39	18.92	50.88
Dry Irrigated	1	1	5	2	9	0.20	0.20	2.02	1.01	3.43
Fallow	20	9			31	1.44	4.96	4.63	3.21	14.24
Total	22	38	22	17	99	1.75	21.63	22.04	23.14	68.56

(B) SRSP – number of landholders and land area under each crop, by size class, *kharif* 2004

Main Crop	Number of landholders growing crop [1]					Area Under Each Crop [2]				
	Sub-Marginal	Marginal	Small	Medium +	Grand Total	Sub-Marginal	Marginal	Small	Med+	Grand Total
Rice	1	18	13	12	44	0.10	5.16	5.86	5.50	16.62
Dry Irrigated	0	5	6	4	12	0.00	1.92	2.02	1.82	5.76
Fallow	21	17	8	4	50	1.65	14.55	14.16	15.82	46.18
Total Land	22	38	22	17	99	1.75	21.63	22.04	23.14	68.56

[1] Fallow includes land reported as 'fallow', 'not cultivated' and not reported as either under rice or Dry Irrigated crops.
Source: India, SRSP (d1): EIP-Baseline Survey

Table F-37: SRSP - Comparison of rice cultivation Kharif 2003 and 2004, by well-being and pipe

(A) SRSP percent of all landholders growing rice and percent area under rice, by pipe and size class - *kharif* 2003

Pipe	Per cent of farmers growing rice					Percent of Area Under Rice				
	Sub-Marginal	Marginal	Small	Medium +	Grand Total	Sub-Marginal	Marginal	Small	Medium +	Grand Total
P2	100%	92%	100%	80%	92%	100%	97%	94%	87%	92%
P5		93%	92%	100%	94%		87%	69%	96%	82%
P9	0%	27%	33%	100%	24%	0%	32%	24%	66%	43%
Total	5%	74%	86%	94%	65%	6%	76%	70%	82%	74%

(B) SRSP percent of all landholders growing rice and percent area under rice, by pipe and size class - *kharif* 2004

Pipe	Per cent of farmers growing rice					Percent of Area Under Rice				
	Sub-Marginal	Marginal	Small	Medium +	Grand Total	Sub-Marginal	Marginal	Small	Medium +	Grand Total
P2	100%	46%	67%	60%	56%	100%	22%	26%	13%	21%
P5		79%	62%	100%	76%		38%	30%	40%	35%
P9	0%	9%	33%	50%	12%	0%	1%	18%	20%	13%
Total	5%	47%	59%	71%	44%	6%	24%	27%	24%	24%

Source: India, SRSP (d1): EIP-Baseline Survey

F.4 Human and social assets

F.4.1 Per cent of landholders literate [5.14, footnote 35]

Table F-38: Literacy among landholders

A: Number literate – landholders/households/males

Study Area *(data source in footnote)*	**Sub-Area**	**Poor**		**Medium**		**Well-off**		**Total**	
Kyrgyzstan (a)		**Heads of household- literate and total**							
		Lit	**Tot**	**Lit**	**Tot**	**Lit**	**Tot**	**Lit**	**Tot**
	Jany Aryk	33	35	191	191	44	44	268	270
	Obi Haet	51	53	66	66	18	18	157	157
KIS (b)		**Household members – literate and total**							
		Lit	**Tot**	**Lit**	**Tot**	**Lit**	**Tot**	**Lit**	**Tot**
	PBK	109	199	116	131	11	14	236	344
	PGW	43	51	113	129	92	108	248	288
	Total	152	250	229	260	103	122	484	632
SMIP (c)		**Males – literate and total**							
		Lit	**Tot**	**Lit**	**Tot**	**Lit**	**Tot**	**Lit**	**Tot**
	Males	95	260	221	387	154	208	470	855
SRSP (d)		Sub-marg.		Marginal		Small		Medium +		Total	
		Heads of household – literate and total									
		Lit	**Tot**	**Lit**	**Tot**	**Lit**	**Tot**	**Lit**	**Tot**	**Lit**	**Tot**
	P-2	0	1	1	13	1	6	3	5	5	25
	P-5			2	14	2	13	5	6	9	33
	P-9	0	21	2	11	1	3	2	6	5	41
	Total	0	22	5	38	4	22	10	17	19	99

Sources:
(a) Kyrgyzstan (a2): WUA Landshare list from WUA key informants, and Stage II Report – numbers do not correspond exactly to number of landholders in sample frame for livelihoods survey
(b) Nepal, KIS (b2): EIP – Livelihoods data – from key informants; count of all literate household members, male and female [NOTE: Data are not available for Outlet 18 in BC-1, were there is a concentration of Dalit sharecroppers. This also does not include Tharu sharecroppers in Pachas Bigha Kulo. These groups are mostly poor and are likely to have lower levels of literacy.]
(c) Nepal, SMIP: Guidelines for Good Governance DL/AP data, Literacy amongst all males in the household (not just main "cultivator"). These data cover 252 households from the DL/AP results - excluding landless category, and combining 'better' and 'big property' categories in 'well-off' category. The information overlaps with, but does not directly correspond to the 157 landholder households covered by the EIP study. It is presented as indicative.
(d) India, SRSP: EIP – Baseline Survey – number of heads of household literate

B: Per cent literacy in landholders households

Study Area (data source in brackets)	Sub-Area	Poor	Medium	Well-off	Total
Kyrgyzstan	Jany Aryk	95%	100%	100%	99%
	Obi Haet	96%	100%	100%	99%
KIS	PBK	55%	89%	79%	69%
	PGW	84%	88%	85%	86%
	OL 18	n/a	n/a	n/a	n/a
	Total	61%	88%	84%	77%
SMIP	WC-1	48%	87%	83%	76%
Males	WC-2	32%	43%	73%	43%
	WC-3	36%	69%	76%	60%
	WC-4	40%	40%	68%	51%
	Total (males)	37%	57%	74%	55%

SRSP		Sub-Marginal	Marginal	Small	Medium +	
	P-2	0%	8%	17%	60%	20%
	P-5		14%	15%	83%	27%
	P-9	0%	18%	33%	33%	12%
	Total	0%	13%	18%	59%	19%

Source: Table A

C: Kyrgyzstan – Pre-land distribution occupation of survey respondents

			Well-being Category			
WUA Jany Aryk	**Classified PrevOcc**	**Occupation - detail**	**Poor**	**Medium**	**Well-off**	**Grand Total**
	Agric	kolkhoz/sovkhoz worker	13%	13%	17%	14%
	Agric	professional/agric	13%			3%
	Skilled	driver		27%	33%	21%
	Skilled	factory	13%	7%		7%
	Skilled	construction worker		7%		3%
	Skilled	craftsman	25%	20%		17%
	Skilled	service worker	25%		33%	14%
	Prof & admin	administration		7%		3%
	Prof & admin	professional		7%	17%	7%
	Other	artist		7%		3%
	Other	student		7%		3%
	Other	housewife	13%			3%
		(blank) (4 out of 33 resp)				
Jany Aryk Total		**(33 respondents)**	**100%**	**100%**	**100%**	**100%**

Obi Haet WUA	Classified PrevOcc	Occupation - detail	Well-being Category			
			Poor	**Medium**	**Well-off**	**Grand Total**
	Agric	kolkhoz/sovkhoz worker	67%	31%		37%
	Agric	professional/agric	11%		20%	7%
	Skilled	driver		25%		13%
	Skilled	factory	11%	13%	20%	13%
	Skilled	construction worker			20%	3%
	Skilled	craftsman	11%	19%		13%
	Skilled	service worker		6%	20%	7%
	Prof & admin	professional			20%	3%
	Prof & admin	office manager		6%		3%
		(blank) (2 out of 32)				
Obi Haet Total		**(32 respondents)**	**100%**	**100%**	**100%**	**100%**

Source: Kyrgyzstan (a1): EIP - Livelihoods Survey

F.4.2 Average size of household [5.15]

Table F-39: Average size of household

Study Area *(data source in brackets)*	**Sub-Area**	**Poor**	**Medium**	**Well-off**	**Total**
Kyrgyzstan (a1)	Jany Aryk	6.8	6.7	6.6	6.7
	Obi Haet	7.5	6.2	6.6	6.6
KIS (b1)	PBK	7.5	5.8	7.0	6.7
	PGW	5.5	5.3	8.4	6.3
	OL 18	6.9	5.3	7.0	6.3
	Total	6.9	5.5	8.0	6.5
SMIP (c)[1]	WC-1	6.3	4.6	7.7	6.3
	WC-2	5.8	6.9	6.6	6.4
	WC-3	7.0	6.4	7.2	6.7
	WC-4	5.7	6.4	5.9	6.0
	Total	6.2	6.4	6.7	6.4
SRSP (d1)		Sub-Marginal	Marginal	Small	Medium +
	P-2	3.0	4.8	4.7	5.2	4.8
	P-5		4.1	4.7	4.2	4.4
	P-9	4.3	4.2	6.3	5.2	4.6
	Total	4.3	4.4	4.9	4.8	4.6

[1] Nepal, SMIP: Guidelines for Good Governance, DL/AP data. These data cover 252 households from the DL/AP results - excluding landless category, and combining 'better' and 'big property' categories in 'well-off' category. The information overlaps with, but does not directly correspond to the 157 irrigator households covered by the EIP study. It is presented as indicative.

F.4.3 Female-headed households [section 5.3.3]

Table F-40: Female-headed households, Kyrgyzstan and SMIP

A: Number of female-headed households, Kyrgyzstan and SMIP

Study Area *(data source in brackets)*	Sub-Area	Poor	Medium	Well-off	Total
Kyrgyzstan (a1)	Jany Aryk	9	8	17	34
	Obi Haet	4	5	0	9
	Total	13	13	17	43
SMIP (c)	WC-1		3		3
	WC-2		1		1
	WC-3	1			1
	WC-4	1			1
	Total	2	4		6

(b1) Nepal, KIS: EIP – not available
(c) Nepal, SMIP: EIP livelihoods data. Does not include 7 hh for which data not available. Counts households where a female is the decision-maker in both the Monsoon and winter seasons (in no households was the female the decision maker in only one season).
(d1) India, SRSP: EIP – Baseline Survey – not available

B: Per cent female-headed households/or with female decision-maker, Kyrgyzstan and SMIP

Study Area *(data source in brackets)*	Sub-Area	Poor	Medium	Well-off	Total
Kyrgyzstan	Jany Aryk	24%	4%	35%	12%
	Obi Haet	9%	6%	0%	6%
	Total	17%	5%	27%	10%
SMIP [2]	WC-1	0%	4%	0%	2%
	WC-2	0%	1%	0%	1%
	WC-3	2%	0%	0%	1%
	WC-4	2%	0%	0%	1%
	Total	5%	6%	0%	4%

Source: Table A.

F.4.4 Formal and informal social groups and collaboration for water management [section 5.3.4]

Table F-41: Social groups for mutual support in our study sites – overview of characteristics

A: Kyrgyzstan – overview of characteristics

Type of Activity	Name of Group/ Organisation	Formal or Informal Organisation		Number of members (range)	Basis for membership	Types of activities undertaken	Remarks
		Formal	Informal				
Irrigation	Informal network		X	2 - 6	Close kin (siblings, uncle), neighbours (mostly neighbours in field, but also residential)	Exhange of information; some coordination of water use; some help with accessing and guarding water supply	There are about 4 such groups in Obu Haet and 9 in Jany Aryk. Some were formerly operating as a single 'peasant farm' composed of landholdings of a group of former kolkhoz workers. More recently the land holders are operating their land holding as individuals, but collaborating for specific activities -- as they consider useful.
	Ashar	X	X	n/a	Close kin (siblings, uncle), neighbours (mostly neighbours in field, but also residential)	Cleaning outlet canals	Informal collaboration to clean in-field canals; organised amongst field neighbours on an 'as needed' basis
	WUA	X		n/a	WUA members	Cleaning outlet canals	Organised by the WUA as needed in the course of the irrigation season. Contribution of 'ashar' labour off-set against obligation to pay irrigation service fee
Agriculture – general	Informal network		X	2 - 6	Close kin (siblings, uncle), neighbours (mostly neighbours in field, but also residential)	Hiring machinery; information exchange; rarely for input purchase or produce sale	Same as informal network operating for irrigation

		Formal or Informal Organisation					
Non-agriculture	Savings	X	X	10-15	kin, residential neighbours, work mates	Group savings	Members contribute a set amount on regular basis; members take it in turns to periodically take out the whole sum in kitty
	House building/Ashar		X	1 - 3	kin, residential neighbours	House/barn construction	Irrigators noted that due to economic circum-stances the occasions for house construction have reduced in recent years.

Source: Kyrgyzstan (a1): EIP Livelihoods Sample Survey, and study team observations

B: Nepal, KIS - overview of characteristics, and participation by well-being category

Activity/type of network or group	General comments	Poor	Medium	Well-off
Local informal networks	Tend to help each other in general and within kinship in particular, farmers can use others' land to install seed bed, may use temporary field channel through other land for spring paddy Common system of support for death and fire victims, and for *tole* improvements. *Parma* system for agricultural labour	Rely on neighbours/kin during crises, exchange water turns within group, but weak and fragmented groups with poor links to other groups in the same village.	Cohesive communities who migrated from the same hill areas, shared interests, few conflicts; tradition of cooperation, rely on wider neighbour hood and kinship networks	Increasingly fragmented due to migration and outside employment. Some believe multi-party system has destroyed the social harmony
Participation in WUA	Very variable participation, each group blaming others for their weak participation in WUA activities	Have little idea about the committee so less participation, many are not represented (as they are landless). Tend to seek neighbours' support instead of WUA, often hold negative opinions towards committee and believe that committee is biased.	Have knowledge on committees and its office bearers, some discuss with committee in managing water and canal desilting, participate in the committee meeting, benefited from training and exposures. Others ignore WUA and use personal social networks or influence to achieve same ends	Many have good knowledge about the WUA and participate actively, often because they see potential for social or political advancement through it. Others ignore it.
Participation in other formal local institutions	Various institutions and groups are formed and working to conserve forest, improve agriculture practices and enhance saving habits of poor and *dalit* farmers	Involved in saving and credit groups, community forest user group, mothers' groups	Many effective clubs and groups, SAGUN: active in promoting governance and improving women role in irrigation, benefited from finance companies and agriculture cooperatives	Involved in LI-BIRD agri-based research program, SAGUN: active in promoting governance and women role in irrigation, have access to BZ project, benefited from finance companies and agriculture cooperatives
Social services	Have good social services because of the establishment of social infrastructures, increase in social unity and relationship, and feeling of neighbourhood	Education, awareness and socio-political situation supportive for social justice, low level of discrimination, sense of neighbourhood at times of extreme vulnerability,	Many are active to establish new shops, increase roads, schools, health posts biogas; shared interests and understanding to use social services	

Source: Nepal, KIS: Study Team observations from focus group discussions

C: Nepal, SMIP - Social groups for mutual support, listing and number operating in T-5 study area

S. No.	Type of Group	Number of Groups/Organisation operating in study area
1	Farmers groups	2
2	Nepal Jan Utthan Munch (Nepal People Strengthening Fedn (Social Welfare - Child Health)	2
3	Youth Clubs	4
4	Rural Development Bank	2
5	Nepal Rural Development Social Centre (NRDSC)	2
6	Water Users group	4

Source: Nepal, SMIP (c): GGG Field Study 2003

D: - India, SRSP - Social groups for mutual support, assessment of activities in the study area

Type of Activity	Name of Group/Organisation	Formal or Informal Organisation		Remarks
		Formal	Informal	
Irrigation	WUA	X		Out of the 43 respondents, 22 reported that they are 'members' in WUAs
Agriculture – general	Rythumithra (farmer group)	X		There has been no attempt to organise common purchase of inputs or sale by the WUA or a farmers' cooperative
Non-agriculture	Panchayat Raj – village level user groups: e.g. Self Help Groups (SHG), Vidya Education committee, Mothers Committee, local and district administrative committees). These are headed by elected leaders, through village level elections conducted by the Revenue Department.	X		Most families are members in one or more of these. However, the social networks are not active in taking decisions or implementing them. The Self Help Groups are not at all active due to poor capacity building efforts.

Source: India, SRSP (d2): EIP – Livelihoods Survey and study team observations

Table F-42: Landholders' collaboration for irrigation –frequency of participation in collaborative activities, by activity

A: Kyrgyzstan – Percent of landholders by frequency of collaboration, by irrigation activity, and average number of irrigators you collaborate with

Irrigation Management Activity	Percent of Irrigators Collaborating *(a)*					
	Frequently Collaborating		Never Collaborating		Average Number of Irrigators You Collaborate With	
	Jany Aryk	Obi Haet	Jany Aryk	Obi Haet	Jany Aryk	Obi Haet
Going to the Murab to request Water	15%	15%	66%	72%	1.5	0.7
Coordinating timing and access to irrigation						
Agree to Coordinate Timing When Water Has Arrived	58%	66%	15%	5%	3.8	4.1
Agree Timing of Irrigation in advance	25%	60%	52%	18%	2.2	3.4
Collaboration to monitor and access water flow to the field						
Going to the head of your outlet to control water supply	44%	39%	13%	33%	3.3	2.1
Going to the Head of Buvakul/Katta Khaz Canal to control water flow	34%	31%	39%	22%	3.5	2.9
Collaboration for water management at field level						
Receive help from others to manage irrigation within your own field	5%	7%	79%	36%	0.7	2.1
Help others to manage irrigation in their field	10%	13%	47%	19%	1.6	2.8
Get help from others to close irrigation to your field when irrigation is finished	5%	16%	47%	27%	2.1	2.3

(a) Note: the balance of landholders reported collaborating 'sometimes' or 'rarely'
Source: Kyrgyzstan (a1): EIP – Livelihoods Sample Survey

B: Nepal, KIS – observations on collaboration for irrigation, general and by well-being category

Well-being Category	Nepal, KIS: Collaboration for Water Management
General comments	Farmers mostly take individual measures to access and guard their water supply. Collaboration tends to be informal and expedient. Individuals may share water with neighbours and kin, but they do not do so consistently. At the outlet level and the individual farm level, water users manage irrigation independently with their own efforts and time. Hard working and active locally resident farmers tend to manage water better than do absentee farmers.
Poor	Poor farmers and landless cannot afford the time to attend meetings when water management is planned, as they have to work at other locations for their daily livelihoods. Sharecroppers have less say in water management decisions as they may be operating on an annual contract, with little security or continuity of tenure. Most absentee sharecroppers are

Well-being Category	Nepal, KIS: Collaboration for Water Management
	landless farmers from adjacent villages. In pachas bigha kulo the sharecroppers from Pullar village have poorer access to irrigation water than do owner-cultivators. These sharecroppers are not considered as the members of the WUA and hence are treated as inferior to other landowners in relation to water management decisions. In addition, they could not get information of rotational day of water or availability of water in the canal. The probability of mismatch of water shortage and their presence in the field is frequent. Usually when sharecropper comes there may not have water in the canal or upstream farmer is operating his or her outlet. Not all sharecroppers request upstream farmers to open the obstruction in the canal. This depends on their relative social status. Sharecroppers consider *ghol* (low) land is better for spring paddy as it needs less water and does not require regular monitoring of water level. But in case of *tandi* (up)land at least alternate day of monitoring is essential and depth of water at all corners of the plot is to be assessed. Poor holders of lowland may suffer from conversion of upland to lowland in a neighbor's field -- due to obstruction of field to field irrigation and/or seepage from paddy field to maize field (see below).
Medium + Well-off	Medium and well-off farmers have better access than the poor to the decision making process for planning and implementing water rotation, because they are better informed and socially better connected. A factor affecting access to irrigation water is the recent trend to convert *tandi* (upland) to *ghol* (lowland) in order to grow more crops (paddy) in spring. This conversion is mostly possible for medium and well-off farmers who can afford the costs of lowering the land. The cost of lowering the land is about Rs 3 to 4 thousands per *kattha*.
Well-off	Well off farmers reputedly do not obey the very rotational rules that they may have helped to craft.

Source: Nepal, KIS: Study team observations from the field and focus group discussions

C: Nepal, SMIP – observations on collaboration for irrigation, general and by well-being category

Well-being Category	Nepal, SMIP: Collaboration for Water Management
General comments	Water distribution management is being done more or less on an *ad hoc* basis and 'might is right' is the principle for its operation. It is considered that rules basically only apply to the weaker groups of the community (if at all). At the higher levels of the system the use of illegal pipes, even into the sub-secondary canal, and unauthorized obstructions of flow in the sub-secondary and tertiary canals are common, resulting in water scarcity at the tail end. Water distribution is supposed to be based on each watercourse having 7 outlets. Each outlet is supposed to serve several plots via farmer-built field channels, with each outlet taking all the watercourse flow in turn. In practice, the watercourses are operated more or less on an *ad hoc* basis. There are quite a large number of unauthorized open cut outlets in the watercourses, many of them flowing simultaneously, as each farmer expects to take water directly from the watercourse. A farmer who finds water in the watercourse diverts it in his field. So, at one time, even four to five farmers may be diverting water to their fields simultaneously - with only a small stream size for irrigation for each of them. Few field channels have been dug, and temporary check structures are common on these channels. For canal maintenance farmers tend to participate in irrigation works either in the form of cash or in labour. Labour resources are used for emergency and minor maintenance of irrigation canals while cash contribution is necessary for routine cleaning of the whole watercourse. However, due to lack of proper leadership, motivation, and lack of morale of

Well-being Category	Nepal, SMIP: Collaboration for Water Management
	WUA officials the level of participation is declining. In most cases the water users themselves carry out watercourse level operation and maintenance as they see fit and upper level maintenance is either neglected or erratic. All groups find it difficult to get water in the time of need, but medium and well-off farmers are best able to achieve this.
Poor	Poor farmers have less access to water because their land is located in unfavourable locations, mostly at the tail end. They do not have the influence to ensure that water is available to them when they need it and when they are present in the field to use it.
Medium	Medium farmers make the greatest effort to capture water. They have the resources to have access to good land and to purchase inputs, and they have the time and influence to ensure an adequate supply of water – by one means or another.
Well-Off	Owners of the larger landholdings, particularly those who let their land to others, are often least interested in the way irrigation is managed. This is because they have alternative income sources and are often occupied away from the locality. However, those who are locally resident often have the greatest influence and access to get water in need. They are reputed to be most likely to make use of illegal outlets and not be penalised. They are also most likely to have the connections needed to influence actions so that water flows to their land through the official outlets/channels.

Source: Nepal, SMIP (c): GGG DL/AP findings and EIP Study Team observations from field and focus group discussions

D: India, SRSP – observations on collaboration for irrigation, by size class

Size Class	Pipe	SN	Is there any system that is being followed in distributing water? If so is it formal / informal? Give detail	Is there any arrangement for deciding time, quantity of water and duration of irrigation? What is the basis for this, who decided/agreed it, who monitors this and how.	What sort of obstructions/unplanned activities have you observed during water release especially with respect to its distribution? (give details)	What measures are being taken by the individuals to streamline the process/correct it? Is it temporary arrangement or institutional arrangement?
Sub-Marginal	2	22	informal from head to tail	lashkar comes and goes, no management role and even he does not take interest. TC also so far not taken any initiation towards it	continuous watch on gate to regulate constant flow of 30 R	nothing of such sort
	9	24	top to bottom approach in irrigating lands, first come first serve	within farmers they will manage to arrange some approach according to the situation	obstructions on water by few big farmers	temporary to push the process forward
		25	no- head to tail end farmers	at different times different types such as: 1-if flow is more, share among neighbours.2- if flow is less, one after other. 3- if very less share part time	many obstructions	it is a sequential process like removal of obstruction and building obstruction

Size Class	Pipe	SN	Is there any system that is being followed in distributing water? If so is it formal / informal? Give detail	Is there any arrangement for deciding time, quantity of water and duration of irrigation? What is the basis for this, who decided/agreed it, who monitors this and how.	What sort of obstructions/unplanned activities have you observed during water release especially with respect to its distribution? (give details)	What measures are being taken by the individuals to streamline the process/correct it? Is it temporary arrangement or institutional arrangement?
Marginal	2	2	informal - negotiation between farmers, first come first serve	Laskar up to minor level, WUA TC -pipe level and individual farmer, Neighbour to neighbour water distribution	creating obstruction to water flow	clearing them through negotiation, demand etc.
		9	informal as per the needs of the farmers, as per the power and strength	informal system amongst few people within the pipe especially in the downstream	releasing less quantity of water at minor. Diversion by people. Requirement by tail end farmers by pleasing upstream farmers for releasing water	temporary conflicts resolution measures
		21	informal distribution from top to bottom and big farmer to small farmer with prior concern to big	earlier no such arrangement. Last one year lashkar and TC are taking some measure to send water regularly	obstructing water flow, quarrels	removing it and making as per their convenience
	5	10	informal, first come first serve, upstream to downstream	no such system	-	-
		13	informal so far	everyone has to follow their responsibility	illegal tapping	awareness about equal distribution
		32	-	for repairs of canals and getting waterfrom field but efforts are in vane	land is llittle elevated	repeatedly asking for release of water to that land
		42	informal head to tail. From powerful to powerless and from big to small farmers	neighbours	Big farmers tap more water, obstructions created at different levels and neighbours creating more problem	all tail end farmers will go collectively and get water required and this needs a lot of struggles
	9	33	informal head to tail, first come first serve	neighbours and other farmers	tapping and obstruction etc	10 members to watch along minor, blocking pipes at up stream, watch and ward for water along minor and at pipe level and field channel
		44	no-first come first serve and head to tail end	few farmers go to head and middle reach to fetch water by removing stones	only obstruction along monor at pipe outlets and inlets	no role being played by TC members. TC members also do not give time for such issues

Size Class	Pipe	SN	Is there any system that is being followed in distributing water? If so is it formal / informal? Give detail	Is there any arrangement for deciding time, quantity of water and duration of irrigation? What is the basis for this, who decided/agreed it, who monitors this and how.	What sort of obstructions/unplanned activities have you observed during water release especially with respect to its distribution? (give details)	What measures are being taken by the individuals to streamline the process/correct it? Is it temporary arrangement or institutional arrangement?
Small	2	1	informal-upstream to down stream	formally no but will see the flow and go for irrigating the water as per requirement	diversion of water someone, down stream and tail end farmers diverting water to their fields. Low canal water in its flow- competition between us	negotiations and understanding the situation and wait till such conflict get resolved as temporary measure
		(blank)	no	no such decision making at WUA level	obstruction to pipes, minor level flows in raising water	discussions, talks, quarrels. Panchayat as temporary arrangements
	5	14	informal head to tail gravity flow	no such arrangement. As water availability we have to go here and there, requests, demanding . Lots of other problems	field channels and pipe outlets have to be cleared by all members under it and take some preparatory measures	collectively requesting to WUA /TC but no solution
		35	informal-head to tail .priority to big farmer and influential person	no such arrangement but farmers become small teams in getting water as and when the time comes and make a viable system to follow in safeguarding the distribution system	diversion of water during nights and less water release by lashkar. Unauthorised diversion to wells and uplands	temporary conflicts resolution measures
	9	16	no such system, many a times head reach farmers use water more than their requirement that lead to wastage and flow unnecesary to tanks	few times as pertime but mostly as perfield requirement	obstructions, diversion to uplands. Diversion through pipes and motors etc	removal of obstructions, negotiating with farmers but very risky process will last no time
		19	informal - head to tail, no sufficient water being released before lining they used to get good water and seepage	neighbours and yourself	motors, illegal tapping, obstructions	collection action repeatedly construction and destruction of such structures at drops
		41	informal head to tail - powerful people first powerless last	neighbours and other farmers	stones, raising, diverting water into wells	scouting along the canal by few farmers
Medium	2	4	informal- chat with and negotiate with others	neighbours and other farmers for discussion in release of and utilization of water	Raise 30 R water to irrigate land quickly	Negotiations etc will serve the purpose to some extent

Size Class	Pipe	SN	Is there any system that is being followed in distributing water? If so is it formal / informal? Give detail	Is there any arrangement for deciding time, quantity of water and duration of irrigation? What is the basis for this, who decided/agreed it, who monitors this and how.	What sort of obstructions/unplanned activities have you observed during water release especially with respect to its distribution? (give details)	What measures are being taken by the individuals to streamline the process/correct it? Is it temporary arrangement or institutional arrangement?
		20	no such mechanism but informally they discuss as per the necessity	no such process . If at all it comes it comes as overflow from the pipe adjacent field otherwise depend on well water	diversion at Minor and pipe level , diversion at field level	discussions, negotiations, quarrels etc
	5	8	informal upstream to down stream irrigation	no such arrangement , normally the farmers themselves decide by their own convenience	obstructions to the flow of water in the upstream in 30R and in pipes outlet	temporary- removing it many times and few times allowing to flow and diverting after the need fulfillment
		15	no such system. But internally every one takes his chance in availing such water for irrigation	lashkar-all along the M 30R and negotiate with farmers and TC members	creating obstruction to the flow- diverting water to the fields, unauthorised irrigation to up lands	individual attention, mutual interaction is leading to resolve to some extent
		28	as such no formal system	neighbours and other farmers depends on the release of water in qualitative terms	upstream people diverting water at times downstream people take water to them	some times taken the case to Panchayat, few times negotiation with those farmers otherwise very few times just remove the blockage
		29	informal negotiations	neighbours - as per the need and amount of land, flow of water other wise depend on well	high land hence will not get water through canal (0.5 out of 2.5 acre will get water under canal)	temporary
	9	17	no- informally through head to tail. Basis of requirement and need emergency	as the farmers observe situation they themselves demand for diversion of water to other fields	many obstructions at different level and drops	temporary as removal to make the flow of water
		18	informal-head to tail . First irrigation takes more time extended up to 25 days later vaarabandhi	No such process to D86 water is generally released for 4-5 months. For minor vaaravandhi. For pipes no such system	night watch and diversion of water to raise water column and upland and wells	by request at times forming team to solve problem collectively but temporarily
		34	informal- first go and first irrigate	nothing like that depends on flow of water. one after the other follow the same process	diversion of water to unauthorized fields and wells	collectively going together and suffering nights to get irrigated to their fields

Size Class	Pipe	SN	Is there any system that is being followed in distributing water? If so is it formal / informal? Give detail	Is there any arrangement for deciding time, quantity of water and duration of irrigation? What is the basis for this, who decided/agreed it, who monitors this and how.	What sort of obstructions/unplanned activities have you observed during water release especially with respect to its distribution? (give details)	What measures are being taken by the individuals to streamline the process/correct it? Is it temporary arrangement or institutional arrangement?
		36	informal one to one- one to many through sharing	between the farmers and neighbours collective effort in getting water from upstream and irrigating the lands	untimely release of water, exploitation in use of water to fill the well, insufficient water release, wastage of water , obstructions created to flow	no such streamlining mechanism is seen as new elections, new members
		39	informal- first go and first irrigate	internally the group of farmers agreed to follow a pattern of irrigating one after the other	tractor load of rocks in obstruction, filling the pipes with stones, stopping water etc	irrigating during nights and requesting head reach farmers explaining the situation

Source: India, SRSP (d3): Water Management Survey

Table F-43: Kyrgyzstan – Characteristics of 'Collaborating Neighbours Networks' for irrigation

Name WUA	CNN ID	How related to other members and background to formation	Other activities of CNN	No of Members
Jany Aryk	5	Both neighbours in field and neighbours in village. The composition doesn't change from year to year because none of the members rent out their land and keep farming the same land. Additional information: After the land distribution utill 2000 there was a cooperative in this area.	machinery hire, assistance in harvesting.	4
	6	Both neighbours in village and neighbours in field. This used to be a peasant farm, consisting of 6 members. They used all to grow wheat. Then the yields worsened and some farmers decided that they want to grow some vegetables. Eventually the peasant farm was spilt on individual shares.	Machinery hire, purchase of inputs, giving advices and help to each other.	6
	7	Both neighbours in field and neighbours in village. In the past there was a group that had common land and cultivated it altogether, something like a mini-kolkhozes. There was Elder, who was in charge of the on-farm work.	Machinery hire, sale of crops, celebrations.	5

Name WUA	CNN ID	How related to other members and background to formation	Other activities of CNN	No of Members
	8	Both neighbours in village and neighbours in field	machinery hire; searching and information sharing on marketing; inputs purchase; planting at the same time. If they, for instance, all choose to grow maize they plant it all together within their total land and then divide fields by each farmer's area	4
Obi Haet	1	2 members are relatives; others are just neighbours in field There are 9 land plots within this field, cultivated by 6 farmers. All of them are members and there are no other farmers within this field.	Crop planting, hiring machinery	6
	2	2 are kin (79 and 80), and 2 others are also kin (81 and 82)	Crop planting, plowing, hiring machinery.	4
	3	2 neigbours in field, and one neighbour in village (as refers to the respondent) The respondent could not think of any other CNNs within the field.	Machinery plowing, apllying chemicals.	3
	4	4 kin and 1 non-kin SG takes water form outlet 16, so he is not very much involved into the irrigation process, but seems that he is still a member of CNN. The fields of 4 relatives is cutlivated jointly. Therefore, one irrigation is applied for all fields.	Plant crops, hire machinery.	5

Source: Kyrgystan (a3) – EIP – Collaborating Neighbours Network Survey

Table F-44: Kyrgyzstan – Landholders employing an irrigator

(A) Number employing an irrigator alone/with others

WUA	Mode of Employing Irrigator	Wellbing Category Poor	Medium	Well-off	Total
JA	Alone	0	23	2	25
	With Others	0	0	2	2
	No of HH in Popln	37	205	48	290
Obi Haet	Alone	2	6	8	16
	With Others	2	0	0	2
	No of HH in Popln	39	83	16	138

(B) Percent employing an irrigator alone/with others

WUA	Mode of Employing Irrigator	Wellbing Category Poor	Medium	Well-off	Total
JA	Alone	0%	11%	5%	9%
	With Others	0%	0%	5%	1%
Obi Haet	Alone	5%	7%	50%	11%
	With Others	5%	0%	0%	1%

Source: Kyrgyzstan (a1): EIP – Livelihoods Sample Survey

Table F-45: Kyrgyzstan - Frequency of contact with *mirab*, by well-being category/size class

How many times did you contact the murab in the last season? a.For authorisation to irrigate (OH)/to get help (JA) (unweighted survey results)

(A) Number of respondents

	Jany Aryk				Obu Haet			
Nos contacts with mirab in last seasor	**Poor**	**Medium**	**Well-Off**	**Total**	**Poor**	**Medium**	**Well-Off**	**Total**
0	9	8	3	20	0	0	0	0
3	0	7	3	10	1	5	0	6
10	0	2	0	2	7	7	6	20
20	0	0	0	0	2	3	1	6
30	0	0	0	0	0	0	0	0
31+	0	0	0	0	0	1	0	1
Total	9	17	6	32	10	16	7	33

(B) Percent of respondents

	Jany Aryk				Obu Haet			
Nos contacts with mirab in last seasor	**Poor**	**Medium**	**Well-Off**	**Total**	**Poor**	**Medium**	**Well-Off**	**Total**
0	100%	47%	50%	63%	0%	0%	0%	0%
3	0%	41%	50%	31%	10%	31%	0%	18%
10	0%	12%	0%	6%	70%	44%	86%	61%
20	0%	0%	0%	0%	20%	19%	14%	18%
30	0%	0%	0%	0%	0%	0%	0%	0%
31+	0%	0%	0%	0%	0%	6%	0%	3%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Source: Kyrgyzstan (a1): EIP Livelihoods Sample Survey [*NOTE: these are unweighted sample survey results*]

Table F-46: India, SRSP – arrangements for deciding time, quantity of water and duration of irrigation

Respondents' answer to the question: "What is the role in any arrangement for deciding time, quantity of water and duration of irrigation of Lashkar,WUA/TC,Your neighbours/other farmers, self"

(A) Number of respondents by type of arrangement and size class

Type of Arrangement	**Size Class**				
	Sub-Marginal	**Marginal**	**Small**	**Medium +**	**Grand Total**
individual		4	4	4	12
negotiated	2	3	3	6	14
lashkar	1	1			2
TC		1		1	2
Grand Total	3	9	7	11	30

(B) Percent of respondents by type of arrangement and size class

Type of Arrangement	Size Class				
	Sub-Marginal	Marginal	Small	Medium +	Grand Total
individual	0%	44%	57%	36%	40%
negotiated	67%	33%	43%	55%	47%
lashkar	33%	11%	0%	0%	7%
TC	0%	11%	0%	9%	7%
Grand Total	100%	100%	100%	100%	100%

Note: These figures must be viewed as only very general indicators. They are for an uncontrolled sample, and the number of respondents in the sub-marginal category is particularly small. Furthermore, the sub-marginal respondents were likely to be giving hypothetical answers as they have not cultivated their fields for some years.

Source: India, SRSP (d3): EIP- Water Management Survey

Table F-47: Kyrgyzstan – Number of landholders collaborating frequently (A) or never (B), by irrigation activity and well-being category

A: Kyrgyzstan – Number of landholders collaborating frequently

Irrigation Management Activity	Number of Landholders Collaborating Frequently							
	Jany Aryk				Obu Haet			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Going to the Murab to request Water	0	43	0	43	6	15	0	21
Coordinating timing and access to irrigation								
Agree to Coordinate Timing When Water Has Arrived	20	123	25	168	6	73	13	91
Agree Timing of Irrigation in advance	5	66	2	73	19	53	11	83
Collaboration to monitor and access water flow to the field								
Going to the head of your outlet to control water supply	15	86	26	127		47	8	55
Going to the Head of Buvakul/Katta Khaz Canal to control water flow	5	72	23	99	9	26	8	43
Collaboration for water management at field level								
Receive help from others to manage irrigation within your own field	0	14	0	14	0	10	0	10
Help others to manage irrigation in their field	0	29	0	29	7	10	0	17
Get help from others to close irrigation to your field when irrigation is finished	0	14	0	14	0	16	7	23
Total Landholders	37	205	48	290	39	83	16	138

B: Kyrgyzstan – Number of landholders collaborating never

Irrigation Management Activity	Number of Landholders Never Collaborating							
	Jany Aryk				Obu Haet			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Going to the Murab to request Water	32	115	45	192	26	57	16	99
Coordinating timing and access to irrigation								
Agree to Coordinate Timing When Water Has Arrived	0	23	21	43	6	0	1	7
Agree Timing of Irrigation in advance	9	101	41	151	15	10		25
Collaboration to monitor and access water flow to the field								
Going to the head of your outlet to control water supply	12	24	0	36	20	21	5	46
Going to the Head of Buvakul/Katta Khaz Canal to control water flow	25	64	25	114	11	15	5	31
Collaboration for water management at field level								
Receive help from others to manage irrigation within your own field	37	162	29	228	26	20	4	50
Help others to manage irrigation in their field	14	101	23	138	26	20	4	50
Get help from others to close irrigation to your field when irrigation is finished	19	97	19	135	13	16	8	37
Total Landholders	37	205	48	290	39	83	16	138

(a) Note: the balance of landholders reported collaborating 'sometimes' or 'rarely'
Source: Kyrgyzstan (a1): EIP – Livelihoods Sample Survey

Table F-48: Kyrgyzstan –Percent of landholders collaborating frequently (A) or never (B), by irrigation activity and well-being category

A: Kyrgyzstan – Percent of landholders collaborating frequently

Irrigation Management Activity	Number of Landholders Collaborating Frequently							
	Jany Aryk				Obu Haet			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Going to the Murab to request Water	0%	21%	0%	15%	15%	18%	0%	15%
Coordinating timing and access to irrigation								
Agree to Coordinate Timing When Water Has Arrived	54%	60%	52%	58%	15%	88%	78%	66%
Agree Timing of Irrigation in advance	14%	32%	5%	25%	49%	64%	69%	60%
Collaboration to monitor and access water flow to the field								
Going to the head of your outlet to control water supply	41%	42%	55%	44%	0%	56%	50%	39%
Going to the Head of Buvakul/Katta Khaz Canal to control water flow	14%	35%	48%	34%	23%	31%	50%	31%
Collaboration for water management at field level								
Receive help from others to manage irrigation within your own field	0%	7%	0%	5%	0%	12%	0%	7%
Help others to manage irrigation in their field	0%	14%	0%	10%	18%	12%	0%	13%
Get help from others to close irrigation to your field when irrigation is finished	0%	7%	0%	5%	0%	19%	44%	16%

B: Kyrgyzstan – Percent of landholders collaborating never

Irrigation Management Activity	Percent of Landholders Never Collaborating							
	Jany Aryk				Obu Haet			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Going to the Murab to request Water	86%	56%	93%	66%	67%	69%	100%	72%
Coordinating timing and access to irrigation								
Agree to Coordinate Timing When Water Has Arrived	0%	11%	43%	15%	15%	0%	6%	5%
Agree Timing of Irrigation in advance	24%	49%	85%	52%	38%	12%	0%	18%

Irrigation Management Activity	Percent of Landholders Never Collaborating							
	Jany Aryk				Obu Haet			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Collaboration to monitor and access water flow to the field								
Going to the head of your outlet to control water supply	32%	12%	0%	13%	52%	25%	28%	33%
Going to the Head of Buvakul/Katta Khaz Canal to control water flow	68%	31%	52%	39%	29%	18%	28%	22%
Collaboration for water management at field level								
Receive help from others to manage irrigation within your own field	100%	79%	60%	79%	67%	24%	22%	36%
Help others to manage irrigation in their field	38%	49%	48%	47%	67%	24%	22%	36%
Get help from others to close irrigation to your field when irrigation is finished	51%	47%	40%	47%	34%	19%	50%	27%

(a) Note: the balance of landholders reported collaborating 'sometimes' or 'rarely'
Source: Kyrgyzstan (a1): EIP – Livelihoods Sample Survey

Table F-49: Kyrgyzstan – Number of members in 'Collaborating Neighbours Network' for irrigation, by well-being category

(A) CNN - Number of Members by Well Being Category

NameWUA	CNN ID	Poor	Medium	Well-Off	Grand Total
Jany Aryk	5		4		4
	6	1	4	1	6
	7		5		5
	8		4		4
Jany Aryk Total		1	17	1	19
Obi Haet	1	1	5		6
	2	2	2		4
	3	2	1		3
	4	2	3		5
Obi Haet Total		7	11		18
Grand Total		8	28	1	37

(B) CNN – Percent of Members by Well Being Category

NameWUA	Poor	Medium	Well-Off	Grand Total
Jany Aryk	5%	89%	5%	100%
Obi Haet	39%	61%	0%	100%

Source: Kyrgyzstan (a1): EIP – Livelihoods Sample Survey

F.5 Livelihood Strategies

F.5.1 Average food sufficiency [5.16, 5.17]

Table F-50: Food sufficiency/contribution of agriculture to household income (as reported by respondents), by sub-area and well-being

A: Overview

Study Area *(data source)*	Sub-Area	Poor	Medium	Well-off	Total
Kyrgyzstan (a1) [1]	Jany Aryk	37%	35%	23%	33%
	Obi Haet	69%	65%	42%	63%
KIS (b1) [2]	PBK	80%	98%	67%	87%
	PGW	83%	95%	100%	93%
	O18	39%	76%	81%	56%
	Grand Total	71%	93%	93%	84%
SMIP (c)[2]	WC-1	50%	85%	100%	88%
	WC-2	57%	88%	100%	79%
	WC-3	63%	95%	100%	91%
	WC-4	57%	94%	100%	84%
	Total	58%	90%	100%	85%
SRSP (d1) [3]		**Sub-Marginal**	**Marginal**	**Small**	**Medium +**
	P-2	58%	79%	88%	90%	82%
	P-5		92%	82%	100%	89%
	P-9	27%	100%	97%	86%	85%
	Total	43%	87%	85%	92%	86%

[1] From EIP Livelihoods Survey. Percent of household income derived from irrigated agriculture (including both home consumption and sale). Respondents' self-assessment.

[2] Percent of year that household food needs are met from home production. Reported as months per year food self-sufficiency. Converted to percent of year that food needs were met from home production. For KIS data available for only 118 out of 125 landholders.

[3] Average percent of household paddy consumption needs met from own production in Kharif 2003 and Rabi 2003/2004. Calculation based on annual per capita availability of home-produced paddy retained for home consumption -- each child in the household given a weighting of .5. 33 households who did not report production of paddy for home consumption were EXcluded when calculating the average (see table B below). Calculated on the basis of 300 kg per capita per year = 100% self sufficiency. Households declaring that they retained a quantity of paddy for home consumption which exceeded 300 kg per capita were entered as 100% for the purpose of calculating the average.

B: SRSP - Landholders in study area not growing paddy for home consumption in Kharif 2003 and Rabi 2003/2004

Pipe	Sub-Marginal	Marginal	Small	Medium +	Grand Total
P2			1	1	2
P5		1			1
P9	20	9	1		30
Total	20	10	2	1	33

Note:
1 Medium + landholder in P2: has most of his land outside the study command area. He grows maize in the study command, for sale.

1 Small landholders: in P2 - has some land outside the command of his pipe (about .6 ha or 30% of his landholding). All the paddy he produces from land under this pipe he sells.

1 Small landholder n P9 – has most of his land outside the command area (about 1 ha or 70% of his landholding). He is 60 years old. He left all the land in P9 fallow for the two seasons.

1 Marginal landholder in P5 – he is 32 years old with 4 small children. He relies on agricultural and non-agricultural labour for income. He left his land fallow in both seasons.

9 Marginal landholders in P9 - 7 left their land fallow in both seasons and rely on agricultural labouring for their income. 1 is a tenant whose paddy production for home consumption is counted elsewhere. 1 is a Muslim landholder who did not cultivate his land and relied on breaking stones and agricultural labouring

20 Sub-marginal Muslim landholders did not cultivate their land and relied on breaking stones and agricultural labouring for their income.

F.5.2 Landholders engaged in off-farm occupations [5.18, 5.19]

Table F-51: Jany Aryk – Per cent of landholders by occupation [269]

A: Jany Aryk – Per cent of landholders by rank of ON-farm occupations, and well-being

Occupation Description	Occupation Ranking[1]	Poor	Medium	Well-off	Grand Total
Agriculture	1	8%	12%	19%	13%
	2	46%	67%	35%	59%
	3	32%	21%	40%	26%
	4	14%	0%	5%	3%
Total		100%	100%	100%	100%
Livestock	1	0%	7%	0%	5%
	2	0%	5%	55%	13%
	3	46%	58%	40%	54%
	4	14%	7%	0%	7%
Total		59%	77%	95%	78%
Garden (fruit/vegetable)	2	8%	0%	0%	1%
	3	0%	5%	15%	6%
	4	46%	46%	45%	46%
Total		54%	51%	60%	53%

B: Jany Aryk – per cent of landholders by rank of OFF-farm occupations, and well-being

Occupation Desc	Occupation Ranking[1]	Poor	Medium	Well-off	Grand Total
Employee	1	19%	33%	40%	32%
	2	14%	14%	5%	12%
Total		32%	47%	45%	45%
Self-Employed	1	0%	11%	0%	8%

[269] For our survey in Kyrgyzstan each respondent was invited to list up to 4 occupations, in order of importance of contribution to household income.

Occupation Desc	Occupation Ranking[1]	Poor	Medium	Well-off	Grand Total
	2	0%	0%	0%	0%
Total		0%	11%	0%	8%
Casual Labour	1	0%	14%	0%	10%
	2	14%	0%	0%	2%
	3	0%	0%	0%	0%
	4	0%	4%	0%	3%
Total		14%	18%	0%	14%
Other [1]	1	27%	4%	0%	6%
	2	14%	0%	5%	3%
	3	0%	0%	5%	1%
	4	0%	0%	35%	6%
Total		41%	4%	45%	16%

[1] Other Off-farm Occupations

WUA	Occupation Rank[1]	Description	Number of Respondents
Jany Aryk	1	bazar, selling milk and yogurt	1
	1	child-care leave	1
	1	commerce in Kazakhstan	2
	1	commerce in Russia	2
	1	seasonal tractor driver, private tractor	1
	1	selling milk and cream in the market	1
	1	tractor services (own)	1
	2	nurse	1
	2	pensioner	1
	4	university teacher	1

C: Jany Aryk – Per cent of landholders by rank of other occupations, and well-being

Other		Wellbeing			
Occupation Desc	**Occupation Ranking[1]**	**Poor**	**Medium**	**Well-off**	**Grand Total**
Housework	1	5%	0%	35%	7%
	2	5%	0%	0%	1%
	3	14%	0%	0%	2%
Total		24%	0%	35%	9%
Pensioner	1	41%	11%	0%	13%
	2	0%	7%	0%	5%
	3	0%	0%	0%	0%
Total		41%	18%	0%	18%
Disabled	1	0%	0%	0%	0%
	2	0%	7%	0%	5%
Total		0%	7%	0%	5%
Unemployed	1	0%	8%	5%	7%

Other		Wellbeing			
Occupation Desc	**Occupation Ranking[1]**	**Poor**	**Medium**	**Well-off**	**Grand Total**
None	3	8%	16%	0%	12%
	4	27%	43%	15%	36%
Total		35%	59%	15%	49%

Source: Kyrgyzstan (a1): EIP – Livelihoods Sample Survey

Table F-52: Obi Haet - Per cent of landholders by occupation

A: Obi Haet – Per cent of landholders by rank of ON-farm occupations, and well-being[270]

Occupation Description	**Occupation Ranking[2]**	**Poor**	**Medium**	**Well-off**	**Grand Total**
Agriculture	1	71%	75%	28%	69%
	2	29%	19%	72%	28%
	3	0%	0%	0%	0%
	4	0%	0%	0%	0%
Total		100%	94%	100%	96%
Livestock	1	0%	0%	0%	0%
	2	0%	38%	0%	23%
	3	28%	0%	50%	14%
	4	0%	0%	0%	0%
Total		28%	38%	50%	37%
Garden (fruit/vegetable)	2	19%	25%	0%	20%
	3	19%	43%	28%	35%
	4	14%	13%	44%	17%
Total		53%	81%	72%	72%

B: Obi Haet – Per cent of landholders by rank of OFF-farm occupations, and well-being

Occupation Desc	**Occupation Ranking[2]**	**Poor**	**Medium**	**Well-off**	**Grand Total**
Employee	1	0%	13%	22%	10%
	2	0%	0%	0%	0%
Total		0%	13%	22%	10%
Self-Employed	1	0%	0%	0%	0%
	2	9%	0%	0%	3%
Total		9%	0%	0%	3%
Casual Labour	1	29%	0%	0%	8%
	2	43%	0%	0%	12%
	3	0%	6%	0%	4%
	4	0%	0%	0%	0%
Total		71%	6%	0%	24%
Other [1]	1	0%	0%	50%	6%

[270] For our survey in Kyrgyzstan each respondent was invited to list up to 4 occupations, in order of importance of contribution to household income.

Occupation Desc	Occupation Ranking[2]	Poor	Medium	Well-off	Grand Total
	2	0%	0%	28%	3%
	3	0%	6%	6%	4%
	4	0%	0%	0%	0%
Total		0%	6%	84%	13%

[1] Other Off-farm Occupations

WUA	Occupation Rank[2]	Description	Number of Respondents
Obi Haet	1	private shop	1
	1	works in Russia	1
	3	private shop	1

C: Obi Haet – Per cent of landholders by rank of other occupations, and well-being

Other		Wellbeing			
Occupation Desc	**Occupation Ranking[2]**	**Poor**	**Medium**	**Well-off**	**Grand Total**
Housework	1	0%	0%	0%	0%
	2	0%	12%	0%	7%
	3	0%	0%	0%	0%
Total		0%	12%	0%	7%
Pensioner	1	0%	6%	0%	4%
	2	0%	6%	0%	4%
	3	0%	7%	0%	4%
Total		0%	19%	0%	11%
Disabled	1	0%	6%	0%	4%
	2	0%	0%	0%	0%
Total		0%	6%	0%	4%
Unemployed	1	0%	0%	0%	0%
None	3	53%	38%	16%	39%
	4	86%	87%	56%	83%
Total		138%	125%	72%	123%

Source: Kyrgyzstan (a1): EIP – Livelihoods Sample Survey

Table F-53 - KIS – Per cent of landholders by occupation

A: KIS – Per cent of landholders by secondary occupation of landholder, and well-being

Location of Work	Type of Occupation	Poor	Medium	Well-off	Total
In Village	Agricultural labour	48%	19%	10%	30%
	Other non-agricultural	19%	17%	0%	15%
Away From Village	Agricultural labour	6%	9%	0%	6%
	Other non-agricultural	46%	60%	80%	58%

B: KIS – Per cent of poor landholders by study area and type of secondary occupation

	In Village		Elsewhere		Total Number of Poor Landholders
Study Area *(data source in brackets)*	Agriculture	Other Occupation	Agriculture	Other Occupation	
1 - pachas bigha ko kulo	32%	25%	0%	36%	28
2 - Pilot Gate West	55%	18%	0%	73%	11
3 - Outlet 18	77%	8%	23%	46%	13
Grand Total	48%	19%	6%	46%	52

Source: Nepal, KIS (b1): EIP – Livelihoods data from key informants

Table F-54: SMIP – Per cent of landholders by secondary occupation

A: SMIP – % of landholders by secondary occupation of landholder & well-being[1]

Location of Work	Type of Occupation	Poor	Medium	Well-off	Total
In Village	Agricultural labour	44%	13%	10%	22%
	Other non-agricultural	17%	15%	28%	18%
Away From Village	Agricultural labour	17%	4%	10%	9%
	Other non-agricultural	31%	36%	28%	33%

[1] Only includes data for WC1, WC2 and WC3. Data for WC4 incomplete

B: SMIP – Per cent of poor landholders by study area and secondary occupation [1]

	In Village		Elsewhere	
Water Course	Agriculture	Other Occupation	Agriculture	Other Occupation
1	25%	25%	0%	13%
2	65%	15%	20%	45%
3	13%	13%	25%	13%
Grand Total	44%	17%	17%	31%

[1] Only includes data for WC1, WC2 and WC3. Data for WC4 incomplete
Source: Nepal, SMIP (c): GGG – edited livelihoods data from DL/AP

Table F-55: SRSP – Per cent of landholders by occupation

A: SRSP –Number of landholders by primary and secondary occupation of landholder and size class

Main Occupation	**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	Grand Total
Farming	2	36	22	17	77
Agric Labour	3				3
Breaking Stones	15	1			16
Missing	2				2
None		1			1
Grand Total	22	38	22	17	99

Secondary Occupation	**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	Grand Total
Farming	14	1			15
Agric labour	3	22	13	3	41
Agric Other	0	2	5	5	12
Non-agric Other	0	6	0	1	7
Missing/none	5	7	4	8	24
Grand Total	22	38	22	17	99

B: SRSP – Per cent of landholders by primary and secondary occupation of landholder and size class

Main Occupation	**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	Grand Total
Farming	9%	95%	100%	100%	78%
Agric Labour	14%	0%	0%	0%	3%
Breaking Stones	68%	3%	0%	0%	16%
Missing	0%	3%	0%	0%	1%
None	9%	0%	0%	0%	2%
Grand Total	100%	100%	100%	100%	100%

Secondary Occupation	**Sub-Marginal**	**Marginal**	**Small**	**Medium +**	Grand Total
Farming	64%	3%	0%	0%	15%
Agric labour	14%	58%	59%	18%	41%
Agric Other	0%	5%	18%	29%	11%
Non-agric Other	0%	16%	0%	6%	7%
Missing/none	23%	18%	23%	47%	25%
Grand Total	100%	100%	100%	100%	100%

C: SRSP - Number of landholders by secondary occupation and class -- other agricultural and non-agricultural

Other Secondary Occupation		Sub-Marginal	Marginal	Small	Medium +	Grand Total
Agric Other	Goat rearing			2		2
	Labour and tractor driver			1		1
	Poultry farm				1	1
	Tractor Driver		2	2	4	8
Non-agric Other	Carpentry		2		1	3
	Labour, Fshing		1			1
	Mason		1			1
	Performing village drama		1			1
	Washerman		1			1
Grand Total			8	5	6	19

Source: India, SRSP (d1): EIP – Baseline Survey

Appendix G SMIP Case Study: WUA Action plans, minutes and reports

G.1 Plan of action to improve the water management practices

G.1.1 Tertiary: 5

G.i Watercourse: 1 and 2

SN	Existing customary practices	Recommended plans to improve the water management situation	
		From the discussion of FOs	FOs along with other farmers
	MAINTENANCE		
Tertiary Level			
1	No usual practices of desilting the tertiary. Last year, other WC mobilised to desilt the tertiary so they also participated in the work.	One time a year.	
2	Last year, WC 1 desilted from bifurcation point to WC 1, and remaining work was completed by WC 2, 3 and 4	WC 1 should desilt the section between bifurcation point of T5 and T6 to WC 1, WC 2 should desilt the section between WC 1 and 2 and remaining part should be desilted by WC 3 and 4.	The remaining part from 7 No road to WC 1 will be carried out by WC 2 with the help of WC 3 and 4 farmers
3	No fixed time for desilting canal	End of Ashadh	
4	Last year, desiltation was carried out by mobilising the farmers but not all farmers were participated in the work	1 labour from each house (whatever the land size will be)	
5	No penalty for those who absent in the canal work	Penalise Rs 100 and amount should be invested in canal desilting	
6	No rules for canal bund destruction	Penalise Rs 251 or restrict from irrigation facility until amount is paid. *Katkhot* should be repaired while desilting the canal	
7	No provision of special person to lead the tertiary desilting work	Sheskant Silwal, Gangaram Pandit and Pitamber Yadav from WC 1, Shanti Devi Urao and Narayan Yadav from WC 2 will lead the work	
Watercourse Level			
1	WC desilting once a year	WC 1 one time a year and WC 2 two times a year (in Baisakh and Shrawan).	Both WCs will desilt the canal two times a year
2	Desilt WC 1 by raising bigahatti and WC 2 by mobilising farmers (2 labours is being mobilised having more than 2 bigha of land but this rule is not properly followed)	Continue the existing practices	
3	Restrict the water until the *bigahatti* amount is not paid	Charged double amount then open the canal	In WC 2, Rs 51 will be penalised from those who are absent in the canal desilting
4	No penalty system for cutting the canal bunds	Closed all outlets that are not in use. And make additional outlet as per the actual need. In WC 2, for Garibdas, Jugnarayan one	Now then, Rs 125 and Rs 251 will be penalise from defaulter in WC 2 and 1 respectively.

SN	Existing customary practices	Recommended plans to improve the water management situation	
		From the discussion of FOs	FOs along with other farmers
		outlet will be provided. Similarly, in WC2A, one outlet need to provide for Jayaprakash Yadav. These works should be managed during canal desilting. In WC1, one each outlet will be provided for Pitamber Yadav, Amber Gurung and Shyam Sunder Yadav.	
5	No one is assigned to monitor the necessity of additional outlets	In order to manage these provisions, Shyam Sunder Yadav, Jagadish Gurung will be responsible in WC 1A and Tej Narayan and Mahendra Yadav from WC 1B	In WC 1, one outlet should be provided for Shyam Sunder Yadav's *khet*
OPERATION			
Tertiary Level			
1	No fixed water rotation. Sometimes able to get more than 4 days and sometimes even 10 days gaps	Identify the reasons. If not, the monitoring committee (Pitamber Yadav and Narayan Semait/Arjun Thapa from WC 1 and 2 respectively) will monitor the actual situation and notify the farmers accordingly	
2	Water used directly from tertiary canal by checking the flow	No one is allowed to check tertiary canal and cutting canal bund to get water. If so, Rs 251 will be penalised and putting social pressure until payment is made.	
3	Canal bund destruction and used water by checking in SS9E also	In order to stop these problems, regular contact with WUC will made. Phanilal Yadav will be responsible to manage those problems.	
4	No provision of water monitoring both in SS9E and tertiary canals	In order to monitor water operation, one lead farmer from each WC would be selected and each farmer will monitor the canal in the rotational basis.	Decided in the tertiary level meeting
Watercourse Level			
1	Mutual understanding to use water during the paddy transplantation	Continue the practices but preference will be given for transplantation	
2	Adoption of water rotation after transplantation	Continue the existing practices	
3	Water is being provided 1 day 1 night to 2A and 3 days 3 nights to 2B	Continue the existing practices	
4	Water rotation on the basis of land size and availability of water	Continue the existing practices	
5	Each farmer is alert in his/her turn standing in the *khet*	Continue the existing practices	
6	No special person to manage water	For eastern side of WC 2,	

SN	Existing customary practices	Recommended plans to improve the water management situation	
		From the discussion of FOs	FOs along with other farmers
	allocation and rotation	Kapaleshwor Yadav and Chullai Urao will be responsible whereas Arjun Thapa, Narayan Yadav and Sitaram Sah will be responsible for western side to manage the work. Similarly, Pitamber Yadav will be responsible for WC 1.	
7	In WC 2, FCs is only constructing for winter and spring crops only. No provision of FCs in WC 1	Continue the existing practices. In WC1, FCs will be prepared in the needy areas.	
8	The concerned farmers are only involved in cleaning the FCs	Continue the existing practices	
9	Either WUG chairperson or group of farmers aware other farmers about their rotation turn	Prepare the inventory of farmers, landholding and records the water turn duration. Monitor whether water turn is as per plan or not.	
10	No special rules for rule violators	Monitor the actual fact. In case of violation of water turn, WUG will be responsible to manage it.	

G.ii Watercourse: 3 and 4

SN	Existing customary practices	Recommended plans to improve the water management situation	
		From the discussion of FOs	FOs along with other farmers
	MAINTENANCE		
Tertiary Level			
1	Desilted last year and some portion of the canal is also desilted this year too	Decided to desilt 1 time a year	
2	Last year, along with watercourse 2, desilted tertiary up to the watercourse 1, this year also WC 3 and 4 desilted some portion of the tertiary canal	WC 3 and 4 should desilt up to the point (Thaleshwor house) near WC 2, WC 2 should desilt up to WC 1 and WC 1 should desilt up to the bifurcation point of T5 and T6	This activity is already implemented (during the preparatory phase)
3	No fixed time for desilting the tertiary canal	Complete within the month of Ashadh	
4	Tertiary desilting through the farmers mobilisation	Each house should provide 1 labour during farmers mobilisation	
5	No rule of penalty for farmers who absent during tertiary canal desiltation	Rs 100 will be penalised from those who absent in the desilting work. Amount collected from this activity should be invested in the tertiary desiltation.	
6	No rule of penalty for canal bund destruction	No one is allowed to cut canal bund onward. Rs 500 will be penalised in case of destructing the canal bund. Otherwise water will not be granted for him/her	

SN	Existing customary practices	Recommended plans to improve the water management situation	
		From the discussion of FOs	FOs along with other farmers
7	Gurudayal Sah and Hari Krishna Sah supervises the work during tertiary canal desiltation	Continue the existing practices	
Watercourse Level			
1	Desilting WC two times an year	First time in the month of Ashadh and second time in Kartik. If there is excess of sand in the canal then in Bhadra also.	
2	Generally 1 labour per household is being mobilised during canal desilting work, some house send even 3 labours	1 labour in case of less than 5 bigha and 2 labours if greater than 5 bigha of land	
3	Those who absent in the WC desilting work gets last rotation but this rule is not applicable in the head part	Rs 100 will be penalised from those who absent in during desilting work. Amount collected from this activity should be invested in watercourse desiltation	
4	There is a tradition to desilt adjacent portion of watercourse. Very few area is desilted in the group approach	It was decided to desilt the whole portion of WC 3 and 4 by respective farmers. Within the WC, head part should be desilted by head farmers and so on.	
5	No rules for canal bund destruction	Unless necessary, all cutting place should be closed during WC desilting work. For this, it was decided to supervise this activity in the leadership of Jagadev Sah/Prameshwor Sah (from WC 3) and Dip Narayan Sah/Nageshwor Sah (from WC 4). This work should be completed by Ashadh end	
6	No rules for destruction of canal bund made by tractors	Should managed by respective farmers immediately	
OPERATION			
Tertiary Level			
1	No rules for managing water within tertiary	No one is allowed to get water except the WC. Rs 500 will be penalise who cut the tertiary canal. Social pressure if denied to pay penalty.	
2	As WC 2 is in low level, it is difficult to raise water in WC 3 and 4	Organise a meeting at tertiary level and acts based on the decisions	
3	No monitoring mechanism from SS9E to tertiary. During peak water scarcity period, farmers used to go up to Aurabani to steal water.	Tertiary level meeting will select two farmer from each WC to monitor in the rotational basis	
Watercourse Level			
1	Mutual understanding of water management for transplantation period	As per the mutual agreement among the farmers. But special preference will be given to transplantation work	
2	Rotation system only after transplantation work is finished	Continue the existing practices	

SN	Existing customary practices	Recommended plans to improve the water management situation	
		From the discussion of FOs	FOs along with other farmers
3	3 hrs rotation is allowed for 1 bigha of land	Continue the existing practices	
4	During peak scarcity period, WC 3 and 4 used to adopt rotation (2 days for each WC)	Continue the existing practices	
5	No divide the land in to smaller blocks for efficient irrigation	Divide WC 3 and 4 in to 4 blocks and provide water for 1 full day in each block.	
6	No rules for water turn violators	Rs 151 will be penalised and restrict from water turn	
7	WUG chairperson used to provide small paper to each farmer mentioning the date and time of water turn	Updates the name, landholding, time/duration of each turn	

G.1.2 Tertiary: 6

G.i Watercourse: all combined

SN	Existing customary practices	Recommended plans to improve the water management situation	
		From the discussion of FOs	FOs along with other farmers
MAINTENANCE			
Tertiary Level			
1	Desilting tertiary canal once a year through the verbal notification	One time a year in the leadership of Tek Bahadur Gurung. Work should be completed by 1st week of Shrawan	
2	Canal desiltation through the mobilisation of farmers. Only 25-35% farmers participate in the work	1 labour from each house (whatever the land size will be).	
3	Rule for water restrict for those who absent during the canal desilting but this rule also not in practice	Penalise Rs 100 and restrict from irrigation facility. The amount should be invested in the canal desilting.	
4	One labour is being mobilised from one household whatever the land size is	Those who absent in the work should pay Rs 101 and restrict water until the payment is made. The amount collected from this activity should be kept by Tek Bahadur Gurung and invested in the canal work	
5	Last year, tertiary canal was desilted by 10-15 farmers	All farmers should be present	
6	Only rental and poor farmers are serious about the canal	Encourage all types of farmers putting strict rules	Tertiary level meeting will decide
7	No penalty system for cutting the canal and using water	All *katkhot* should be maintained during the canal desilting work	
Watercourse Level			

SN	Existing customary practices	Recommended plans to improve the water management situation	
		From the discussion of FOs	FOs along with other farmers
1	Bigahatti will be raised to desilt the canal. 25% of ISF should be mobilised during canal desilting work (but this rule is not practiced).	Rs 101 will be penalised from those who absent in the canal work and restrict water until payment is made.	
2	No one is leading the work to mobilise the farmers	One monitoring committee will be formed comprising Domi Mandal, Masaudi Roy and Kapaleshwor Yadav from WC 1, 2 and 3 respectively.	
OPERATION			
Tertiary Level			
1	Irrigate directly through checking the tertiary canal	Penalise Rs 151. *Katkhot* should be managed while desilting the canal. No one is allowed to check tertiary canal without prior notification.	

G.2 Minutes of Tertiary level Ad-hoc Committee Meeting

Meeting No:-1
Date:- 2061-4-13 Wednesday
No of participants:-
The number of FOs from watercourses were observed as 10 from WC-1,8 from WC-2,6 from WC-3 & 7 from WC-4.Due to heavy rain during the meeting time the presence was expected to be low.

(a) Tertiary Maintenance.
It was reported that the allocated portions of tertiary (T5) was cleaned by the WC-1, WC-2, WC-3&WC-4 (though a small portion was left & it was supposed that the portion would also be cleaned immediately. Hence the meeting assumed that all the portions are cleaned). It was realized that cleaning work was late due to transplanting work and heavy rainfall. It was decided that the absentees would clean the remaining portion of T5 & if they do not clean then penalty would be charged without any concession and this matter would be discussed seriously in next meeting. T6 has not yet been cleaned and decided to clean as early as possible.

(b)Formation of Tertiary Level Committee.
It was realized that formation of several committees for various activities as per agreed action plan made confusion and did not allow to fell responsibility. Moreover it created difficulties to organize meeting, monitoring and taking action. Hence it was decided to form a single tertiary level committee to look after all the activities related to tertiary level (maintenance, operation, monitoring etc from sub-secondary to the intake of watercourse).It was also decided to treat this committee as good as elected committee. The meeting decided to form the committee of following members representing from all watercourses.

Shesh kanta silwal	WC1	Member
Pitamber Yadav	WC1	Member
Arjun Thapa	WC2	Chairman
Narayan Singah	WC2	Member
Ram Dayal Saha	WC3	Member
Brij Narayan Yadav	WC3	Member
Hari Kishan Saha	WC4	Member
Dev Narayan Saha	WC4	Member
Gokul Chandra Thakuri	T6	Member
Tekh Bahadur Gurung	T6	Member

It was also decided that this committee will organize meetings as & when needed (in other than tertiary level meeting day also) & they may allocate work division also. It was decided that the selected FOs of respective WC will be committee at WC level & that committee will be treated as good as elected WUG.

(c) Cleaning of watercourses
It was reported that cleaning of WC-1 & 2 is already completed though it was some what late than agreed date due to transplanting work. More than half portion of WC-3 &4 was also completed & decided to complete the cleaning work within a week. It was decided that the absentees would be involved in further cleaning work.

(d) Cuttings & Additional Outlets
It was reported that all the cuttings were closed in WC-1 & 2. One cutting was converted into outlet in WC-2. The cuttings were not closed or corrected in WC-3&4 &it was decided to prepare implementation plan in coming Sunday meeting.

(e) Damage by Tractor
It was reported that there were damages at 2 places in WC-2. One is already corrected and other one will be corrected when the wetted soil will be dried.

(f) Operation at Tertiary
It was reported that there are cuttings/illegal outlets at 5 places in the tertiary canal (two bigger and three smaller). It was decided that the newly formed committee will study and take action.

(g) Equitable Water Delivery.
It was the main topic in the meeting day. Mr.Basistha explained about the different options for different situations, which is mentioned in his FTR. In principle the meeting agreed to follow the system but it was decided to observe whether the system would be practicable or not.

Meeting No:-3
Date:- August 31,2004
No of participants:-12
Decisions taken:-

1. Kundan Shrestha, Engineer of Duhabi sub- division was agreed to increase the level of embankment of sub-secondary canal & to remove illegal pipes but the work has not been done till date. Hence it was decided to go for delegation on Sept 3, 2004. A sum of Nrs51 will be charged as penalty if any member of ad-hoc committee will not participate in delegation.
2. If the member of monitoring committee does not perform his duty (monitoring up to Aurabani) and if not attend the meetings, for the first time he has to pay Nrs11 as penalty.
3. It was decided to visit the field of T6 area to monitor the cuttings & illegal pipes on Sept 1, 2004.

Meeting No:-4
Date:- Sept 22,2004
No of participants:-17
Decision taken

1. It was reported that with active participation of the members of ad-hoc committee in addition to other about 100 beneficiaries, illegal pipes situated in sub-secondary canal were removed.

Meeting No:-5
Date:- Oct 17,2004
No of participants:-13
Decision taken

1. As the irrigation is still needed to the late transplanted crop, Duhabi Sub-division/WUCC will be requested to supply water regularly up to Oct 31,2004.
2. It was agreed to organize tertiary level ad-hoc committee meeting regularly in following days also.

Meeting No:-6
Date:-Oct 31,2004
No of participants:-12
Decision taken

1. It was decided to hold meetings on 16 Nov 2004 to discuss on the sustainability of ad-hoc committee & to organized meetings on regular basis.

G.3 WUA monitoring reports on action plan implementation

G.3.1 Tertiary Level Meeting 2

S. No.	Agreed Action Plan	Status of action Till Date	Conclusion & Plan For Future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion. T6 will be cleaned by volunteer labour.	Done as per action plan but work was done some late. T6 also cleaned.	As it was not nicely cleaned from intake of WC 2 to tail, it was felt necessary to clean again & decided to clean again within Bhadra.
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.	The absentees were utilized to clean again nicely instead of penalty of cash. T6 collected penalty of NRS 50 /- from one person & trying to collect from other absentees also.	None
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	All the cuttings were blocked. No any further cuttings observed.	It any person cuts tertiary he has to repair and pay NRS 500. If he does not repair he has to pay the cost of repair along with penalty.
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more. T6 also will clean twice in a year	Cleaning work is completed as per plan. WCs of T6 also cleaned	WC 1 & 2 are planning to clean again in Bhadra.
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.	WC 1 A – Though it was agreed to clean collecting Bighauti, it was cleaned by volunteer labour (decision was changed) based on land holding (13. 5 x 10 ft per Bigha of land). WC 1 B – collecting Bighauti WC 2, 3 & 4 – through volunteer labour. (some said that the change in decision in WC 1 A was due to difficulty in collecting Bighauti & some other said that the quality of work would be better if cleaned by ourselves).	None
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 –	WC 1 – No penalty as work was done as per agreement. WC 2 – Penalty from one person is already collected.	Penalty will be collected strictly

S. No.	Agreed Action Plan	Status of action Till Date	Conclusion & Plan For Future
	A sum of NRS 100 will be charged as penalty for absentee.	WC 3 – Penalty is already collected from one person & water is not provided to other person who has not paid T6 – Water is not given to absentee & demanding for the deposition of penalty.	
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 25 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.	The cuttings in WC 1 & 2 are converted to outlets which were found necessary & others are blocked. In WC 3 & 4 blocking of cuttings are on – going.	For the management of the cuttings in WC 3 & 4, discussion will be done in forth coming WC level meeting.
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses. Level of water at the intake of WC 1 will be the basis for water distribution.	WC 1 & 2 did not agree & distributing to all WCs irrespective of the level of water at WC 1 intake. But WC 3 & 4 are practicing under stressed condition (2 days for WC 3 and 2 days for WC 4).	WC 1 & 2 committed that they do not do any illegal work (no cutting & no blocking) but distribute to all WCs & Satisfy upon the amount of available water. But WC 3 & 4 agreed that they make 2-2 days rotation under scarcity.
9.	Tertiary level ad hoc committee will be responsible for monitoring of water allocation & distribution from SS9E to tertiary & action will be taken based on their observation. Committee has to submit application to WUC, WUCC, SMIP for necessary action. The committee should also monitor opening & closing dates & take initiation for necessary action.	10-members committee was increased to 15 members in the first meeting of ad hoc committee & again increased to 20 in this tertiary level meeting. The committee is working as per agreed action plan.	Meeting is going to be organized with engineer on 22nd August in Aurabani to discuss on various issues.
10.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.	As per agreed action plan, transplanting work is being done	None
11.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day/ block.	Rotational system is being followed as per plan.	None
12.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.	WC 1 is keeping up-dated record but other WCs are not keeping properly. Yet no water theft has been	Records will be kept properly.

S. No.	Agreed Action Plan	Status of action Till Date	Conclusion & Plan For Future
		observed exc one (see other heading).	
13.	Each individual should be present at his turn for monitoring	Beings done but not so much careful	Concerned person will monitor strictly & also monitor the activities of monitoring committee.
14.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs	Though it was decided not to construct field channel in WC 1, 3 & 4, they felt necessary to construct field channel at some places. Hence WC 1, 2, & 3 has constructed field channel at several places & WC 4 is also planning.	If the filed channel is not constructed at needed places, water will not be distributed till the field channel is not constructed.
15.	Tertiary level committee will be responsible for all the activities relater to sub-secondary & tertiary canals & watercourse level committee for watercourses.	It has been realized that the committees are being active and performing their job satisfactorily. They contacted WUC, WUCC & also went to SMIP to discuss on issues & find out solutions.	They were requested to be still more active.

G.3.2 Tertiary level meeting No.3

G.i Presented by WC-1

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.	10 persons did not participated in cleaning work.	Penalty will be collected compulsorily now onwards. Movement of animals in embankment is now checked.
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.	10 absentees were utilized to clean again properly.	
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	No any cuttings	
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.	T5-1A was cleaned once where as T5/B was cleaned twice.	As the accumulation of silt is more another cleaning will be done by the end of Aswin.
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer	T5-1A was cleaned once by volunteer labors. T5-1B was	

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.	cleaned by colleting bighauti @ Rs55/bigha. As Nrs250 was saved 1B was cleaned 2nd time utilizing the saved amount.	
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.	All contributed for cleaning (1A- by volunteer labor based on land holding & 1B by bighauti).	
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.	Out of 6 cuttings 5 was blocked & one was converted into additional outlet. Other 3 more outlets were kept.	
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.	No water is being supplied through other than WCs.	
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.	As per agreed action plan-transplanting work was completed.	
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.	Water was distributed to both 1A & 1B @ 5½ hours per bigha of land.	
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.	Recorded of RWS is kept in written. No theft till date	Record keeping will be made in more comprehensive way.
12.	Each individual should be present at his turn for monitoring	Monitoring is being done by concerned farmer at WC & tertiary level & tertiary level ad-hoc committee is monitoring at sub-secondary level.	
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs	Filed channels are constructed in about 50% area. Field channels will be constructed in remaining area in winter.	Field channels will be constructed compulsorily in winter.

G.ii Presented by WC-2

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year	Cleaned by all beneficiaries	As the accumulation of

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.	except 6 persons as per agreed plan.	silt is more, it is decided to clean again by the end to kartik for winter crop.
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.	Six absentees were used to clean again as penalty.	All should be involved & if any body will not participate, penalty will be charged compulsorily in future.
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	All the cuttings were closed except at one place where illegal pipe is kept for irrigation (Field of Thaleswar)	Landowner will be called in next meeting & decision will be taken.
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.	2B was cleaned two times (one for spring paddy or one for monsoon paddy). 2A was cleaned at one time.	Another cleaning will also be done if accumulation of silt will be more.
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.	Cleaned by volunteer labors	Will be cleaned by volunteer labor in future also.
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.	Out of 2 absentees one was excused as he was sick & another person paid Nrs51 as penalty.	Rules will be imposed strictly.
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.	Out of 4 cuttings 3 were closed & one was converted to additional outlet. Another one more outlet was also constructed.	Water will be delivered only through legalized outlets.
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.	No water is being delivered through other than WCs.	Will continue.
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.	As per agreed action plan-transplanting work was completed.	
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal	Rotation was done@ 1 day & night for 2A & 3 days & 3 night for 2B as per plan. Incase of water delivery for more than 4 days, water was distributed on the same	Rotational system will be changed based on the availability of water.

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.	proportionate (equitable) way. The rotation was 3 hours per bigha.	
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.	Written record of rotation was maintained & informed to all farmers. There is no water theft till date.	
12.	Each individual should be present at his turn for monitoring	Monitoring is being done by concerned farmers at WC & T levels & Tertiary level ad hoc committee is monitoring at sub-secondary level.	
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs	There are field channels in 2B. In 2A it was difficult to reach water up to tail due to lack of needed field channels. It was felt necessary to construct field channels by 5 farmers.	Five farmers will construct field channels within 3 days.
	Additional action	As the width of embankment at the intake of T5-2 is narrow it was difficult to run cartload & tractor. It was decided to increase the width utilizing penalty amount, volunteer labor & SMIP will also be requested for additional fund.	

G.iii Presented by WC-3

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.	Cleaned as per plan.	Continuity will be given in future.
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.	Seven absentees were used to clean remaining portions.	Now onwards penalty will be charged strictly.
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	All the cuttings were closed except at 2 places (Arjun Thapa & Narayan Simait).	Decision will be taken in next tertiary level meeting.

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.	Once cleaned utilizing volunteer labor.	Next cleaning will also be done by the end of Aswin.
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.	One person per household & 2 persons per household having more than 5 bighas of land were participated in cleaning.	Will be followed in following years.
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.	Two persons were not present. One paid Nrs 100 as penalty & were was not distributed to other one person who did not pay penalty till date.	
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.	16 cuttings were closed &additional outlets were kept at 6 places. Later on 5 persons irrigated by making new cuts.	Decided to close these cuttings next day.
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.	Irrigating water at 2 places directly from tertiary.	Will be discussed in next tertiary level meeting.
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.	As per agreed action plan transplanting was completed.	Will be followed in the same way.
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.	Under stress condition rotational system was follower between WC3 & 4 (WC3 was closed to irrigate WC4 & WC4 was closed to irrigate WC3)	Will be followed in future also.
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.	Farmer wise record of rotation was kept. No water theft till date.	Will be followed in future also.
12.	Each individual should be present at his turn for monitoring	Monitoring is being done as per plan.	
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs	Field channels are constructed at several places, work is going on	

G.iv Presented by WC-4

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.	Tertiary was cleaned by volunteer labor @1 person per household & 2 persons per household having more than 5 bighas of land.	Will be followed in the same way.
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.	The absentees were used to re-clean properly.	Penalty will be charged in future.
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	All the cuttings were closed except at 2 places (Arjun Thapa & Narayan Simait)	Decision will be taken in next tertiary level meeting.
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also Bhadra if more accumulation of silt	Once cleaned utilizing volunteer labor.	Next cleaning will be done by the end of Aswin.
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.	One person per household & 2 persons per household having more than 5 bighas of land were participated in cleaning.	Will be followed in following years also.
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.	First day, 50% of WC was cleaned in which 10 persons were absent. Next day 10 absentees were utilized double of their labor for cleaning.2 absentees in the next day paid Nrs100 per person as penalty.	Penalty will be charged strictly.
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct tractor damage.	All the cuttings (23 in number) were closed & additional outlets were kept at 11 places.	
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.	Irrigating water at 2 places directly from tertiary.	Will be discussed in next tertiary meeting.
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.	As per agreed action plan transplanting was completed.	Will be followed in the same way in future also.
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for	Under stress condition rotational system was follower between WC3 & 4 (WC3 was closed to irrigate WC4 & WC4 was closed to irrigate WC3)	Will be followed in future also.

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day/ block.		
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.	Farmerwise record of rotation was kept. One-person theft the water and it decided to discuss matter in the field.	This matter will be discussed in next WC level meeting.
12.	Each individual should be present at his turn for monitoring	Monitoring done as per plan	Will be followed in future also.
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs	It was decided to construct field channel compulsorily where additional outlets are kept and decided to irrigate only through field channels. Construction work of field channel is on- going –most complete	Field channel at remaining place will be constructed tomorrow.

G.3.3 Tertiary level meeting No.4

G.i Presented by WC 1

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.		
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.		
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	Ram Narayan Yadav, Resident of outside of command area irrigated his field by cutting tertiary & told that he was not aware of the present rules. He begged for excuse & blocked the cutting & paid Nrs51 as penalty.	
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.		
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.	As there was more accumulation of water at about 100m. length, 13 persons organized emergency meeting & cleaned the 100m . portion	

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
		by themselves. As there was no notification, no penalty charged to others.	
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.		
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.		
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.		
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.		
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day/ block.	As the number of days per turn is increased from 4 to 6 days, now the rotation is fixed @ 7 hours instead of 5.5 hours per bigha. As the water is sufficient at present field-to-field irrigation is practiced instead of hours per bigha.	It was agreed to irrigate field-to-field basis if water is adequate & in hourly basis if water is scares.
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.	Farmers of WC 3&4 closed the intake of both WC 1&2 & used all the water in one night. They realized that it was their mistake & will not do such work in future & begged excuse.	Record of RWS will be kept properly.
12.	Each individual should be present at his turn for monitoring		
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs.		

G.ii Presented by WC-2

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.		

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.		
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	Though it was decided to called land owner to remove one illegal outlet, no discussion has been done till date.	
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.		
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.		
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.		
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.		
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.		
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.		
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day/ block.	It was decided to distribute water for 36 hours to 2A & 70 hours to 2B (calculation was done on hours/bigha basis instead of 1 night 1 day & 3 night 3 days). Due to adequacy of water irrigation is done on field to field basis at present)	Water will be distributed on hour per bigha basis under scares condition.
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.		
12.	Each individual should be present at his turn for		

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	monitoring		
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs		

G.iii Presented by WC 3

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.		
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.		
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	No decision has been taken with regards to illegal pipes kept at 2 places.	This matter will be finalized in next tertiary level meeting.
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.		
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.		
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.		
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct tractor damage.	No action was taken to close these cuttings.	Monitoring will be done to find out whether these 2 cuttings are needed or not & will reach to conclusion for winter season.
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.		
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.		
10.	WC 1 - Water will be distributed based on land	It was agreed to divide	Under scares condition

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.	whole area into two blocks & to distribute water to one block in one turn & to another block in next turn (one irrigation per two turn). As there is adequate water, this system is not followed at present. Field to field irrigation is followed.	block wise rotation will be followed
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.		
12.	Each individual should be present at his turn for monitoring		
13.	Field channel will be constructed in WC 2 as per need in monsoon & only in winter in other WCs.	Construction work of field channel is not completed	The work will be done within 2-3 days.

G.iv Presented by WC-4

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.		
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.		
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	No decision has been taken till date.	This matter will be finalized in next tertiary level meeting.
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.		
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.		
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.		
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as	No action was taken to close these cuttings	Action will be taken in winter season.

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.		
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.		
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.		
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.	It was agreed to divide whole area into two blocks & to distribute water to one block in one turn & to another block in next turn (one irrigation per two turn). As there is adequate water, this system is not followed at present. Field to field irrigation is followed.	Under scares condition block wise rotation will be followed
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.		
12.	Each individual should be present at his turn for monitoring		
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs		

G.3.4 Tertiary level meeting No.5

G.i Presented by WC-1

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.		
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.		
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be		

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.		
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.		
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.		
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.		
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.		
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.		
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.		
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.	As the rice is at ripening stage at resent & there is adequate supply of water at present, no RWS system is followed. Irrigation is being supplied as per need basis.	
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.		
12.	Each individual should be present at his turn for monitoring		
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs		
	Additional action	Group is formed for fund raising activities in order to make the program sustainable	Continuity will be given.

G.ii Presented by WC-2

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.		
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.		
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	It was decided to come to conclusion before concluding session.	
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and in Bhadra if accumulation of silt is more.		
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.		
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.		
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.		
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.		
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.		
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on	As the supply if water is adequate & requirement is also less, water is distributed as per need of farmer. No rotation system is followed.	

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.		
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.		
12.	Each individual should be present at his turn for monitoring		
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs	As filed channels could not be constructed as per need in monsoon now all the farmers will construct for winter crop.	
	Additional action	Group is formed for fund raising activities in order to make the program sustainable	Continuity will be given.

G.iii Presented by WC-3

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.		
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.		
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	No decision.	Will be decided before concluding session.
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.		
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.		
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.		
7.	All the cuttings in WC will be blocked on	Action will be taken in	

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.	winter season.	
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.		
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.		
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.	As there is adequate supply of water and water is required for later transplanted crop only, no rotation is followed. Irrigation is done by needed persons only.	
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.		
12.	Each individual should be present at his turn for monitoring		
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs	Not fully constructed.	Field channels will be constructed compulsorily in winter season.
	Additional action	Group is formed for fund raising activities in order to make the program sustainable	Continuity will be given.

G.iv Presented by WC 4

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.		
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.		
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will	No decision.	Will be decided before concluding session.

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
	not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.		
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.		
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.		
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.		
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.	Action will be taken in winter season.	
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.		
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.		
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day / block.	As there is adequate supply of water and water is required for later transplanted crop only, no rotation is followed. Irrigation is done by needed persons only.	
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.		
12.	Each individual should be present at his turn for monitoring		
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs.	Not fully constructed.	Field channels will be constructed compulsorily in winter season.
	Additional action	Group is formed for fund raising activities in order to make the program	Continuity will be given.

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
		sustainable	

G.3.5 Tertiary level meeting No.3, 4 & 5 (compilation)

G.i Presented by T6

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.	Performed as per agreed action plan 78 were participated	
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.	9 were absents. 1 paid penalty	Trying to collect penalty from others.
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	Existing cuttings were closed. One person cut again and water was not provided to him till penalty amount was paid.	
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.	Cleaned as per plan.	
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.	T6-1 & 3B- Bighauti. T6-2, 3A-Volunteer labor.	
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.	5 persons did not participated in cleaning in T6-2 & paid penalty amount @Rs50/ person.	
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.	Outlets are not kept but irrigating by cuttings WCs	Out lets will be kept at fixed places in winter season.
8.	Tertiary level ad hoc committee has to arrange for equitable water distribution between watercourses.	Tertiary is cut at one place but from 2nd turn irrigation is done only through WCs	
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.	As per agreed plan transplanting was completed.	

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.	Water was distribution on hourly basis (3 hours/bigha). At later stage there was no rotational system as water supply was adequate and need was decreased.	
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.	Record is kept properly & no water theft.	
12.	Each individual should be present at his turn for monitoring	Monitoring is done by concerned farmer.	
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs	Field channels are not constructed. It was agreed to construct in winter season.	
	Additional action	Ad-hoc committee was formed in T6-2 (water course level committee)	

G.ii Presented by tertiary level Ad-hoc committee

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
1.	Tertiary level ad hoc committee will be responsible for monitoring of water allocation & distribution from SS9E to tertiary & action will be taken based on their observation. Committee has to submit application to WUC, WUCC, and SMIP for necessary action. The committee should also monitor opening & closing dates & take initiation for necessary action.	Tertiary level Ad-hoc committee formed several sub groups for monitoring & supervision. The work done till date are as follows:- 1. Gauge reading& finding out the reason for less or more supply of water. 2. Action was taken to increase the capacity of SS9E. 3. Establishment of linkage with WUCC for regular & proper supply of water. 4. Action taken to increase days in each turn (from 4to 6 days) 5. Monitoring the cleaning work done in sub secondary canal. 6. Monitoring the	Will be continued.

S. No.	Agreed Action Plan	Status of work in this period	Conclusion & Plan for future
		operational aspects of water distribution.	
2.	Tertiary level committee will be responsible for all the activities relater to sub-secondary & tertiary canals & watercourse level committee for watercourses.	1. Reorganization of tertiary level ad-hoc committee (number increased to 20). 2. Delegation to SMIP, WUCC and submitted the application to take the action of the problems related to water operation. 3. Re- delegation for the above matter & most of the works were done. 4. Invited sub-division engineer to monitor the problems. 5. Monitoring field channel construction & water operation at all levels.	Will be continued.
3.	Meetings of tertiary level committee.	Organizing regularly as per decision (minutes are available in separate sheet)	

Note:- Monitoring of water operation was not done in case of adequate water supply when there was no problem of irrigation water.

Date of Tertiary level meetings & number of participants

Meetings No	Date	Number of participants						
		WC-1	WC-2	WC-3	WC-4	T6	Others	Total
3	13 Sept	10	9	7	11	12	-	49
4	6 Sept	11	9	7	9	11	4	51
5	30 Oct	10	7	6	7	11	1	42

G.4 Final Report

G.4.1 WC level

S. No.	Agreed Action Plan	Implemented as per action plan	Implemented with change in action plan[271]	Partially implemented not or implemented
1.	Tertiary canal will be cleaned once in a year by the end of Ashad month through the volunteer lobour @ one person	Implemented as per action plan.		

[271] some part of action plan was charged or totally changed

S. No.	Agreed Action Plan	Implemented as per action plan	Implemented with change in action plan[271]	Partially implemented not or implemented
	per household. Beneficiaries of WC 1 are responsible to clean from bifurcation to intake of WC 1 & WC 2, 3, 4 for rest of the portion.			
2.	A sun of NRS 100 will be charged, as a penalty per person for absentee & the water will not be provided till the penalty is not pain. The collected penalty will be used for clearing of tertiary.	Implemented per action plan (some part was changed)	The absentees were used to re clean tertiary as penalty instead of Nrs100/person in T5-1, 2, 3,&4.	
3.	All the existing cuttings in the tertiary will be blocked. A sum of NRS 500 will be charged if the cuttings will be made onwards. Water will not be provided till the penalty is not paid. The person who is responsible in cutting has to block it by himself. The collected amount will be utilized for maintenance of tertiary. The same rule is applied for irrigating by blocking tertiary.	Implemented per action plan (some part was changed and some was not implemented)	One person who was not aware of the rules cut the tertiary & paid penalty of Nrs 100 in addition to closing the cut portion.	Still illegal pipes at 3 places (one at T5-2 & two at WC 3&4) were not removed. This matter was discussed in each meeting but could not come to conclusion.
4.	WC will be cleaned twice in a year. WC 1 & 2 in Baishakh & Shrawan & WC 3 & 4 in Ashad & Kartik and also in Bhadra if accumulation of silt is more.	T5-1B & T5-2B & T6 as per plan.		T5-1A, T5-2A,T5-3 &T5-4 were cleaned only once. It was not found necessary to clean 2 times.
5.	WC 1- collecting Bighauti based on land holding; WC 2, 3, & 4 – through volunteer labour @ 1 person per household, 2 persons if land is more than 2 Bigha in WC –2 & 2 persons if land is more than 5 bigha in WC 3 & 4.	T5-1B, 2A, 2B,3, 4 & T6 as per plan	T5 1-A was cleaned by volunteer labor dividing the WC & allocating to individuals based on land holding.	
6.	WC 1- water will not be given if bighauti is not paid & he has to pay double amount to get water. WC 2 – A sum of NRS 51 will be charged as penalty for absentee. WC 3 & 4 – A sum of NRS 100 will be charged as penalty for absentee.	As per plan.	One person who did not participate was excused, as he was sick.	
7.	All the cuttings in WC will be blocked on cleaning day. Additional outlets will be kept as per need based on the decision of committee. A sum of NRS 251 per cutting will be charged as penalty. Water will not be distributed till the penalty is not paid. The concerned person has to correct the damage made by tractor.	As per plan (except in T6 & some portion of WC 1,2, &3)	As the locations for additional outlets were not determined in T6, irrigation was done by cutting WCs in the first rotation.	Illegal outlets/cuttings at 1 place in WC-1, 1 place in WC-2 & 5 places in WC-3 were not closed. This matter was discussed in meetings but could not reach to conclusion.
8.	Tertiary level ad hoc committee	As per plan (except some	In T6, water was	Irrigation through

S. No.	Agreed Action Plan	Implemented as per action plan	Implemented with change in action plan[271]	Partially implemented not or implemented
	has to arrange for equitable water distribution between watercourses.	portion of first rotation in T6)	irrigated by cutting WC but from rotation 2nd as per plan.	illegal pipes at 2 places in WC 3 &4. This matter was discussed in meetings but could not reach to conclusion as these outlets were used occasionally.
9.	Water for transplanting will be distributed on the basis of mutual understanding. Priority will be given to transplanting rather than for irrigating transplanted field.	As per plan.		
10.	WC 1 - Water will be distributed based on land holding (hours/Bigha). WC 2 - 1 day & 1 night for 2A & 3 days & 3 nights for 2B & distributed based on land holding. WC 3 & 4 – Under normal condition equal amount to both WCs but in scarcity 2 days for WC 3 & 2 days for WC 4 & distributed based on land holding (hours/ Bigha). WC 3 & 4 will be divided into 4 blocks & water will be distributed @ 1 day per block.	As per plan except as mentioned in next column.	Instead of 1 night 1day & 3 nights 3 days distribution in 2A &2B, this duration was changed on the basis of land size (36 hours for 2A & 60 hours for 2B). No rotation was followed under adequacy of water availability (field to field). Under scares & drought condition, total command area was divided into 2 blocks & first irrigation was given to one block (50% area) & another block was irrigated in next rotation (one irrigation per 2 rotations).	
11.	Record of rotation of each individual will be kept properly & a sum of NRS 151 will be charges as penalty if found irrigating in other rotation and he will not get water on that turn.	As per plan.		
12.	Each individual should be present at his turn for monitoring	As per plan.		
13.	Field channel will be constructed in WC 2 as per need in monsoon also & only in winter in other WCs			Partly implemented & decided to implement fully in winter.
	Additional action	Group was formed in each WC for fund raising program in order to make the programme sus-tainable.		

G.4.2 Tertiary level

S. No.	Agreed Action Plan	Implemented as per action plan	Implemented with change in action plan[272]	Partially implemented not or implemented
1.	Tertiary level ad hoc committee will be responsible for monitoring of water allocation & distribution from SS9E to tertiary & action will be taken based on their observation. Committee has to submit application to WUC, WUCC, and SMIP for necessary action. The committee should also monitor opening & closing dates & take initiation for necessary action.	Implemented as per plan with some change. Additional action An ad-hoc committee was formed consisting of 9 members in T6-2. All the illegal pipes situated from head of SS9E to T3 were removed by the participation of beneficiaries For the permanent solution of various problems discussed with technician & WUCC & agreed to take actions gradually.	Increased the number from 15 to 20. Rotation changed from 4 days on to 6 days on.	Monitoring work was stopped from 6 turn due to adequacy of irrigation water (supply was more than demand)

G.5 Evaluation by of activities by users

G.5.1 T5: - Well-Off

S.No	Actions agreed/taken	How actions were implemented.	Was this useful?	Will it be done next year?	How this activity could be improved.	What actions needed now.
1	***Improved in water Management.*** A better plan was introduced (fixed duration per unit area, varying according to WC, applied at time of shortage, an agreed order of irrigation agreed for time of better supply.)	Rotational system was modified as per need and availability & adequacy of water supply.	Was useful.	Yes	Supply of water should be as per full capacity of SS9E as supplied in this monsoon.	Farmers should be mobilized through institutional arrangement as done during program implementation. Initiation should be taken by WUC/ Ad-hoc committee.
2	Rotation in SS9E changed from 4 days on 4 days off to 6 days on 8 days off	This action was not taken always.	Was useful.	May be	This action should be regularized.	WUC/Ad-hoc committee should be active in future also. Meetings should be regularized. Monitoring should be continued.
3	FSL at head of SS9E changed from 42 to 52 cms.	This action was not taken always.	Was useful.	May be	This action should be regularized.	WUC/Ad-hoc committee should be active in future also. Meetings should be regularized. Monitoring should be

[272] some part of action plan was charged or totally changed

S.No	Actions agreed/taken	How actions were implemented.	Was this useful?	Will it be done next year?	How this activity could be improved.	What actions needed now.
						continued.
4	Water levels at intake to SS9E, T5 and WCs were monitored.	Monitoring was done regularly.	Was useful.	Yes	Continuity will be given.	WUC/Ad-hoc committee should be active in future also. Meetings should be regularized. Monitoring should be continued.
5	Farmers agreed to irrigate in accordance with plan.	Irrigation was done through mutual understanding. RWS was changed modified based on situations organizing meetings.	Was useful.	Yes	(i) Regularization of meetings at WC level. (ii) Regularization of meetings at tertiary level.	(i) Meeting /discussion on monthly basis at WC levels. (ii)Information dissemination to all beneficiaries.
6	Penalties were imposed on people who stole water/ break plan..	Now water was theft. Water was supplied as per agreed changed plan. penalty was imposed modifying agreed plan.	Was useful.	Yes	Continuity will be given.	Regurgitation of WC level meetings/discussion.
7	Improved Institutional Arrangements. WUG/committees worked more in accordance with agreed responsibilities for cleaning canals & managing water.	WC level committee & tertiary level ad-hoc committee worked satisfactorily with full responsibility.	Was useful.	Yes	Committees at both levels will work & continuity will be given in future also.	Regularization of meetings at both WC & tertiary levels.
8	Ad-hoc tertiary committee set up to manage T5 and coordinate with WUC/WUCC	Fully worked as per decision.	Was useful.	Yes	The ad-hoc committee should be institutionalized (should be assumed as good as legal institute.)	Regularization of meting of ad-hoc committee.
9	Maintained as per need Field channels constructed as per need.	Field channels were constructed but not fully	Partly useful.	Yes	Meeting will be held & places will be determined & field channels will be constructed compulsorily in winter season.	To save water. Field channels will be constructed. Water will not be provided if field channel is not constructed.
10	Illegal cutting & outlets were closed and outlets were kept at needed places in systematic way.	Action was taken as per agreed plan.	Was useful.	Yes	Penalty will be imposed strictly as per agreed plan.	Meetings will be regularized to take actions.

G.5.2 T5: - Medium

S.No	Actions agreed/taken	How actions were implemented.	Was this useful?	Will it be done next year?	How this activity could be improved.	What actions needed now.
1	***Improved in water***	Based on mutual	Was	Yes	(i) Construction of	WUC/ad-hoc

S.No	Actions agreed/taken	How actions were implemented.	Was this useful?	Will it be done next year?	How this activity could be improved.	What actions needed now.
	Management. A better plan was introduced (fixed duration per unit area, varying according to WC, applied at time of shortage, an agreed order of irrigation agreed for time of better supply.)	understanding agreed action plan was modified particularly in scares & drought conditions.	useful.		field channels compulsorily. (ii) Supply of water at full capacity. (iii) Imposition of rules and regularities for illegal pipes & cuttings.	committee & SMIP should work jointly for equitable water distribution from head of SS9E to tertiary. Coordination meeting should be organized.
2	Rotation in SS9E changed from 4 days on 4 days off to 6 days on 8 days off	Action was not taken regularly (some times only)	Was useful.	May be but it is necessa ry.	Making arrangement for 6 days on & 2 days off.	Ad-hoc committee should taken initiation contacting concerned authorities. (WUCC, SMIP)
3	FSL at head of SS9E changed from 42 to 52 cms.	Action was not taken regularly (some times only)	Useful to some extend .	May be but it is necessa ry.	FSL at head of SS9E should be 52 cms always.	Ad-hoc committee should taken initiation contacting concerned authorities. (WUCC, SMIP)
4	Water levels at intake to SS9E, T5 and WCs were monitored.	Monitoring was done by committee members only.	Useful to some extend .	Yes	Monitoring work will be continued but monitoring committee should pushed regularly.	Training should be given to WC level & ad-hoc level committees on different aspects of monitoring system.
5	Farmers agreed to irrigate in accordance with plan.	Irrigation was done through mutual understanding. RWS was changed/ modified based on situations organizing meetings.	Was useful	Yes	Regularization of meetings at both WC & Tertiary level.	Mass meeting should be organized in each WC before the plantation of seasonal crops (winter, spring, monsoon)
6	Penalties were imposed on people who stole water/ break plan..	Penalty was charged modifying agreed plan.	Social ly very useful	Yes - more strictly.	Warning should be given in meetings.	List to be prepared & notify publicly who are involved in illegal works.
7	Improved Institutional Arrangements. WUG/committees worked more in accordance with agreed responsibilities for cleaning canals & managing water.	Worked but needs to be more active.	Was useful to some extend .	Yes	(i) Number of committee should be reduced. (ii) Review of activities organizing meetings.	WC level committee & tertiary level ad-hoc committee should be recognized by SMIP /WUCC/WUCCC
8	Ad-hoc tertiary committee set up to manage T5 and coordinate with WUC/WUCC	Fully worked as per decision.	Too much useful.	Yes	The committees should be legalized.	WC level committee & tertiary level ad-hoc committee should be recognized by SMIP /WUCC/WUCCC
9	Maintained as per need Field channels constructed as per need.	Field channels were constructed but not fully as per requirement.	Was useful	Yes	Meeting will be held & places will be deter mined & field channels will be constructed	To save water. Field channels will be constructed. Water will not be provided if field channel is not

S.No	Actions agreed/taken	How actions were implemented.	Was this useful?	Will it be done next year?	How this activity could be improved.	What actions needed now.
					compulsorily in winter season.	constructed.
10	Illegal cutting & outlets were closed and outlets were kept at needed places in systematic way.	Implemented but not totally.	Was useful	Yes	Imposition of penalty will be strictly followed.	Meetings will be organized for warning & imposition of penalty.

G.5.3 T5: - Weak

S.No	Actions agreed/taken	How actions were implemented.	Was this useful?	Will it be done next year?	How this activity could be improved.	What actions needed now.
1	***Improved in water Management.*** A better plan was introduced (fixed duration per unit area, varying according to WC, applied at time of shortage, an agreed order of irrigation agreed for time of better supply.)	Based on mutual understanding agreed action plan was modified particularly in scares & drought conditions.	Was useful	Yes	Constructing field channel compulsorily.	* Organization of mass meeting at WC level. * Distribution of water based on the decision to be taken in meeting. * Preparation of water distribution plan for winter crop. * Monitoring by WC level & ad-hoc committee.
2	Rotation in SS9E changed from 4 days on 4 days off to 6 days on 8 days off	Action was not taken regularly (some times only)	Was useful	Yes (not sure)	Making arrangement of 6 days on & 1 day off	* Organization of mass meeting before sowing of wheat. * Regular meeting of ad-hoc committee.
3	FSL at head of SS9E changed from 42 to 52 cms.	52 cms was not regular. Some times it was even less than 42 during drought period.	Was useful	Yes (not sure)	52 cms should be continued.	Ad- hoc committee should send delegation to WUCC for sustainable arrangement.
4	Water levels at intake to SS9E, T5 and WCs were monitored.	Monitoring was done regularly in each turn.	Was useful	Yes	All beneficiaries should take active participation.	Regularities of meeting. Installation of gauges. Work division (responsibilities.)
5	Farmers agreed to irrigate in accordance with plan.	Irrigation was done through mutual understanding. RWS was changed modified based on situations organizing meetings.	Was useful	Yes	Organizing discussion programs & implementation of decisions.	Regularization of meetings of ad-hoc committee.
6	Penalties were imposed on people who stole water/ break plan..	Social punishment was imposed to thief of water. Hence water theft was checked.	Was useful	Yes and more	Through mutual under standing.	Regularization of meetings of ad-hoc committee.
7	Improved Institutional Arrangements. WUG/committees worked more in	WC level committee & tertiary level ad-hoc committee worked	Was useful	yes	Farmers will push Ad-hoc committee regularly.	Regularization of meetings of ad-hoc committee. (Ad-hoc committee is

S.No	Actions agreed/taken	How actions were implemented.	Was this useful?	Will it be done next year?	How this activity could be improved.	What actions needed now.
	accordance with agreed responsibilities for cleaning canals & managing water.	satisfactorily with full responsibility.				active so no problem.)
8	Ad-hoc tertiary committee set up to manage T5 and coordinate with WUC/WUCC	Fully worked & the committee was still more active during drought.	Was useful	Yes	Farmers will push Ad-hoc committee regularly.	Regularization of meetings of ad-hoc committee. (Ad-hoc committee is active so no problem.)
9	Maintained as per need Field channels constructed as per need.	Field channels were constructed but not fully as per requirement.	Was useful	Yes	Constructing field channels by all farmers. Decision will be taken in the meetings.	Not providing water to the farmer who do not construct field channel. (Will be decided in meeting)
10	Illegal cutting & outlets were closed and outlets were kept at needed places in systematic way.	Action was taken as per plan.	Was useful	Yes	By the imposition of rules strictly to cheek cuttings /outlets.	Excess drain water of WC1 goes to field. That should be converted towards the command area of WC-2. Request will be made to SMIP

G.5.4 T6 - medium

S.No	Actions agreed/taken	How actions were implemented.	Was this useful?	Will it be done next year?	How this activity could be improved.	What actions needed now.
1	***Improved in water Management.*** A better plan was introduced (fixed duration per unit area, varying according to WC, applied at time of shortage, an agreed order of irrigation agreed for time of better supply.)	RWS was followed during scares & drought condition (hours/ bigha). No RWS when water was adequate. (Field to field irrigation)	Was useful.	Yes	Demanding more water during scares & drought conditions. Ad-hoc committee is capable to work in this line.	Farmers should be mobilized through institutional arrangement as done during program implementation. Initiation should be taken by WUC/ Ad-hoc committee.
2	Rotation in SS9E changed from 4 days on 4 days off to 6 days on 8 days off	This action was not taken always.	Very	Yes	Additional water will be demanded during drought condition.	Ad-hoc committee should initiation to increase the days of rotation in future also.
3	FSL at head of SS9E changed from 42 to 52 cms.	This action was not taken always.	Not so much useful.	Expected.	Increasing the level even more than 52 cms.	Ad- hoc committee should send delegation to WUCC & should follow regularly.
4	Water levels at intake to SS9E, T5 and WCs were monitored.	Monitoring was done regularly.	Was useful.	Yes	Continuity will be given.	WUC/Ad-hoc committee should be active in future also. Meetings should be regularized. Monitoring should be continued.
5	Farmers agreed to irrigate in accordance with plan.	Irrigation was done through mutual understanding.	Was useful.	Yes	(i) Regularization of meetings at WC level.	(i) Meeting/discussion on monthly basis at WC levels.

S.No	Actions agreed/taken	How actions were implemented.	Was this useful?	Will it be done next year?	How this activity could be improved.	What actions needed now.
		RWS was changed modified based on situations organizing meetings.			(ii) Regularization of meetings at tertiary level.	(ii) Information dissemination to all beneficiaries.
6	Penalties were imposed on people who stole water/ break plan..	Fully implemented.	Was useful.	Yes	RWS will be prepared & will be effectively disseminated.	Committees should be active in future also.
7	Improved Institutional Arrangements. WUG/committees worked more in accordance with agreed responsibilities for cleaning canals & managing water.	WC level committee & tertiary level ad-hoc committee worked satisfactorily with full responsibility.	Was very much useful.	Yes	Committees at both levels will work & continuity will be given in future also.	Regularization of meetings at both WC & tertiary levels.
8	Ad-hoc tertiary committee set up to manage T5 and coordinate with WUC/WUCC	Fully worked as per decision.	Was useful	Yes	Ad- hoc committee will be pushed to make still more active.	Regularization of meting of ad-hoc committee.
9	Maintained as per need Field channels constructed as per need.	Partially implemented.	Was useful	Yes	Construction of field channels by all beneficiaries.	To save water. Field channels will be constructed. Water will not be provided if field channel is not constructed.
10	Illegal cutting & outlets were closed and outlets were kept at needed places in systematic way.	Partially implemented	Useful to some extend .	Yes	Rules will be imposed strictly in winter season.	Meetings will be regularized to take actions.

G.5.5 T6: - weak

S.No	Actions agreed/taken	How actions were implemented.	Was this useful ?	Will it be done next year?	How this activity could be improved.	What actions needed now.
1	***Improved in water Management.*** A better plan was introduced (fixed duration per unit area, varying according to WC, applied at time of shortage, an agreed order of irrigation agreed for time of better supply.)	RWS was followed during scares & drought condition (hours/ bigha). No RWS when water was adequate. (Field to field irrigation)	Was useful.	Yes	* Beneficiaries should be conscious about RWS. * Mutual understanding. * Imposition of rules for RWS.	* Mass meeting. * Regular meetings of ad-hoc committee. * Effective communication.
2	Rotation in SS9E changed from 4 days on 4 days off to 6 days on 8 days off	Rotation changed from 4 to 6 days due to this program. But 6 days supply was	Was useful.	Yes	6 days rotation will be regularized through the efforts of	Ad-hoc committee should take active imitation to continue 6 days rotation.

S.No	Actions agreed/taken	How actions were implemented.	Was this useful ?	Will it be done next year?	How this activity could be improved.	What actions needed now.
		not regular.			committees of both levels.	
3	FSL at head of SS9E changed from 42 to 52 cms.	This action was not taken always.	Not so much useful.	Yes	Increasing the level even more than 52 cms.	Ad- hoc committee should send delegation to WUCC & should follow regularly.
4	Water levels at intake to SS9E, T5 and WCs were monitored.	Monitoring was done regularly.	Was useful	Yes	Nominees of committees should monitor regularly in each turn.	One person should be hired by the contribution of all beneficiaries to monitor this activity.
5	Farmers agreed to irrigate in accordance with plan.	Irrigation was done through mutual under-standing. RWS was changed modified based on situations, meetings.	Was useful	Yes	RWS will be still improved based on need. Mass meetings will be organized to discuss on this matter.	Meetings will be organized before the plantation of wheat crop.
6	Penalties were imposed on people who stole water/ break plan..	Fully implemented. No action was taken.	Was useful	Yes	Continuity will be given.	Ad-hoc & WC level committee should monitor regularly.
7	Improved Institutional Arrangements. WUG/committees worked more in accordance with agreed responsibilities for cleaning canals & managing water.	WC level committee & tertiary level ad-hoc committee worked satisfactorily with full responsibility.	Was useful.	Yes	Committees at both levels will work & continuity will be given in future also.	Regularization of meetings at both WC & tertiary levels.
8	Ad-hoc tertiary committee set up to manage T5 and coordinate with WUC/WUCC	Worked as per decision. Was still more active under drought & scares conditions.	Was very much useful.	Yes	Beneficiaries should also assist to committees.	Organization of meetings of both levels before wheat plantation.
9	Maintained as per need Field channels constructed as per need.	Partially implemented.	Was useful	Yes	Constructions field channels by all beneficiaries.	Imposition of penalty to those who do not construct field channels.
10	Illegal cutting & outlets were closed and outlets were kept at needed places in systematic way.	Partially implemented.	Useful to some extend .	Yes	Organization of meetings of beneficiaries to discuss on this issue.	Mass meetings before wheat plantation & imposition of penalty.

Appendix H Formats for monitoring repairs, maintenance and water management - SMIP

These formats were developed at SMIP to monitor the progress, outputs and outcomes of interventions in this study. These were developed by the farmer organizers and used by them to record data as required. They may not be applicable to other projects, but they are included here as examples. Suitable forms should be designed at an early stage in the programme.

Format 1:	Participation of farmers in cleaning the tertiary canal
Format 2:	Bank maintenance of the tertiary canal - rectification of illegal actions
Format 3(A):	Cleaning of watercourse through voluntary labour
Format 3(B):	Cleaning of watercourse through financial contributions (Bighaati)
Format 4:	Bank maintenance of watercourse - rectification of illegal actions
Format 5:	Details of outlets to be closed and additional outlets planned
Format 6:	Water distribution monitoring at Sub-secondary canal (SS9E)
Format 7:	Water distribution monitoring at tertiary canal
Format 8:	Water distribution monitoring at watercourse level
Format 9(A):	Water distribution roster at watercourse
Format 9(B):	Actual water distribution in watercourse

Formats number 1 to 5 mainly consisted of information related to system maintenance, resources mobilization and so on. These formats represent one time data. Format number 6 provides information on operation of sub-secondary canal SS9E. Format number 7 and 8 relates to the operation of tertiary canal and watercourse. Format 9 presents water distribution roster at watercourse

Data on flow measurement and canal operation were recorded on daily basis, while other data were recorded as and when needed.

Format -1

Participation of farmers in cleaning the tertiary canal

Tertiary canal: Date:

Watercourse:

Section of tertiary canal cleaned during the period:

Approximate length cleaned:

Other partner (WC) for cleaning:

Portion cleaned in partnership:

Lead person:

SN	List of all farmers cultivating within WC	Participation in cleaning (✓)(✗)	Remarks
			Names of farmers not participating and actions taken 1. 2. 3. Total penalty paid by …….persons …….amount. Action taken against those who did not pay. 1. 2. 3. Further action needed. 1. 2. 3.

Format-2

Bank maintenance of the tertiary canal - rectification of illegal actions

Tertiary Canal: …… **Inspection Date:** ……..

Number of existing cuttings …….and blockages ……..

Number corrected since last inspection: cuttings …….and blockages……..

Why remaining cuttings & blockage are not corrected:-

When remaining cuttings & blockage will be corrected:-

If any will not be corrected then why:

Lead persons in these activities

Records of farmers who cut the canal banks or block the flow in tertiary canal

SN	Name of farmer	From which WC	Cutting or blockage	When (Date)	Where (Place)	Reasons for doing so	What penalty was imposed	Was penalty paid	What action taken if penalty not paid	Remarks

Format-3(A)

Cleaning of watercourse through voluntary labour

Tertiary No: Date:
WC No:

Location cleaned:

Approx total length:

Lead person managing canal cleaning:

SN	Name of farmers cultivating within WC	Irrigated area	Participation in cleaning (✓)(✗)	Action taken against those who do not participate

Format-3(B)

Cleaning of watercourse through financial contributions (Bighaati)

(Mobilization of resources with respect to land or household or some other units)

Tertiary No: Date:
WC No:

Basis for calculating *bighatti*

Location cleaned:

Approx total length:

Lead person managing canal cleaning:

SN	Name of farmers cultivating within WC	Irrigated area	Amount paid	Action taken against those who do not contribute

Format-4

Bank maintenance of watercourse - rectification of illegal actions

Tertiary Canal: …… **Inspection Date:** ……..

Watercourse No…….

Number of existing cuttings …….and blockages ……..

Number corrected since last inspection: cuttings …….and blockages……..

Why remaining cuttings & blockage are not corrected:-

When remaining cuttings & blockage will be corrected:-

If any will not be corrected then why:

Lead persons in these activities

Records of farmers who cut the canal banks or block the flow in tertiary canal

SN	Name of farmer	From which WC	Cutting or blockage	When (Date)	Where (Place)	Reasons for doing so	What penalty was imposed	Was penalty paid	What action taken if penalty not paid	Remarks

Format-5

Details of outlets to be closed

Name of Tertiary Canal: Date:

Watercourse:

Name of lead farmer:

S.N	Location of existing outlet	Farmer's name whose land is irrigated	Irrigated area	How will the land be irrigated	When to dig field channel	Actions taken for this	Remark

Details of planned additional outlets in watercourse

Name of Tertiary Canal: Date:

Watercourse:

Name of lead farmer:

S.N	Location of additional outlet	Farmer's name whose area to be irrigated	Irrigated area	How the area was irrigated before	When to install outlet	Actions taken for this	Remark

Format -6

Water Distribution Monitoring At Sub-Secondary Canal (SS9E)

Name of data recorder: **Date:**

1. Gauge reading at Aurabani: …….. cm

2. Is there any obstruction in the canal or cutting of canal bank? Yes / No
   - If Yes, where and who did it? ……...
   - Is such action reported to WUC Chairman? Yes / No
   - If yes, how was it reported Written / Verbal
   - Who reported it? ……...
   - What action was taken? ……...

3. Gauge reading at PD of T5/T6: …….. cm
   - Is there any obstruction in the PD: Yes/No
   - D/S flow condition in T6: Free/submerged
   - Is there any substantial change in flow since yesterday? Increased/decreased/No
   - If yes, what are the reasons? ……...
   - If the increase or decrease of flow was not intended, did any body tried to rectify this? ……...
   - If yes, what actions were taken and who by? ……...

4. Was their any dispute in distributing water to tertiary canals? Yes/No
   - If yes, what was the cause of conflict? ……...
   - What was the nature of conflict? ……...
   - Who was involved in the conflict? ……...
   - Was it resolved? ……...
   - If yes, who resolved it and how was it resolved? ……...

5. Meetings to discuss water management
   - Has there been any meeting of farmers (WUC or *ad-hoc* committee) to discuss water management? Yes or No
   - If yes, who met? ……..
   - what was discussed? …….…….
   - what actions were taken? ……..

6. Any other incidents or issues? If yes, describe briefly ……..

Format- 7

Water Distribution Monitoring at Tertiary Canal T5

Name of data recorder: **Date:**

1.	Is there any obstruction of flow in canal in T5?	Yes / No
	If Yes, where and who did it?	……..
	Is such action reported to tertiary level ad hoc committee?	Yes / No
	If yes, who report it and what action is taken?	……..
2.	Is there any cutting on canal-bank in T5?	Yes / No
	If Yes, where and who did it?	……..
	Is such action reported to tertiary level ad hoc committee?	Yes / No
	If yes, who report it and what action is taken?	…….
3.	Gauge reading at WC-1	……. cm
	Is there any obstruction at APM:	Yes / No
	If yes, was it intended?	Yes / No
	Causes:	…….
	Do downstream condition affect flow through APM to WC?	Yes / No
4.	Gauge reading at WC-2	……..cm
	Is there any obstruction at APM:	Yes / No
	If yes, was it indented?	Yes / No
	Causes:	…….
	Do downstream condition affect flow through APM to WC?	Yes / No
5.	Gauge reading at PD of WC3 and WC4:	……..cm
	Is there any obstruction in the PD:	Yes / No
	If yes in which WC?	WC-3 / WC-4
	Is there any substantial increase or decrease in flow in WC3/4 PD compared to yesterday?	Increase/decrease/no
	If yes, what are the reasons?	…….
	If the change was not intended, did any body tried to rectify this?	Yes / No
	If yes, what actions were taken?	…….
	Who took this action?	…….
6.	Was their any dispute or conflict in distributing water to watercourses?	Yes/No
	If yes, what was the cause of conflict?	…….
	What was the nature of conflict?	…….
	Who was involved in the conflict?	…….
	Was it resolved?	…….
	If yes, who resolved it and how was it resolved?	…….
7.	Meetings to discuss water management	
	Has there been any meeting of farmers (WUC or ad-hoc committee) to discuss water management?	Yes or No
	If yes, who met?	……..
	what was discussed?	…….…….
	what actions were taken?	……..
8.	Any other incidents or issues? If yes, describe briefly	……..

Format -8

Water Distribution Monitoring at Watercourse

(To be filled in weekly meeting)

Name of observer: Date of observation:

Watercourse number:

Irrigation turn: Date from ….. to …..

1. **Average water available at the head of the WC:**
   Too little, less than average, average, moderately high, plenty

2. **Water distribution modality at tertiary:**
   (To be finalized at tertiary level meeting to be held on 28 July, 2004)

3. **How water is distributed between branches A and B of the watercourse:**
   Ad-hoc management (describe what happened)

   Water distribution based on mutual agreement (describe the basis)

   Water distribution in rotation (describe how it is monitored)

   Continuous to both canals (A and B) (In this case, how is flow split?)

   Any other methods?

4. **How water is distributed to farmers within watercourse A**
   Ad-hoc management

   Water distribution based on mutual agreement (describe the basis)

   Water distribution as per turn (describe how sufficiency in one's plot is judged?)

   Water distribution as per time share (how many hours per bigha of land, any differences between low land,high land)

   Any other method?

5. **How water is distributed to farmers within watercourse B**
   Ad-hoc management

   Water distribution based on mutual agreement (describe the basis)

   Water distribution as per turn (describe how sufficiency in one's plot is judged?)

   Water distribution as per time share (how many hours per bigha of land, any differences between low land,high land)

   Any other method?

6. Is there any obstruction or bank cutting of the water course?	**Yes / No**
If Yes, how many?	……..……
where ?	……..
who did it?	……..
What action is taken?	……..
7. Was their any dispute or conflict in distributing water?	**Yes/No**
If yes, what was the cause of conflict?	……..
What was the Nature of conflict?	……..
Who was involved in the conflict?	……..
Was it resolved?	……..
If yes, who resolved it and how was it resolved?	……..
8. Irrigation sufficiency	
In this turn, did all farmers irrigate their land?	Yes or No
If no, what percent of farmer could not irrigate their lands	……..
Where are the unirrigated lands located?	……..
How they will be irrigated in the next turn?	……..

9. Major issues and general comments of the group about above mentioned activities and improvements to be made for the next irrigation turn

Format -9A

Water Distribution Roster at Watercourse

Watercourse number:
Irrigation turn:
Date: _____to _____

SN	Name of farmer	Land location (H/M/T)	Irrigation turn as per roster				
			Land Area (B/K/D	Date	Time		Total hours
					from	To	

Format -9B

Actual Water Distribution in Watercourse

Watercourse number:
Irrigation turn:
Date: _____to _____

SN	Name of farmer	Land location (H/M/T)	Irrigation turn as per roster				
			Land Area (B/K/D	Date	Time		Total hours
					from	To	