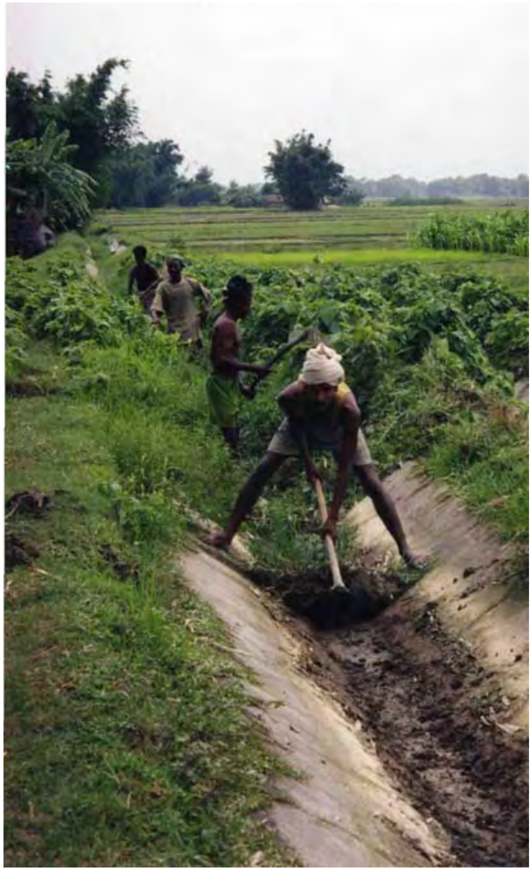
Equity, Irrigation and Poverty

Guidelines for Sustainable Water Management

Final Report



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Summary Report

1 Introduction: objectives of study

It is now widely recognised that irrigation has many direct and indirect impacts on the livelihoods of the poor, and that it is important for poverty reduction (Hussein, 2005, Lipton 2003, Smith 2004). However, the direct impact is severely reduced by poor management of water distribution at a local level. Even within small areas some farmers can get an adequate supply of water while others have insufficient water and may even be forced to abandon their crops.

One approach now widely adopted for solving this problem is to transfer responsibility for management at a local level to the users, often referred to as Participatory Irrigation Management (PIM). Associations of water users (WUAs) responsible for management within areas of around one to two thousand hectares are established, are provided with a reliable supply of water from a strengthened system for managing the main canals, and are then expected to manage the canals and the water within that area. This process of privatisation has been much studied (Vermillion, 1997, Samad & Vermillion, 1999). Although it requires extensive reforms at all levels in the water sector (Samad, 2005), there is still an assumption that once WUAs are set up they will be able to manage water well (Johnson, 2001). This assumption appears to be unjustified, and there are technical and institutional reasons (including social and power relations) why distribution of water remains inequitable.

We recognise as a starting point that land in many countries is not shared fairly, but in our study we do not address either issues of land reform or the separation of water rights from land rights[1]. We believe that water is often even more inequitably distributed than land. If water were distributed proportionately to the crop needs for area farmed, then poor farmers would be able to make better use of their land. In this study we looked at cases where land distribution is very inequitable (most of Nepal and India) and others where land ownership is relatively uniform (Kyrgyzstan and to a lesser extent some parts of Nepal). In both cases we believe that water could be distributed more fairly and that this would reduce poverty

In this project we investigated how WUAs share water at local level, evaluated what impact this has on the livelihoods of the poor, and then helped the WUAs to improve distribution of water amongst their members[2]. We also reflected on the process of establishing WUAs and embedding them in the community: one of the early findings of this study was that despite considerable efforts to date, many WUAs are not well connected with the communities they represent. We therefore linked this study to a parallel project[3] in Nepal to strengthen WUAs and embed them in their community.

[1] Separation of land and water rights is seen by some as a way of strengthening the livelihoods of the poor (Hussein, 2005), who have little land, but in Sri Lanka there is concern that it will have the opposite effect and result in a loss of water rights by the poor (Samad, 2005). The complexity of this issue has also been discussed for India by Chambers (1988).

[2] We worked directly with the water users, as well as with WUA committee members and staff. We helped them to identify ways that water users could work with the WUA to bring about an improvement. As we will describe below, the improvements involved both institutional and procedural changes.

[3] DFID KaR R8023: Guidelines for Good Governance

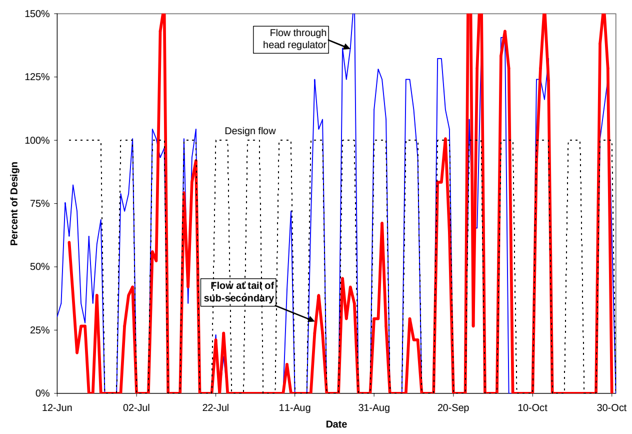
This was an action research project, implemented in India (Andhra Pradesh – AP)[4], the Kyrgyz Republic and Nepal, with supporting information collected from China. Its aim was to identify methods for improving water distribution, to test these techniques on two projects, and then to draw up guidelines for wider application.

2 Role and performance of Water Users' Associations

In the most commonly adopted PIM model, water users' associations (WUAs) are made responsible for management of the lower parts of the system, whilst the government generally retains responsibility for the main canals (sometimes with some involvement by the WUA, as in Nepal). It is expected that WUAs will be able to collect water charges and other resources; arrange maintenance of canals; share water equitably amongst their members; resolve conflicts; and coordinate with the government or main system managers. In return the government assists in formation and capacity building of the WUA and undertakes to deliver a reliable supply to the WUA (for which the main system management should be paid a fee). The details of these responsibilities vary, and are described in Chapter 5. Many WUAs have had a beneficial impact (Samad, 2005) but few have had the impact that has been hoped for and few have been able to make as much progress with equitable water distribution as had been expected. As we discuss in Chapter 5, the WUAs in our study sites are local organisations which are rarely as democratic as anticipated - they tend to be dominated by local elites who continue to attend to their own access to water while neglecting most of their other responsibilities.

Whilst our focus was on improving water distribution, it became apparent through these case studies that there was a more fundamental deficiency in most WUAs, in that they are not 'embedded' in the community[5] – they are not understood, not trusted, and cannot make or enforce rules. Their roles and responsibilities may be ambiguously defined, not clearly understood or not fully agreed with by either the executive members or the water users. Finally they lack key technical skills to manage water effectively.

Box 1: Canal flows as a percentage of design at head and tail of WUA



The consequence of this is an unfair distribution of water, with the inequity increasing down the system (we examine the concepts of equity in more detail in chapters 2 and 7, but it is generally acknowledged that each farmer is entitled to a share of water proportionate to the area of his land). An example of unfair distribution is illustrated in Box 1, which shows the flows at the head (in blue) and tail (in red) of one WUA at Sunsari Morang Irrigation Project (SMIP, in Nepal) in 2002, before the

[4] There was exceptionally poor rainfall in northern AP during the study period. This meant that there was no irrigation possible in the study area, which is in the Sri Ram Sagar Project, and precluded much of the work originally envisaged under this study.

[5] The way the WUAs have been established – generally externally promoted and with insufficient consideration for the local social and political context, or for the livelihood assets and strategies of different categories of water users – has contributed to this failure to be 'embedded'.

start of the study. This distribution is expressed as a percentage of design flow: little water reaches the end of the system until very late on in the season, when there is little need for water. There are weak procedures for sharing water – mostly decided by individual farmers rather than through consensus. The WUA is hardly engaged in solving this problem and gives greater emphasis to other tasks, such as lobbying the main system management to promote particular interests related to contracts or water delivery as requested by influential individuals. Farmers recognise that access to water is unfair, but they regard this as inevitable and essentially a problem to be solved by others. This causes local disputes and conflicts: these may not be overtly expressed but they contribute to a background of ill-feeling. This has far-reaching impacts, for example by feeding into more fundamental conflicts such as the 'maoist' insurgency in Nepal. This underlines the wider social and political importance of improving irrigation management.

This background and our methods for investigating and improving the situation in our selected study sites are described in Chapters 1 to 4 of this report.

3 Development history of WUAs and its consequences

There is a common pattern to the development of WUAs in the study areas: they have all been established within the wider context of government legal and institutional reform of the water sector, and they all have centrally standardised constitutions which define their entitlements and obligations. There are, however, variations between the countries and they have developed from two different backgrounds: one approach built on experience with community management of small-scale irrigation[6] (Nepal and India); and the other followed on from privatisation of state or collective farms (Kyrgyzstan). WUAs in Kyrgyzstan fill a void created by the collapse of collective agriculture, and are thus less threatening than those in India and Nepal which take over some responsibilities from existing government departments.

In the 'community model', groups of farmers who are traditionally smallholders are encouraged to form a legally registered association to work together to manage the irrigation system which serves the group[7]. In the latter, WUAs have taken over responsibility for management of the on-farm canals from the state farm[8]. The WUAs are required to deliver water to individual farmers who were previously (in many cases) workers on the state farm. In Kyrgyzstan, WUA managers are likely to be technically skilled and to have had the same water management role under the previous system, but in Nepal and India the WUA committee members tend to be village leaders with little technical expertise or interest.

Within these two strands there are many local variations, and it is important to note that the history of land and water development, as well as of social and power relations, does have a profound impact on the nature and performance of irrigation management organisations. Variations occur within as well as between countries: Khageri Irrigation System (KIS, in Nepal) was developed from forest and settled by smallholders in the 1960s; whereas SMIP (also in Nepal) was developed by relatively rich people who were granted extensive land rights by the central government. They employed local people to

[6] Traditional community management groups are rarely democratic and often rely on strong autocratic leadership (see for example Pradhan, et al. 2001 and Mosse 2004 who describe the situation in Nepal and Tamil Nadu, India): such arrangements are often effective but not necessarily equitable. Modern WUAs are set up to be more democratic and egalitarian, but Pradhan sees this as a reason for their poor performance: he believes that such 'western' concepts are not accepted by the community

[7] They may previously have worked together on an informal basis for community management of natural resources, but they are unlikely to have had a corporate identity for water management. Now they are encouraged, as a matter of government policy, to form a users' association.

[8] Some of this took place spontaneously after the collapse of state farms after independence from the Soviet Union. But it subsequently became a matter of government policy, supported by external donors including the World Bank.

clear and cultivate land on a share-cropping basis - a system which was changed by land reforms in the 1960s but which has left a profound legacy in the form of a highly stratified social environment, with strong patron-client relations.

Box 2: WUAs in Kyrgyzstan

Obi Haet has a 7-member WUA council, elected by a representative assembly of the farmers (1 representative per 20 ha) for a 3 year term. Day to day management is provided by a separate WUA directorate, who are paid from the irrigation service fee (ISF). The assembly approves by-laws and has power to penalise those who break the rules. In practice the *ayil okmotu* (local government) or *aksakals* (village elders) are most involved in dispute resolution. The WUA manages a contract for bulk supply with the *raivodkhoz* (irrigation agency) and pays a bulk volumetric charge for this. *Mirabs* (ditchriders) are the main agents of communication between the WUA and the users. Fee collection is good, but this has created some opportunities for dubious practices – a few people reported "*it is the elites who get water easily, those who have enough money… simple people do not get water this easily*". Nevertheless, as we report later, this WUA is more active and water is more equitably distributed here than in other study areas. The *mirab* is both active and highly respected, and the Director plays a key role.

Irrigation management in India is more centralised than in Nepal, and the reforms were promoted by central government[9] – initially driven by the need to save money. Land distribution is even more polarised than in Nepal, but the system of WUAs now promoted has much in common with the community-based approach adopted in Nepal. In both cases, social relations are strongly influenced by concepts of caste and untouchability. China by contrast has more in common with Kyrgyzstan, but increasingly favours contract models of management, giving financial incentives to managers – at least in those systems we visited in Ningxia.

We describe the structure, obligations and entitlements, and rules of the WUAs in the study areas in some detail in Chapter 6. Despite the local differences, there is a remarkable similarity in the way they are set up – perhaps reflecting the ubiquitous influence of donors and the relatively small number of people involved in advising on irrigation reforms. Certain characteristics are particularly relevant here:

- WUAs have been introduced in a top-down manner, generally as part of a project which has included a substantial construction component; and
- Institutional development activities have focused on the formation of organisations and on developing administrative and technical competence. Insufficient effort has gone into addressing social and power relationships or on strengthening the ability to design and enforce rules which will be accepted by water users. Both are needed for sustainable management, whatever form the WUA takes.

These weaknesses mean that the WUAs have had difficulties in meeting their obligations (as laid down in their constitutions and by-laws), and their performance has been dependent on the motivation, dedication and ability of the leader[10]. Actual water distribution is determined more by the relations between individual users and the WUA executives than by overall performance of the WUA as an institution[11].

[9] In our case study, by the government of the state of Andhra Pradesh, with strong encouragement from the World Bank.
[10] Kolavalli & Brewer (1999) also confirm the crucial role of strong and motivated leadership in a national review of WUAs in India, and Shah et al. (2004) describe the benefits from giving WUA managers in China strong financial incentives
[11] Here we refer to the WUA *institution* not only as an organisation, but as a set of rules and relationships. Our understanding of the word 'institution' is discussed in Chapter 2.

4 Existing systems and performance of water distribution

Water rights are often politically contentious, and entitlements to water are not rigorously defined in any of the study sites. In our sites, farmers assume that they are entitled to as much water as their crop requires and that the system should be able to supply this – they have little appreciation of the costs or constraints of achieving this. There is little concept of pre-season planning of either crops or water (with the exception of imposing some restrictions on the areas of rice[12]). Farmers see planning to be a theoretical exercise unrelated to actual distribution of water.

Nevertheless, the main system managers need some sort of plan for managing the main system. At SMIP (Nepal) the canal supplying the WUA is operated on a rotational basis with a constant discharge – but the duration of rotations may be adjusted to suit availability of water. There are inevitable variations due to rainfall, sediment, or river flows. These can be compensated for by farmers if there are sound communications from the project office to the WUAs and users.

While a reliable bulk supply to the WUA is a pre-requisite for effective water management within its command area, it is equally important that the timing of this should be predictable. We demonstrated in this study that the total volume used can be reduced if farmers know when water will arrive. We found poor communications to be a crucial weakness in all study areas during this study. In SMIP rotations are decided by the project office with little consultation, and poor communication, with the users. Although still weak, performance was much better in WUAs which had relatively good communications with the supply agency: at KIS (Nepal) a proportional share (but not the absolute quantity) between branch canals is fixed and this agreement is well-known and adhered to; and in Kyrgyzstan the contract between WUA and supply agency is (in effect) based on the previous years' actual supply.

The physical layout is another important constraint to the management system, although knowledge and understanding of the layout by water users is equally important. There was a major rehabilitation at SMIP which enabled a logical and coherent management system and should have made it easy to operate[13]. However, the strong design advantage of the system was undermined by a lack of awareness by the end users of how it was supposed to be operated. They did not understand it and disrupted it, rather than attempt to work within it. In the other sites, which were not so extensively restored, there are more mismatches between infrastructure and management – for example, in all other cases there were a large number of small outlets with few control structures on the canal, as can be seen on this photograph of a branch canal and outlet in Kyrgyzstan. Equitable water distribution under these conditions demands skills and management resources which the WUAs we studied did not have. These are constraints that the WUA must be able to address: it is

[12] There are strict and well-enforced limits in Kyrgyzstan, but crop restrictions which were recently introduced in the study area in AP are largely ignored

[13] This was designed according to the principles of "structured irrigation" (Albinson & Perry, 2002) which is intended to make operation simple and delivery of water proportionate to land area.

unrealistic for users to expect all physical problems to be resolved before a WUA takes responsibility, and water management systems need to be developed to accommodate the limitations of the infrastructure[14].

Box 3: WUA and village boundaries at SMIP

T5 serves two main villages: Sattarejhora and Hattimuda. Residents, who are mostly Yadavs (traditionally a livestock-owning caste), of Sattarejhora farm land in T5-1 and T5-2 as well as in three watercourses of T6. These are all within the same registered WUA (Sitaganj), but in 5 separate subordinate water users' groups. Hattimuda is mainly inhabited by Sahs, a separate ethnic group, and they farm land both in T5-3 and T5-4 (Sitaganj WUA), and in Shankarpur WUC. Coordination within these villages is much easier than between them, making it difficult to manage water effectively at tertiary canal level (T5). Interestingly, however, disputes between communities are said to be easier to solve than those within the same village.

Finally, the mismatch between physical layout and organisational boundaries can be a difficulty. WUA boundaries and membership do not always conform to logical hydrological units. In SMIP individual water users often operated land in a number of locations, under the jurisdiction of more than one WUA. Villages are located on high ground between canals, and cultivate land on either side of the village – it is therefore normal for WUAs to cut across rather than coincide with social boundaries. In Kyrgyzstan there are many points of transfer of management with little scope for measurement and control at these points. This makes it difficult to design hydrologically rational WUAs. However, the WUAs in Kyrgyzstan are more active than at SMIP and are better able to recognise and cope with this constraint.

Actual distribution of water at field level in the study area is managed on one of the following bases:

- *Warabandi*: a fixed time per unit area each week, regardless of crops and regardless of flow in the outlet.
- Defined order: each farmer takes water in turn for as long as they need it – the frequency of irrigation is thus related to the availability of water, but depth is according to need. This may be predetermined (eg from head to tail of an outlet as in Nepal) or negotiated between individual farmers (as in Kyrgyzstan).
- On demand – with an indenting system between farmers and ditch riders.
- *Ad hoc* – farmers take water as and when they need it, closing other outlets, cutting canal banks, or doing whatever they consider necessary to capture sufficient water.

In practice a combination of several methods is used, with different systems in different outlets or at different times.

Table S.1: Access to water at Khageri (Nepal)

Location	Percentage time fields are dry		
	Poor farmers	Medium farmers	Well-off farmers
Average of all plots			
Head	7%	8%	8%
Middle	10%	12%	14%
Tail	24%	23%	4%
Worst plot			
Head	19%	15%	10%
Middle	61%	14%	14%
Tail	30%	39%	4%

Observations during this study showed that there is increasing inequity down the system. At SMIP virtually no water reached the tail of the WUA, except at times of heavy rainfall when it was not required and was rejected by upstream farmers. Land distribution is also inequitable, with poor farmers more likely to have land at the tail. However, well-off farmers who have land at the tail of the system are able to capture a relatively good

[14] Indeed there is a strong case to be made for delaying such improvements until the WUA is well-established, so that they can plan the improvements they want. At the same time, if there is no hope of improvement in the physical condition of the system water users may simply see no point in investing effort, and resources, in the WUA. We selected schemes for this study where the physical condition did not fundamentally constrain the ability of the WUA to manage water.

supply. At KIS the worst plots managed by poor farmers were dry for 60% of the time, as compared to 14% of the time for the rich farmers' worst plots (Table S.1).

Inequity is less pronounced in Kyrgyzstan than in Nepal since the overall water supply is quite generous, tail-end lands can compensate by drainage reuse or illicit access to other canals, and a standard area of land has recently been distributed to each person. Access to water here is more related to relations between farmers and the WUA, than to location or well-being.

In SRSP (AP, India) poor farmers were also concentrated at the tail of the study area, but as in Kyrgyzstan, access was compensated for, to some extent, by drainage flows as well as by direct pumping from the canals. Still, relatively better off farmers were in a better position to use these options than the poor.

Existing systems for water management are described in Chapter 7, and the resulting water distribution is analysed in Chapter 8.

5 Livelihoods and water management

The assets and livelihood strategies of different well-being groups have an important influence on water distribution. Access to resources other than water is highly polarised in our study sites: indeed access to land in Nepal and India is a proxy for wealth. Poor farmers have less land, in worse locations, and under less secure tenancy conditions. They are also less likely to own tractors or livestock for ploughing, and are more dependent on hiring equipment from others. As we have noted earlier, land distribution is more equal in Kyrgyzstan.

While irrigated agriculture is a critical component of rural livelihoods in the study countries, it is not the only source of income. Off-farm occupations are also important for many. This means that many water users must allocate their time between cropping activities, including water distribution and associated activities - such as the demands of WUA membership[15] - and these off-farm occupations. The way they manage water is guided by their access to information about when and how much water will be available to them, and their level of technical knowledge. Furthermore, their willingness and ability to influence water distribution are constrained by social and political factors. These factors included their relations with other water users, their social status, their political influence, and their vulnerability to the actions of others who are more powerful than they are. We found that while many water users observed that water distribution rules were flagrantly being broken, they were reluctant to do anything about it. They did not want to 'rock the boat' with their neighbours, or feared some form of retribution, perhaps from a landlord or otherwise socially powerful person.

The way people combine agriculture with other income earning activities depends on their well-being and location: more than 50% of people in our Kyrgyzstan sites needed to work outside their farm, regardless of well-being. This was particularly the case in Jany Aryk where land holdings are extremely small and there are a wide range of casual and permanent employment opportunities in the adjacent town. The situation is more polarised in Nepal, where barely 50% of poor farmers can survive from irrigated agriculture, as compared to 100% of rich farmers who are able to do so. However, the more wealthy and better educated may choose to rent their land to others so that they can undertake more profitable jobs or businesses. While the wealthy and better educated land owners are in a better

[15] Water users are often expected to contribute labour to maintain irrigation infrastructure. Attendance at WUA meetings also requires an investment in time.

position to get information and manage their access to water, they do not always pass these advantages on to their tenants – who are the ones who actually need the information and use the water.

The nature of these alternative activities and the relationships between the stakeholders in irrigated agriculture are critical for water management. Off-farm demands make it difficult for water users to cope with erratic and unpredictable water flows to their field. These demands also often mean that there are fewer opportunities to make in-field contact with their farm neighbours; this may reduce both the opportunities and the incentives to cooperate and agree on water distribution rules. This is particularly true of Kyrgyzstan, where land has only recently been allocated to individuals – who have not yet been able to form strong social relations with their neighbours in the field. Unpredictability of water supply, the need to fit irrigation in with other activities and weak ties with other water users all make for an individualistic and opportunistic approach to accessing water. This contributes to a downward spiral of deteriorating water distribution.

Box 4: Sources of income at Khageri

67% work outside the village to supplement farm income, but the nature of this is very variable, and depends on the well-being of the farmer.

Whereas 78% of poor people working outside the village are in unskilled casual jobs, only 4% of medium farmers and no well-off farmers work in such jobs outside the village.

Of those who are unable to own or rent sufficient land in the village and who choose to rent outside the village 80% are poor and 20% are medium. It is much easier for medium farmers to rent good land nearby their house as they can convince the landlord that they can afford the inputs needed for a good crop.

Poor farmers find it more difficult to negotiate good terms for renting land: 35% of poor farmers as compared to just 12% of medium tenants are obliged to rent land on the relatively unfavourable fixed contract terms, rather than as sharecroppers.

Poor farmers have less control over when they can be on their land, making them more dependent on a predictable timing, yet they have weaker relationships with the WUA.

As noted earlier, all well-being groups stress the value of reliable and predictable supply of water – even if this means they receive less water in total. This is most critical to poor farmers who are more likely to depend on casual labour or to have little flexibility over the time that they can return to work on the land. They are less able to influence the timing of supply to suit their individual needs, to obtain information on when water will be available to them, or to get local people to guard their share or irrigate their fields if they need to work away from the village.

While reliable and predictable water deliveries are necessary, they are not sufficient for improved water distribution. As we mention in Section 4, another factor is water users' understanding of the way the system is supposed to be managed, and knowledge of how they can make the best use of water in their fields. Thus water users' human resources must also be considered, both in terms of basic literacy and in terms of technical knowledge about what can be expected from the physical infrastructure, how it needs to be maintained, and about on-farm water management appropriate for different crops. Yet as we discuss in Chapter 5, although the need for technical training of farmers is often recognised in programmes to promote WUAs, our observation was that the level of implementation of information and training was inadequate and was mainly given to executive members of the WUAs.

We found that in Kyrgyzstan educational standards are extremely high (verging on 100% literacy), although poor farmers are more likely to be illiterate. However, what was more critical than basic literacy was inadequate crop husbandry knowledge – particularly how to make the most efficient use of the water available. Also, limitations in water users' knowledge about the role of the WUA and of water users' relationship and responsibilities to the WUA made for unrealistic expectations of the service the WUA could provide, without greater cooperation from the users.

Literacy was far more of an issue in India (where only 8% of marginal farmers in the study area are literate) and Nepal (65% literacy amongst the poor at KIS, and 25% at SMIP). Here the method of communication, using channels that do not depend on the ability to read notices, etc, becomes important. But we found that reliance on word of mouth tended to mean that only those with good connections with influential WUA members got information. It is not surprising that the poorer water users and those who are socially marginal, such as women and absentee sharecroppers and tenants, have less knowledge of how the WUA should operate, what their own role in irrigation management is, or how to make best use of limited water supplies.

Finally, reliability and predictability of water supply to the field depends on the willingness of upstream water users to allow water to flow according to agreed rules[16], and not to interfere with the flow in an *ad hoc* and undisciplined way. In all of our study sites water users complained about the indiscipline of others, but they felt unable to do anything about it. They looked to ‘someone else’ to provide the leadership to make and enforce rules. In SMIP (Nepal) and SRSP (AP – India) they had little confidence in the leadership offered by the WUA. In KIS (Nepal) and in our sites in Kyrgyzstan they had more confidence, but still had reservations about the WUA’s ability to prevent water theft by the influential.

A strategy to improve the way water is distributed must take into account the options available and choices made by different categories of water users, and we explore these in Chapter 5.

6 Progress achieved on case studies: diagnosis and improvement

We worked in five projects in three countries to understand the range of problems and develop guidelines which would be comprehensive as well as practicable. We intervened to improve water management in two of them (SMIP in Nepal and Obi Haet in Kyrgyzstan).

For our work we developed a participatory diagnostic process which aimed to facilitate better engagement between water users and the WUA. This helped them (and us) to monitor existing performance and to understand the technical, social and institutional problems. Using this information they were able to develop action plans to solve these problems. The nature of participation by users in WUAs varies according to the type and history of the WUA. The actions that they proposed to take are briefly summarised in Table S.2 and discussed further in Chapter 9 of this report.

At SMIP, the water users prepared and implemented an action plan for maintaining canals, removing illegal structures, monitoring canal operation and ensuring the correct supply to the tails of canals, developing rules for distributing water, monitoring compliance with all rules and penalising defaulters. This involved an intense process of discussion and negotiation amongst the users and with the WUA. It built on our experiences in running water users’ schools which helped to build good relations

[16] In Chapter 2 we discuss the distinction between formal and informal rules and how these are reflected in the way that water is distributed in practice.

between users and the WUA in the previous season[17]. The planning and implementation of improvements to water distribution were made possible by following this coherent and comprehensive process. These methods are described in more detail in Chapter 9.

The first step in implementation was to improve standards of maintenance, as illustrated in these 'before' and 'after' pictures of tertiary canal maintenance. This enabled the WUA to proceed with the more tricky issues of illegal outlets and then the implementation of rules for water distribution.

The outcome of this was to help the WUA to make a marked improvement in access to water amongst disadvantaged users at SMIP in Nepal. Before the start of this study, the last two tertiary canals (which serve 30% of the area) received less than 10% of the water entering the WUA command – even though the WUA as a whole received more than its entitlement. Most of this already inadequate supply arrived late in the season when they did not want water. By contrast, at the end of the study (2004), these two canals received the 30% they were entitled to and this was spread as required through the season. This improvement was reflected downstream in the supply from the tertiary canal to water courses and to the end users.

This better distribution was achieved by making use of water that was previously wasted, rather than by taking water from others. This is important for the sustainability of the changes: few farmers will willingly give up scarce water supplies, and we emphasised measures that would benefit everyone. We stressed that irrigation need not be a 'zero-sum' game: everyone benefits from a well-managed system[18]. The WUA developed rules for operation and maintenance of all levels of canals, from sub-secondary down to the field, as outlined in Box 5. They also introduced systems for monitoring compliance with these rules, and penalties for defaulters – which were enforced rigorously.

WUAs did not find direct flow measurements within their areas of responsibility to be of much value, except for monitoring division of flow between relatively large canals. This is because of complexities of measurement and the wide range and nature of unmeasured and uncontrolled inflows and outflows. They were able to develop and

Box 5: New water distribution rules at SMIP

Sub-secondary canals: standard rotation between sub-secondary canals (931 l/sec, for 4 days in 8 except at times of shortage) replaced by a variable rotation managed by the higher tier of WUA, with reliable communications down to end-users

Tertiary canals: users became aware of and agreed with the design principles, and WUA enforced the existing rules which permitted no direct offtakes or other interventions in the tertiary canals

Watercourses: illegal outlets to be eliminated, with field channels to be dug where needed to ensure access to fields. Order of irrigation for land preparation and transplantation to be negotiated by WUA and users at start of season, with water for transplanting taking priority over irrigation of earlier transplanted crops (except that irrigation in the afternoon will be permitted to prevent damage to crops). Once transplanted, irrigation will be in a defined order (rosters for this have been prepared) except at times of shortage when the same order will be followed but farmers will be limited to a specific number of hours per unit area (duration varies according to watercourse: 4.5 hours/hectare in WC-2).

[17] under KaR R8023 (Mott MacDonald, 2003)

[18] It will not always be possible to distribute water more fairly while maintaining the existing level of supply to those who had a previous advantage. However, as listed below, the benefits can also take the form of a more reliable supply, less effort required to guard supplies, or less social tension and conflict with other water users. Reduced social tension may become particularly important in conditions of social unrest and militancy.

implement effective rules for monitoring flows through proxy indicators of time or depth, but even these are difficult and were only required at times of shortage. Improved skills in water management, such as ensuring adequate stream size and defining rotations, made it easier to design and monitor such proxy measures on a trusted and equitable basis. Strong WUAs are also able to improve standards of maintenance and control 'illegal activities such as informal checks and bank cuts: these are a pre-requisite for improved water management.

Box 6: Some achievements at SMIP in Nepal

In 2004, 100% of the design discharge was supplied to the head of the WUA, and the tail watercourses also received 100% of the design discharge. By contrast in 2002, 125% of the design was supplied at the head, but virtually none reached the tail. As a result of these projects, they used less water overall, and tail-end farmers had a much better supply.

Four illegal outlets from the sub-secondary canal were closed, and two open cuts replaced by small pipes, resulting in more water reaching the tail of the canal.

Tulsi Devi Magar, a widow at SMIP reported that *"there were fewer conflicts, less fights, no need to wait in field, no fear of snake bite as one can go to field with a torch this year"*.

The water users saw several benefits following on from this:

- Crop productivity - SMIP is a supplementary irrigation scheme, so most people can get an adequate yield in most years, but those at the tail who have very unreliable supplies do suffer from low yields. These farmers (on the social and physical margins of the system) were particularly appreciative of the improved supplies.
- Time saving – avoiding time wasted on unproductive activities such as guarding one's own supply, removing blockages and illegal outlets upstream; or extra time spent in the field due to uncertainty over when water will reach one's field, or because of a very low flow rate.
- Better social relations – an awareness and understanding of the role of the WUA and a growing willingness to participate in it, recognition of the challenges faced by the leaders, and better relations with neighbours with fewer unresolved conflicts, thereby encouraging cooperation in other activities.

We worked in Obi Haet in the Kyrgyz Republic for a single season[19] so there was little time to identify and implement measures for improving water management. Here the measures focused on improved communication and coordination, so that farmers knew which outlets were entitled to water and could monitor which were flowing. This simple measure – the *mirab* (ditchrider) just wrote the names of those authorised to irrigate on a centrally located blackboard each morning – had a remarkable impact. Farmers reported an immediate benefit in terms of improved relationships and reduced conflict over water.

7 How to improve water management: the approach developed in this study

While it is difficult to improve water distribution, the benefits we were able to observe are considerable. To achieve these benefits in this project we identified and adopted the following measures:

- Identify entry points – where users and WUAs are prepared to attempt improvements
- Improve the technical skills both of individual water users and of the WUA executive

[19] Cropping is only possible between April and October, and thus our field work was confined to a single season. In Nepal we were able to work through two cropping seasons and were able to draw on experiences from the previous year under R8023.

- Promote better communications between water supply agency and WUA; and between WUA and users
- Strengthen social capital and relationships – create opportunities to promote a mutuality of interest in fairer water distribution across groups, and to champion the interest of those without voice
- Promote better institutional governance – bring water users and WUA committee members together to analyse both their irrigation system and the WUA; to encourage more realistic expectations, to increase confidence in, and respect for the WUA so that it is able to adopt and enforce rules for fairer water distribution, and to improve relations with the irrigation department.[20]
- Embed the WUA in the community and build capability for change (including awareness of what they can do and the skills to do it).

Participatory social and resource mapping to understand irrigation system, problems and options for their solution

When we analysed our implementation experience we identified two further measures which we think should also be part of a strategy to improve water distribution:

- Identify the drivers for change and factors promoting the status quo, and use this to develop an intervention strategy. This should be part of an initial planning activity, but should be reviewed periodically during implementation.
- Provide long term support (at a low level) to help them to solve problems as they arise. Such long term low-level support should be budgeted for from the outset[21].

Discussing WUA activities in water users' school

Developing technical skills in water management by the WUAs was the focus of the study and we helped them develop appropriate procedures and rules for this, and indictors for monitoring achievements. This was, however, only possible as part of the coherent, integrated approach outlined above. Guidelines derived from our case studies are presented in Chapter 12 of this report and outlined here, using one of our case study sites (SMIP) as an example.

The WUA in our study site at SMIP was set up a decade ago and clearly demonstrates the pitfalls of failing to make sufficient effort from the outset to "embed" the WUAs socially. For a variety of reasons WUA committee members are seen to be ineffective or corrupt, and the performance of the WUA committees has eroded the relationship between water users and the WUA, and social relationships amongst farmers.

[20] We did not study the broader question of irrigation financing and water charges, which is well-covered in HR Wallingford (2004) (R8027), but we did focus on measures that the WUA is able to finance and ensured that they designed sustainable financing mechanisms for every action they took. In this way we helped to reverse a downward spiral of poor water distribution, dissatisfaction with the irrigation service, unwillingness to pay water charges, insufficient funds for infrastructure operation and maintenance, uninterested or discouraged WUA executives – poor water distribution, etc.

[21] As an action research project our work was constrained to a very limited time frame. By linking our work with a previous research project, R8023, in Nepal we were able to see the benefits of a longer intervention. But at the end of our work we still saw the need for additional low level support – which was outside the scope of our research aims and resources.

Our presence here was spread over two years. The first year was part of a separate project. Activities during this year included a rapid participatory planning study followed by a water users' school (WUS) which was conducted over the course of one cropping season (Season 1). The WUS was needed to recover from a situation in which the users had lost all confidence in the WUA, and to develop new links between users and the WUA. All categories of users[22] were engaged in the programme to varying degrees. At the end of this programme water users had a good understanding of the irrigation system and its constraints; they recognised their role in its management; they identified key gaps and problems. They were able to resolve some problems and were prepared to participate actively in tackling others in the future.

In the second year we implemented a second one season-long programme under this project (Season 2). In Season 2 we focused specifically on measures needed to improve water management: better coordination and communications with the main system managers; control of illegal activities in canals and outlets; improved maintenance; and introduction of systematic field level operating rules – as outlined briefly above in Box 5. Considerable progress was achieved by the end of the season. But it was in the course of the irrigation season that the agreement and initiation of concrete actions took place. This meant that some tasks still remained to be completed. For example, while people were reluctant to give up land for construction of temporary field channels once they had transplanted paddy, they were willing to do so before the start of the coming season. It was only once they had started to implement improved procedures that they were able to see both the benefits and difficulties and to start coping with practical issues such as methods of monitoring flows, managing data, allowing for multiple sources and uses of water, and so on. Designing and implementing appropriate rules takes time, requiring extensive consultation and communication as well as good understanding of the technical requirements.

At the conclusion of our field work it was evident that water users still needed a third season of support (Season 3) to address outstanding technical, social and institutional issues and to put measures which were initiated in the second season on a stronger, and more sustainable, footing. Considering technical elements, this would include helping the WUA committee members to work with volunteer farmer water monitors and water users to prepare pre-season plans more systematically. Socially, more time was needed to control some illegal actions and to agree suitable alternatives with the farmers who have taken them. Additional support for the institutional element could encourage follow through with activating the various tiers of the WUA, including the formalisation of a key sub-committee. The WUA committee members could be helped, with training and technical backstopping, to work more effectively with water users and to provide water users with the leadership not only for water distribution, but also maintenance, which they clearly wish for.

Discussions around furrow irrigation at the tail of Obu Haet (Kyrgyzstan)

[22] Including all well-being categories (rich, medium and poor), landlords, owner-farmers, unofficial tenants, agricultural labourers and landless water users. Both 'ordinary' farmers and executive members of the WUA were involved.

This experience indicates that three seasons of relatively intensive support spread over two to three years is needed to revitalise a WUA and to introduce effective operating systems. It should be noted that this depends entirely on 'software' improvements – no construction or infrastructure development was involved. Maintenance standards were improved, but this was achieved by the WUA and using their own resources. After the third season a much lower level of background support, with periodic visits and specialist consultancy on call, would be needed in the longer term. This would help to ensure that progress is sustained, and that the WUA committees receive the advice they need to help them solve problems as they emerge.

Illegal outlet at SMIP, later replaced by irrigation through field channel from legal outlets

This programme was implemented through a local NGO, with support from a national NGO and the Department of Irrigation as well as from the international team on this project. The role of our teams was important not only for their technical capacity, but also for their explicit aim of highlighting and championing the interests of those who have suffered from existing water distribution – particularly the poor and marginalised whose interests have tended to be neglected. Thus the findings of our study are relevant not only to strategies to improve water distribution in particular, but also to the way the 'institutional development' of WUAs has been promoted. While the creation of new formal associations of water users has been emphasised[23] in the past, there has often been insufficient effort to make sure that the water management institution genuinely responds to the needs, and constraints of all water users, including the poor and marginalised. Without champions these groups are often unable to influence the performance of the WUA. We have shown that it is unrealistic to assume that WUAs will naturally operate according to principles of good governance, democracy and equity even if formal laws, regulations and constitutions are supportive. These are important conditions, but we have seen in our study areas that they have not been sufficient. To be more realistic, a strategy to improve management of irrigation should include an analysis of the drivers of change, as well as the factors and interests that obstruct change, at all levels from the field to the macro. It is then necessary to identify and support the catalysts and champions which will promote institutional development according to the principles that are aspired to.

Extending our approach will depend on the resources and capacity of suitable 'champions'. These will often be local NGOs, and a considerable part of our effort on this project and its predecessor was devoted to building this capacity. Once this local capacity for institutional development has been established we estimate the cost of the WUA strengthening programme to be around $75 per ha: a small proportion of the typical physical rehabilitation cost of over $1,000 per hectare. The process will be quicker if the WUA has been newly formed and is still enthusiastic, where there is no need to recover from a sense of frustration and failure. Such WUAs provide an opportunity which should be grasped while it is still available: this study has revealed the scope for improvements and practical methods for achieving them.

[23] The development of new associations has sometimes been equated with the formation of 'social capital'. As we discuss in Chapter 2, we think this use of the concept of 'social capital' is too narrow and results in a misplaced emphasis on the formation of formal organisations. This neglects wider 'social capital' considerations of how to achieve greater fairness in rules and in actual behaviour.

8 Conclusions

The emphasis in this project was on how to help water users' associations to develop improved procedures for distributing water to farmers' fields, and to show that this would have a beneficial impact on the livelihoods of the poor.

We have outlined in this report the systematic process we adopted for strengthening local institutions, for improving their co-ordination with external water supply agencies, and for helping them improve the distribution of water and thereby reduce losseas and wastage of water. We have not prejudged how the water users should want water to be shared, but enabled a social and political dialogue amongst all classes of stakeholder (including women and poor farmers as well as the rich male farmers and landlords who traditionally dominate WUAs) on the nature of a 'fair' distribution and how the WUA can achieve this. We conclude the report by summarising the achievements of this study in terms of improved water distribution and livelihoods on sample projects.

We have shown that it is not effective to address water distribution in isolation – technical, social, institutional, and policy conditions which affect water distribution must all be considered. Thus there are four 'key ingredients' required to improve irrigation water management:

- Improved technical and management procedures, designed by
- Well informed, involved stakeholders, and implemented by
- A strong, 'embedded' and respected local institution, working within
- An appropriate external environment, which gives WUAs the necessary authority and support, and assures them of a predictable water supply.

Table S.2: Actions proposed for improving water management in the case study sites

<table>
<tr><th colspan="2">Intervention</th><th>KIS</th><th>SMIP</th><th>OH</th><th>JA</th></tr>
<tr><td>Institutional reform</td><td>Engagement with users</td><td>Improve confidence that rules will be enforced fairly and consistently</td><td>Strengthen process of engagement started previously through a programme of water users' schools</td><td colspan="2">Engage with users and WUA to build willingness to comply with rules and penalties: use of 'act' against defaulters</td></tr>
<tr><td rowspan="3">Organi-sational: structure and staffing of WUA</td><td rowspan="3">Awareness (and definition, if needed) of roles, responsibilities, willingness to discharge responsibilities</td><td>Initiate representation of Kaparkhori on WUA</td><td>Revitalise WUC and improving communications</td><td colspan="2">Create awareness of the role and responsibilities of WUA, GA and users</td></tr>
<tr><td>Improve representation on WUA</td><td>Stimulate greater involvement by WUA management</td><td></td><td>Stimulate greater involvement by WUA management</td></tr>
<tr><td>Employ seasonal dhalpa</td><td>Employ seasonal dhalpa or farmer-monitors</td><td>Employ part time mirab at critical times</td><td>Improve performance of mirab</td></tr>
<tr><td rowspan="2">Commun-ications</td><td>Communications within WUA and with service provider</td><td>Improve communications between WUA and sub-committees</td><td>Improve comm.-unications between users, WUA and project office</td><td></td><td></td></tr>
<tr><td>Communications between WUA and users</td><td>Communications of decisions and aware-ness of main canal operating systems</td><td>Agreement and awareness of water delivery schedule</td><td>Publicise names of those authorised to irrigate each day</td><td>Introduce coupon system, and publish names of authorised to irrigate each day</td></tr>
<tr><td rowspan="2">Maint-enance</td><td>Establish and implement rules for maintenance, and finances</td><td>Improved systems for timely maintenance of key components of main system.</td><td>Develop rules for mobilising resources and implementing maintenance</td><td colspan="2">Introduce systems for regular maintenance of inter-farm canal by WUA and outlet channels by user</td></tr>
<tr><td>Reduce need for and opportunities for water theft</td><td></td><td>Remove illegal outlets and dig field channels from legal outlets</td><td></td><td></td></tr>
<tr><td rowspan="4">Operation</td><td rowspan="4">Implement systematic procedures for operation of canals and structures</td><td>Introduce systematic operating rules for Kaparkhori outlets: coordinate operation of KK and LMC</td><td>Introduce flexible operating system for sub-secondary canals</td><td></td><td></td></tr>
<tr><td>Establish target water levels in LMC</td><td></td><td>Coordinate rice and cotton irrigation</td><td></td></tr>
<tr><td>Improved rules and procedures for rotati-onal operation of BC1</td><td>Agree principles for managing water (systems /situations)</td><td>Agree principles for managing water to outlets</td><td>Agree principles for managing inter-farm canal, and outlets</td></tr>
<tr><td>Improve water sharing within large outlets at times of shortage: detailed rules for critical times: indicators for time, depth and duration</td><td>Develop rosters for irrigation, order of irrigation, and indicators of target depth to apply as agreed above</td><td colspan="2">coordination between users within outlet to irrigate in a logical sequence and to close outlets at the end of irrigation. Provide technical advice on optimal water management techniques, especially cotton</td></tr>
</table>

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Chapters and Appendices

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
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

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)

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

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

SAGUN: Strengthened actions for governance in utilisation of natural resources project (Nepal)

SC: Scheduled Castes (India)

SEAGA: Socio Economic and Gender Analysis

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)

USAID: United States Agency for International Development

WB: World Bank

WC: Water course (Nepal)

WID: Weining Irrigation District (China)

WRA: Water Resources Act (Nepal)

WRR: Water Resources Regulations (Nepal)

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)

1 Introduction

1.1 Background

Irrigation systems are designed to ensure that farmers get a reliable supply of water for their crops. Substantial investments in irrigation during the latter part of the 20th Century were made with this aim in mind, and the performance of these investments is documented in an extensive literature. Unfortunately many of these studies show that despite experience with irrigation in various parts of the world for 8,000 years, modern systems have often failed to fulfil their aim (Chambers, 1988 provides a powerful summary which is unfortunately still largely true almost 20 years later). Many farmers on these irrigation schemes do not experience a predictable and timely supply of water, and this has adverse consequences for the benefits they are able to derive from the investments. Since an important justification for many of these projects has been their anticipated contribution to reducing poverty, the effect of this disappointing performance on the poor is a pertinent consideration.

Often the reasons for this unsatisfactory performance can be found in issues of water sector policy and funding. In recent years there have been a number of major efforts to reform the irrigation sector, and more recently the water sector as a whole, in an attempt to address some of these problems - both to reduce expenditure by the government and simultaneously to improve the performance of the schemes (see for example Oblitas and Peter, 1999; Vermillion, 1997). A major thrust of the reforms has been to establish local water users' associations (WUAs) and to devolve management responsibilities to them. Amongst their many functions, these new organisations are assumed to be willing and able to distribute water in an equitable manner, and to be able to do so better than the government was able to before. Rather curiously, there are few studies which examine whether water users' associations are actually able to achieve this.

This study therefore focuses on a problem which is generally inadequately addressed – the way irrigation water is distributed at the local level. In doing so, we consider the technical and managerial aspects of water distribution, but we also look beyond these to examine the social and institutional relationships that shape access to irrigation supplies by different categories of water users in different parts of the system. The study aims to identify the problems and then test measures that will help water users themselves to bring about a more fair distribution of water – and improve the contribution that irrigation can make to reducing poverty.

A critical problem for management of irrigation, particularly in medium and large schemes (over, say 500-1000 ha), is that there are so many stakeholders; a single project typically serving many thousand farmers. Poor farmers have small holdings, often in remote corners of the system, and frequently find it difficult to access water or to assert their rights. In the past it was common for government to manage irrigation on such schemes entirely by itself and to attempt to deliver water to each individual farmer. This approach was not often successful, and in practice strong farmers were able to take water when they wanted and weaker farmers were neglected. The problems were compounded by under-funding and deteriorating infrastructure. For these and other reasons, a more 'participatory' approach is now generally recommended and many of these management tasks are now devolved to WUAs, as described in Chapter 2. These approaches aim to be more inclusive and to ensure that schemes are managed by people who have a direct stake in them.

Underlying this participatory approach are bold assumptions about the inherent ability of 'community'-based management to achieve improved irrigation service performance, including distributing water equitably. These assumptions are based on observations of the good performance attributed to some indigenous farmer-managed irrigation schemes (Ostrom 1992) and on intensive pilot studies such as Gal Oya in Sri Lanka (Uphoff, 1992). Improved water distribution has indeed been achieved on some schemes following irrigation management transfer, particularly at the higher levels of the system. But this is often a result of better maintenance made possible by recent infrastructure improvements, as well as the simple fact that there is now an organisation directly interested in canal operation at a local level. Slightly better communications between main system managers and the local organisation may also have contributed. However, the apparent successes have not been widely replicated: correspondingly good results have not been achieved in subsequent projects (Mott MacDonald, 2002). Furthermore, a review of the evidence used to support the positive impacts of irrigation management transfer found weaknesses in the way the information was collected and reported (Vermillion, 1997).

At lower levels of the system WUAs generally have been given the formal responsibility for managing water distribution amongst their members. But while supplies from the main system to WUAs are often monitored accurately[1], little attention has been given to the management and monitoring of water distribution within the command area managed by the local water users' associations. It has simply been assumed that the WUA will find its own ways to manage internal distribution so as to meet the needs of all farmers in its area. In practice, the procedures which WUAs follow for water management are often crude, so that farmers obtain water in a fairly arbitrary order and unpredictable quantity. The ability of the WUA to enforce rules is still in question – particularly where it requires the elite farmers to restrict their own water use. Recurrent observations of inequity in water distribution between those at the head and those at the tail of the system show that the assumption that WUAs will meet the needs of all farmers is often not valid: poor internal water management makes water distribution inequitable, and disputes are common. Not surprisingly, concern has been expressed that elite farmers may capture a disproportionate share of water in this situation, and livelihoods suffer (Mott MacDonald, 2002).

1.2 Objectives and General Approach for the Study

Our aim in this study was to identify and test methods to improve access to water, particularly for poor farmers on large-scale irrigation projects. A number of technical, social and institutional factors make equitable water management difficult. We tried to understand these factors in representative case studies, and then to elucidate how, and to what extent WUAs can actually ensure an equitable supply of water to all users. This was implemented over one calendar year (2004) in the Kyrgyz Republic, India and Nepal[2], on a small number of irrigation schemes which were originally government-managed but where the responsibilities for water distribution at a local level have now been devolved to user organisations.

We embarked on our research with the view that improved technical procedures, with enabling local institutions, will create conditions for water to be shared more equitably. But we considered that local level improvements would only be possible within an appropriate external policy environment which gives WUAs the necessary authority and support and assures them of a predictable water supply.

[1] The WUAs may be charged according to the actual volume of water used – in fact the ability to charge WUAs by volume of water used has provided a major impetus for this monitoring.

[2] We also drew on experience with WUAs in China, largely compiled from a review of secondary data but supported by a very limited field investigation

Within our study programme we were not in a position to address the policy environment, or the water supply to the WUA. We therefore aimed to select case study sites where we felt a supportive external environment was in place and where water supply made it possible for the WUA to manage irrigation in accordance with rules.

We could then concentrate on addressing the technical expertise and social and institutional relationships needed to design and implement workable and equitable rules at the local level. In doing so we recognised that under the social and power relationships that are likely to prevail, it would be necessary to give due attention to the likely effect of any proposed changes on the interests of those who are better off and influential, who might otherwise subvert the programme, as well as on the livelihoods of the poor.

On our sample projects we developed and tested a process which we hoped would provide a basis for establishing effective procedures elsewhere. The steps in this process can be summarised as:

- Enable water users to evaluate for themselves the consequences of the way water is managed for the whole community of water users. This means working with them to identify practical ways to monitor and analyse water flow to all who have a justifiable claim on it.
- Enable water users to make a judgement about the fairness of these consequences for all stakeholders (including those whose interests have been overlooked in the past).
- Enable a social and political dialogue amongst the full range of stakeholders on the importance of 'fairness' and on the effort that they are willing to make to achieve it.
- Identify the rules, procedures and sanctions to achieve a fair distribution. The power of enforcement will lie at various levels, from the direct users, through various institutions, such as the WUA, government (local and central), and the judiciary. The more the users have been involved in developing and approving the rules, the more likely they are to be observed, and the less reliance there will have to be on outside enforcement.
- Implement rules, procedures and sanctions. Ideally this will take place in an atmosphere of general acceptance of these rules, etc.
- Modify the rules, procedures and sanctions in the light of experience (within what is recognised to be a dynamic balance of power and interests).
- Identify, and address, organisational, policy, and other factors, including those which are external to the WUA itself, which affect the way that water is distributed.

This list of steps presumes that a suitably motivated and oriented 'champion' of equitable water distribution could be identified to implement them. In our case, our study teams took on the role of 'champion'. In other cases the identification of who will be the most effective champion will depend on the particular social and institutional context of the irrigation system. It may be the WUA, the ID, an NGO, or some other 'actor' with an interest in the water distribution issue. As will be discussed in the section on 'drivers of change' in Chapter 2, and in our conclusions in Chapter 11, the identification of an effective champion, and a realistic time frame, will be very important for the likelihood that these steps will result in more equitable water distribution.

There are many different types of irrigation system, and water distribution in each system is shaped by its specific historical, cultural and social characteristics. So it is not possible to identify standard solutions. However, through working in a number of case studies, we aimed to establish a common, systematic approach and procedures to develop methods suitable for each particular circumstance.

1.3 Structure of the report

This report synthesises the findings from several case studies, and is structured as follows:

- Summary
- Introduction and background
    - Introduction (Chapter 1)
    - Statement of the problem – background to water users' associations in the study countries, understanding the relationship between access to water and livelihoods, the problems caused by inadequate water management, and technical, conceptual, and methodological issues to be considered when addressing these problems (Chapter 2)
    - Methods – selection of study sites and description of the methods we followed during the study (Chapter 3)
    - Overview of case study sites – natural resources, infrastructure, social context and institutional arrangements (Chapter 4)
- Analysis of case studies
    - Relation between livelihoods and irrigation management (Chapter 5)
    - Management arrangements - implementation and performance, and the relationships between water users and water users' associations (Chapter 6)
    - Water distributions systems (Chapter 7) and the achievements in equitable distribution (Chapter 8)
    - Processes adopted for improving access to water in this project (Chapter 9)
    - Outcomes of the study : implications for reducing poverty through improved water management (Chapter 10)
- Synthesis of findings
    - Summary of findings and outline of recommended approach (Chapter 11)
    - Practical measures to promote equitable and suatainable management (Chapter 12)

Appendices provide further details of the study, as follows

- Logical framework for the study (Appendix A)
- Irrigation management reform in China: a review of progress with WUAs (Appendix B)
- Legal and policy background to water management in Nepal (Appendix C)
- Development and performance of WUAs in Ningxia Province, China (Appendix D)
- Quantitative data on water distribution in study sites in Nepal and Kyrgyzstan (Appendix E)
- Livelihoods – supporting data (Appendix F)
- WUA action plans, minutes and reports (Appendix G)

In addition, a volume of guidelines, summarising our recommended approach, and incorportating the summary and conclusions of this report are published separately

2 The problem: unfair distribution of water on large irrigation systems

2.1 Introduction

In this chapter we review the literature to consider the practical and conceptual issues associated with our study objectives – more equitable management of irrigation to reduce poverty. Our focus is on our four study countries – Nepal, India, Kyrgyz Republic and China – which were selected in order to provide a wide range of irrigation systems from which we hoped to learn lessons which could be applied widely[3].

We first review the measures which have been adopted to reform the irrigation sector in general and to improve water management in particular (section 2.2). The nature of the reforms and the way they are implemented has a substantial impact on whether they lead to an improvement in water management, and thus it is important to understand the wider contect. In the next section we focus on the specific technical and management procedures for controlling and monitoring water flows (section 2.3).

These institutional reforms and new procedures have, in the past, been the primary focus in attempts to understand water distribution problems and identify solutions. However, we have broadened our investigations to include considerations of livelihoods since irrigated agriculture is just one aspect of people's livelihood strategies Thus we follow the discussion of institutional reforms by an examination of the implications of water distribution practices for farm livelihoods – particularly for the livelihoods of the poor (section 2.4).

This then leads into a discussion of the concepts and methods we used to address social and institutional aspects of water distribution (section 2.5). In this discussion we consider the application of elements of the Sustainable Livelihoods Approach (SLA), the meaning of 'equity' or 'fairness', and the institutional requirements for promoting a more 'equitable' or 'fair' distribution of water. We incorporate the analysis of 'Drivers of Change' (DOC) as an approach which can be helpful to identify measures to move water distribution to become fairer than it is. We discuss the value and pitfalls of using 'participatory' methods as a way of engaging with different categories of water users.

Finally we conclude by summarising key lessons from the literature (section 2.6) with a statement of the premise which has guided our research into how to achieve greater equity in water distribution (section 2.7)

2.2 Irrigation reforms and participatory irrigation management

2.2.1 Introduction

This section provides an overview to the irrigation reforms in the study countries, seting them in the wider context of water sector reform leading on to the history of WUA formation, and specific measures to improve water management by WUAs.

[3] The selection process and the activities in each country is described in Chapter 3. Most field work was done in Nepal and Kyrgyz Republic, but we also undertook an extensive survey of one WUA in Andhra Pradesh (India). We relied mainly on secondary data for China.

Water sector reforms (section 2.2.2), have been stimulated by the growing stress on water resources, and the poor performance of previous water management systems for ensuring sustainable access to water of adequate quality. This has included programmes to introduce local management of irrigation, which have made some progress but has proved to be more complex and difficult than was initially assumed and requires further effort and support to make it sustainable. The study countries have different backgrounds and have followed slightly different approaches, but their experiences and common interests suggest that there is considerable benefit to be gained by synthesizing this experience. One key lesson is the need for high level support, requiring political commitment and the support of the water bureaucracy. There is a need to reform but there can be strong resistance to change at this level.

We then outline the history of WUA formation in the study countries (section 2.2.3). The early stages of reform were started in advance of policy formation and legislation, but new policies and laws have now been enacted in all study countries. We outline these developments in each of the study countries, leading up to the history of our case study WUAs. We have also undertaken a more comprehensive review of legislation in Nepal, which is included as Appendix C.

Finally we discuss specific measures to improve water management by WUAs in each of the study countries (section 2.2.4)

There is an extensive literature on many of these topics and in many countries, but there is a very variable coverage of the specific topic of interest in this study (water distribution at a local level) in the case study countries. In Nepal, there are a large number of donor-funded projects and a large network of national and international researchers in the field of irrigation management so that there is an extensive body of literature which we have drawn on for this study. There are, however, gaps in this literature and this review has enabled us to focus our field research on the critical gaps relating to water distribution at a local level and the impact of this on livelihoods.

In India, as in Nepal, there is a wealth of literature on many aspects of irrigation management which we have drawn on to gain an overall understanding of the reform process so that we could place our field observations in a broader context.

By contrast there is far less literature on water management in Kyrgyzstan than in India and Nepal, but we have been able to draw on key studies prepared for national level projects and then focus on our specific area of interest at a local level. There are, however, fewer objective evaluation studies available. The literature in the international domain on water sector reform and WUAs in China is far more sparse and less analytical than for the other study countries. As will be apparent below, the scale and diversity of irrigation management systems in China is also much greater. This has meant that we adopted a different approach and focused on gaining an overview of management systems from which we hope to learn lessons to be applied in the other countries. We have, however, undertaken some small local studies to supplement the literature with field observations.

2.2.2 Wider reforms – the context that WUAs operate in

(i) Background to the reforms

The performance of the irrigation sector has long been a concern. Robert Chambers (1988) described the problems of poor management and inequitable distribution of the limited supplies in graphic detail. This is mirrored in the water sector as a whole, with widespread fears of 'water wars' as the limited resource becomes over-exploited and polluted. This has led to two parallel strands of reforms: improved institutional arrangements for irrigation management; and wider water sectoral reforms with an emphasis on ensuring access to safe drinking water for all. Initially, the irrigation reforms were narrowly focused on irrigation, particularly at the local level, but more recently they have been integrated with the broader water reform process.

The water sector has been the subject of major international debate recently since demand for water frequently exceeds the quantity available, and the quality is deteriorating. Traditional forms of management are seen to be inadequate for the scale of the problem.. The 1992 International Conference on Water and the Environment in Dublin was a key step in raising the profile of the sector, and led to development of the concepts of integrated water resources management (IWRM). There have been several other major international forums – such as the four World Water Forums, the World Commission on Dams, etc. New approaches for water management and new legislation have now been introduced in many countries including all of our case study countries[4]. IWRM is now actively promoted by the Global Water Partnership[5], is widely recognised as fundamental for sustainability and is regarded as a precondition for achieving the millennium development goals[6]. From the perspective of this study, the recommendations for greater participation by end-users and devolution of responsibilities to a local level are particularly relevant.

Within this broader context, irrigation itself has been underperforming, and the central institutions responsible for managing water lack the capacity or resources to improve the situation. The common approach to resolving this problem is to devolve responsibilities to a local level, giving a greater management control to farmers: this is expected to be both more efficient and more equitable. As Groenfeldt notes,

> "*Governments cannot do everything, and there are some things that they are simply not very good at doing. Farmers who depend on irrigation water for their livelihoods have the strongest incentive to manage that water carefully. No public sector agency could ever match the discipline that farmers impose on themselves when they manage their own irrigation systems*". (Groenfeldt, 2000).

Most countries which have a significant area of irrigated agriculture have therefore embarked on a process of devolving responsibilities through processes of participatory irrigation management (PIM) and irrigation management transfer (IMT), which we will review in the following sections.

[4] Other legislation of particular note includes the EU water framework directive and the South Africa Water Law – the former for its focus on integrated water resources management and the latter for the participatory process followed in preparation of the legislation

[5] www.gwpforum.org/

[6] UN Millennium Project Task Force on Water and Sanitation, working paper (www.unmillenniumproject.org/documents/tf07apr18.pdf)

(ii) Experiences with irrigation management transfer (IMT)

We should first note that IMT is often presented as some form of panacea for solving a multitude of problems – poor performance, underfunding, deteriorating infrastructure, and so on. It is expected that "*improved quality and cost efficiency of irrigation management will result … and save money for the government as it divests itself of the responsibility to finance routine costs of operation and maintenance"* (Vermillion, 1997).These objectives are often not rigorously defined and may, at least in part, conflict with each. Farmers have a strong and direct interest in solving the problems of unreliable water delivery, whereas governments have a greater interest in reducing expenditure on O&M. The implicit expectation is that the total costs of irrigation management will be reduced so that governments can reduce their expenditure without increasing the financial burden on the farmers, whilst improving the performance of the system.

Whilst this rationale for IMT is often stated, there have been few studies to substantiate the performance of irrigation after reform, despite the widespread adoption of IMT programmes. Quantitative data on changes in water management is particularly lacking. Vermillion also reports that the research has rarely been rigorous and that most authors demonstrate a bias in favour of transfer, which makes it difficult to draw objective conclusions – we discuss aspects of his recommendations for improved research methods in Chapter 3.

Although IMT was initially expected to be easy to implement, and to yield substantial benefits which would easily be sustained as farmers realised the value of taking over management responsibilities, the reality has often been rather different. It became apparent that many farmers were more interested in the rehabilitation that is often associated with IMT and lost interest once this is complete; governments were often driven by the need to reduce expenditure; and the new institutional arrangements often proved to be weak and without a sustainable financial basis. Unfortunately there is little rigorously-researched data on the impact of IMT, which makes it difficult to draw firm conclusions, but we consider some of the evidence here.

We will first review two overall studies of IMT and then very briefly consider the Philippines and Sri Lanka where the reform process started early and has been well-studied. Vermillion (1997) provides a thorough review of the objectives with irrigation management transfer, summarises progress to that date, and gives some guidance on how to implement IMT. We will review experiences in the study countries in later sections (section (iii) below).

Most studies are conducted as part of, or soon after completion of, IMT activities - when the farmers and farmer organisations are still enthusiastic and are still being given external support. As we will discuss later, such early successes are often not sustained. There are many reasons for this, but we will just highlight three here:

- Part of the cost saving is achieved by expecting farmer representatives to manage irrigation systems for no remuneration and little incentive in the long-term;
- Infrastructure was often improved at the time of handover, as an incentive to the farmers to take responsibility for it – this means that it can be operated for a few years with little maintenance, but as no systems have been put in place or resources for repairs provided, performance has deteriorated; and
- Once success was achieved on small pilot projects, it was assumed that it would be easy to 'scale up' the methods, but these are given less support and are often more problematic to manage.

Vermillion recognises these problems and concludes by summarising six points which are now generally regarded as pre-requisites for sustainable transfer:

- A clearly recognised and sustainable water right and water service
- Infrastructure that is compatible with the water service and local management capacities
- Well-specified management functions and assignment of authority
- Effective accountability and incentives for management
- Arrangements for viable and timely conflict resolution
- Adequate resources that can be mobilised for irrigation management.

It is however, easier to state these requirements than to achieve them in practice. There is an extensive literature which describes the preconditions and requirements for establishing local organisations (eg Ostrom, 1992, Agrawal, 2001), but these reports tend to give less attention to the context within which the organisations are required to operate. As we will discuss below this wider context is critical - the long-term survival of WUAs "*has more to do with factors of local legitimacy, effective links with the government, support from the bureaucracy, and especially external investment*" as Mosse (2003 p292) reports for tank irrigation in Tamil Nadu in India. This fits well with our experience in Nepal on an earlier project (Mott MacDonald, 2004) which demonstrated the need for both strong local organisations and a supportive external institutional environment.

Most reform programmes now stress both levels of irrigation management (eg Skogerboe *et al*, 2002), although as we will see below these higher level reforms are much more difficult to implement. Some comprehensive reform programmes were successful in their early days (see for example Oblitas & Peter, 1999, regarding the programme in Andhra Pradesh and Svendsen & Nott, 2000, regarding Turkey), but may not be sustained. 'Second generation problems' (Svendsen *et al* 2000) may often emerge, which can undermine the reforms.

Another review (Shah *et al* 2002) five years later also found little evidence of sustained progress. They noted that the impact has been mixed (with, for example, increased yields in the Dominican Republic, no change in Mexico and a reduction in cropping intensity in Senegal), and that good performance in early years (for example at Kano in Nigeria, and in Bihar, India) was gradually dissipated. However, they did find some encouraging results and note that the best results were to be found in places where

> "*there is a dynamic high performing agriculture; average farm size is large enough … to operate as agri-businessmen … linkages with input supply systems and … output marketing systems are strong … and the costs of self-managed irrigation are an insignificant part of the gross value of farming*" (Shah *et al*, 2002).

These are conditions which they found to apply in Mexico, Turkey, USA and New Zealand, where Vermillion's preconditions either already existed or could be put in place. More surprisingly they found that "*many situations where IMT seems to have succeeded are also marked by highly unequal distribution of land ownership*" – such as Colombia (Ramirez and Vargas, 1999). This appears to be coincidence rather than a causative factor[7], although they note that large landholders could in theory become the champions with sufficient influence needed to make IMT succeed. The role of local champions in establishing WUAs is indeed very important, as Kolavali and Brewer (1999) also stress, and this is an issue which we will address later in this chapter.

[7] Other studies of Colombia, however, suggest that farmers do not want IMT because they fear that powerful farmers would abuse the system (Vermillion and Garces-Restrepo, 1996)

Shah *et al* conclude by stating four conditions which they have found to be necessary for successful IMT. Rather than highlighting the specific institutional requirements as Vermillion did, they focus on the need for substantial benefits from well-managed irrigation:

- It must hold out the promise of a significant net improvement in life-situations for a significant proportion of members
- The irrigation system must be central to creating such improvement
- The economic and financial cost of sustainable self-management must be an acceptably small proportion of income; and
- The proposed organisation design must have – and be seen to have – low transaction costs.

As we will discuss later (chapter 5 *et seq.),* we also found that the degree to which these conditions can be met is important for the sustainability of the reforms. Farmers are particularly intolerant of high organisational transaction costs, but they take a broad view of the benefits of irrigation – which is used for many purposes and is a source of many conflicts. Maximising agricultural production is not the only benefit, and reduction in conflicts (which can affect many other aspects of livelihoods) is seen as an important outcome of management reform.

A frequently cited reference for IMT is the Philippines, which was a pioneering country for irrigation reforms and achieved some striking successes (Korten and Siy, 1989). But these reforms focused on the local level, with the result that this IMT programme is now seen by some to have reached an impasse (Raby, 2000), and unable to progress beyond limited, local activities. Panella (2002), in his review of the situation stresses the need for an integrated and comprehensive approach. He notes that formation and training of irrigation associations (IAs) has become a proxy indicator for effective management, whereas in fact achieving such an administrative target is little related to actual management performance. Despite shared management he found that IAs have little authority or responsibility, with the result that the programme has stagnated and they have failed to develop social capital. In his view, partial reforms may exacerbate rather than solve problems and have an adverse long-term impact.

Samad has studied the global reform process from its early days, and has recently evaluated the reforms in Sri Lanka (Samad, 2005) where, as in the Philippines and in many other countries, the early reforms (in the 1980s) were aimed at the local level - to give farmers responsibility for tertiary and secondary canals, and thereby reduce the obligations of the government. Sri Lanka also had a long history of locally managed irrigation (see for example Leach, 1961 and Brohier, 1934), which provided the inspiration for much of the modern reforms (such as those at Gal Oya – Uphoff, 1992). This led to greater farmer participation in management and was an important step in the reform process (Samad & Vermillion, 1999) – these programmes were relatively successful as they involved low political risks and had built-in incentives through associated investment programmes.

Here too, however, wider reforms were seen as essential to making the local reforms effective and thus reforms in the 1990s focused at the higher level, when the government attempted to establish a new water policy and appropriate institutional structure. Despite considerable emphasis on stakeholder consultations and participation which aimed to achieve a consensus on the content of the policy, the draft policy remains highly controversial – particularly regarding sensitive issues such as water rights and the cultural value of water - and has not yet been implemented. Samad notes that the later reforms were more complex, carried higher risks and foundered in a '*hostile and ideologically charged environment*'. He concludes by stressing the '*importance of public education and political liaison both before and during the reform process'*. The process is ongoing, but the failure (in the short-term) of the macro-reforms to provide an environment which is conducive to participatory management has limited the ability and willingness of the farmers to take on a more active role. Government officers, for example, are reluctant to hand over their decision-making powers and they retain a confused role.

In conclusion, it appears that transfer of local responsibilities to farmers can have a substantial benefit in the short term but that it is difficult to sustain this without undertaking wider reforms of the water sector, and these are more controversial and politically sensitive. These reforms require the irrigation bureaucracy to change from an implementing role to a supporting role. This is seen to be professionally and financially threatening and requires new skills and attitudes as we will discuss further below (section (iv)). This in turn affects the sustainability of reforms at a local level, which are undermined by a lack of support, and a failure to embed the new institutional arrangements in the local culture.

(iii) IMT in the study countries

The study countries have very different social and political backgrounds, and this has strongly influenced the development of participatory management. WUAs in Nepal and India have been modeled on the experience of traditional farmer-managed irrigation schemes (FMIS) which often perform much better than agency-managed schemes, whereas in China and Kyrgyzstan they have been introduced to replace centralized management on state or collective farms. In both situations the challenge has been to create the social and institutional conditions for WUAs to be effective in circumstances that are significantly different from both farmer-managed schemes in Nepal and India, and centrally managed farms in China and Kyrgyzstan.

In Nepal and India, some functions previously undertaken by government agencies have been transferred to newly established WUAs – this is potentially a threat to those who undertook these tasks in the past and creates a risk of confusion over responsibilities. The situation in Kyrgyzstan and China is slightly different. In Kyrgyzstan, WUAs have been set up to take on functions previously taken on by state or co-operative farms. These large farms have been dissolved and privatised, so there is little threat to the previous managers and less confusion of roles. Communes were replaced by the houshold responsibility system in China longer ago than in the case of Kyrgyzstan, and there was a longer gap before establishment of WUAs. New village-level management arrangements were already in place before the introduction of WUAs, making them more controversial and difficult to set up.

WUA development in Nepal and India drew on the pioneering experience in the Philippines and Sri Lanka, referred to above. Modern WUAs here attempt to replicate traditional management organisations (albeit perhaps made more representative and democratic - see for example, Lam 2002, regarding Nepal), and many early attempts to introduce them focused almost exclusively on the local organisation (see for example Mollinga, 2002 regarding the programme in Gujarat). These programmes have been partly successful but were more difficult to implement than had been anticipated. The management requirements of modern irrigation are different from those on traditional schemes, and the institutional arrangements are difficult to transfer (the history of institutional arrangements is important – we will discuss this, using the concept of 'path dependence' later – section 2.5). IMT in India followed a similar pattern, but established the programme much more rapidly – with WUAs set up in the entire state of Andhra Pradesh in 1997. Both countries now recognise that WUAs need to be strong community-based organisations but that they need more support than they were given in the past. Both, however, have found it difficult to give the support needed – a new Government in AP has new priorities, and the political crisis in Nepal has considerably reduced the government's ability to assist WUAs – and there is not yet a consensus on how this should best be given. A recent review of the programme in AP (Reddy and Reddy 2005) found that despite all the effort put into the IMT programme, most effort was devoted to infrastructure rather than institutions.

WUA development in China and Kyrgyzstan, developed from a very different background, but also drew on the experience of WUAs in South and South-east Asia, and adopted a similar model. Irrigation in Kyrgyzstan was previously centrally managed and individual farmers had very little involvement. People worked on large state (*sovkhoz*) or collective (*kolkhoz*) farms rather than manage land as smallholders. The collapse of the soviet system led to land privatisation when the old large farms were broken up into very small individual smallholdings, resulting in a gap in the management system. Previously the irrigation department (*raivodkhoz*) delivered water to the state/collective farm, which managed water down to field level. Now another organisation was needed as the intermediary between the *raivodkhoz* and field-level irrigators: the WUA was expected to provide this role. It should be noted that there is some distrust or misunderstanding of 'participation', since it can be associated in people's minds with discredited approaches, such as collective farms.

The traditional collective management system in China was in principle similar to the concept of a WUA (Hussain & Biltonen, 2004). However, it differed from the ideal of a WUA because the heads of democratic management organisations were in fact appointed by the government and not elected. There was little communication or accountability between leaders and farmers, which led to water distribution being weakly-matched to farmers' needs (Feng, 2002). This is still the situation in most WUAs – 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*". Of course, a similar criticism can be levelled at newly-formed WUAs elsewhere – they are rarely as democratic as intended. In China as elsewhere there was often 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).

A key element for strengthening management in some parts of China, has been to give water managers financial incentives to improve management rather than to strengthen the community base of management. As Shah *et al* (2004) report about Ningxia province, managers are sometimes permitted to retain the difference between the fees they collect from the farmers and that which they have to pay on to the supply agency. This is seen as an important advance on the old management system when they were paid a fixed fee. It gives them an incentive to optimise water efficiency, whilst still ensuring that the farmers have a sufficiently good supply that they are willing to pay for the service. There is too little data available yet to conclude whether the approach is successful or sustainable, but it is an interesting innovation which needs to be considered carefully. It differs fundamentally from approaches adopted in the other study countries - in India and Nepal, WUA managers are required to work for no pay, and in Kyrgyzstan they are given a small but fixed salary. The issue of incentives for WUA leaders and staff is critical e for the sustainability of WUAs, which we address later in this report.

Kyrgyzstan and China are both regarded by many as success stories in terms of IMT (World Bank 2006a and World Bank 2006b), partly because they gave equal emphasis to 'top-down' and 'bottom-up processes'. In both cases, however, the reforms are newer and may yet suffer from 'second generation' problems. These countries have also not been so rigorously or critically studied, and objective data is hard to come by. Both countries recognise and have attempted to address the critical problem of remuneration for WUA managers, although neither have yet been able to solve it fully. Nepal and India, by contrast, give more emphasis on the community basis of WUAs. These contrasting approaches suggest that a synthesis of the experience in the four countries can be beneficial to all.

(iv) The role of the bureaucracy

Our focus in this study is on the WUA: we are concerned specifically with distribution of water within the WUA. However, as we have stressed earlier, they do need to be considered in their wider context. The performance of the agencies supporting the WUAs is critical for the success of the WUAs, for two specific reasons:

- They should provide a reliable supply of water to the WUA; and
- They should provide technical assistance and support to WUAs, either directly or by facilitating coordination with other agencies.

The fact that WUAs can only be effective if they operate in an appropriate institutional environment is widely recognised, and much is said in the literature on IMT about the need to reform bureaucracies, and to transform them from an implementing role to one of regulating and supporting. This is easier to state than to achieve in practice. It is politically contentious and is often seen to result in a reduction in staff numbers (indeed the need for cost saving is often a driver for attempts to introduce reforms). It also requires a change in roles, to ones which are often perceived to be less satisfying in professional terms and may also reduce the opportunities for rent-seeking that Chambers describes so graphically (Chambers, 1988). Resistance to change at this level is deep-seated. We will discuss this later in the context of drivers for change, and it is clearly a key issue for the success or otherwise of water management improvements.

There are many different possible approaches for reform of the bureaucracy. Shah *et al* (2004) make an interesting comparison in their review of reforms in India[8] and China, revealing very different attitudes to the bureaucracy. They report that the Chinese employ far more bureaucrats[9] to manage water than India, yet they have been able to restructure their bureaucracy and change its role. In some places, starting in Shenzhen in 1991 they have unified the previously fragmented water management roles under a single Water Affairs Bureau[10]. Whilst they note that such a large bureaucracy has its drawbacks, they point out the need for "*the role of the state to grow – not shrink – as the stress on water resources grows further. … for, leave alone direct regulation, even indirect instruments of water management require a bureaucracy to implemen*t". However, literature on the performance of and reforms within the irrigation bureaucracy is even more sparse than that on WUAs, and we have not been able to identify specific details of the actual measures undertaken to transform bureaucrats and there appears to be resistance in China as much as in other countries

Resistance to bureaucratic change is very high in all four countries, as well as most others where IMT is being introduced, and the sparse literature gives little guidance on the performance of reforms at this level, or successful methods which can be applied elsewhere.

[8] The situation in Nepal is rather similar to that in India, although pressures on government resources have prevented the irrigation bureaucracy from becoming as large or as deeply entrenched

[9] "*in Liaoning province, some 40,000 government staff are employed in water bureaus at different levels, excluding an equal number at village level. Gujarat is bigger than Liaoning, but has just around 11,000 public officials employed by water related departments… which will shrink …to less than 500 by 2010*" Shah et al (2004).

[10] Although it should be noted that there is resistance to this change in many provinces, and unified bureaux have not been widely formed yet.

2.2.3 History of WUA formation

(i) Introduction

Whilst WUA formation started on a small scale in a fairly informal way in the study countries, it was not possible for the reforms to progress far until they were supported by appropriate policies and legislation. This has required enactment of new primary legislation, combined with water sector and irrigation policies and regulations which define the rights and responsibilities of WUAs and the other organizations involved in irrigation management. Land reform and land ownership, has also shaped the performance of WUAs. Land reform legislation in Nepal was passed in the 1960s, but the legacy of old patterns of land ownership continues to influence WUA performance. Land reform in Kyrgyzstan is the most recent in our study countries, and has probably resulted in the most equitable distribution of land which was distributed to individuals in the 1990s.

In this section, we will describe the history of legislation and policy development in each country, followed by a brief summary of the status of the WUAs in our case study sites There are many parallels in the reform process between the study countries, and thus we will briefly provide a comparison of the four countries before considering each one individually

Of our four study countries, Nepal was at the relative forefront in instituting government policies to support and promote the formation of Water Users' Associations (WUAs). Policy and legislation passed in 1992[11] made it mandatory to involve WUAs in all stages of irrigation project development and provided for the joint management of large irrigation schemes, with farmers to be given total responsibility for smaller schemes (under 2,000 ha). Under joint management, autonomous WUAs would be given the responsibility for operating and maintaining blocks below a certain level, typically around 1,000 ha, while the Department of Irrigation office remained responsible for the upper parts of the system. In the Kyrgyz Republic and Andhra Pradesh (AP), India similar legal measures were introduced in 1997. In the Kyrgyz Republic a resolution was passed allowing the legal establishment of WUAs[12], and in Andhra Pradesh the Andhra Pradesh Farmers' Management of Irrigation Systems (APFMIS) Act was put into effect[13]. WUAs were established under a number of projects in China from the early 1990s, although the new water law was only drafted in 2002 and the relevant regulations required for WUA implementation are still being prepared

These initial legislations were subsequently modified. In the Kyrgyz Republic the 2002 law "On Unions (associations) of Water Users"[14] determined the legal status of WUAs and specified the basis for their establishment and organization, while the Water Code 2004[15] accorded the legally registered WUAs ownership rights over the irrigation and drainage systems within their service area (Herrfahrdt *et al*. 2005, p.36, Verheijan, 2005, p. 31). In AP the APFMIS legislation was reformed in 2002[16] to change aspects of the structure, functions and tenure of WUA committee members. The Andhra Pradesh Management of Irrigation System Rules were issued in 2003, with subsequent further

[11] Water Resources Act 1992 (No. 2049 of 1992)- An Act made to provide for the management of water resources, 17 December 1992, Irrigation Policy 2050 (1993), revised in 1997 and 2003, and the Irrigation Regulations 2056 (2000).

[12] Presidential Decree. 1997. *Resolution: On Water Users' Associations in Rural Areas.* Approved by the Prime Minister of the Kyrgyz Republic on August 13, 1997

[13] Andhra Pradesh Farmers' Management of Irrigation Systems (APFM1S) Act- 1997 (Act 11 of 1997)

[14] Law of the Kyrgyz Republic "on Unions (Associations) of Water Users, No. 38, official publishing on 27th of March 2002

[15] Water Code of the Kyrgyz Republic, No. 8, 12th of January 2005

[16] A.P.F.M.I.S. Act Amendment Ordinance 10 of 2002

amendments related to, for example, the delineation and formation of Water Users Associations[17] (GOAP, 2003a).

All countries have followed comparable approaches, with considerable revision as they encountered problems or the optimism of the early days dissipated. External influences have been very important, with the World Bank playing a key role in promoting a fairly standard model for WUAs. However, in each case there have been important indigenous developments – this is most evident in China but can be seen to some extent in all study countries.

The situation in the four study countries is briefly summarised below (Table 2.1), and this is discussed in greater detail in the following sub-sections.

Table 2.1: Overview of irrigation reforms and WUAs

	Nepal	**India (AP)**	**Kyrgyz Repblic**	**China**
Legislation	Water resources act (1992) introduced concepts of participatory management; revision in progress but cannot be enacted until Parliament restored. The local self-governance act (1999) gives some water management respons-ibilities to local govern-ment, and the civil code (1959) contains provisions relating to water manage-ment which are still valid	AP Farmers Management of Irrigation Systes Act (APFMIS, 1997), revised 2002, to give farmers organisations an effective role in irrigation management	Law on Unions of Water Users (2002), recognizes water users associations (WUAs) as legal entities with rights and obligations for water management. Water code (2004) defines rights and respons-ibilities to use water resources; establishes water rights on hydro-logical basis and tariffs to reflect O&M costs.	Water Law (2002) created an enabling environment for integrated water resources management,
Policy	Participatory policy introduced in 1992, reformed 1997 and 2003. National Water Resources Strategy prepared in 2002	Need for participation recognised in 1994, white paper 1996, Irrigation Sector policy, 1998 (Oblitas & Peter 1999)		
Water rights	State ownership, use rights granted to WUAs – most non-industrial uses are exempt from licensing requirements. Civil code gives priority of rights to the first constructors of an irrigation system LSGA requires local bodies to plan for use of water resources	Water rights defined by 'localisation', whereby plots of land are authorised for 'irrigated dry' or 'rice' cropping	Long-term water rights defined in water code	Water owned by state, use rights may be granted. Situation developing, following new water law
Land rights	Private ownership and rights of transfer. Land developed before 1964 influenced by previous system; land developed more recently is more equitably distributed	Private ownership and rights of transfer. Highly stratified ownership patterns. Formal and informal systems for rental of land are both common	Privatised in 1995 – communally farmed land shared on a fixed area per individual basis. Some restrictions on sale, but land may be rented and a process of consolidation is in progress. Land distribution still very homogeneous	Land owned by state, but allocated to individuals to manage under various systems tenure, with varying degrees of security as part of reforms initiated in 1978 (starting with abolition of communes and intro-duction of the household responsibility system.

17 The Andhra Pradesh Farmers Management of Irrigation Systems (Delineation and Formation of Water Users Associations) Rules, 2003 - Amendments

	Nepal	India (AP)	Kyrgyz Repblic	China
Water charges	Fixed by state on an area basis, collected by and shared with WUAs. Collection performance generally poor. Additional maintenance charges/contributions may be levied directly by WUA	Fixed per crop per hectare. Electricity for pumping groundwater charged at a fixed rate per well (independent of duration pumped)	Calculated on a volumetric basis, but converted into a per hectare charge for farmers. WUA buy according to volume delivered to the WUA as a whole and charge farmers according to the area irrigated	WUA buy on volumetric basis, users in Ningxia charged on area basis (derived form past years usage per hectare). In Xinjiang nominally charged according to flows measured to individual farmers
Irrigation management	Joint management of schemes more than 2,000 ha. WUAs responsible for lower levels and participate in management of main system for which operational responsibility remains with DOI	ID manage main canals, handing over to WUAs for areas of about 1,000-2,000 ha	*Raivodkhoz* manages main canals and sells water to WUA which owns and is responsible for management of lower level canals	Hierarchy of management organisations, involving water management institutions, local government and WUAs – not consistent across schemes and provinces

(ii) Nepal

Reforms in the Nepal water sector followed on from major political changes – the collapse of the panchayat system and restoration of multi-party democracy in 1990. This was followed by major legal and policy changes, as HMGN (His Majesty's Government Nepal) began the task of revising acts and producing new regulations under the new constitution. The new Water Resources Act (WRA) was passed in 1992, the Water Resources Regulation (WRR) and the Irrigation Policy (IP) in 1993, followed by the Irrigation Regulation in 2000, which specified the role and authority of the WUA to mobilize labour for system maintenance, and for record keeping, and explicitly required it to provide water at appropriate time and quantity to users. The irrigation policy has been revised twice (1997, 2003) and a draft revision to the WRR has been prepared. Following publication of the water resources strategy, the water resources act will again be revised. Policy and legislation is thus emerging and gradually becoming more comprehensive, but always with slight inconsistencies between the different components.

There is a strong emphasis on participation in the IP, which was developed with emphasis on providing support and development of FMIS, and later to transfer management of all or part of agency-managed systems to users. Development of new large-scale irrigation is geinve lower priority. The degree of participation in formulation of the policy is probably less than anticipated in the implementation of it, although there has been involvement by organisations such as the NFIWUAN (National Federation of Irrigation Water Users' Associations - Nepal) in recent revisions of the IP. There has also been no specific awareness-raising programme to encourage knowledge of the policy (and the various changes in it), but understanding is growing through implementation of a series of sector projects (Irrigation Line of Credit -ILC, Nepal Irrigation Sector Project - NISP, Irrigation Sector Project - ISP, Second Irrigation Sector Project SISP and Irrigation Management Transfer Project - IMTP).

A common perception is that the new policies were introduced in order to reduce HMG expenditure, and this view was supported by one of the objectives of the second revision of the IP ("*to decrease the government's involvement in the construction, maintenance and operation of irrigation*"). This specific objective was removed from the third revision, but references to cost sharing remain.

A more detailed account of the legal and policy background to WUAs and IMT in Nepal is presented in Appendix C. This policy and legislation generally covers the requirements for WUAs, but there are some areas of weakness although there is some variation in the extent to which they are applicable, understood, agreed with or applied to specific projects:

- The WUA is created as an autonomous body, with legal personality, but the legislation provides limits to their autonomy;
- Some functions are defined (to operate and maintain the systems, including distribution of water at appropriate times and quantities, and to keep records of fees paid and of those members who do not receive water);
- Few powers are given to the WUA (they have limited power to collect fees, or penalise for non-payment of fees or unauthorised use of water), although they can 'mobilize public participation for maintenance';
- They should maintain records of payments and establish a maintenance fund, although the means of collection of funds is not specified;
- Registration is required for certain HMG procedures – specifically to get assistance from some programmes - but appears to confer few other benefits (although it enables them to operate bank accounts);
- The structure of the WUA and the basis for representation are defined in law regardless of local conditions and requirements; and
- Water rights are not defined in law (but may be informally or culturally defined) and no abstraction licence is required for irrigation.

In Nepal the history of development of irrigation systems and the inspiration for WUA development was based on a predominance of relatively small, FMIS. Large scale, government-developed, irrigation schemes only gained importance in Nepal from the 1970s[18], and even now FMIS, most irrigating less than 500 ha, provide about two-thirds of the irrigation in Nepal. Much of the development of large scale irrigation in Nepal was funded by foreign donors, and their disappointment with the poor operation and maintenance performance of these schemes in the 1980s encouraged interest in alternative approaches – particularly drawing on the experience of farmer-managed irrigation. Local NGOs and activists had by then taken considerable interest in this heritage and were influential in stimulating the adoption of this concept on government-managed irrigation. This led to the active promotion of Participatory Irrigation Management (PIM), with the support of foreign donors, such as the United States Agency for International Development (USAID), the World Bank (WB) and the Asian Development Bank (ADB). They encouraged new legislation, and supported WUA development as part of subsequent investments in irrigation infrastructure. Following the 1992 provisions WUAs were set up by the Department of Irrigation to meet the requirements of the irrigation policy. This process is well-described by Khanal (2003).

Under the new legislation, ownership of water remains vested in the state but formal rights to use water can now be granted to WUAs or individuals (although most uses are exempt from the need to

[18] In Nepal, the recorded history of irrigation begins with evidence of self-help groups in the sixteenth century. An edict of King Ram Shah in the seventeenth century stated that irrigation and its management were the responsibilities of the community (Riccardi, 1977 cited in Pradhan, 1989). Irrigation remained a small-scale activity with just a few *raj kulos* (royal canals which had state patronage) until the first public sector irrigation system, Chandra Nahar, was constructed in 1923 and users were expected to resolve conflicts themselves. The rights of riparian land owners to use water from the stream abutting their land was established in National Code, 1910, but the first specific law for the water sector was the Irrigation Act, 1962. This was replaced by the comprehensive Canal, Electricity and Related Water Resources Act, 1966, which introduced the concept of water tax and licensing for water use.

obtain a license). Ownership of infrastructure also remains with the state, but responsibilities to manage irrigation systems should now be transferred (fully or in part). Schemes larger than 2,000 ha[19] are intended to be joint-managed with management of smaller schemes entirely transferred to the users. Land is privately owned, but ownership patterns are strongly influenced by earlier arrangements when land was state-owned – particularly the system of granting rights (known as *birta* or *jagir*) to favoured individuals to develop large tracts of land (Regmi, 1976). This was abolished through land reform legislation in the 1960s, when land ceilings were also introduced[20].

Of the two case study sites, work on establishing the WUA in Khageri Irrigation System (KIS) started in 1992; the WUA was registered in 1993 and the Joint Management Agreement was signed in 1995. It was among the first 5 WUAs selected for Joint Management under the USAID-supported Irrigation Management Project (IMP), and continued to be supported under the Irrigation Management Transfer Project (IMTP) which received USAID grant funding as well as support from ADB. The process of WUA formation and adoption of Joint Management began at about the same time in our other study site in Nepal at Sunsari Morang Irrigation Project (SMIP). In this case, the change in management system was accompanied by a more comprehensive programme of rehabilitation and completion of the physical infrastructure, under a World Bank-funded programme (SMIP II). Here the WUA was registered in 1994 and the Joint Management Agreement was signed on 26th March 1996. Both WUAs have thus been in existence for about a decade but, as will become apparent from later sections of this report, their activities and performance, and attitudes towards them are very different.

(iii) India

The government of the Indian state of Andhra Pradesh, like that of Nepal and many Indian states, came under the influence of international donors to promote PIM in the 1990s. This stimulated a vast literature on PIM, which is summarised by Brewer (1999) covering the situation across the country up to that date – although without specific focus on the topics of this study.

Large-scale government irrigation schemes in AP have had a longer history and a more dominant role in irrigation development than they have in Nepal. Since its formation in 1953 the state of Andhra Pradesh gave high priority to irrigation and developed millions of hectares in large (average size 114,000 ha) and medium (average size 3,200 ha) irrigation schemes. These were operated and maintained by the state. By the mid-1990s the state was facing serious financial difficulties, while having to recognize that irrigated area, particularly at the tail end, had declined in several major commands due to insufficient maintenance, poor cost recovery of water charges, limited user involvement, and low quality of agricultural extension (GOAP, 2003b, p. 2 - 8). An Andhra Pradesh government “White Paper” published in 1996 stated that only 2.3 million ha out of the 4 million ha of potential irrigated area created was actually under irrigation[21] (Pangare, 2002 p. 39). The state turned to the World Bank for funds to rehabilitate its infrastructure, and to complete the development of partially completed schemes.

Against this background, the government of AP was being encouraged to consider IMT and the formation of water users’ associations from the early 1990s. In 1991, the World Bank Economic

[19] The cut-off size has changed slightly with successive policy revisions and also differs between the hills and *tarai.*

[20] the *birta* system was abolished in 2018 (1962) and is seen as a key step in the abolition of what is commonly regarded as feudalism in Nepal. This was followed by land reform in 2024 (1968) which introduced land ceilings (1.25 ha plus a small area for a houseplot in the hills, and 16 ha plus 2 ha house plot in the *tarai*). Despite the various ruses that landlords used to circumvent the ceilings this was a major step in social reform.

[21] This figure is clearly a very rough estimate with varying estimates offered.

Development Institute (EDI) sponsored a team of AP government officers to visit Mexico – Mexico was seen by the World Bank as an important model for WUA development and irrigation management transfer (Sun, 2000). This was followed by the implementation of pilot projects for WUA formation in SRSP in the early and mid-1990s (Prem, 2002, p. 244]. A further catalyst was a study tour to observe PIM in Thailand and the Philippines which was organised by the AP State Irrigation Development Corporation. This helped to create political commitment amongst government ministers (Witjes *et al*, 1999). The support for the formation of WUAs was a significant feature of the Third Andhra Pradesh Irrigation Project (APIP III) funded by the World Bank, which was approved in 1997. Subsequently funding for support to WUA development was transferred to the Andhra Pradesh Economic Restructuring Project (APERP) approved in 1998 (Srinivasulu, 2002).

A massive formation of WUAs took place in the whole state in July-August 1997, when over 10,000 WUAs were instituted simultaneously over the entire state. Distributary committees were also formed at this time, but project committees were never formed. These initial WUAs completed their 5 year term of office in July 2002. There was a gap until new WUA elections were held in October-November 2003. Kadambapur WUA at Sri Ram Sagar Project (SRSP), which we selected as a case study site, was part of this blanket program and, in keeping with the procedures throughout the state, its WUA was formed in 1997 and new officers were elected in 2003 with slightly different boundaries[22] (Mott MacDonald, 2004b). Distributary committees, however, have yet to be re-elected.

Further details of the reform programme in Andhra Pradesh are given in Oblitas and Peter (1999), which observed that there was an almost immediate improvement in water distribution – due to a range of physical and institutional factors. Sivamohan and Scott (2003) reviewed the process a few years later and found evidence of continued progress but also identified a number of weaknesses – including the lack of farmer involvement in water allocation, and continued involvement by the Irrigation and Command Area Development Department (I&CADD) at low levels with possible collusion with rich farmers. The change in national and state government in 2004 has also had influence on the course of the reforms[23]. Reddy and Reddy (2005) reviewed the process after six years of implementation and found several key gaps in the IMT process. They found that elite capture of WUAs was a significant problem - particularly as positive discrimination has reduced their control of local government institutions, greater resources were channelled through WUAs than local government, and the landless were formally excluded. Also the WUAs were only responsible for surface water, whereas groundwater is an integral part of the irrigation system. They found the Irrigation Department to retain very significant roles in operation, maintenance and conflict resolution, leaving WUAs most active in organising meetings.

(iv) Kyrgyz Republic

Following the collapse of the Soviet Union in 1991, the Kyrgyz Republic took major steps to reform agriculture, including privatising land and reforming the irrigation sector. Irrigation projects in the Kyrgyz Republic are generally much smaller than those in India (Mott MacDonald, 2000), and were designed for a completely different management regime[24]. In the Soviet era, the end users were state or collective farms (sovkhoz or kolkhoz) which each operated around 1,000 ha, but in 1995 these were

[22] However, one of the twelve TC positions remained vacant after the 2003 elections, reportedly due to the large number of candidates although it is unclear why this prevented an election.
[23] These only became significant after the completion of the fieldwork and are not covered in this study
[24] There had been massive government investment in irrigation development, especially from the 1950s, with large areas of 'virgin land' converted to crop cultivation, mostly irrigated – totalling about 1m ha by 1991.

subdivided and the land distributed to smallholders. This created hundreds or even thousands of small management units within what had been previously operated as a single farm. This resulted in a need for a new organisation to fill this gap and, with international assistance, a comprehensive programme including establishment of WUAs was initiated. It also made it essential that the new individual farmers (who may not previously have worked as farmers) were given considerable support and training. The reforms leading to introduction of WUAs are thus an extremely small part of far-reaching social and political changes. Since 1992, the water administration has been reorganised, water fees have been introduced, a new Water Code was adopted in December 2004, and a law on WUAs was passed in 2002 giving them legal status, responsibility for O&M and ownership rights over tertiary infrastructure.

The post-independence government faced both financial and organizational difficulties in operating and maintaining its irrigation sector. It became a major recipient of international financial assistance, and this gave donors a significant opportunity to influence national policy and they encouraged the country to adopt PIM. This was slightly later – in the late 1990s – than in Nepal and AP. One avenue of influence has been the World Bank-financed On-farm Irrigation Project (OIP) which began implementation in 2000 (World Bank, 2000), and supported the formation and development of WUAs, with WUA Support Units in each *oblast* and *raion* (Herrfahrdt *et al*, 2005). This coherent and comprehensive approach has led to Kyrgyzstan being regarded as one of the success stories in Central Asia (and indeed worldwide) in terms of irrigation reforms (Johnson *et al* 2002, Lusk 1998, World Bank 2006). These reforms are an on-going process and it is clear from Johnson's paper (*op cit*) and Thurman (2001) that there are still some problems.

By 2010 it is expected that 500 WUAs will cover all of the approximately 1 million ha of irrigated land in the country. The two case study sites selected for this project - Obu Haet and Jany Aryk - established WUAs in 1999. Each was then re-registered under OIP to ensure that it conformed to the provisions of the 2002 WUA Law – Obu Haet in November 2002, and Jany Aryk in October 2003.

(v) China

Most reviews of WUAs in China are general and descriptive, although a series of papers compiled by the Ministry of Water Resources (MWR, 2002) provides a good overview of the different approaches throughout the country. Giordano *et al* (2004), Hussain & Biltonen (2004) and Wang *et al* (2006) provide a synthesis of the readily available literature. A valuable review has recently been prepared by the China Irrigation District Association (CIDA, 2005): this describes the history of participatory management, the application of PIM in 19 provinces, the achievements to date and problems encountered, and concludes with recommendations for the future. We have not, however, found any comprehensive or systematic evaluation of progress to date.

As in the Kyrgyz Republic, irrigation reform followed on from major rural reforms – in the case the introduction of the household responsibility system, starting in Anhui Province in 1978, which replaced the system of collective management of agriculture through the commune system. Various irrigation management systems emerged in different parts of the country, with water management stations, townships and villages taking lead roles in irrigation management at the local level. Farmers were required to contribute unpaid labour for canal maintenance[25], but did not have much other direct involvement in irrigation O&M. There appear to have been many different systems - these are largely

[25] the formal system of labour contributions was abolished recently, although farmers continue to be involved in unpaid canal maintenance. The WUAs help to organise informal contributions, now that the obligation to contribute has been removed.

undocumented but the previous history of irrigation management does have a significant influence on subsequent performance of WUAs (Feng, pers comm., CIDA, 2005). It has proved easier to establish effective formal WUAs in irrigation systems where there was previously a greater local role in management.

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 – there are no large landowners or complicated or variable sharecropping arrangements as are common in South Asia, although there is a very high degree of land fragmentation. As in the other study countries off-farm income is also very important in China. This may be from local employment or from seasonal or long-term migration to urban areas

Water resources are administered by a nested hierarchical administrative system. The Ministry of Water Resources (MWR) is at the highest central level directly under the State Council, with Water Resource Bureaus at the provincial, prefecture and county levels and water management stations at the township as the lowest level. MWR issues policies and regulations, provides technical guidance, and influences the local bureaus by allocating investment funds from the central government.Water resources bureaus are in practice mainly controlled by the government at the same level, since they are appointed by the governors. In some cases, allocation between provinces is coordinated by river basin commissions. There is thus potential for conflict between these parallel systems, as well as between upstream and downstream since the MWR does not have the power to enforce allocations between provinces. This has led to a series of reforms which in turn affect water rights, ownership of infrastructure, pricing policy and management arrangements.

A new water law was passed in 2002, and concepts of participatory management are widely accepted (MWR, 2002). The implications of this new law are now being worked through to provincial level. The reforms are new and not fully implemented or even understood by the farmers, so progress is still patchy; there is also little quantitative data to demonstrate performance under the new management systems, but there is a general consensus that significant progress has been achieved.

There is a strong rhetoric of participatory management, 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.

Donor-funded projects tend to be more widely reported in the international literature: Li Ou *et al* (2004) provide an interesting assessment of the progress and problems encountered during implementation of the Piyun project in Anhui Province. They draw conclusions on the details of the process for introducing participatory management in China which, despite the very different context, are equally applicable to many situations in India, Nepal or Kyrgyzstan:

- 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, and
- 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 … [*but*] these sections of the community don't take naturally to the approaches… [*and*] 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.

The CIDA review (*op cit*) concluded that experience with WUAs in China has been highly positive, and drew six specific conclusions from their evaluation of the reforms to date:

- Government support is a pre-requisite for PIM,
- Information dissemination and training is indispensable,
- Water users should understand the principles of PIM and the role of the WUA,
- Infrastructure should be in a sound condition,
- Methods should be adapted to local conditions but follow a consistent general pattern, and
- Good leaders should be selected.

There was little literature in English available on WUAs in China at the start of this study, and thus we undertook brief studies in Ningxia and Xinjiang, with reconnaissance visits to WUAs in Hebei, Jiangsu and Hubei. These are reported on in Appendix B, with the findings from a more systematic survey which we undertook in Ningxia being presented in Appendix D[26]. These provide some further details of the development history, process and performance of WUAs in these provinces.

In Ningxia, two new management regimes have been introduced: contract management and WUAs. Contracting to individual managers, rather than establishing democratic WUAs is the most common arrangement, but these are very similar in many practical details. Where WUAs exist, they are often just a guise for management by the village leader himself (81% had a village leader as chairman). However, even if they are the same people they work in a different organisational structure from the previous collective management and, as Hussain & Biltonen (2004) report, this gives them greater motivation to improve water management.

WUAs appear to have been initially less successful in Xinjiang[27]. This was partly due to more severe constraints on water resources, which meant that WUAs were not given a reliable water supply from the main canal system. There also appeared to be less government commitment to WUAs, as they favoured a system in which the lowest level of government bureaucracy – the water management station at township level – provided water directly to individual households[28]. Later reports, however, indicate that there has been strong progress with WUAs since then (World Bank, 2006a)

[26] Hussain & Biltonen (2004) report on a slightly larger study in the same area in Ningxia. This study also covered Henan Province

[27] Reidinger and Olsen (pers comm. 2002) – senior officials from the World Bank who were particularly involved in WUA development in China as a whole and Xinjiang in particular.

[28] Ziebin Jhang (pers comm.. 2002) – Chinese Academy of Sciences, Urumqi

(vi) Conclusion

There are thus many common features and some differences between the processes adopted in the four countries. Nepal started the reforms at a relatively early date, with informal WUAs established in the 1980s, but the process really took off with major political changes and the introduction of democracy in 1990 which led to legislation and policy, stimulated by the lack of goverment funds for maintenance and the poor performance as compared to farmer-managed irrigation. However, the early successes have not always been sustained for reasons which we will discuss later in the report – it has proved difficult to embed the WUAs in the community, they lack a sound financial basis and are reluctant to take on what is seen as the Government's job. Failed WUAs often become enmeshed in local politics and associated with suspected corruption, but there have been some successes in places where determined efforts were put in to tackle these issues. The legislation and policy is supportive, and the bureaucracy are relatively supportive (as Nepal seen as a global pioneer of IMT and this brings some kudos to those involved) but some still see IMT as a threat.

There was strong political support for irrigation reforms in AP, driven by a financial crisis (although in this case without a fundamental political change). This led to a 'big bang' approach which started with legislation and election of WUAs across the state in 1997. They were given strong support but political interest had declined by 2002 when the first WUAs were due for re-election, and deteriorated further with the new government in 2004. Legislation is largely supportive and was revised in time for the second round of elections, but there appears to be a lack of commitment by many in the bureaucracy. As a result the WUAs were not given independence, and remain reliant on a 'competent authority' [an engineer in the I&CADD] for many decisions. WUAs are also strongly linked in practice to local politics.

In Kyrgyzstan, WUAs were also set up in response to major political reforms after the collapse of the Soviet Union – which resulted in fundamental changes in land tenure and agriculture. This resulted in an institutional vacuum for local management of irrigation. WUAs were set up and have been given strong support, with appropriate legislation and policies being introduced. The process is however, recent, and although it is believed to be very effective, some problems may yet emerge. In contrast to South Asia, WUAs appear to have a technocratic rather than political focus which enables them to resist many of the pressures which WUAs in Nepal and India face.

Irrigation reforms in China were driven by poor performance of the sector and a need for rural reforms which is seen as underperforming in comparison to the economic success of urban areas. Management systems were previously very complex and placed a high financial burden on farmers without ensuring adequate resources for O&M. Another important driver has been the severe stress on water resources in some parts of the country. The new policy has strong high-level support, but this is taking time to be translated into fundamental reforms at a local level as they have a heritage of strong central command system. There appears to be resistance by the bureaucracy, a reluctance of farmers to become involved and some difficulty in breaking the link between local political systems and irrigation management.

2.2.4 Programmes to improve water management by WUAs

(i) Introduction

One of the expected benefits of irrigation management transfer is improved operational performance, resulting in a more equitable distribution of water. But while a lot of the literature asserts that this has been achieved, Vermillion (1997), who reviews this literature, found it difficult to draw rigorous conclusions for the evidence available. This is because of of the limitations of the research[29] and difficulties in isolating the impact of IMT from associated programmes for rehabilitation. Of the studies of surface irrigation he reviewed, eleven stated that there was an improvement, three showed a deterioration, and two suggested that there was no change in performance.

Vermillion cites two examples with a long-term data set. One is from Nanyao and Bayi in North China, where data from 1972 to 1993 shows a reduction in water use which is partly attributable to the more active involvement of farmers and village governments in irrigation manangement (Johnson *et al*, 1995). Another long-term time series available is for the Columbia basin in the USA, where Svendsen and Vermillion (1994 – cited in Vermillion, 1997) found no long-term change in irrigation delivery performance.

Despite the limitations of the evidence, Vermillion concludes that:

- Water distribution is not being improved by IMT as much as is expected;
- Any improvements that are achieved are not sustained after the initial investment; and
- The improvements may not be particularly equitable.

Although inconclusive, this suggestion of underperformance is a key part of the rationale for this study. We can therefore start by reviewing the literature on the study countries (including China) on these aspects. We will examine considerations of equity in more detail in section 2.5.

Although it is often assumed that farmers want complete control of operation in order to improve their access to water, this is not always the case: one study in Colombia suggests that the majority want the agency to retain a role in water management in order to prevent abuses by powerful farmers, although studies there indicate the need for strong local champions (seee section 2.2.2). The tension inherent between these two contrasting views is also evident in the schemes we have studied in a Nepal (Mott MacDonald 2004a) – even some people on the same schemes may have opposing opinions.

(ii) Nepal

The majority of the large number of studies on water management in Nepal relates to FMIS (eg Parajuli 1999, Yoder & Martin, 1998) rather than agency-managed schemes. Experiences on FMIS are nevertheless relevant – particularly since the form of WUA promoted on many new projects is strongly guided by the heritage of FMIS. Parajuli (1999) is particularly relevant since he describes and analyses the different methods used for distributing water, the institutional arrangements which support these, and the agro-ecological situations in which the various methods are most successful. He demonstrates that indigenous local organisations are capable of designing and implementing appropriate hydraulic structures and operating rules. These rules take account of their own perceptions of equity, which are themselves linked to social and agro-ecological conditions.

It is, however, difficult to transfer the concept of community management to agency-managed schemes which lack this tradition – although there have been many attempts to do so. There is now a growing body of literature on projects transferred from the state to the users (eg Khanal, 2002 who

[29] Most of these studies are short-term so he could not draw conclusions on the sustainability of the changes: long-term time series data on irrigation performance comparing the situation before and after reforms are rare.

documents many of the problems encountered in the Irrigation Management Transfer Project (IMTP) which focused on projects ranging from 2,000 to 10,000 ha).

In one positive example, Khanal documents the process by which the WUA in KIS (one of our case study sites) became able to improve water management at main canal level thus improving supplies to the branch canals which are the focus of our study. Loof *et al* (2000) also report on operation of this system. Mishra and Molden (1996) report a large improvement on one of the IMTP projects (West Gandak), but this was unfortunately not sustained. The WUA failed to carry out its responsibilities effectively, became highly politicised and lost its acceptance by the community (HR Wallingford, 2003). Elsewhere, there has been a gradual decline in performance once the initial project-led intervention is completed, which leads to an air of cynicism amongst water users, and an increasing reluctance to be involved in the future. Rules for water distribution may be defined but they are rarely followed, and penalties cannot be enforced on those who ignore the rules, as we observed in SMIP (Mott MacDonald, 2004). However, most of the literature on water management on large-scale systems in Nepal contains little detail on water distribution and often does not distinguish between actual and theoretical systems.

An important study is by Pradhan (1996) who describes water management in three projects – Banganga, Mahakali and Pithuwa - where there were different approaches to design of the systems and to managing water. In Banganga, much effort was put into making the system fully flexible, and into developing tertiary level WUAs to manage this water. However, they were unable to function because the main system supply was too unreliable – water is scarce and the flexibility in design made it easy for strong farmers to use their influence to get a good supply. Here, a tail to head rotation was planned by the District Irrigation Office for reasons of equity, but this was not achieved in practice as the farmers have *de facto* control of main canal operation. There was no effective institution at the main canal level (at that time) – despite several different attempts to establish WUAs - and there was insufficient water in the main canal to ensure reliable supplies to the tertiary units. These supplies became erratic making it impossible for tertiary level WUGs to manage the water.

Mahakali, by contrast, was designed to make operation much simpler, with few adjustable control structures. However, farmers were reluctant to accept the rigidity in water distribution imposed by this design, particularly as there was an ample supply in the river, and they modified the operational procedures and institutional arrangements in practice. Their reluctance to comply with the rules was no doubt encouraged by several changes in design philosophy during project implementation, when there had been little participation in developing the design concept. The scheme is still not complete, but there would be an overall shortage of water if it were fully developed. The present informal arrangements would however be well-established by then and difficult to change.

Pithuwa is a much smaller project, and was designed for a flexible gated operating system. However, the farmers themselves adapted this and introduced a fixed proportional system: they were able to adopt a water-management system comparable to that on traditional FMIS.

In conclusion we note that it has been difficult to transfer experiences from successful FMIS (where sophisticated and accurate water distribution systems can be seen) to new projects. This suggests that the complexity of ‘embedding’ new organisations in local communities has been underestimated. Too little effort has been given to this aspect, as opposed to developing bureaucratic and administrative procedures. As a result initial improvements in water management are rarely sustained. Nevertheless, overall management has improved on several projects in Nepal to the extent that we could focus on the details of water distribution and livelihoods at a local level.

(iii) Andhra Pradesh

The water management reform programme Andhra Pradesh (AP) had a very high political profile and considerable international support. It has been much studied and evaluated (eg Hooja *et al* 2002, van Koppen *et al*. 2002), and many consider it to be a model for wider application – not least for its comprehensive and systematic approach. The programme has been described by Oblitas and Peter (1999), who provide a good overview of the process adopted when introducing WUAs in AP, and make some preliminary observations on their performance. However, it is not without its critics: Jairath (2001) independently evaluated the impact of participatory irrigation management (PIM) on water distribution and found a large improvement in area irrigated but concluded this was due to an improvement in the condition of the main canals (eg due to desilting or weed clearance) and found no evidence of greater control over water use leading to better equity in distribution. She also concluded that head-end or influential farmers would not voluntarily give up their advantage, and that no government would be politically able to enforce a change. However, some redistribution could be possible if more profitable but less water-intensive strategies could be devised and demonstrated.

It is not surprising that opinions on such a wide-ranging programme should vary: Raju (2002) commented that the "*Andhra Pradesh programme on WUAs is a standing example of how an impossible task can be made possible*", whereas Jairath (2002, p222) reports that "*the hypothesis regarding PIM resulting in a greater control over water use and increasing the equity of distribution is not validated from the field investigations*". Raymond Peter (2002), one of the architects of the reforms takes a balanced approach, stating that "*it is too early even to say whether they [reforms in Andhra Pradesh] are successful or failed*". Whichever view one takes, another of Jairath's conclusions is particularly relevant for this study: "*the ability of WUAs to institute water distribution according to well-defined rules has been relatively difficult to achieve*". She sees this as one of the two preconditions for successful WUAs, the other being the availability of financial resources on a sustainable basis.

Unfortunately much of the initial support and enthusiasm has now been dissipated, and there were long delays in holding new elections at the end of their first five year term of office – even though the legislation was amended to resolve some perceived weaknesses[30]. There was a long delay before the newly-elected bodies were given any training, and distributary committees were not re-elected. The WUAs are very dependent on I&CADD (where there was still some resistance to reforms amongst officers who encouraged dependence by the WUAs and sought to retain much of their traditional role).

The programme covers the whole state, which includes several very large-scale projects such as the Sri Ram Sagar Project (265,000 ha) on the Godavari river and the similarly-sized Srisailam Right Bank Canal projects on the Krishna river, which have been developed incrementally over long period. Some rehabilitation was done on these projects at the same time as reforming management[31], but there was limited scope for fundamental changes in the infrastructure. The rehabilitation programmes started before the reforms were introduced and are still on-going. Some of the rehabilitation was aimed specifically at making the system easier to manage with the new system of WUAs.

Koppen *et al* (2002) looked specifically at the poverty impact of IMT in AP and noted that poor farmers are more dependent than the rich on canal water, as they are less likely to own wells, and are

[30] The new WUAs have an incremental system of elections – rather than the entire committee being elected for five years, one third of the committee is elected every two years, for a six year term. This ensures continuity of skills and knowledge within the WUA but it is difficult to start. One third of the new committee will only be in office for two years and one third for four years

[31] This was included in three successive WB-funded projects APIP II, APIP III, and APERP as described earlier

more likely to own poor-quality land at the tail of the system. However, farmer participation in WUA activities is rather low and most small farmers are unaware of WUAs. Small farmers may participate in repair work, the larger farmers are more involved in meetings and committees. Such inequity in participation undermines both the distribution of benefits from IMT and the viability of WUAs. Although improved surface water management would benefit the poor more than the rich, Koppen attributes most of the change that has occurred to the impact of rehabilitation rather than management reform.

In conclusion it is apparent that there are widely differing opinions on the reforms. There have been some improvements in water delivery – whether due to improvements in infrastructure, institutional arrangements or some combination. The institutions are still weak and not sufficiently financially sound to sustain improved management; they have not had the direct impact that had been hoped for although they made significant achievements in the early years when they were given much support and encouragement.

(iv) Kyrgyz Republic

The break-up of former state and collective farms made a change of management essential, as we noted earlier. This led to the formation of WUAs as part of a new management structure - although many of the individuals who previously worked in water management for the *sovkhoz* or *kolkhoz* continued to work in a similar role in the WUA. They now they need to work with individual farmers, and provide water to meet their demands, and these new responsibilities made it essential that the WUAs were given assistance in organisational management, water distribution and so on. There have been several donor-funded projects to provide this support. The performance of some new WUAs set up under these programmes has been evaluated in various reports, with slightly different conclusions. As these various studies have covered different WUAs using different methods, this is not surprising.

As part of the preparation for the On-farm Irrigation Project (OIP), Sera (1999) reported that farmers in WUAs in the Osh area (where our case study sites are located) were actively involved in the process of irrigating - they guard their supplies, are able to make some assessment of the amount of water needed and received, and quickly report perceived inequities in water supply to the WUA, *aksakal* or *Ayil Okmutu*. However, Sera also reported conflicts between farmers, particularly about the poor availability of the water as well as its poor quality at the tail, and conflicts between whole settlements at the head and tail end of the canals.

The World Bank evaluated OIP at the conclusion of the project as part of the preparation for a follow-up project. They reported that WUAs have been an outstanding success, although they do not document specific changes in water management practices. Verheijen (2005) undertook a survey of WUAs (including Obu Haet) as part of this process and reported that:

> "*Taking into account the difficulties with establishing WUAs in other countries in Central Asia, the progress regarding the formation and registration of WUAs in the Kyrgyz Republic is a clear indication that farmers have recognised the need to have an organisation at on-farm level aimed at the O&M of the on-farm irrigation infrastructure.*" (Verheijen, *op cit* p13)

These positive conclusions are not matched by all independent evaluations. For example, IWMI have run a multi-country project in Central Asia including Kyrgyzstan, in the form of a competition to save water. The study includes field measurements of water use in different areas and under different management regimes (Murray Rust *et al*, 2003), which found that WUAs were effective in improving water distribution, but they concluded that any improvements observed during the study would not be sustained in the absence of wider institutional reforms.

A more recent study by IWMI of two WUAs near to Osh in southern Kyrgyzstan (Hassan *et al*, 2004) examined the core water management functions (operation, maintenance, resource mobilisation, conflict resolution and organisational management) of the new institutions in Kyrgyzstan. They reported a fragmented impact not dissimilar to other countries: examples include head farmers appropriating water beyond their entitlements; informal conflict resolution with little involvement of local stakeholders; inadequate financial resources; and organisations constrained by an outdated command-oriented management model with few opportunities for formal participation by water users. In conclusion they reported the "*approach to WUA development tended to remain within the entrenched model of government services and did not sufficiently embed the WUAs in the communities they served*". A specific problem that they noted which is of particular relevance to our study is that the increasing number of agricultural units complicates water management and that the infrastructure is incompatible with the requirements of demand-based water management. As a solution to this they recommend a proportionate supply-based system comparable to that used in South Asia (ie *warabandi*).

Sehring (2005) considered the performance of two WUAs in the north of Kyrgyzstan – an ethnically distinct area from that studied by IWMI – against the same functions. She found considerable water theft and consequent social tension, depite this not being a water-scarce region. Many conflicts here are suppressed and individuals are urged not to go to court as this would bring shame to the village.

Despite his generally favourable conclusions on progress with establishing WUAs, Verheijen (2005) also reported problems of water distribution:

> *"The Baseline Assessment Survey among three WUAs in Aravan Raion in Osh Oblast confirms that water management within the WUA Service Area could be improved. Although more than 90% of the respondents stated that they adhere to the irrigation schedules of their respective WUAs, even in times of water shortage, 24% to 48% of the interviewed farmers reported that they steal water if they need more water and that about 10% give bribes to get more water. The non-compliance with the existing WUA rules for the distribution of irrigation water leads to conflicts. Between 20% and 40% of the respondents see the unfair distribution of water as the main reason for water conflicts, while 18% to 45% consider water stealing as the main cause of conflicts between water users. About 20% of the interviewed farmers experienced water-related conflicts in 2004. (TES 2004) Disputes between farmers were initially handled by the WUA itself, but they referred to the Aksakal court if the WUA could not resolve them. The decision of the Aksakal court is considered to be final and binding. (SERA 1999a)"* (Verheijen, *op cit* p48)

The independent evaluations are thus more critical of the achievements than those made by donors, although it is difficult to draw firm conclusions regarding the significance of the conclusions. The donor-funded evaluations tend to compare performance with WUAs elsewhere in the world, and concluded that those WUAs in Kyrgyzstan are relatively very good (C Finney, pers comm[32]), whereas the independent evaluations observed that there are still significant problems. The conclusions are thus not necessarily incompatible.

[32] Consultant to the World Bank for the preparation of WMIP, Kyrgyzstan, 2005

Our observations support the generally good performance of WUAs, but we noted many parallels between the problems observed in Kyrgyzstan and those in Nepal and also India. As Hassan and Sehring both noted, there are unembedded institutions, conflicts which are suppressed rather than resolved (with reliance on local, traditional systems for conflict management, rather than the WUA), poor knowledge of water management, weak finances, and little focus on equity of water distribution at farm level.

Kyrgyzstan, however, has some key advantages which may make it easier to solve these problems and thereby improved reliability and equity of access to water. These include the higher educational standards, with almost universal literacy; simple land ownership patterns; acceptance of the principle of paying for water, albeit at a low rate; and the nature of WUAs which are able to employ paid, professional water management specialists.

(v) China

China provides yet another contrasting picture, which we describe in more detail in Appendix B. There is some evidence of significant improvements in water management being achieved in China (Feng, 2001 and FAO 2001), although there does not appear to have been any rigorous independent evaluation of any aspect of WUAs 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 studies … 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).

Shah *et al* (2004) review this Chinese experience and draw several conclusions of direct relevance to South Asia. They stress the fact that China has already given up on the traditional communitarian model of organisation for managing irrigation projects and that 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. As Wang *et al* (2006) note, they appear to give greater emphasis to leadership than to participation. This is not to say that they do not regard participation as important – they recognise the importance of electing WUA leaders (CIDA, 2005) – but that it is too early to expect deeper, large-scale participation (given the nature and recent history of rural Chinese society).

China has adopted several alternative solutions to the problem of delivering appropriate and timely supplies of water. 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. By defining responsibilities and improving financial transparency they aimed to simplify and rationalise management and thereby reduce water wastage (World Bank, 2003b[33]). Water distribution *per se* is not seen as a priority for the reform programme, but is regarded as a logical consequence of improved management (see, for example, Reidinger 2002). As Shah *et al* (2004) note the Chinese appear to favour approaches which give managers a financial incentive to manage water efficiently – at least in Ningxia and Hebei provinces. Weak finances are still seen as a major problem for WUAs (Feng[34], pers com) and this discourages many WUA leaders

[33] World Bank, 2003b Yangtze Basin Water Resources Project, Implementation completion report
[34] Feng Guang Zhi, Former Director, Rural Water Department, Ministry of Water Resources

from being very active[35]. Zhou (2002) reviewed all aspects of the reforms, but also stressed the great emphasis given to pricing to ensure that farmers pay for what they use, and to reduce demand.

Our study in Ningxia (Appendix D) gives some evidence that there is some improvement in water distribution, but there are many variables – crop type, location, infrastructure condition, WUA leader knowledge, etc - which may affect the outcomes which we could not analyse. We found that WUAs where managers who have strong financial incentives to improve management were able to use 16,000 m^3/ha rather than 20,000 m^3/ha by collectives or WUAs with weak incentives[36]. This is a positive finding, but should be treated with a degree of caution as the study was small, and there are many potential reasons for differences – and they may simply reflect different limits imposed by the bulk supplier or the main system infrastructure rather than reductions in demand from the WUA (Appendix B).

This system of incentives adopted in Ningxia depends on the WUA managing water well and being able to retain a variable margin between the amount that they pay the bulk supplier for water and the amount the farmers pay to them. It is only possible if there are reliable measurement systems, which is a problem in some WUAs – in some cases it is necessary to use current meters for flow measurement, which is time-consuming and difficult to sustain. Flow measurements are probably accurate to $\pm$10%, at best - a figure comparable to the magnitude of potential savings.

The importance of ensuring well-motivated leaders is widely recognised in China – in addition to direct financial incentives, reduction in unresolved conflicts and improved water distribution are seen as important factors contributing to the motivation of leaders (Feng, pers comm.). Relying on financial incentives might seem a risky system, and might put pressure on leaders to force an excessive reduction in supplies to users in order to ensure that they receive an adequate remuneration for themselves. However, it is regarded in Ningxia that there is a sufficient degree of accountability since farmers may simply refuse to pay if they do not receive an adequate water supply.

Other studies which include evidence of the impact of reforms on water distribution in China include Johnson *et al* (1995) who reported on reforms in two irrigation districts in Hebei, each about 4,000 ha in area. These predate the formal introduction of WUAs but 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 World Bank has had a powerful influence on irrigation reform in China, through programmes to introduce democratic WUAs. Unfortunately there is little or no published information on the performance of these WUAs, although anecdotal evidence suggests that there has been a positive impact on efficiency and equity of water distribution (Reidinger, 2002, World Bank, 2006a). In reality, WUAs introduced on these projects differ substantially from the design (see, for example, Appendix B regarding WUAs in Xinjiang and Hubei, and Bhatia *et al* 2002 for WUAs in Jiangsu). Those that we visited reported very varied achievements, but they were different in many respects with infrastructure in a very different conditions. This makes valid comparisons difficult.

External resources and influences had a significant impact: one WUA in Hubei was only able to irrigate half their land and could not retain any money for their own salary or for routine maintenance;

[35] As we also observed in our reconnaissance study of the Zhanghe ID in Hubei province
[36] This incentive system is analysed further in Shah et al, (2005)

another was in excellent condition with newly lined canals and reported a significant reduction in water use. This irrigation district (ID) was studied by Jing Liu et al (2002) who reported that, averaged over 10 WUAs, there was a significant increase in farmer labour contributions to O&M as a result of the WUA. However, they did not give details of water distribution methods, areas irrigated, or full data on the amounts of water delivered. They reported a mean water usage of 35,600 m^3/ha with a range of zero up to 133,650 m^3/ha – a very high variation and a very large quantity of water, even for rice which is the predominant crop in this area.

Other provinces have followed different models and are also less reported internationally. MWR (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 in Hebei province (Bhatia *et al* 2002) state with a degree of pride that they do not follow the World Bank model; they regard their own reform process as more appropriate to their local situation and believe that efficiency of water use has improved.

Li Ou *et al* (*op cit*) report on the situation on the Piyuan canal in Anhui, where there was some resistance to the concept of participatory management through a WUA, and instead the farmers wanted measured deliveries to each household provided by the water management station. This would have been impossible, as an average branch canal irrigates 43 ha and 760 households, but it led to a protest raised against the proposed management arrangements, which needed to be addressed by a public awareness campaign.

Shaanxi is another province which has introduced WUAs amongst other methods of reforming irrigation management. Here the preferred route is via a ‘contractor’ model of water management. The performance of contract management in the Guanzhong ID has been very impressive in terms of improved water delivery, as reported (Johnson, 1999), although it remains to be seen whether contractors will sustain their interest after the initial construction phase is complete (Mollinga *et al*, 2003).

There is a general perception that WUAs have led to an improvement in water distribution in China, although this is not discussed in detail or quantified, even in the evaluation by CIDA (2005). They did however, note that PIM did lead to more systematic water distribution and a reduction in conflicts: for example “*before the association was set up in Liaohe Irrigation District, Jiangxi Province, people struggled fiercely for water by opening or blocking the canals during the peak irrigation period, causing frequent water disputes and rather serious irrigation disorder. After the founding of the association, they designated specific people, through democratic election, to manage water. There is one water delivery person assigned for each water use group to be soly responsible for water distribution in the group, which has put an end to arbitrary canal opening and water snatches and has effectively improved water efficiency.*” (CIDA, 2005).

(vi) Conclusions

Literature in all four countries confirms that there has been progress achieved as a result of the water sector reforms and the establishment of WUAs. However, the evidence is inconclusive and opinions vary as to the magnitude of the achievements. The methods differ in each country, with India and Nepal favouring community-based unpaid organisations, and China and Kyrgyzstan preferring more professional paid organisations. WUA leadership is generally drawn from established local leaders – usually in local government, but sometimes from previous state or collective farms – despite the avowed intention to separate water management from local government.

Institutional reforms are usually part of a package of measures including infrastructure development which makes it difficult to isolate the specific impact of the WUA: this will only become possible several years after completion of the rehabilitation.

It is hard to find a WUA which has improved water distribution on a sustainable basis, and for which there is convincing evidence (even anecdotal evidence) of the achievement. We visited many WUAs in the four study countries and studied a considerable body of literature without finding one which could provide a well-documented model. This is not to say that WUAs have not had a beneficial impact in many places – many positive achievements are evident from the literature.

However, it is clear that WUAs have not yet been able to solve fully the problem of ensuring a fair distribution of water to all users – which is the specific objective of this study.

2.3 Flow monitoring systems

2.3.1 The context – internal water distribution systems and procedures

We describe above the general process for establishing WUAs and involving them in improving water management. In this study, however, we have a more specific focus – on distribution of water by the WUA within its area of responsibility. There appears to be an assumption (as discussed in general terms in a recent email conference - FAO, 2001) that a local democratic organisation will be able to manage water reliably and equitably without requiring much assistance. However, as Meinzen-Dick (2001) stated this may be over-optimistic assumption: "*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*." It is difficult, even for locally-based organisations, to deliver a reliable supply of water to each of their members, and we have found little evidence that sufficient attention or effort has been given to ensuring a reliable water supply. The result is that distribution often becomes inequitable, disputes are common and livelihoods suffer.

China is one of the few countries where successful achievements in internal water management are cited (Johnson, 2001), although as is so often the case the evidence is anecdotal and there is insufficient information available on how it has been achieved and how these lessons could be transferred to other parts of the world. In some parts of China they attempt to provide measured supplies to individual or small groups of farmers (Mu[37], pers comm.), and in other parts WUAs employ common irrigators to distribute water on a consistent basis to individual farm plots and this is believed to ensure an equitable distribution (Gao Hong, 2002, Radosevich[38] pers com). In general, however, 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 (Wang, pers comm, 2001). These techniques do not appear to be applicable in South Asia – largely because of the much greater inequity in land ownership (Bhatia pers com). The *warabandi* system, however, which is commonly used in the Punjab (India and Pakistan) also aims to ensure a fair distribution. We will consider these and other methods in the following sections.

[37] Head of the project management unit for the Tarim II project in Xinjiang
[38] Consultant to World Bank with long involvement in WUAs in China

Procedures for managing water distribution are highly dependent on the nature of the infrastructure. Traditionally irrigation systems were built with a large number of gates and control structures at all levels of the system which make it theoretically possible to control precisely the distribution of water. These, however, are complex to manage and expensive to maintain. This aspect of design has often been neglected in the past, but design of irrigation to facilitate equitable water distribution is now a well-recognised topic with key papers by Horst (1998), Facon (2000) and Plusquellec (2002). Some of the case studies on this project (such as Sunsari Morang in Nepal and to a lesser extent the Sriramsagar Project in Andhra Pradesh where the budget per hectare for command area development was much less) took some of these considerations into account in the rehabilitation designs (Albinson & Perry 2002 and World Bank 1997). A more common situation, however, is where projects have already been built and there are few resources available for modifying the design to simplify or improve management. Generally such projects are old (see for example the West Gandak project in Nepal – Khanal, 2003), designed for a different style of management and possibly for different crops. This is the situation on most of the projects that we are studying.

2.3.2 Objectives of flow measurement

(i) Overview

First we should consider why is necessary to monitor flows. It is only of value if it is done for a specific purpose. Much of the literature is concerned with measuring flows so that water can be charged according to the amount used (see, for example, Small & Carruthers, 1991). This is widely recommended but little progress has been achieved, and Cornish *et al* (2004) now consider it to be unnecessary. Reliable flow measurement is very difficult to achieve on large irrigation schemes, because of:

- The large numbers of structures needed;
- Technical difficulties in designing robust and reliable measurement structures;
- The lack of the head needed to make such structures to work;
- The time and effort involved in collecting and using the data; and
- The ease with which structures can be bypassed.

Transaction costs are very high and can only be justified if there is a clear benefit to be gained by measuring flows (and recording, checking, analysing and using the data). Flow measurement in the main system has rightly been given greater attention than monitoring flows within WUAs. This is essential for ensuring good overall water management in the system as a whole.

Some form of monitoring the flows is needed, but this does not necessarily require volumetric measurements. Such monitoring is needed to:

- provide a basis for water charges, ensure that farmers are aware of the value of water and encourage them to use it efficiently
- to enable users to monitor flows against a plan, and to see how much they are getting as compared to other farmers; and
- foster trust and transparency in operation.

Actual flow measurement is always difficult for the reasons stated above, and it may be possible to design proxy indicators of flows which are more appropriate. But they need to be suited to specific local requirements and to be introduced with the understanding and support of the water users.

Lack of monitoring usually affects the poorer farmers most severely because they are generally in the weakest position to assert their claim and to ensure water delivery to their fields.

(ii) Flow measurement and water charges

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 *et al*, 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, 1995). Further, the elasticity of demand is such that it is rarely possible to reduce demand significantly by charging according to volume. Perry thus believes that pricing is unlikely to be effective in redistributing of water between rich and poor, although anecdotal evidence suggests that it is the poor who are often more conscientious in paying fees (Parajuli, pers com).

Cornish *et al* (2004) provide a comprehensive review of options for water charging, and report that the theoretical ideal of volumetric charging is rarely achieveable:

> "*However, the smooth relationship … where price and quantity are directly linked, requires that each purchaser can independently decide how much water to buy at the offered price, and that this desired level of supply can be individually delivered to the purchaser. Thus, for volumetric charging to serve as an incentive to reduce demand, the irrigation infrastructure and methods of water ordering and distribution must allow different volumes of water to be delivered and measured to individual farms. The infrastructure of many irrigation schemes in the developing world is designed to deliver water either on the basis of continuous flow or by rotation. Such infrastructure and its management are generally entirely incompatible with controlled, individualised volumetric delivery to farmers. This vital factor can make volumetric charging an impractical basis for charging on schemes in many developing countries.*
>
> *It is sometimes suggested that water be supplied on a volumetric basis to an aggregated, intermediate point such as a WUA, where monitoring of the volume delivered is relatively easy. The WUA would then take responsibility for allocation among individuals. While this approach has the advantage that within the WUA peer pressures may assist in controlling excessive demand, the question remains as to how infrastructure that has proven inadequate to make individualised and measured supplies under agency management should be amenable to such management by farmers*" (Cornish *et al,* 2004 p25).

China has the strong advantage of a long tradition of paying for water services. There have been water charges at Qingtongxia (QID) for over 2000 years. The rates may have increased sharply recently, but the concept is well-established and accepted. Water charges are seen both 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.

Direct measurement of water supply to individual farmers is a common objective in China. In the Tarim Basin in Xinjiang, for example, measurement weirs have been installed for individual farms in pilot areas, and farmers pay for and are issued with receipts for each delivery (HeHai, 2001). This is an extremely arid area where there are extreme pressures on water resources. However, the transaction costs in measuring water use, and in collecting and accounting for the fees are clearly high, and many do not consider it practicable (Lohmar *et al*, 2003).

Bos and Wolters (1990) report that irrigation efficiency tends to increase as charges are increased – whatever the pricing mechanism. There are several possible reasons for this – for example:

- There may be greater funding for O&M in such projects;
- Charges are typically higher in areas where there is a greater water shortage and hence efficiency is higher; or
- High charges for water may stimulate a greater appreciation of the value of water.

(iii) Flow measurement to ensure compliance with allocation and pre-season plans or contracts

Monitoring can help to promote orderly water distribution when observations are related to some form of agreed water distribution plan. Water distribution can then be managed to match the allocations incorporated in the plan. This plan may be prepared through a formal procedure, but a plan may exist in practice even if it is not formally documented or agreed. The nature of the plan influences the need for measurement to comply with it – in some cases proportional division or time sharing is sufficient, but in others actual flow measurements are needed.

As we will discuss below (section 7.2), approaches to pre-season irrigation planning vary significantly between countries and projects, but procedures are generally fairly weak.

(iv) Flow measurement to enhance transparency and trust between farmers

Water users are often particularly concerned to ensure that they receive a fair share of water as compared to their neighbours and other water users. Measuring flows and issuing water tickets is an effective way of ensuring this. This is done in parts of China – both in areas with WUAs and in areas which are managed in the traditional way. Such 'tickets' do help in ensuring a very high transparency in water deliveries, and for this reason are apparently very popular in Xinjiang (Mu, pers com).

At the time of our fieldwork in Xinjiang, progress was still slow and there was little local enthusiasm for WUAs[39], although they did appreciate the improvements in transparency (Mott MacDonald, 2002). However, the situation evidently improved in subsequent years, since the World Bank report in the implementation completion report that:

> "*The 15 "mature" WUAs at the center of the project are operating smoothly and detailed M&E shows clearly the benefits: (i) considerable water savings (gross water use was reduced by 16.8% from 1,149 cum/mu to 956 cum/mu); (ii) through the introduction of volumetric charges, annual water fees paid by farmers were reduced by 24.2% from Y36/mu to Y27.3/mu; (iii) an increase of 42.6% in water productivity from Y0.82/m3 to Y1.27/m3; and (iv) increased annual production value/mu (from Y950 to Y1,127). In addition, WUAs provided*

[39] this view was shared by the relevant World Bank officials at that time

hard to quantify benefits such as improved dispute resolution processes, transparency, reliability and equity of water distribution, and reduced labor inputs in managing irrigation on-farm. These benefits particularly favored women because of their close involvement in farming activities." (World Bank, 2006a)

Unfortunately the supporting data are not readily available, and it is not clear how the benefits were achieved in practice or why, given their apparent success, so few WUAs have been set up. Whilst it is to be hoped that lessons learned are being applied on related projects in China, particularly in Xinjiang[40], the lack of publicly-available information makes it difficult to use this experience elsewhere in the world[41].

2.3.3 Techniques for sharing water

Among the commonly used alternatives to direct flow measurement are time or depth of irrigation, and proportional division of flow. Monitoring soil moisture provides a more sophisticated variant of measuring depth of irrigation. Different approaches may even be needed on the same scheme to allow for differences in the level of accuracy and level of control required at different times and locations. There are many factors affecting the accuracy and type of monitoring or measurement needed, including social conditions, the types of crops grown, topography and soil type, land ownership patterns, and the availability of water.

(i) Control and measurement of flows into canals

Techniques for measuring flow are well established and documented (Bos *et al*, 1990), but it is rare to find a project where accurate measurement structures are installed at all key locations.

Our concern is with monitoring flows to ensure equitable water distribution, but it is also done for the purpose of determining water charges. It is debatable whether measuring water as a basis for charges promotes or discourages monitoring for equitable distribution (see Perry, 1996 for a discussion of this). Some argue that charging according to the quantity received (using flow monitoring as a basis for assessing charges) can make water use more efficient, and so make more water available to users, but it could also be argued that making a link between water monitoring and charges discourages accurate flow measurement. It also encourages tampering and damage to monitoring structures.

Flow measurement in practice is difficult, requiring suitable structures (weirs or flumes[42]), sufficient head[43] to operate the structures, and adequate time and skills to collect and interpret the data. To be useful it needs to be combined with control structures which make it possible to adjust the flow to meet some predetermined figure. Significant human resources and management skills are needed for this whole process. Even if structures exist, they may not be accurate - a very common problem is that farmers raise the downstream water level in order to irrigate critical fields close to the offtake[44]. This reduces the flows and the head loss across the structure, and makes the standard calibration totally unreliable. In many cases farmers perceive that measurement structures reduce flows and they may

[40] including the DFID-funded Pro-poor rural water reform project
[41] However, an evaluation is now being planned (J Wang, CCAP, pers comm., 2006)
[42] Exisitng control structures can sometimes be calibrated, but this is usually less accurate, convenient or transparent than dedicated structures
[43] difference in water level between upstream and downstream of the structure
[44] ie the highest fields which are physically the most difficult to irrigate

damage or destroy them. It is essential that there is an awareness programme so that the farmers understand the purpose of the structures and how they work.

If there is insufficient head to install measurement structures, or they simply do not exist, it is possible to measure the flow in a canal by observing the cross-section area and measuring the velocity of flow (using a current meter or floats) in a uniform section of the canal. However, this is less accurate and more time-consuming than use of a measurement structure; they may not be done sufficiently frequently and there is temptation to neglect the measurements (N Djailobayev[45], pers com., reporting on personal experience in Kyrgyzstan), but they may be the only option available in places where there is insufficient head loss. Sometimes water manaers simply rely on their own judgement – for example the 'eye' method used in Kyrgyzstan. With practice this can be quite accurate but it is obviously subjective and lacks transparency.

Canal flows can also be calculated from water level, but in this case care needs to be taken to ensure that that it is flowing freely and that there are no downstream checks in place at the time of measurement. Sedimentation in the canal can also significantly alter the stage-discharge relationship – this is a problem in areas where there is a high sediment load (such as Ningxia in the Yellow river basin in China – Appendix B).

For these reasons, flow measurement is usually only attempted at high levels in the system (perhaps down to supplies to individual WUAs, but often not even down to that level). Direct measurement to individual farmers would be an enormous task. This has been attempted in some places, and is widely recommended as the best solution – particularly as part of a programme of demand management, but performance has not been very good so far.

We refered above to the difficulties of measuring flows to individuals, even in pilot schemes, and this is confirmed by our observations in this project in the Kyrgyz Republic, where there is some willingness to attempt such solutions. This is a widely recognised problem, and 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 [IWMI], pers comm. 2002).

It should be noted that it is not sufficient to be able to measure the flow – it is also necessary to be able to control the flow. If the flows cannot be controlled rationally (either in a fixed proportion or in an adjustable manner), then measurements simply provide evidence of the quality (or otherwise) of management. For example, in most tertiary units we visited in Ningxia, there were gated offtakes to control (and measure) flow into lateral canals but no cross regulators. This meant that the tertiary canals have to be operated at full discharge (unless the water level is raised by placing temporary timber checks). Such an approach is likely to contribute to wastage as well as cause inequities in distribution, and may account for some of the very high irrigation duties reported in here (Appendix B and D).

(ii) Proportional distribution of un-measured flows

Accurate proportional distribution is common in certain situations on traditional irrigation in Nepal. Here the flow is not measured (although it would be possible to do so) but it is simply split between two canals on a fixed proportional basis (the basis is often area, but it may reflect some other system

[45] Senior member of Department of Water Resources

of water rights, such as contributions to original construction). For example, farmers on the Julpha system monitor distribution carefully, with precise timings and allocations of water. They do not quantify water in litres per second 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, they may use simpler or more informal methods in some seasons, when water is not so scarce.

The same concepts are applied on modern 'structured irrigation' schemes (Albinson and Perry, 2002), such as SMIP in Nepal where flows within sub-secondary canals are designed to be shared between tertiary canals on a proportional basis (ie the flow into each tertiary canal is proportional to the area irrigated by that canal). Proportional division is not always technically possible, since it does depend on their being adequate head loss. It is simple to manage, but it cannot be imposed if farmers do not accept the basis for it – it is easy to interfere with proportional dividers.

(iii) Distribution by controlling time of flow

The time that water is flowing is much easier to observe than the actual quantity of water. This can be a proxy measure of actual 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[46] (Malhotra, 1982) is the best known example of this approach – it is common in North West India, and because of its simplicity and transparency there have been many attempts to introduce it elsewhere (including Andhra Pradesh and Nepal) but these have not usually been successful. They may be adopted on paper but they are rarely followed through since farmers do not accept the basis or the suitability of such an approach. Even in its original areas, there are signs of increasing deviations in practice (Bandaragoda, 1998).

Many farmers on the Sunsari Morang Irrigation Project in Nepal rejected this approach as being too inflexible to be useful, and they adjust flows informally, which defeats the purpose (Mott MacDonald, 2002). Rainfall, variations in topography, soil conditions and levelling, and diversity of crops all influence the applicability of a rigid rotation.

(iv) Distribution by controlling order of irrigation

In some cases, farmers follow a strict order of irrigation, but the duration varies according to the requirements of each plot (to suit weather, crop stage, soil type etc). This retains the advantage of simplicity, but permits some flexibility. The duration of irrigation can be determined according to locally accepted indicators of irrigation, but it lacks one key feature of the *warabandi* system – predictability. Farmers do not know in advance when water is going to be available. This is a serious disadvantage in places where irrigation is only one part of farmers' livelihoods so that they need to know in advance when water is going to be available so that they can be ready to take advantage of it. It is also less transparent and easier to abuse: there also need to be agreed indicators for deciding how long each farmer should be permitted to take water for – these are considered next.

[46] Each farmer is assigned a precise time and duration for irrigation, and is entitled to the entire flow in the watercourse for this time (however much that is). The schedule is based on land area and is at a fixed time and day of the week.

(v) Indicators for managing depth of irrigation

Ultimately what the crop needs is a certain depth of water at particular times of crop development. Frequency, duration and application method can be adjusted to achieve this. From the crop point of view the ideal is to monitor soil moisture conditions in the root zone and apply water as needed to keep this within a specified range. Such an approach is only possible in a system with adequate water supply, and where water is available on demand. It will also depend on growing high value crops in order to justify the investment.

Simpler approaches are needed for the situations we are concerned with – large scale surface irrigation via open channels for relatively low-value crops (although with perhaps higher value crops on some parts of the system). Appropriate indicators depend on the type of irrigation - eg depth of flooding in rice irrigation, ensuring water reaches the end of a furrow for a certain duration. These are influenced by irrigation practices (quality of land levelling in basins, length and slope of furrows) as well as soil type, crop stage, expectation of when water will next become available.

Irrigation is often unreliable in the study countries, so that farmers do not know when they will next receive water: they have varying degrees of confidence that the overall schedule will be complied with, or that they will be able to get water when they need it. They may well be tempted to take more water than they require, fearing that they will not be able to get water again when they want it. This is particularly true of rice, which can easily be over-irrigated without damaging the crop as water is ponded in the fields. Many farmers are aware that they can achieve the same yields with less water, but they do not have confidence in the system to deliver smaller but more timely quantities.

Some of these factors depend on individual skills and understanding and others are more universal. This raises questions such as should a farmer who does not bother to level his land receive sufficient water to irrigate it in its poor condition, or should he receive the same volume as his neighbour who has invested in land levelling. Such questions need to be understood and answered locally, and must be agreed by all users.

2.3.4 Responsibilities for managing actual delivery of water

From the discussion above, it is clear that it is not easy to design objective rules which can be rigidly followed and thereby ensure an equitable supply of water to all users. Requirements vary, water is rarely sufficient to meet all demands, farmer management skills vary, and so on. Even if the rules can be devised, it is still difficult to implement them. There are cases where rules are unambiguously defined, such as with the proportional weirs described by Parajuli (1999) on FMIS in Nepal. However, even most FMIS rely on more informal approaches. As Mosse states for Tamil Nadu

> "*Rules exist, but are established or modified each season, or even each watering. They are of course, negotiated and contested, but rarely ignored. However more fundamental than rotational rules or field position are the relationships of authority and service which govern both rule-making and water allocation processes*." (Mosse, 2003 p158).

This can also be observed in Nepal – for example the Kamala Uttarbahini Irrigation Project (Mott MacDonald 2004)[47] where many farmers were willing to cite an agreed and precise water-sharing rule between branch canals but could not give an example where it was actually applied as stated.

[47] studied in DFID KaR R8023, the precursor to this project.

Implementation of the rules, requiring trust in those who adjust gates or monitor gate settings is thus absolutely critical. In some schemes this is left entirely to individual farmers, with the WUA playing a rather distant role as arbitrator between individuals; in others the WUA may provide a water guard to observe and monitor compliance (possibly with authority to adjust incorrect settings); and in a third category they may appoint common irrigators to manage irrigation to each individual.

(i) Distribution managed by individual farmers

The most common arrangement in the study countries is for farmers to manage irrigation on their own land – including measures to open outlets and divert water from the lowest level supply channel (watercourse, field outlet, etc). Whilst they are expected to comply with the rules for water sharing, there is rarely a formal system for monitoring compliance with these rules – most commonly it is left to disgruntled neighbours to complain or take direct action if someone is taking too much water or water out of turn. In some cases there is a system of watchmen or ditchriders who monitor the process.

(ii) Distribution managed by common irrigators

Common irrigators (for example the *gondaolao* - literally 'trusted people' - used in Gansu, China) may be used either to save farmers' time or they may be employed to ensure a consistent approach for all farmers[48]. A variant is where individuals manage water, but a watchman monitors compliance with the rules. More informal and much less equitable alternatives to common irrigators are used in some places – the *pani bahuse* of Bijaypur (Mott MacDonald 2004) are privately employed 'strongmen' who ensure a good supply for their employers but not to other irrigators.

As there are many subjective elements to the application of water management rules or indicators (whichever ones are chosen), there are likely to many differences in practice according to whether each farmer is permitted to manage water on an individual basis or whether a common irrigator is employed.

In Ningxia in China, there is a system of communal irrigators who are paid the equivalent of about $15/ha/year 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 system has been refined in some places where there is also a`WUA – in these cases the common irrigator may be paid by the WUA and they may impose penalties for poor performance (by the irrigator). The irrigators are generally chosen by, or with the approval of, the village leader.

The common irrigators are employed by the farmers to manage irrigation on a consistent basis – although they still need indicators to decide when to stop irrigating each plot as noted above. This ensures that each field is irrigated in turn and is not dependent on the farmer being present at the time of irrigation. However, it still leaves farmers with problems in deciding when to do agricultural activities such as weeding or fertilizing since these activities are closely related by the timing of irrigation. It may also be difficult for the managers to plan the canal flows that will achieve this distribution, and common irrigators are still vulnerable to pressures by influential people. It is

[48] In countries such as China and Kyrgyz Republic, where communal management has recently been replaced by individual responsibility for many aspects of agriculture, irrigation may continue to be managed for farmers. Countries such as Nepal and India which do not have a heritage of communes or collective farms are more likely to rely on individual management of irrigation

generally believed that use of common irrigators results in a more equitable distribution but we have not been able to find any specific evidence to support this.

Mosse reports on a similar system in Tamil Nadu where common irrigators (*nirppaccis*), who distribute water according to the dryness of the fields and the needs of the crop rather than a rigid timeshare. In unusually dry seasons each farmer is authorised to grow crops on a certain percentage of their land (as this is a tank-based system, shortages can be predicted). In extreme cases, each household is allocated sufficient water to cultivate an equal fixed area. These rules do avoid problems of head-tail inequities but do not ensure equal access since the *nirppaccis* are strongly dependent on the leading households who may still get privileged shares of water (ibid p160).

In some FMIS in Nepal, too, common operators manage water for all owners. Pant (2000) mentions that in Ghachowk Irrigation System one hired operator performs water management through the season. Landowners are not allowed to operate their outlets, but may request the operator. The rules of water distribution are predefined with consensus among the landowners and cultivators.

(iii) Indenting systems

The *shejpali* system (Brewer *et al*, 1999) is common in West India; in this each farmer submits an application for crops to be irrigated each season. If the application is approved, the Government is then obliged to deliver water as required by these crops. The farmer pays a fee according to the crop. This is clearly much more demanding to administer but is more flexible than the *warabandi* system (and thus more open to abuse by influential farmers). Wade (1982) documents some of the approaches used to subvert the official management systems.

In Kyrgyzstan, farmers submit requests for water to the *mirab*, who compiles all such requests and issues coupons to those who are authorised to irrigate. Those farmers who are given a coupon then open (and close) the canal accordingly and the mirab monitors compliance with the coupon. He may close the canal if more water is taken than is authorised.

2.4 Water distribution and livelihoods

2.4.1 Potential contribution of irrigated agriculture to livelihoods

Irrigation has been shown to contribute to rural incomes both directly through increased productivity and cropping options, and indirectly through a range of forward and backward linkages (Hussain, 2004; Chambers, 1988). Smith, a member of a team that conducted a comprehensive review of the contribution of irrigation to livelihoods[49], summarised the specific ways in which irrigation can benefit the incomes of the poor:

- increased farm and non-farm employment, upward pressure on wages and lower food prices;
- reduced income variance and enhanced resilience to crises;
- raised productivity of assets: labour, and land; plus improved ability of farm households to take advantage of new livelihood opportunities such as alternative higher-value crops, intensified livestock production and other market openings;

[49] The DFID KAR-funded project, Contribution of irrigation to sustaining rural livelihoods R7879 (Hasnip et al, 2001).

- freedom from indebtedness, greater independence, self-confidence and assertiveness;
- increased access to other goods and services. (Smith, 2004 , p. 253)

A major factor in the contribution that irrigation makes to boosting productivity is its ability to provide greater control and predictability of water supply (*ibid*., p. 245; Skogerboe, *et al*, 2002, p. 5; Lipton, *et. al*., 2003, p. 14).

2.4.2 Adverse effects of inequitable water distribution

But as many authors have observed, the ability of irrigation to contribute to poverty reduction depends on the details of how it is managed in practice, and whether it actually offers a reliable supply of water, equitably distributed (Brabben, et. al. 2004, Chambers, 1988, Lipton *et al*., 2003, Skogerboe, *et al*., 2002*)*.

Among the factors that have contributed to difficulties in distributing water equitably is the decision (on many schemes in South Asia) to distribute a limited quantity of water over a large area, rather than to deliver an abundant supply to a more restricted area[50]. This has been the approach in our study site in Andhra Pradesh (World Bank, 1997), and in SMIP in Nepal (Facon, 2003). Equitable water distribution in these situations of designed scarcity makes it particularly demanding for the irrigation system to be managed skilfully and for water users to be disciplined in the way they use water. But good water management and water user discipline are also needed when scarcity is intermittent, or varies from season to season, as is the case in our sites in Kyrgyzstan, and in KIS in Nepal. Often the discrepancy between official entitlement, for example as set out in a cropping plan (see section 7.2) and perceived individual needs leads to undisciplined acquisition of water, using various 'illegal measures' when water is scarce (Lipton *et al*., 2003, p. 21). This causes water flows to fluctuate, and often results in unpredictable delivery of water to at least some portions of the irrigation system (Mott MacDonald, 2002).

This, in turn, undermines one of the expected benefits of irrigation – improved production made possible by predictability of water supply. Unpredictability makes rational decision-making about crop choice and input use more difficult. It also causes problems for allocation of labour time, not only to irrigation and crop husbandry, but also to off-farm activities. Rural livelihoods are commonly composed of a 'portfolio' of activities, both on-farm and off-farm (Ellis, 1999). This mix is important to all categories of water users, but it is particularly important for the rural poor (Smith, 2004).

Aside from its effect on crop performance and income-earning activities, lack of skilful and disciplined water management introduces other costs to water users individually, such as social tension, distrust, disagreements, and need to police water delivery to one's own field[51]. And the general lack of discipline also has consequences for the operation and maintenance of the irrigation system generally. Loss of confidence in the service deliverer (in our sites - the WUA), leads to lack of respect for all of its rules – not only water distribution rules, such as when and how much water to take, but also rules against damaging the infrastructure, for example through illegal outlets or bunds. It undermines willingness to contribute to maintenance of the system in labour and fees. This in turn

[50] This decision is commonly taken for political, economic and social reasons. A political, economic and social case can be made for aiming to maximise the area, and number of people, who benefit from an investment in irrigated agriculture. Be that as it may, this does not alter the fact that this creates extra challenges to water management.

[51] Chambers has a nicely illustrated review of the measures adopted by farmers to access irrigation water. He notes that these measures include "appropriating" and "guarding", both of which can involve risks of retaliation and violence (1988, p. 161-162).

undermines the ability of the service provider (WUA) to maintain the infrastructure, which contributes to deterioration in the infrastructure, and in the irrigation service it is able to deliver (Mott MacDonald, 2002)[52].

2.4.3 Implications for the poor

Hussain, in his study of the anti-poverty impacts of irrigation observes that the impacts vary across and within irrigation systems. He concludes that the incidence and severity of poverty are significantly higher in those settings where land and irrigation water distribution is inequitable, irrigation infrastructure is poorly managed, and farmers' access to production-enhancing technologies and support measures is limited (Hussain, 2004, p. 8). Water supply to the lower parts of the system is generally worse[53] than upper parts, and such land is more likely to be owned by those of low status.

Considering the effects of inequitable water distribution, Robert Chambers' oft-quoted book, Managing Canal Irrigation, continues to be relevant. Among the pitfalls in irrigation performance which he highlights is what he describes as "*the deprivation of tailends [which is] notorious, and is confirmed again and again*." He notes that these portions of the system often suffer "*from receiving too little water, unpredictably, and late, if indeed water is received at all*" (Chambers, 1988, p. 21). He illustrates how this poor distribution affects the crops that can be grown, reduces yields, and damages income and returns to labour. He finds that those at the tail end also have inferior access to government services, transport, and information and are relatively politically weak. He concludes:

> "*For farmers, to be a tailender is to live at a permanent disadvantage with high risks involved in farming decisions. For landless labourers, tailends provide less work and less assured work. The deprivations of tailends are multiple, affect all of the poor, and keep people poor*." (*ibid*., p. 24).

This graphic summary highlights the consequences of inequitable water distribution, even if, in practice, it is simplistic to draw the problem as simply head-ender versus tail-ender. Division into 'head' and 'tail' is a crude division masking many local variations (due to micro-topography, irrigation layouts etc) (Mott MacDonald, 2004). In some circumstances it is those in the middle-course who are at greatest disadvantage (Lipton, *et al*., 2003, p. 8). Mollinga, commenting on his study of irrigation schemes in South India, noted that to some extent, those who are able to wield enough political influence become 'head end' farmers independent of the geographical location of their land (Mollinga, 1992, p. 19). It has been observed that where there are rich farmers at the tail, water supply to the tail is better and this can benefit all farmers at the tail – as observed on the Narayani project in Nepal (HR Wallingford 2003). This is well-recognised– those promoting WUAs at SMIP in Nepal tried to ensure that the chairmen held land at the tail, but unfortunately this was not sufficient to ensure water for other farmers at the tail in this case. WUAs in Andhra Pradesh are also required to have chairmen and vice chairmen from opposite ends of the WUA command.

Inequitable water delivery disadvantages all of those who suffer from it – whatever their position in the irrigation system and well-being status[54]. But the poorer members of the community, who by

[52] This lack of discipline may also be the outcome of other factors that undermine respect for the WUA – such as the actual, or perceived, corruption and inaction of WUA leaders (Lipton, 2003 p. 16; Skogerboe, 2002, p. 19). This lack of respect also contributes to a lack of respect for water distribution rules.

[53] In some cases there is a large volume of supply to the tail but at the wrong times, and this may cause flood damage.

[54] This is not a problem confined to Asia – head-tail problems are found in irrigation systems throughout the world

definition have fewer livelihood assets[55], are most disadvantaged by inequitable water distribution. If they are deprived of their entitlement to irrigation, the loss in production makes their situation even worse, from an already weak economic position. They are least able to cope with the unreliability of water supply to the fields that they are cultivating. They have fewer reserves to compensate for loss of a crop, or for being forced to grow less remunerative crops. They are unlikely to risk investing in yield-improving complementary inputs if they are not sure that they will get the irrigation they need.

Off-farm employment is often an essential part of their livelihood strategy. An unreliable irrigation supply makes it difficult for them to allocate their time so as to get the best possible results from both their crops and their off-farm income-earning activities. The poor often rely on agricultural employment on irrigated farms. Poor water distribution can affect the crop choices, and incomes, of their potential employers. Employers with a less reliable supply of irrigation will be less inclined to take on additional labourers and this means fewer employment opportunities for the poor who are most likely to depend on such employment as a part of their overall income.

2.4.4 Water distribution and women

Women are often major contributors of farm labour. Irrigated crops often increase the demands for labour on the tasks that are traditionally allocated to women: transplanting and weeding, whereas they may not increase male labour inputs, e.g. for ploughing and land preparation (Smith, 2004, p. 252; Zwarteveen, 1995, p. 7). Furthermore, male migration and off-farm employment is giving women an increasing need to be involved in all aspects of crop husbandry, including irrigation management.

It is often reported that women are generally excluded from decision-making in relation to irrigation – both within the WUA and in the household (eg Merrey *et al*, 1997), and they are in a weaker negotiating position to claim their share of irrigation for their crops (Zwarteveen, 1995). Representation on WUAs is almost invariably linked to land ownership, but almost all land in Nepal and India is registered in the anme of men. Although the specific reasons vary, cultural pressures often outweigh stipulations of a certain number of female members to be recruited for WUA committee membership, and women are either unrepresented, or used as tokens discouraged from taking an active role in the committee discussions and decision-making (Luitel, 2001; Shyamala and Rao, 2002).

It is not sufficient simply to require greater participation by women in formal institutions. As Zwarteveen (2006, p188) notes in "*an irrigation system in Peru, where about half of the members were women, and where both women and men attended meetings. Observations during these meetings showed that although male members on average talked around 28 minutes, female members only talked for 3.5 minutes. Although 'speaking time' cannot be used as a straightforward measure of influence, women did explain that they felt diffident about articulating their concerns in meetings, and that they were afraid of making mistakes and being ridiculed*" There are many more examples of women being excluded from formal institutions, But Zwarteveen's analysis confirms that simply ensuring that women are elected members of WUAs is far from sufficient to ensure their participation or that management reflected their interests. She concludes "*in sum, 'seeing' gender in irrigation management thus not just requires allowing women to enter into the already defined and ideal-typical domains of irrigation decision making. It also and crucially requires rethinking the boundaries of, and functioning within, these domains*."

[55] The Sustainable Livelihood framework identifies five 'capitals' or categories of assets (human, social, physical, natural and financial) which are combined in various ways to achieve a livelihood outcome. In Chapter 5 we will use an analysis of asset status and outcomes to help us study the effect of water distribution on water users from different well-being groups. See also our discussion of the SL framework in section 2.5.2.

Cultural restrictions also limit the measures women can take to claim and protect access to irrigation (van Koppen, 1999, p. 11). For example, views about pollution in Hindu cultures, may exclude women from working in canal maintenance, which may be a prerequisite to entitlement to irrigation. They may be reluctant to guard water delivery to their field, especially at night, even when this is a practical necessity to assure their supplies (Zwarteveen, 1995, p. 8). In some places women are able to exploit the situation and break the rules because they are not formal members of the WUA (Zwarteveen and Neupane, 1996) but the position of women in society makes it more likely that these limitations make it more difficult for women to access water.

2.5 Social and institutional issues: concepts and methods for observation and analysis

2.5.1 Introduction

In the previous sections we discussed the policies regarding transfer of water management responsibilities to WUAs, technical considerations in how water is monitored and managed, and the implications of inequitable water distribution for the poor. In this section we review some concepts and methods for understanding the social and institutional factors which affect the way water is distributed in practice at the local level. We identify analytical approaches that we consider to be relevant to our work, and discuss both their advantages and limitations. This will lead into a presentation in section 2.7 of the approach that we chose to adopt for our study.

The interaction of social and institutional factors affecting the operation of an irrigation system is complex, and it is a challenge to observe and analyse it. It is the outcome of historical, structural, cultural and social processes; it is demanding to understand these processes, and to translate this understanding into practical actions (Mosse, 2003a, gives a perceptive and very relevant account of these interactions in irrigation systems in Tamil Nadu). Furthermore, the social and power relationships inherent in a research activity not only influence what can be observed, but also have an effect on the social dynamic that the researchers seek to observe (Douglas, 1976; Mosse, 2001, 2003b). Farmers and other stakeholders carefully gauge what they are willing to say to researchers. The way water is managed may be modified simply because researchers are observing it.

We bear these interactions in mind as we seek concepts and methods which help us to reach a practical understanding of the way heterogeneous groups of people with differing personal characteristics, assets and interests interact with each other, and the irrigation system; and we recognise that this takes place under changing economic, political and environmental circumstances. We hope, as we do so, to be able to derive a guide to action which furthers the aims we set out in Chapter 1.

In our study we have incorporated various analytical frameworks and concepts which have been developed to deal with the complexity we refer to above. These have been used by workers interested in various aspects of development, including irrigation development:

- The **Sustainable Livelihoods Approach (SLA)** offers a way to organise one’s thinking when observing the interaction between individual actors, their assets, the wider physical and institutional environment, and livelihood outcomes. We have found the SLA particularly useful as a way to keep sight of different categories of water users. It helps us to structure our observation of the way that these different actors, including those who are poor and those who are better off, interact with irrigation within the wider institutional and environmental context.

Within the SLA the concept of '**social capital**' is both particularly relevant, and contentious. We will discuss this concept and its applicability to water distribution.

- The concept of '**equity**' takes first place in the title of our study, so it is appropriate for us to state our understanding of the meaning of 'equitable water distribution'. We acknowledge the social, political, and cultural influences on the meaning of this word in practice, and explain how we have incorporated this recognition when addressing the aim of making water distribution 'more equitable'. In our discussion we look at the relationship between the words 'equitable' and 'fair', and explain why we have chosen to use both words in our text.
- **'Institutions' and their 'development'** have been an important theme in discussions and programmes concerned with improving the performance of irrigation systems. Often the formation of organisations called "Water Users' Associations" has been used interchangeably with 'institutional development'. We think that this conflation of 'organisation' and 'institution' is confusing, and can lead to problems when trying to understand what is going on in the management of water distribution. We state how we intend to use some key terms associated with 'institutions', and how these terms relate to water distribution.
- Our action research is about measures to promote change in the direction of greater equity. An analysis of the '**Drivers of Change**' provides a way to think about the interests which promote or resist change, and the way these interact to influence the direction that change might take. This gives a framework for developing strategies which will promote change in the direction of a more fair distribution of water.
- The 'methods', 'tools', and philosophy which fall under the umbrella of '**Participatory Development'** are part of the Sustainable Livelihoods Approach. They can offer fruitful and potentially mutually beneficial ways for researchers to engage with 'participants' – yielding useful information, insights, and guides to action for both. At the same time, as we discuss below, we recognise that there are problems with the application of the concepts and methods of 'participation'; and we outline how we have taken these problems into account.

While we have found the elements listed above to be relevant for our work, we recognise that they also have their critics. Broadly speaking, we can identify two main lines taken in these criticisms. On one hand, critics have found weaknesses in the way that concepts, or frameworks, have been formulated. Loose, incomplete, or logically inconsistent formulations can undermine the ability to test propositions derived from them. On the other hand, critics have challenged the way that these concepts have been used as guides for particular policies and development activities. They argue that the concepts have been used to justify a pre-determined agenda and that by doing so they have glossed over the special interests and contradictions inherent in that same agenda. For example rosy views about 'community' organisations and the nature of 'social capital' have been used to rationalise the handover of financial and management responsibilities to WUAs; but the main agenda has been a handover in order to fulfil predetermined political and financial objectives. These views have tended to gloss over political relationships which may constrain equity in water sharing.

In the following sections we discuss each of the elements listed above – their relevance and limitations as applied to our research. Our aim has been to draw on the strengths of these concepts and methods so as to find a practical way to engage with water users. At the same time we have been conscious of their shortcomings. Our actual practice has reflected the inevitable difficulties and pitfalls of working in situations inherently characterised by contradictions and conflict. It has also shown how these elements can be applied with positive results.

2.5.2 'Livelihoods' and their analysis

(i) The Sustainable Livelihoods Approach

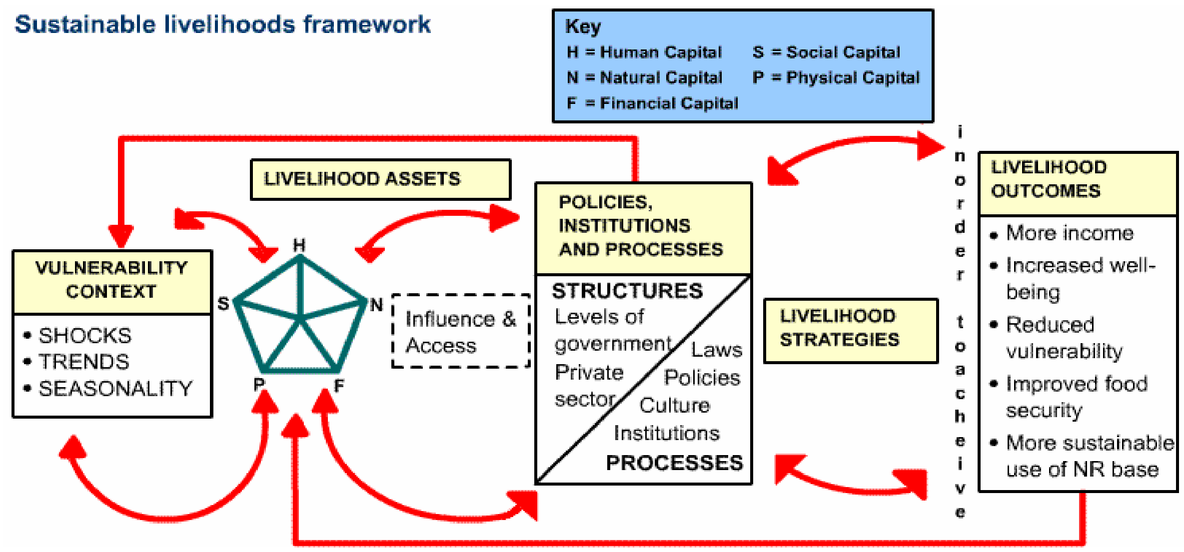
The aims, content, and applications of the Sustainable Livelihoods Approach (SLA) are usefully set out in DFID's "SL Distance Learning Guide" (available on-line at http://www.livelihoods.org), and the genesis of the Sustainable Livelihoods Approach has been reviewed by Solesbury (2003). Solesbury points out that an important attraction of the approach is that it is people-centred. This was among the features that encouraged its adoption by DFID and other international development organisations, particularly from the 1990's when there was a sense of dissatisfaction with development approaches which focussed on resources and technologies (*ibid*., p. 16).

The key elements of the Sustainable Livelihoods Approach include:

- **An aim**: to eliminate poverty
- **A set of principles**: focusing on people, being responsive and participatory, working on various levels, working with partners, being dynamic, and taking a wide view of sustainability.
- **A way of working with people, organisations and agencies**: development is approached as a collaborative and co-operative effort.
- **A way of structuring analysis**: the use of the Sustainable Livelihoods framework as a tool to understand the diversity of livelihood opportunities, constraints and strategies which are open to people, particularly poor people. The SL approach specifies a set of core principles which should guide livelihoods analysis: special effort to understand the livelihood circumstances of marginalised and excluded groups, taking account of social divides that make a difference to people's livelihoods (for example, men, women, different age groups, to be considered separately, rather than taking the household as the sole unit of analysis), build on people's strengths, think about change over time, and flexibility in the application of methods.
- **A view on how to identify policy interventions**: by helping to explain relationships between policies, institutions, processes and the livelihood priorities of the poor, the analysis of livelihoods can be used to identify policy interventions that will benefit the poor.

The SL framework, illustrated below, aims to capture the dynamic interaction between: (1) external factors that make poor people vulnerable (the Vulnerability Context), (2) the five core asset categories, or types of 'capital', which are available to people, and which influence the choices and strategies open to them (the Asset Pentagon: human, social, natural, physical and financial capital), and (3) policies, institutions and processes (PIP) which "operate at all levels, from the household to the international arena, and in all spheres, from the most private to the most public" (DFID, SL Guidance Notes). Within the framework, the PIP is seen to cover actions designed to achieve particular goals ('policy'), organisations and the way they function ('institutions'), and the way that policies and institutions change over time ('processes'). Livelihood strategies are defined as the activities and choices people make to achieve their livelihood objectives. Livelihood outcomes are the achievements of the livelihood strategies.

Figure 2-1 : Sustainable Livelihoods Framework



Source: DFID Sustainable Livelihoods Guidance Notes

(ii) Strengths and weaknesses of SLA

The strengths and weaknesses of the SLA have been subject to discussions in many papers and reviews. These are readily available on the internet through sites such as those operated by DFID (www.livelihoods.org) and the Chronic Poverty Research Centre (www.chronicpoverty.org). General conceptual and practical issues have been considered in papers such as those of Murray (2001) and Macqueen (2001).

Among the strengths of the SLA are its focus, its scope of analysis, the elegance of summarising complex interactions in a single, neat, diagram, its offer of a method of investigation which is consistent with its principles, and an approach to bringing about policy change. Thus it clearly states a priority – a focus on actions that will benefit the poor. It presents a way, through the 'asset pentagon', to organise observations and to analyse the changing combination of assets that make up livelihoods. Also, as summarised by Murray, it highlights the need to put livelihoods in a historical context, and to recognise that livelihood strategies are not only changing, but cut across conventionally separated sectors (urban/rural, industrial/agricultural, formal/informal, etc.). It stresses the need to conduct analysis at different levels – micro, meso and macro; and to consider social relations within as well as outside the household (Murray, 2001). We would add that it draws on the philosophy and experience of participatory approaches to gather information in a way consistent with its people-focused and collaborative principles. And it explicitly incorporates issues of power and politics by including in its framework the dynamic relationship between policies, institutions and processes and livelihood assets, highlighting the role of influence and access. All of this is to be considered with a view to identifying strengths and opportunities to bring about positive improvements in the livelihoods of the poor.

Some of the strengths of the approach are also a source of its weaknesses. The inclusiveness of its scope can make it rather overwhelming – where does one start when deciding what information to collect and how to analyse the information that has been collected? The elegance of its summary moots many questions about the amount of attention that should be given to individual components and levels, and about the interpretation and application of the terms used in the diagram. For example, Murray (2001) has considered that the 'Vulnerability Context' does not give sufficient importance to economic and social sources of vulnerability, such as rampant inflation or 'uncivil conflict'. He also considers that inequalities of power and conflicts of interest are not sufficiently acknowledged. In response to this criticism it could be argued that the framework leaves it open to the user to determine the most appropriate balance of attention and to make clear the interpretation of concepts for the circumstances and the aim of the application. For example in their use of elements of the SLA ODG/NORMS (2003) argue for a focus on the Policy, Institutions and Process box when addressing the livelihoods outcomes of social forestry activities in the Nepal Terai. As we will discuss in section 2.5.5, the 'Drivers of Change' (DOC) approach has emerged as a way of focussing attention on the political and institutional processes that impact on the poor.

A criticism of the asset pentagon is that the use of the term 'capital' inappropriately introduces an economic metaphor. It implies that all the assets, including the human and social, can be invested in and can be subjected to the same sorts of economic analysis as investments in physical and financial assets. Macqueen (2001) illustrates how the use of the term 'capital' within the asset pentagon, creates conceptual problems for prioritising 'investments' and for evaluating the effectiveness of those investments. He observes that "*economic valuation methods [do] not allow us to compare important components of development problems, [and] they actively discriminate against certain components [human and social capital]*."(p. 4). Hulme (2000) discusses the specific difficulty of identifying indicators of progress in the development of 'social capital'.

Another criticism of the asset pentagon is that by being limited to five assets, it leaves out one or more important dimensions. CPRC (2002) reviews the arguments for adding 'political capital' as an asset "*based on access to decision-making in the political process*." Mosse, drawing on Bourdieu, highlights the concept of symbolic capital when he explores the social and political processes involved in irrigation. Thus for example he observes that: "*the protection, construction, or repair of irrigation works has long involved investments which generate symbolic capital in the form of honour or authority and create domains of influence for individual leaders*" (Mosse, 2003, p. 23).

While the use of the concept 'social capital' is particularly controversial, it is also pertinent to our exploration of water distribution, so we will give it more attention in the next section. The participatory methodologies have also been criticised, and we address the relevant issues in section 2.5.6.

(iii) 'Social capital' and its critics

As we have noted above, 'social capital' is one of the assets identified in the SLA 'asset pentagon'. Outside the SLA framework, the concept of 'social capital' received increasing attention and interest in the 1990's (UK Cabinet Office, 2002; Grootaert *et al*, 2003) and has been the subject of a special programme of discussion and research in the World Bank (http://www.worldbank.org/poverty/scapital). Narayan (1999) and Woolcock and Narayan, (2000) review the concepts from the perspective of researchers who work within the World Bank.

As the UK Cabinet paper (2002) illustrates, there are a range of definitions applied to the term 'social capital'. DFID's Sustainable Livelihoods Guidance Notes give a very broad definition of 'social capital': "the social resources upon which people draw, in pursuit of their livelihood objectives". This definition could be considered to encompass the political and symbolic 'assets' which were referred to in the previous section. As presented in the DFID SL Guidance Notes, social capital is a set of resources which are developed through interactions which enable people to work together, through membership in formalised groups, and through relationships of trust that facilitate cooperation. Social capital can have an impact on other types of 'capital', for example by making business relationships more efficient, by improving the management of common resources, or by sharing knowledge. The relationships that constitute 'social capital' can also help people to survive in times of vulnerability, and contribute to a sense of well-being. At the same time, the guidance notes acknowledge limitations to the application of the concept. There are few numerical indicators or quantifiable ways to represent social capital; and they point out that social capital "*can have both positive and negative aspects. The simple existence of a variety of groups within a community does not necessarily mean that the whole community is benefiting*". The UK Cabinet paper (2002) points out that social capital can be associated with 'downsides' such as exclusion, social divisions and rivalry, economic inefficiencies and criminality (pp. 31 -33).

As we noted above, one of the criticisms of the term 'social capital' is its presentation as an asset which can be 'invested in', just as other economic assets can be invested in; and critics point out that there are problems with formulating the concept so that it can be quantified. Other aspects of the economic metaphor which have been used, such as appreciation/depreciation, or aspects of game theory which are ahistorical and focus on optimising individuals have also been criticised (these are summarised in Sobel, 2002).

Aside from the ambiguities of a loose definition and an identification with economic values, some critics object to the way that the term 'social capital' has been used to guide development policy by international development agencies, particularly the World Bank.

Critics such as Mosse argue that the concept of social capital has been used to gloss over the social divisions, political stresses, and historical and cultural processes which surround social relationships (Mosse, 2003, pp. 270ff). In this policy context social capital has been presented as an asset held by 'communities'; and a 'community' has been viewed as a unified whole which can be supported to act in a coherent way for socially positive ends. The 'community' is expected to act consensually and in a way that suits the best interests of all of its members. As Cleaver has observed, this directs development policy toward "*building social capital through 'getting institutions right'… to create institutional space for inclusion of the marginalized*" (Cleaver, 2002, p. 2).

In defence of writers such as Woolcock, Narayan, the authors of the UK Cabinet paper, and the DFID SLA Guidance notes, we note that they all take pains to point out the importance of power relationships, and the other processes we have just noted.

But while these may be recognised in such writings, in practice 'social capital' has often been viewed as a resource held by a homogeneous 'community', which can be tapped, and enhanced, for development. Against this, Cleaver (*ibid*.) argues that her observation of the options open to the poor challenges an optimistic view that 'social capital' can be increased through collective action, building trust through association. She notes that in practice cooperative behaviour is *ad hoc* and intermittent, and is exclusionary as well as inclusive. The poorest people are disadvantaged by both generalised norms and personalised interactions, and are unable to negotiate such arrangements to their advantage. She argues for an understanding of the norms of institutions, and of how they may operate to the disadvantage of those with little status, ability to articulate, or to contribute to a compromise solution.

Of particular relevance to our study is the way development agencies have promoted the formation of organisations such as water users' associations, and their approach to 'getting these institutions right' (see for example the overview paper for the FAO IMT-E-mail Conference, 2001). As we will discuss in Chapter 5 our case study sites have been the subject of this form of 'institutional development'; but the water user organisations have not been very successful in enabling social relationships for more equitable water distribution.

Considering the general applicability of the term ‘social capital’ to our study, we accept that there are difficulties with defining and measuring ‘social capital’; we fully agree that ‘social capital’ should not be viewed as an unalloyed ‘good’ held by a homogeneous ‘community’, and that elements such as culture and history, power relationships, conflicts of interest, and the vulnerability of the poor, must all be factored into what to ‘do’ about the social assets which play a role in livelihood outcomes.

At the same time, in our effort to understand the way water is distributed, particularly in the context of the way that WUAs have been promoted, we think some of the concepts associated with the term ‘social capital’ are useful. So when we look at the access of different categories of water user to irrigation we think it is useful to consider the characteristics of their social networks, the social norms that affect their access to irrigation, and the sanctions that are applied if the norms are transgressed. We also wish to consider the characteristics of the different types of social capital which they do (or do not) rely on, such as bonding (for example, with family members, field neighbours, or by ethnic group), bridging (for example, across portions of the irrigation system, between ethnic groups) and linking (for example, between different castes, in patron-client relationships, between landlord and tenant).

These observations can help us to consider the options, as well as the social constraints, to making irrigation distribution fairer. We realise that as we do so we need to take into account power balances and interests, social and cultural values, and the vulnerabilities of the poor; and we consider these features in our livelihoods analysis.

Furthermore, while we accept the dangers of using the economic metaphor of ‘capital’, we like the way it draws attention to the potential value of allocating resources to address ‘social capital’. By understanding the ‘social capital’ of the poor, we can find ways to strengthen their position. But we do not assume that this will automatically be generated internally within ‘the community’. It is likely to take an ‘investment’ in people, time, and money to enable the poor to increase their power and leverage. Ideally this can be done in a way that is safe for the poor – and that does not increase their vulnerability. As we will discuss below in section 2.5.5, this is likely to require the involvement of sensitive and committed champions. It seems appropriate to point out the need to ‘invest’ in this when so many resources have been invested in irrigation infrastructure, and in Irrigation Management Transfer, with the assumption that the poor will benefit simply because they are part of a ‘community’ of water users.

(iv) Our application of SLA

In our investigation we wish to understand the relationship between the technical and physical aspects of water distribution, the social and institutional context, and the livelihood strategies of individual water users. The SL approach helps us to structure this investigation. This is reflected in our overview of the case study sites (Chapter 4) where we describe the history and agricultural objectives of the irrigation developments, the social context, the physical and natural resources, and the political and institutional context in which the irrigation systems operate. In Chapter 5 we consider the assets available to different categories of irrigation water users, their diversified livelihood strategies, and how these shape their relationships with other water users, and their access to irrigation. We are particularly interested in the access of the poor, but as we noted in section 1.2 we realise that their options must be understood in the context of the assets and livelihood strategies of those who are better off.

We then look in more detail at the structure and activities of Water Users' Associations (Chapter 6). We discuss the rules surrounding their operation and the way that these organisations have performed in practice. Here we see how policies, institutions and processes at the macro -- international and national -- level, affect the irrigation system and the field -- the meso- and micro- levels.

In the following two chapters (Chapters 7 and 8)we look at how a physical resource – the irrigation infrastructure itself – has interacted with technical, institutional and social factors to create particular natural resource outcomes -- the availability of irrigation water to different categories of water users. This analysis guides us to a strategy for improving water distribution, which we describe in the succeeding chapters.

2.5.3 Entitlements and concepts of equity and fairness

In this section we compare the meaning of the words 'equity' and 'fairness' and how this relates to rules, the way rules for water distribution are formally and informally expressed, and our own understanding of 'equitable water distribution'.

The Shorter Oxford English Dictionary defines **equity** as: "fairness, impartiality, even-handed dealing." On the other hand, the definition of **fair** not only refers back to equity and impartiality, but also adds "legitimate, in accordance with the rules or standards" (OUP, 2002). The incorporation of concepts of legitimacy and rules in the definition of 'fair' highlights the social context for the interpretation of what is a 'fair' way to distribute water. This interpretation varies across cultures, communities and circumstances. 'Fairness' is the outcome of both formally stated rules, and informal practice, and it is the result of a dynamic process of struggle and accommodation between different interest groups[56] (Boelens, 1998). Furthermore, as observed by Pradhan and Meinzen-Dick, "water rights and the laws from which they are derived are linked to wider cultural meanings and values associated with water…" (2003, p. 37). In our discussion we use both 'equity' and 'fairness'. We use 'equity' because it is the term most widely used in discussions of how water *should* be distributed; but when we wish to highlight the social context in which equity in water sharing is being negotiated we will use the word 'fair'.

As we will see in Chapter 6, formal rules for water delivery as set out in legislation related to the formation of Water Users' Associations (WUA) often stipulate that WUAs should distribute water 'equitably'. In our case studies, the indicators of 'equity' are not explicitly defined, although distribution proportional to land area cultivated is implicit in the structured irrigation system design used in SMIP, Nepal and SRSP, Andhra Pradesh.

Informal 'rules' for equitable water distribution are generally much more difficult to identify than those that are formally documented. On one hand social norms of fair water distribution might be stated by respected leaders or affirmed in public statements and shared oral accounts. On the other hand what Ostrom calls 'rules-in-use' are only observable through the way that activities actually take

[56] Boelens suggests that, "… *equity stands for fairness not according to general principles, but according to the conceptions of social justice of diverse localities*." He points out the risks of failing to recognise the dynamic, and situation-specific nature of concepts of equity: "…*the enclosure of equity in institutional frameworks, official policies and legal constructions bears great risks. Equity easily loses its proper dynamic and unfair games may be played in the name of equity*." Formal rules and legal justice are the outcome of power struggles and conflicts between different interest groups (1998, p. 20 -21).

place in practice (Ostrom, 1992, p. 20). These practices reflect what is considered 'normal' or accepted behaviour. The behaviour of water users, and the agreements that they may reach amongst themselves, often incorporate a range of different considerations[57] such that the outcome, while at least apparently satisfactory to the parties to the agreement, do not strictly meet a formally specified criterion of fairness, such as water distribution proportional to land area.

Another consideration when reflecting on the relationship between the formal and informal rules governing fair water distribution is that there may be a contradiction between what people say *should* happen, and their actual behaviour. Water users may assert that water should be shared fairly, yet their actual practices may be against their own stated ideals of equity or fairness. Nevertheless, water users, including those who suffer from these practices, appear to accept them as inevitable. This inequitable behaviour, and its acceptance, can be widespread and can appear to represent implicitly accepted standards of behaviour. This would seem to qualify these inequitable practices as 'rules-in-use', even if the behaviour goes against the stated ideals for what is needed to achieve impartiality, social justice or good community relations (Mosse, 2003, p.161ff, makes interesting observations on the discrepancy between publicly expressed rules or norms, and privately followed guides for behaviour in water distribution).

As we will see in succeeding chapters, this discrepancy between ideal and actual behaviour is frequently the case when it comes to the sharing of irrigation water. People often say water should be shared fairly, but they still take more than their entitlement. Or if they can't take more, they say they would do so if they could. Does this make it an accepted rule for 'fair' water distribution? The use of the word 'rule' in this context can therefore be rather confusing, so we will not try to distinguish between formal and informal 'rules' in our discussion. Rather, we will look first at the expressed rules, whether formally documented or informally stated – and the principles behind them, and then at actual practices. If there is a discrepancy between principles and practice, we will then consider how to create the conditions for water users to reconcile the two to achieve greater fairness in water distribution. This may well involve a shift in the balance of power and a process of negotiation if there are strong interests wishing to maintain existing arrangements, 'inequitable' as they may be for the poor.

As our own point of departure, we accept an initial definition of 'fair' water distribution as proportional to land area cultivated and appropriate to the crop. We recognise that in many countries land is not shared fairly, and so this allocation of water can aggravate the inequity. But within the aims of our study we do not address either issues of land reform or the separation of water rights from land rights[58]. We believe that water is often even more inequitably distributed than land. If water were distributed proportionately to the crop needs for area farmed, then poor farmers would be able to make better use of their land. In this study we looked at cases where land distribution is very inequitable (most of Nepal and India) and others where land ownership is relatively uniform (Kyrgyzstan and to a lesser extent some parts of Nepal). In both cases we believe that water could be distributed more fairly and that this would reduce poverty.

[57] Chambers points out that from the point of view of the individual cultivator there is a "trade-off between quantity of water on the one hand, and the predictability, timeliness and convenience of water delivery on the other."(1988, p. 38).

[58] Separation of land and water rights is seen by some as a way of strengthening the livelihoods of the poor who have little land (Hussein, 2005), but in Sri Lanka there is concern that it will have the opposite effect and result in a loss of water rights by the poor (Samad, 2005). The complexity of this issue has also been discussed for India by Chambers (1988).

2.5.4 Institutional requirements for equitable water management

(i) Introduction

As discussed above, equitable water management is a concept related to ideals of fairness and even-handedness. The way this concept is understood and put into practice depends on the institutional environment in which water distribution takes place. We noted earlier (Section 2.2) that the promotion of Water Users' Associations has been seen as an important measure for improving the performance of irrigation systems. Among the benefits expected from the 'institutional development' of WUAs is more equitable water distribution (Ostrom, 1992; Skogerboe, *et al*, 2002; Lipton, 2003). Syed Hassan stresses the importance of WUAs being able:

> "*… 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*" (Hassan, 2001).

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)"*.

(ii) Institutions, organisations, and institutional arrangements: definitions

The interest in WUAs has brought with it the common use of the word 'institutional' – often in various ways that are sometimes confusing. For example sometimes it is used to refer to rules, sometimes to the organisations that make and implement the rules, sometimes to the way that rules are applied in particular circumstances. In this study too we will be discussing WUAs, and 'institutions'. Here we define some terms as we will use them to discuss institutional aspects of water distribution (North, 1992; Ostrom, 1992, Morrison, et. al., 2000, Klein, 1999):

- **Institutions** are the 'rules' that govern the way the irrigation system is operated and maintained. This includes rules such as how to define 'equitable', or 'fair'[59], distribution of water, how to operate the irrigation system to achieve this distribution, who is responsible for doing what, and the penalties for failing to observe these rules. These rules establish the '**institutional environment**' in which organisations, groups, and individuals make decisions and take actions. Formal institutions (such as by-laws, national laws, policies, the national constitution, and international laws and treaties) as well as informal norms, customs and conventions are part of the institutional environment.
- **Organisations** are social groupings which are responsible for making and implementing rules for a common purpose. They interact with institutional rules, but they are distinct from 'institutions'. Organisations or social groups decide and enforce the rules for water sharing, and they implement (or fail to implement) the distribution of water in accordance with these rules. It is institutional rules which determine how organisations are structured and who can belong to them: such as the committees, general assemblies, working parties, etc. which make up the WUA organisation.
- **Institutional arrangements** are the arrangements that are set up for particular transactions. They are the specific agreements put in place in a particular irrigation system at a particular time. For example the particular arrangements that are put in place to distribute water in any particular season amongst the water users in a particular area. The distinction between formal rules and formal institutional arrangements is fairly clear. For example there may be a rule that a WUA is

[59] We use both the words 'equitable' and 'fair' here because formal WUA documents tend to use the word 'equitable', while we want to flag the socially constructed aspect of deciding a legitimate way to distribute water.

supposed to make an agreement for delivery of water from the bulk water supplier, and that the WUA is entitled to an upper limit, or specific proportion of the water that is expected to be available during the season. The institutional arrangement is the contract for delivery which is agreed between a specific WUA and a specific bulk water supplier in a particular season. The distinction between informal institutions (such as social norms, customs and conventions), and informal institutional arrangements may not always be so clear. As we noted earlier informal institutions are frequently expressed as 'rules-in-use' which are difficult to observe except in the practical arrangements observed on the ground. But these arrangements may not only be highly variable, they may also not be consistent with publicly expressed norms. However, widespread acceptance of particular institutional arrangements as the norm can mean that in effect they become part of the institutional environment.

- **Agents** are individuals and organisations pursuing particular interests. Individuals and organisations establish rules and make institutional arrangements for water to be distributed. As we will discuss in section 2.5.5, drivers of change, the arrangements that agents make to distribute water are constrained by institutions, but agents also influence and change institutions. Their strategies are influenced by history, cultural understandings, and 'structural features' such as economic and social structures. The strategies of individual water users are also influenced by their livelihood assets, including their knowledge, for example, of their rights to water and of technical aspects of water management, and by their social relationships with other water users and with WUA officers and staff. Other agents who influence water distribution include WUA committee members and staff, irrigation department staff, and politicians.

(iii) Institutional requirements for equitable water distribution

Combining our earlier discussion of the meaning of equity, as a principle of fairness and even-handedness, with our discussion of what we mean by institutions, organisations, institutional arrangements and agents, we propose the following institutional requirements for equitable water distribution:

- rules which assert that water is supposed to be distributed equitably, and which define the indicators for judging if water has been distributed equitably;
- organisations (expressed through the actions of informal groups, committee members, staff, politicians, etc.) which are willing and able to apply and enforce the rules of equitable water management amongst the water users to whom the rules of equitable water management are supposed to apply;
- water users who are willing and able to enter into institutional arrangements so that water is distributed equitably at any specific place and time.

As we noted in section 2.2 the promotion of Water Users' Associations has been widely seen as a way to develop more effective irrigation management. Our study focuses attention on water distribution in irrigation systems where formal institutional rules, organisations, and institutional arrangements have been developed in the context of promoting Water Users' Associations (WUA). National laws have been promulgated and WUAs have been established for the delivery of irrigation services to water users. These institutions have been shaped by their history: by the circumstances that led to the development of particular rules and by the way those rules were implemented in practice. Their history influences the attitudes and behaviour of all of the parties, or agents, who are supposed to be governed by these rules, and the attitudes and behaviour of these agents in turn shapes the way that the rules develop. In discussions of the 'New Institutional Economics', this is referred to as 'path dependence' (North, 1992).

In Chapter 6 we examine the formal provisions, laws, constitutions, and bylaws of these WUAs in our study sites. This, combined with the history of irrigation reforms and WUA establishment described in section 2.2, helps us to understand the 'path' that has led to the water distribution practices that we have observed in our field studies. We consider the extent to which the requirements listed above have been met, how water has been distributed in practice, and the extent to which water distribution practice has been consistent with the rules, as well as the principles, of equitable water distribution. This provides the groundwork for developing a strategy for promoting greater fairness in water distribution practice.

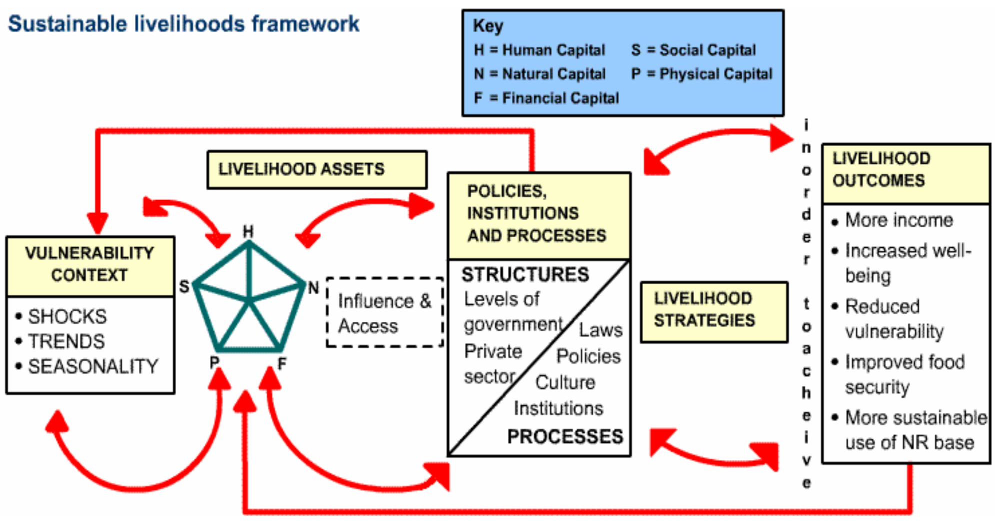
2.5.5 Drivers of Change

(i) The 'Drivers of Change' approach

We noted in our discussion of the Sustainable Livelihoods Approach that it, and particularly the concept of 'social capital', have been criticised for not focussing sufficient attention on political relationships and processes.

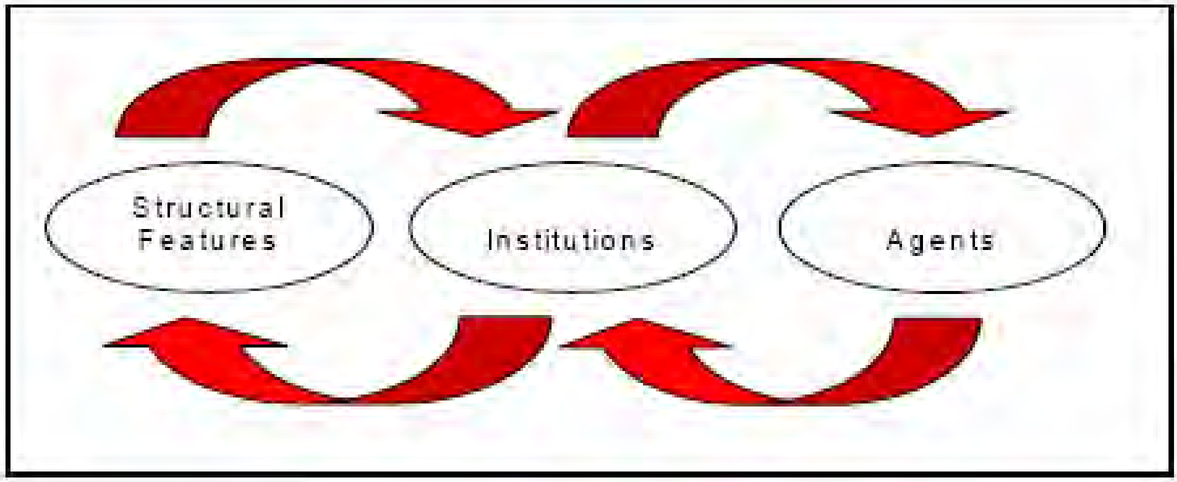
The 'Drivers of Change' (DOC) approach can be seen as a shift of attention to the political. It began to be formulated in the latter 1990s and developed out of a recognition by donors, including DFID, that in order to achieve the 'pro-poor' objectives set out in the Millennium Development Goals (MDG), development strategies and programmes needed to be informed by better political and institutional analysis (DFID, 2004a; Warrener, 2004; OECD, 2005)[60]. This analysis aims to understand the economic, social and political factors that either drive or block change. In this way it should be possible to identify the opportunities, incentives and restraints to pro-poor change This understanding would be used to achieve specific policy objectives: (1) predicting the pro-poor consequences of certain policy interventions, (2) identifying factors and forces that are likely to generate pro-poor changes; and (3) define (potentially unconventional) entry points (Moncrieffe, 2005).

A conceptual model of 'Drivers of Change' was proposed to help structure this analysis. It is interesting to compare this framework with the SLA framework we presented earlier:



[60] Documents presenting the approach and examples of the way it has been applied can be found at the DFID website: http://www.grc-exchange.org, e.g. Duncan, *et al.*, 2003, and at the Chronic Poverty Research Centre website: http://www.chronicpoverty.org/CPToolbox/PolicyInfluence_MediaEngagement).

The Drivers of Change Framework



Source: DFID 2004b, pp. 1-2.

The components of the DOC framework are:

Change: which can be both negative and positive in its effects on agents' interests (signified by the red arrows).

Agents: individuals and organisations pursuing particular interests.

Structural features: history of state formation, natural and human resources, economic and social structures, demographic change, regional influences and integration, globalisation, trade and investment, and urbanisation.

Institutions: rules governing the behaviour of agents

Institutions take a central place in the 'Drivers of Change' framework. The focus shifts from people and their livelihoods to political interests and processes. 'Organisations' are distinguished from 'institutions' and are grouped with individuals as 'agents'. Agents influence structural features through institutions, so this analysis focuses on "formal and informal rules, power structures, vested interests and incentives within these institutions" (*ibid*.). As stated in a DFID paper, "*a 'driver' of change is not just a reforming individual, but processes of interaction between structural features and agents, centred on relationships of power, inequality and conflict*" (DFID, quoted in Bird and Grant, 2005, p.15). From a strategic, pro-poor, point of view the 'Drivers of Change' are "*the individuals, organisations or broad processes of change which DFID must identify ways to support*" (Warrener, 2004, p. 12). In our view, many of the details of the SLA framework are subsumed within the 'structural features' component of the model, although the 'asset pentagon' might be considered to be incorporated in the 'agents' component.

The 'Drivers of Change' approach is valuable in its explicit acknowledgement of the need to incorporate the analysis of power relationships in development policy and strategy. However, a recent DFID review of the experience of using this approach noted that it is still early days in translating this analysis into operational outcomes. It concluded that while its use has yielded insights into a complex range of issues, it has been less fruitful in offering "*suggestions about the potential and practical* *'levers of change", or understanding of "how behavioural change could be brought about*" (DFID, 2005, p.2). An OECD review observed, "*DOC and power analysis is potentially challenging because it reveals how little is really known about how to promote progressive and sustainable change, and often highlights the limits of donor intervention*" (OECD, 2005, p.31).

(ii) Identifying 'drivers of change' for improved water distribution

As we report in Chapters 5 - 8, inequity often persists despite the availability of adequate, if not ideal, technical possibilities, and even when formal rules, and informal ideals, of equitable water distribution exist. The 'Drivers of Change' approach, by directing our attention to the 'agents' of change, helps us to address the social and political question - what will it take to make the current arrangements for water distribution more fair? We approach this question by considering who are the winners and losers from the current arrangements, and what measures, incentives and other motivations, would be needed to bring about a change in those arrangements. These measures can be the 'levers of change'. If we identify these we can develop a strategy to move change in the direction of greater equity.

To develop this strategy we can draw on the SLA, on concepts from the New Institutional Economics (NIE) (reviewed in Morrison, *et al*, 2000; North, 1992), and, on an analysis of 'agents' from a DOC perspective – their positions, relationships, and claims (Moncrieffe, 2005). The Sustainable Livelihoods framework helps to organise thinking about the assets that groups and individuals have available to them to pursue their livelihoods. They draw on these assets when participating in social interactions, including for the distribution of irrigation. NIE considers the role of information, relationships, incentives and motivations to promote collaborative outcomes, or to create conditions for opportunism in social interactions. Drawing on Moncrieffe, a strategy for engagement to bring about change toward greater equity, including identifying whom to engage with and how, should consider (1) the **positions** of agents and why they hold these positions. This is likely to incorporate many influences, related to culture, values, norms, and relationships, and not only the more individualistic or economic considerations often used in the game theory approaches incorporated in NIE (critiqued in Mosse, 2003, p. 273ff; illustrated in Ostrom, 2004) (2) the **relationships** between agents, including the processes by which relationships are reinforced; (3) the **claims** of these agents, and their avenues for representing their claims (Moncrieffe, 2005).

So, for example, sometimes poor water management practices, and associated inequities, are the result of lack of knowledge of the appropriate technical practices, or of the rules that have been adopted for sharing water. This lack of knowledge (a 'Human Capital' asset, in the SL framework) can result in what is referred to in NIE as 'asymmetric information' [61] . Lack of knowledge among at least some water users, combined with social factors such as the balance of power and influence amongst different categories of water users, may allow some people to take more water than they are entitled to. Also lack of information, and subjective perceptions of their interests and options, may cause the various agents[62] involved in water distribution to resist technical and formal changes which could promote more equitable water distribution. This suggests that information about newly introduced technologies has not been effectively communicated and that the institutions have not become socially embedded. The 'social capital' of shared and accepted rules has not been formed. The strategy for

[61] "**Asymmetric information** occurs where access to information by one party (or parties) to a transaction is better than access by another party. Asymmetric information can be used as a source of power in determining the outcome of the transaction". Morrisons, et. al. 2000.

[62] By "agents" we mean all the people who have an effect on how water is distributed. The "agents" include not only the water users, but also others who are involved with irrigation management, such as ditch riders and other officials, politicians, etc.

intervention would then be guided by identifying effective ways to deliver information and forge relationships to embed institutions for fairer water distribution.

(iii) The role of 'champions' of change

Bird and Grant (2005) have identified a number of 'barriers to pro-poor change', including, "*poor mobilisation around social movements, co-opted and low capacity leadership, weak identification as constituencies by elected leaders, and poor or partial representation by interlocutors*". They note that, "*the need to deliver improved rights for marginalised and vulnerable groups is rarely seen to justify either increased political attention or the devotion of increased resources to those groups*" (Bird and Grant, 2005, p. 10). Among the elements that they consider necessary to bring about change are "*effective lobbies in areas where they are currently absent or weak,… fora for debate and the emergence of strong political leadership*" (*ibid*., p. 11). However, as we noted in section 2.5.2 poor people have difficulty negotiating arrangements to their advantage.

This means that in many cases it is unrealistic to expect poor water users to assert their claims to water without the support of more influential champions. In the findings of a study in three states in India, Kolavalli and Brewer highlight the role of external agents in establishing and guiding the performance of Water Users' Associations. They find that in only 2 of the 21 associations they studied did farmers not have external help in organising themselves. They note that these agents have not only given organisational, technical and political support to the associations. They have also worked with potential leaders among the weaker sections of the community. They remark that the "*role [of these external agents] as independent arbitrators in building consensus is crucial. Change which would otherwise be opposed by existing power bases remains unopposed as they see external agents as being powerful in their own right. There is always the threat of external agents pressuring government agencies into acting on behalf of the weaker sections of the community*" (Kolavalli *et al*, 1999, p. 264).

We consider that an important element in a strategy for a fairer distribution of water is to identify and recruit appropriate champions, or agents of intervention. These champions need to have the motivation, as well as the social and analytical skills, and political leverage, to work with the poor and marginalised, as well as all other irrigation stakeholders, to bring about the changes necessary to achieve greater equity.

2.5.6 "Participatory development" – interpretation and application to action research for more equitable water distribution.

Much of the discussion surrounding irrigation sector reform has put great stake on the "participation" of water users in managing irrigation. Indeed "Participatory Irrigation Management" (PIM) is a common shorthand for the transfer of water management responsibilities to water users, usually via a Water Users' Association (Sun, 2000).

The use of the term 'participation' has become widespread, and in some cases it has fallen victim to the ambiguities and misuse that Cohen and Uphoff warned against in their paper, "Participation's place in rural development: seeking clarity through specificity":

> "*At present, concern with participation is popular, and one can hardly be against the concept, broadly conceived. When the meaning of development is said to include aspects of popular participation, promoting this becomes good by definition. Participation is often endorsed*

> *unambiguously, on normative grounds even if the empirical basis is not as clear. There is a real danger that with growing faddishness and a lot of lip service, participation could become drained of substance and its relevance to development programmes disputable."* (Cohen and Uphoff, 1980, p. 213).

The term 'participation' is often used to mean the contribution that water users are expected to make in labour or cash toward the rehabilitation of infrastructure. Their 'participation' in a Water Users' Association is sometimes assumed to exist simply by dint of the fact they *may* have been involved in the selection of WUA committee members. The use of "participation" as a cover for making unwanted, and possibly unwonted, demands on people has even given rise to a critique of the 'tyranny of participation' (Cooke and Kothari, 2001).

But the fact of this misuse does not deny the need to find ways to engage water users if there is to be a genuine connection between them and the service provider that is supposed to represent their interests, and to see to it that they receive a reliable irrigation service. There is no simple and quick way of achieving this. As North observes, the process of institutional change is slow and complicated (North, 1992, p. 6). A recent review aiming to identify mechanisms of water governance which are high benefit and low cost for the poor, highlights the still-outstanding questions about the socio-political processes which can lead to better outcomes for the poor (Cleaver, *et al*, 2005).

Our approach was to combine three strands in our action research. Firstly we adopted a philosophy of engagement to involve as wide a range of stakeholders as possible in our activities. We hoped that our working method would establish relationships of trust and of effective communication. This would help us to understand and work with their understandings and assumptions about the way water is distributed. It would also help us to produce evidence that would be credible and convincing and lead to practical solutions (cf. CPRC, 2005, overview paper on "Understanding the key opportunities and bottlenecks when using research to influence pro-poor policy change"). In this way the action research process could help the water users to develop their own solutions, while we came to understand this process better.

Secondly we used a selection of methods from the "Participatory Learning and Action" tools[63], particularly mapping, well-being ranking, focus groups, individual interviews, and group discussions to try to locate and engage with the full range of irrigation water users, including those who are marginalised, such as women and the poor generally. These tools helped us to understand how their livelihood strategies interact with irrigation water management – with the particular water distribution outcomes which we were able to observe.

Thirdly, while we recognised that there were tensions underlying the way water is distributed our intention was to create a new forum, both potentially fruitful and safe, for this tension to be played out. The aim of this forum was to create the possibility for different interests to be represented in altered circumstances. Here the balance of power and the opportunities for expression could be shifted in favour of the poor and marginalised, at least a bit. This would make it possible for relationships – bonding, bridging and linking – to be changed or newly established. The drivers of positive change could come into force to make the operation of the irrigation system more fair, and hopefully more sustainable.

[63] See PLA Notes: London: International Institute for Environment and Development.

2.6 Key findings from the literature

The discussion above enabled us to refine our research question and methods, but first we will summarise the key observations from the literature on the impact of water reforms:

(i) Irrigation reforms and participatory irrigation management

Whilst our immediate objective is simply to improve access to water by individual farmers, this cannot be achieved in isolation. Water management needs to be understood in a much wider context, and the entire process of water sector reforms has a profound influence on water distribution at a local level:

- The irrigation sector is challenged by growing demand, deteriorating infrastructure and water quality, and central institutions increasingly lacking in the capacity and resources to deal with these problems. This has consequences not only for the medium and longer term sustainability of the irrigation infrastructure, but also for equity in sharing an essential, but increasingly limited resource, with the consequences this has for poor people in particular.
- In the last two decades far reaching reforms have been introduced to the sector to try to improve its performance, while relieving central government of some of its burdens. A key element in these reforms has been an expectation that devolution of irrigation management responsibilities would help resolve these difficulties. Initially the focus of the reform process was on the hand-over to farmers of responsibility to manage tertiary and lower-level canals. However, it was soon recognized that this would be neither effective nor sustainable unless policy changes for the water sector as a whole were implemented. There is a general assumption that a sound institutional framework will lead to greater equity in water distribution, and a reduction in conflicts.
- These policy changes have proved to be politically contentious, and in many countries they have failed to create an environment conducive to farmers being willing and able to take a more active role in irrigation management. It appears that institutional reform has not led to significant changes in the way water is managed by individuals or groups of farmers. Where new rules have been introduced, these have often been poorly defined, inappropriate to the local situation, difficult to enforce or widely ignored.
- The performance of WUAs is strongly related to the history of WUA formation, and the management arrangements which were locally in operation previously. Previous local arrangements often continue to influence management informally even after the reforms. The way that water is distributed at a local level – which, in the end is the ultimate purpose of irrigation, however, remains a little-studied topic.
- In all of our study countries, WUAs have been promoted as part of internationally funded programmes. A common theme in observations of modern WUA performance is that they are often seen as externally imposed organisations, they are rarely embedded in the community; and farmers remain reluctant to take on significant new responsibilities for irrigation management – particularly where this involves socially contentious tasks such as sharing water or resolving conflicts. The leaders are also often unwilling to devote much time to irrigation management, especially as they receive little or no remuneration. The difficulties are especially marked on large schemes.

(ii) Flow management and monitoring systems

Improved water management depends on introducing improved procedures for managing and monitoring water distribution. This is an issue which has both technical and institutional dimensions. The problems surrounding irrigation management and the equitable distribution of water are often seen as primarily technical: related to techniques for forecasting demand and supply of water, planning distribution, measuring and recording flows, and managing gates and other outlets. But in practice it is difficult to design objective rules which can be implemented, especially with the infrastructure which exists on many schemes and the nature of land tenure[64]. Given the physical characteristics of the schemes, the staff available, and the opportunities for tampering the physical infrastructure, there is rarely the degree of control and measurement that would be desirable from a technical point of view. Even where it does exist, the transaction costs of collecting and using the data are often prohibitive.

There are many technical difficulties with flow measurement, and a large number of structures would be needed to measure the flows in many different places. Flow measurement structures are only accurate if there is a difference in water level across the measurement structure, but this is not always available, or may affect the ability to irrigate some land. Methods that do not depend on a water level difference are usually less accurate and much more time-consuming. Even if well-designed, built and operated, measurement structures may not be very accurate, and in practice, it is difficult to achieve an accuracy of better than ± 10%. Flow measurement is commonly perceived to reduce water flows and structures are often sabotaged for this reason.

Given these realities, simplified procedures are almost always needed. These depend on a combination of technical and institutional measures which need to be implemented together.

(iii) Water distribution and livelihoods

Irrigation aims to increase agricultural productivity and have a wide range of positive impacts on livelihoods including reduction of poverty and a number of secondary and indirect benefits. These are often not achieved, and the irrigation sector has been widely criticized for this failure:

- Without an effective combination of technical and institutional measures to manage and distribute water equitably, irrigation will fail to deliver the agricultural benefits, and to fulfil its potential impact on reducing poverty through a range of direct and indirect factors.
- Poor water management has been shown to have adverse consequences on the poor and women who are marginalised both from irrigation decision-making and from access to water.

(iv) Social and institutional issues: concepts and methods for observation and analysis

The social and institutional factors affecting irrigation management are complex. We need to draw on a variety of analytical tools to understand them. When making our analysis we should be clear about our understanding of terms such as ‘equity’ in water distribution, ‘institutions’ and ‘organisations’. We also need to develop an intervention strategy which champions the interests of the poor while being realistic and practical about how to deal with power relationships, and which promotes engagement with all categories of water users as well as with other stakeholders. The development of workable solutions will draw on a combination of social, institutional and technical skills.

- In order to identify appropriate institutional measures we need a sound understanding of the complex interactions which affect water users and the institutional environment in which they pursue their livelihoods. Appropriate analytical approaches for studying or intervening in irrigation management are changing and evolving, and none are without their critics. We find the

[64] Informal and changing arrangements for land tenure make it difficult to identify and involve all stakeholders, understand their requirements, ensure that they are aware of the rules and so on – this influences both our research methods and irrigation management, and will be discussed further in Chapter 3.

Sustainable Livelihoods approach to be a useful tool although we recognise its shortcomings as it is complex and some aspects are difficult to apply or are contentious – notably concepts of social capital and whether it is possible to 'build' social capital. The drivers of change approach, is a more recent complement to Sustainable Livelihoods framework, and it can provide valuable insights for the analysis of power relations which affect institutions and irrigation access.

- Equity is a contentious issue. While commonly used, it is rarely defined and is open to many different interpretations. In our own use of the term we distinguish between concepts of 'equity' and of 'fairness'. 'Equity' is a more abstract term, which is commonly used in legal documents that give WUAs the responsibility to distribute water 'equitably'. 'Fairness' includes socially constructed 'legitimacy' as well as 'equity'. Local rules which are socially accepted may be considered legitimate and fair within the community, even though they may not be equitable according to some external principle – such as water distributed in proportion to area cultivated. It is important to consider local conceptions of fairness when dealing with equitable water distribution.

- It is also important to be clear in the definition of terms used when discussion 'institutions'. A lack of clarity or rigour in definitions can lead to incorrect understanding or inappropriate actions. Confusion of 'organisations' (such as WUAs) with 'institutions' (such as the rules governing the way an irrigation system is managed) can lead to an over-emphasis on the mechanics of holding meetings, complying with quotas for women's participation etc, rather than on developing rules for ensuring fair water distribution which can be applied and enforced.

- We have identified, from this review, three institutional requirements for equitable water distribution: (1) **rules** and indicators of whether the rules are being followed, (2) **organisations** willing and able to apply and enforce rules, and (3) **water users willing and able to** enter into institutional arrangements that **conform to the rules**.

- Drivers of change analysis reminds us that the irrigation distribution outcomes that we observe are an expression of prevailing power relations. Powerful interests may operate to resist change to existing institutional arrangement. The poor, who are most likely to suffer from bad and inequitable water management, are least able to challenge those strong interests. This indicates the need for independent arbiters who are willing to champion the interests of the poor and weak. These arbiters must make it possible for rules to be designed locally by the users and embedded in the institutional set up. In their work they must guard against copying rules and organisational arrangements uncritically from other areas. Even in nearby areas social, topographical, soil or other features may be significantly different.

- These observations point to the need for a way to engage with local users to analyse existing arrangements, and then negotiate and design to rules and procedures. The term 'participation' is often used in the irrigation sector as something intrinsically desireable. But its practice has often actually referred to unwanted, but compulsory, contributions to offset irrigation service costs. Such abuse has led to a critique of the concept, presented as the 'tyranny of participation'. Despite this abuse, we still see merit in the careful use of the aim of 'participation' to meet a critical need to engage water users in the process of developing systems that ensure that they receive a reliable water service.

- The adoption of improved and effective institutional measures is a challenge. Enforcement of rules is difficult – infringement by a small minority can quickly undermine rules established and initially followed by the majority of users. This is why it is so important to enable a process that is resilient to occasional infringements. And these rules must also be technically sound. This means coordinated and complementary institutional and technical skills must be available to support water users to achieve the aim of more equitable water distribution.

2.7 The research questions

Drawing on the findings summarised in this chapter, we initiated our research from the premise that access to water on irrigation systems is not equitable[65], but that it could be made more equitable by introducing improved systems and procedures for monitoring and managing water distribution. However, in order for these systems and procedures to take root, to become embedded, they must be introduced as part of a process which takes due account of the wider social and institutional context. We considered that this process should be implemented with an understanding of the livelihoods, interests and relationships of the key actors and of their ability to influence the institutions that shape the way water is distributed. A strategy to make water distribution fairer, in the interests of the poor, will involve appropriate champions of the interests of the poor, and take account of the drivers of change.

The aim of our research was to operationalise these observations by developing and testing a practical programme of intervention to bring about a fairer distribution of water. Our testing procedure involved evaluating the results of four inter-related activities:

- Understand the social and institutional context: learn how the livelihood strategies of different categories of water users - particularly the poor - have interacted with the institutional context to shape the way that water is distributed.
- Verify that water is inequitably distributed in our study sites and evaluate the implications for the livelihoods of the poor.
- Test an approach to engage with all categories of water users and other relevant actors to identify measures which can promote a more equitable distribution of water.
- Present guidelines for promoting more equitable water distribution, based on our experience with testing this approach.

In our procedure we addressed questions related to technical aspects of water distribution on the one hand, and social and institutional aspects on the other.

The technical questions were:

- Is it true that water is not equitably distributed across social groups and parts of the system? As we discussed earlier, we take an initial definition of equity as water distribution proportional to land area cultivated and appropriate to the crop. We are interested not only in differences between upper and lower parts of the system, but also in whether farmers of different socio-economic groups in the same area receive different supply.
- Is it true that the existing physical procedures for monitoring water distribution are inadequate to enable water managers or users to implement any plan for equitable water distribution?
- Is it true that the procedures can be improved and could make it possible for water to be distributed more equitably?

If the answer to the technical questions is ‘yes’ then it confirms that water distribution is inequitable, but that it is technically possible to distribute water more equitably.

However, in order identify ways to achieve this improvement, we would need to answer a set of questions related to the social and institutional aspects:

[65] In the sense that the socio-economic status of water users influences their access to water

- Is the interaction between water users'[66] livelihood assets and strategies, and water management, conducive to equitable water distribution? Are water users from all well-being categories, including the poor, able to exert sufficient influence, and to adopt other measures, to gain equitable access to irrigation?
- Do the history, rules and relationships governing the WUAs result in organisations that are effective in performing their responsibilities, including the responsibility to ensure that water is distributed equitably in the field amongst all entitled water users, including the poor?

If the answer to the institutional and social questions is 'no', then it indicates a need to introduce changes in the relationships that contribute to this inequity, before we can hope to introduce procedures which would result in greater equity.

In order to answer these questions, and to test a process for promoting greater fairness, we included the following steps in our action research method:

- Enable water users to evaluate for themselves the consequences of the way water is managed for the whole community of water users. This means working with them to identify practical ways to monitor and analyse water flow to all who have a justifiable claim on it.
- Enable water users to make a judgement about the fairness of these consequences for all stakeholders (including those whose interests have been overlooked in the past).
- Enable a social and political dialogue amongst the full range of stakeholders on the importance of "fairness" and on the effort that they are willing to make to achieve it.
- Identify the rules, procedures and sanctions to achieve a fair distribution. The power of enforcement will lie at various levels, from the direct users, through various institutions, such as the WUA, government (local and central), and the judiciary. The more the users have been involved in developing and approving the rules, the more likely they are to be observed, and the less reliance there will have to be on outside enforcement.
- Implement rules, procedures and sanctions. Ideally this will take place in an atmosphere of general acceptance of these rules, etc.
- Modify the rules, procedures and sanctions in the light of experience (within what is recognised to be a dynamic balance of power and interests).
- Identify, and address, organisational, policy, and other factors, including those which are external to the WUA itself, which affect the way that water is distributed.

In our study sites we took the role of champions of the interests of the marginalised poor water users. But as we analysed water users' livelihoods we worked with all categories of users. Our aim was to identify both the physical practices and the institutional provisions which they were willing to accept and enforce for more equitable water distribution. In this way we would see if the systematic procedures which we followed could lead to the identification of solutions appropriate to each location which are compatible with the livelihood strategies of water users. Through the process we adopted we would try to take into account the influence of all relevant 'agents', and identify the 'drivers of change'. This would then yield guidelines for promoting more equitable water distribution.

The details of our study method are presented in Chapter 3, while the guidelines which are the outcome of our findings are in Chapter 11.

[66] As we will explain in Chapter 3 we classified water users in our study sites into three socio-economic categories: poor, medium and well-off.

3 Methods

3.1 Overall approach

The approach which we adopted in this study was guided by our experiences on a previous related project (Guidelines for Good Governance [GGG] - KaR R8023). The present project built on the methods which we developed to provide effective support for sustainable development of WUAs on three projects in Nepal (Mott MacDonald, 2004a). Here we used comparable methods, but rather than examining wider issues of WUA governance we focused more specifically on the measures needed for equitable water management.

In carefully selected schemes we incorporated the following key elements in our approach:

- Action research implemented by a multi-disciplinary and multi-national team which included senior professionals, local NGOs and water users from the case study countries, together with an international team of engineers and sociologists who were able to co-ordinate and synthesize experiences across countries.
- Use of a participatory methodology, working with water users who played a key role in the research. We encouraged water users to collect and use data needed for management of their own schemes, but in a form which could be analysed for our wider research purposes.
- Development of an understanding of existing social and institutional relationships, water management practices, and the factors which influence them, by a combination of literature reviews, direct observation in the field (using the participatory methodology referred to above), and a mix of interviews with key informants, focus groups, and randomly selected samples of landholder-irrigators.
- Introduction of innovations which we helped the WUAs and the water users to identify and implement on three schemes; and
- Synthesis and analysis of all findings in order to draw more general conclusions and to develop an approach for improving water management elsewhere.

These elements are described in more detail in the following sections of this chapter.

3.2 Case study selection

3.2.1 Country selection

The institutions and procedures adopted for irrigation management are different in each country. However, there are many common themes and requirements. Water users' associations are widely promoted in many countries for taking on a key role in management, although both the nature and role of WUAs and the social and political context that they operate in is very variable. The use of the same term – WUA – in very different contexts can be misleading and it implies a much greater similarity than is the case. We wanted to understand water management within these divergent situations so that our recommendations could reflect the variations, as well as common features, in the way water is managed by WUAs and farmers.

The criteria which we adopted for country selection was:

- where WUAs are formally recognised and exist within a sound legal and institutional framework;
- where performance of WUAs is generally reported to be good;
- where we believed governments, WUAs and other key stakeholders would be willing to participate in the study; and
- where we had good contacts so that we could work efficiently in our limited timescale.

On this basis we selected the following countries:

- Nepal, where there has been an active policy of participatory irrigation management and WUA development since the 1980s (Khanal, 2003, p. 39) and where we had established effective working relations at all levels through our earlier work;
- Kyrgyz Republic which has taken rapid measures since independence to establish participatory irrigation management and has passed a water code to support it (Herrfahrdt, *et. al.* 2005, p. 35);
- Andhra Pradesh in India, which is internationally recognised (Oblitas & Peter, 1999) to be a pioneering example of modern participatory irrigation management; and
- China, which has the reputation of making substantial progress in improving the efficiency of water use by WUAs (Johnson, 2002).

We planned a slightly different programme in each country in order to meet the overall objectives of the study with resources available. We originally planned to study existing practices through literature review in all four countries supported by field observations in two (India and Kyrgyz Republic) leading on to implementation of measures for improvement in these same two sites. We modified this plan at several stages:

- We added a field investigation at Khageri Irrigation System (KIS) in Nepal as the literature was found to be too sparse on the specific topic of water distribution within WUAs and its relationship to livelihoods to be useful;
- We could not study existing practices in detail or introduce improvements in India since a series of poor monsoons in that part of Andhra Pradesh meant that irrigation releases were much less than normal. We could, however, observe how farmers coped with an extreme situation and draw some conclusions from this; and
- We wanted to capitalise on the excellent local relations which we had established through our earlier work[67] on one project (Sunsari Morang Irrigation Project – SMIP) once it became clear that this site had now achieved more of the preconditions necessary to make progress with equitable water distribution than any of the other study sites[68].

For these reasons, we did the majority of the work in Nepal and Kyrgyzstan where, in each case, we studied existing water management practices on two sites and implemented improvements on one site. In India, we made a study of existing practices on four WUAs within one very large irrigation system,

[67] Sunsari Morang Irrigation Project, included under Guidelines for Good Governance (GGG) (DFID-KAR R8023) – Mott MacDonald (2004)
[68] This progress was only achieved on GGG after the initial planning for this project (EIP) was complete, so it was not included in the original plann

followed by a more detailed study within one of these WUAs. Our work in China was confined to a literature review of existing practices, drawing on field observations made during the previous study.

3.2.2 Seasons for study

Since the study duration was only sufficient to allow 12 months to cover all fieldwork we were unable to work on the same scheme in the same season in successive years.

In Nepal, there are two irrigation seasons each year but the differences in water management requirements are fundamentally different between the seasons as there is a monsoon climate. Here we chose to work in one scheme in the spring season, and then apply the lessons from this to a different scheme in the monsoon. We first studied one project (KIS), in spring 2004 and used this primarily to understand the water management systems in use there, in order to draw lessons which could be applied elsewhere. As a secondary aim, we tried to help the first WUA to introduce its own improvements in spring 2005, without any further assistance - except for a field-level workshop at the start of the 2005 crop season.

Using lessons from this study, we aimed to implement improvements on another project (Sunsari-Morang Irrigation Project - SMIP) in monsoon 2004. In SMIP we were also able to draw on observations of existing monsoon water management practices, drawing on our earlier work on a previous study at SMIP in monsoon 2003. The limited amount of cropping in the spring season in this part of SMIP and the substantial differences in water management practices made a spring season investigation less appropriate on this site.

We originally planned a more comprehensive study in Andhra Pradesh where there are two cropping seasons each year which are both entirely dependent on irrigation. We aimed to study four sites in *rabi* (dry season) 2003/04 (December-March), with a view to understanding water management sufficiently well that we could implement improvements on one site in *kharif* (monsoon) 2004 (July-November). In this relatively arid tropical region, inter-season variations in water management practices are relatively small, so this made a two-season intervention potentially fruitful. However, the lack of water in *kharif* made this plan impractical. Nevertheless, we were still able to make some more detailed investigations of existing water management practices in that season.

There is only one irrigation season each year in Kyrgyzstan, because of the severe winter. It is slightly extended by some overlap of crops during this season - with rice and cotton grown after winter wheat. Here we aimed to gain sufficient understanding of water management in the early part of the season to make it possible to introduce minor improvements later in the season, as water became scarce.

We did not plan any field investigations in China, and we relied on earlier observations from GGG in Ningxia and Xinjiang provinces and other available literature. The lessons from this research are presented in chapters 2 and 11 only, with supporting information in Appendices B and D.

3.2.3 Project selection in each country

The field study sites within each country were selected using a slightly more detailed version of broadly the same criteria. Thus we aimed to select WUAs which were:

- well-established, registered and existing within a sound legal and institutional framework;

- generally reported to be performing well, and managing irrigation in accordance with a system of rules (rather than distributing water on an *ad hoc* first-come first-served basis) – although in practice we were unable to find WUAs which strictly followed formal rules;
- known to us and where we had effective contacts so that we could work efficiently in the limited timescale of the project;
- willing to participate in the study and where we believed other key stakeholders would be keen to be involved (i.e. the WUAs should recognise the need for improvement in water distribution, and there should be good relations and communications with the bulk water supplier [Department of Irrigation, *Raivodkhoz*, etc], so that it is confident in the total supply that it will receive);
- the canal system is in operable condition (some shortcomings are expected, but the WUA must be able to control flows even if just by informal means), and the rehabilitation status is such that it does not influence the study, since many schemes are in the process of rehabilitation[69];
- there is an adequate but not excessive water supply; and
- conveniently located to facilitate logistics, without being untypical of the country as a whole.

Given our methodology the 'willingness to participate' criterion was the most critical, but we endeavoured to meet all other criteria, particularly in those sites where we attempted any interventions. We had worked on related study on three WUAs in Nepal for the preceding two years, and selected one of these (in Sunsari Morang Irrigation Project) for this follow-on study[70].

We were not able to meet all criteria in the sites in India where there was extremely little water available during the study seasons. One site in Nepal (KIS) was only appropriate in the spring season and not in the monsoon, which meant that it was not a suitable site for the intervention phase.

We needed to select a relatively small area to work in, given the time and resources we had available. Our target area was about 250 ha per site for detailed study with a more general study of the WUA as a whole. This is much less than most WUAs in our study countries, which ranged in size from 1,000 ha in Andhra Pradesh (Kadambapur) up to 7,900 ha (Sitaganj - SMIP) in Nepal. We selected secondary or tertiary canals 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 operable condition
- Relatively simple physical system
- Command area of roughly 100-250 ha
- Between 100 – 200 farm management units
- WUA recommendations.

This led to the following site selection (Table 3.1)

[69] Minor preliminary measures (such as cleaning watercourses, or closing illegal outlets) may be necessary before users are even willing to discuss changes to water management measures, or may need to be linked to the development of new rules. If the required measures are minor and within the capacity of the farmers/WUA they could be implemented during the study, but projects requiring more extensive repairs or maintenance would not be suitable for this study.

[70] This site was selected as it is part of a large irrigation system with a widely-perceived need to improve water distribution. The other two sites (Kamala Uttarabayini and Bijaypur), are much smaller and face far less serious problems of water management and we felt that there was less to be gained by undertaking this study in those locations

Table 3.1: : Selected case study sites

Country	Project / WUA	Detailed study areas
Nepal	Khageri (KIS)	BC-1 (Outlet 18) and BC-2 (pilot gate west and *pachas bigha kulo*)
	Sunsari Morang (SMIP) - S9 (Sitaganj)	SS9E – T5
India	Sri Ram Sagar (SRSP)	D-86 (M30R in Kadambapur WUA, in which we focused on three pipe outlets P2. P5 and P9), following on from preliminary studies in Kadambapur, Mirzapur (D-86 M50R), and Metpally and Pothireddypet in DBM-15
Kyrgyz Republic	Obu Haet (OH)	Buvakul canal
	Jany Aryk (JA)	Khatta Khaz 1 canal

In the case of China we undertook a rapid survey of WUAs in Ningxia Hui Autonomous Region (Weining and Qintongxia irrigation districts – two large districts in the middle reaches in the Yellow River)[71] and made reconnaissance visits to Xinjiang Uigyur Autonomous Region, in the extreme northwest of China and adjacent to the Kyrgyz Republic. Both are arid regions, with agriculture being entirely dependent on irrigation, and in both cases water resources are greatly over-exploited.

3.3 Methodological aims

Our aims were to identify and tests methods for improving the livelihoods of poor farmers by achieving greater equity in water distribution, by:

- Addressing the interaction of technical, institutional and social issues;
- Establishing contact with different categories of water users (especially the marginalised, such as the poor and women) – recognising differences in access, interests and power relationships;
- Promoting engagement through joint analysis;
- Stimulating empowerment – through knowledge, skills, and connections for influence; and
- Encouraging 'ownership' of results by water users, to promote sustainable and continuing moves toward greater fairness.

Our approach in this study was one of action research[72], so that we could achieve acceptance by the communities which we were working with and ensure that we tested new methods rather than simply documented problems and identified potential solutions. However, it did add considerable methodological complexity, not least since the 'action' influences the 'research'. As Mosse (2003) reflected in relation to his experience on the DFID-funded Indo-British Rainfed Farming Project, we needed to recognise our place as actors within the institutions which we were trying to understand.

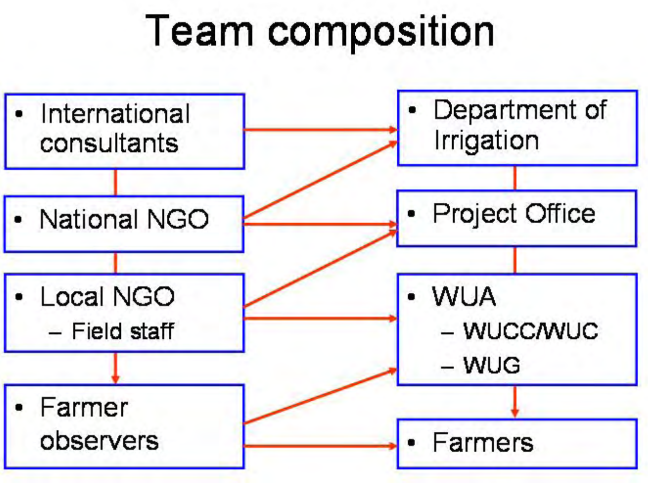
We used participatory techniques in our research and structured this around the 'Sustainable Livelihoods Approach'(SLA) - we discuss the strengths and weaknesses of these approaches in Section 2.5. In our writing up we faced the challenge of presenting a coherent story, while acknowledging that the model we had in mind at the beginning is not the one we present now, that we have not always been sure of what we were looking for, of what we were going to find, and that we missed things along the way.

[71] This survey was undertaken by the Chinese Center for Agricultural Policy, as part of KaR R8023
[72] Action research methodologies aim to integrate action and reflection, so that the knowledge developed in the inquiry process is directly relevant to the issues being studied. They help the individual practitioner develop skills of reflective practice; and also help organization members develop a culture of inquiry as part of their work life, to develop learning organizations or communities of inquiry (http://www.bath.ac.uk/carpp/ppar.htm).

3.4 The approach we adopted

3.4.1 Team composition and working method

Developing an appropriate team with links at each level to the relevant organisation was a critical part of the study. We illustrate the structure adopted for the case study at SMIP in Nepal. The vertical lines denote the main organisational linkages, but we worked to ensure close liaison between all levels. Our objective was to ensure learning and capacity-building at each level, so that improvements identified or introduced under our study could continue to be adopted and supported in the future.



The composition of the team was multidisciplinary at each level: the international team comprised water management specialists and social development specialists which was mirrored by the same composition in the national NGOs. At a local level, the team was more focused on 'field' skills and comprised an agriculturist/water management specialist supported by community development specialists. The farmer observers (FOs) were unpaid local people, selected by the local NGO in conjunction with the WUA.

There was some simplification in the case of the other case studies, where we planned a less comprehensive intervention, but the general approach was the same.

The farmer observers worked with the WUA at local level (ie the water user group at SMIP, the branch canal committee at KIS and the *mirab* in Kyrgyzstan). They collected and compiled data for the WUA, and helped the WUA use this and other information to prepare action plans, develop and implement rules. They reported to the WUA and farmers in regular field level meetings, which were documented by the local NGO who facilitated the meetings. The national NGOs visited periodically, assisted the local NGO and prepared more analytical reports. These field trip reports provide the information for the case studies in the boxes in this report and were also used to prepare sub-project case study reports. This information was synthesised and analysed by the international team to prepare this report. The international team also visited each site periodically and guided implementation of study. All field reports are incorporated in the international visit reports.

3.4.2 Participatory action research

We adopted the following procedures for working within each study site, with slight variation to suit local circumstances:

1. Establishment of close co-ordination with WUAs, water service providers and support agencies through initial meetings both during site selection and afterwards.

2. Selection of local farmer observers (FOs) who would observe actual irrigation practices, and participate in meetings and workshops (see below) to discuss their observations. The selection process was important and was based on a household inventory (by location), wealth ranking, recommendations of the WUA, and willingness to participate. They were thus chosen to represent different interest groups (both socio-economic and location), and yet be acceptable to the WUA so that their observations and recommendations would be given due credence. The information generated for the selection of the FOs was also used to provide baseline information on the livelihood status of water users in the study areas. This helped us to develop procedures to ensure the representation and involvement in our study of all categories of households, particularly marginalised poor and female-headed households.

3. Facilitation of meetings to evaluate procedures and their context, and hence develop ideas for improving management. These meetings were attended by the FOs, sometimes with WUA and agency representatives. Meetings were arranged so that not all FOs attended all meetings, but they were convened according to wealth or location so that representatives of the various interest groups could all have an opportunity to speak freely and we could understand the different perspectives. There was also at least one large meeting in each WUA where all were invited to attend. These meetings were facilitated by our team, in some cases with the assistance of a local NGO.

4. Observation of water distribution outcomes (flow measurements). We measured flows using simple techniques in locations where the observations would be useful for management as well as research. We also made indirect measurements or observations (such as water depth in rice fields) where this was more appropriate. The measurement techniques were chosen in conjuction with the WUA, so that the WUA would be able to continue the measurements if they wished, and the recorders were selected from the FOs.

5. Studies of livelihoods and institutional contexts (participatory and questionnaire-based). The FO meetings yielded a considerable amount of information on the livelihoods of the different categories of water users, but these were supplemented with specific studies to fill in gaps in our knowledge using a mixture of PRA and questionnaire-based methods; and

6. Final field-level workshops to discuss observations, conclusions and recommendations.

We followed these steps in Nepal and Kyrgyzstan, but the lack of water in India during the study period meant that we had to adopt a simplified approach. It was not practicable to recruit farmer observers who could report on existing systems and then facilitate improved management, nor was it possible to measure flows. Thus we omitted the steps listed in steps 2 – 4 above.

3.4.3 Livelihood assets data

(i) Listing of landholders and well-being classification

For our research it was important to know who used water, and what their interests in the irrigation system were. Such lists would also be needed by the WUAs for their future management of the system. None of the WUAs, however, had complete, up-to-date and reliable lists of their membership, let alone of other local stakeholders who used water but were not entitled to membership (eg unofficial tenants such as sharecroppers). Lists were sometimes prepared when the WUA was set up but they were not updated - these lists often included people who were now dead, or had migrated or sold their land, and excluded many others who had moved into the area. This was an issue both for our research and for the WUAs ability to manage the system. We had to collect data that was sufficiently accurate for our purposes and help the WUA to prepare appropriate lists for their long-term management.

Our teams worked with key informants and irrigators in groups and individually to build up a picture of the social, human, physical, natural and financial capital assets which contribute to the livelihoods of irrigators in each study area. With the help of the local informants our study teams classified irrigators in the study areas into three or four wealth, or ‘well-being’, categories[73]. In Kyrgyzstan and Nepal our teams were able to work with local informants to develop well-being classification criteria that incorporated a range of asset characteristics including, but not entirely based on, land holding. Local informants then classified households into well-being categories using these criteria. Our analysis of these data uses this classification of irrigators into ‘poor’, ‘medium’ or ‘well-off’.

In India it was not possible to follow this procedure for various logistical reasons. Consequently using information from a baseline survey conducted by our team, we classified irrigators into four strata using land area cultivated as a proxy indicator for well-being. However, two subsequent surveys of non-random sub-samples of irrigators in the study area yielded information on the broader, non-land, assets that influence well-being status. Villagers said that they considered financial status, political influence, education and personal character, as well as number of dependents and presence of children who are earning, as key determinants of well-being status. Our impression is that, with some exceptions (e.g. where a ‘marginal’ land holder had been able to migrate to Dubai and subsequently acquired a tractor), land was an adequate, if not strictly consistent, indicator of irrigators’ well-being status for the purposes of our analysis[74].

Well-being classification is subject to uncontrollable influences from both the local informants and the approach of the study team. Nevertheless, the distribution of study households gave some indication of relative incidence of different categories of household in each of our sites. This suggests that there is the least polarisation of households in our sites in Kyrgyzstan where perhaps two thirds of households are in the ‘medium’ category. Jany Aryk may have a higher proportion of households in the ‘medium’ and ‘well-off’ categories. This would be consistent with greater off-farm income earning opportunities associated with being closer to the city of Osh. Our site in SRSP has the largest proportion of households in the poorest two categories. This reflects the caste composition and structure of landholdings in this area – the majority of households are from Backward or Scheduled castes, and 20% are poor Muslim households[75]. It would appear that the proportion in the poor,

[73] The procedure for conducting ‘well-being’ or ‘wealth’ classification is described in Grandin, Barbara. 1988. Wealth Ranking for Smallholder Communities: A field Manual.
[74] However the data does not allow us to rigorously test this assumption.
[75] See discussion of ethnic and caste composition below.

medium and well-off categories are about equally distributed in KIS and SMIP. But this may reflect the procedure used when classifying households (respondents tended to allocate households into three equal sized well-being groups).

As in Kyrgyzstan, land in China has recently been allocated to individuals and is still owned by the state: farmers cannot buy or sell the land they farm – with the result that farm size is a poor proxy for household weatlth in these countries[76].

(ii) The farmers we studied

This research is concerned with the way that water is distributed for irrigation. So in our investigation we focused on land-holding farm households within the command area of our study locations. We did not include landless labourers. But we did include landless farmers (for example, tenants or sharecroppers, who do not own any land). We also included households with very small land holdings who could potentially benefit from irrigation – whether or not their land was actually irrigated or cropped during the time of our study. In SRSP there was a distinct group of Muslim landholders with very small holdings - less than 0.2 ha. These households reported 'breaking stones' and labouring as their primary source of income. None of these Muslim households had cultivated their land for the last five years. They did, however, report 'agriculture' as a secondary occupation, although some respondents may have meant agricultural labour for others rather than farming on their own land. We have included this group as a distinct category, identified as 'Sub-Marginal'. Aside from the 20 Muslim households, concentrated in P-9, the 'Sub-Marginal' category in our SRSP baseline survey included two other households that did report farming as their primary activity: a 'Scheduled Caste' landowner in P-9 with 0.2 ha, and a 'Backward Caste' landowner in P-2, with 0.1 ha.

(iii) Collection of information on livelihoods and relationships

The details of the sample sizes, data analysis procedures, and adjustments that have been made to the data for the purposes of analysis and comparison are presented in Appendix F. Briefly, the method used in each site was:

- Nepal: using the list of landholders and landowners prepared for the well-being classification at the beginning of our field research, toward the end of our study season our social researcher interviewed key informants to obtain additional livelihoods asset information for the individuals on the list. This was used to supplement information that was collected more informally through the season. In theory we should have obtained information for 100% of landholders, but, as discussed in section 3.5.3, some landholders were not included, while information was provided for some absentee landowners who were not actively involved in irrigation during our study season. This was particularly the case in KIS, Nepal.

[76] In their study of Ningxia and Henan, Hussain & Biltonen (2004) 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 (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. Land fragmentation is, however, a particular problem – Hussain & Biltonen report that households typically have around 5 small parcels of land. This is a consequence of the original allocation when people were given a mixture of land of different qualities, but is a much greater degree of fragmentation than we observed in Kyrgyzstan.

- Kyrgyzstan: toward the end of our field research[77] a questionnaire survey was conducted which included questions about livelihood assets, collaboration with others, water management, and contact with the WUA. Our social researcher interviewed a random sample of 65 landholders (15% of landholders in our study sites), stratified by well-being category and access to irrigation. The landholders list prepared for the well-being classification was used as a sample frame. We alos undertook a brief survey of 'collaborating neighbours' – small groups of people who worked together on a regular basis for irrigation.
- Andhra Pradesh, India: three rounds of surveys were conducted in our study site. A questionnaire baseline survey to obtain livelihoods information for all landholders in the study area was conducted during *kharif* 2004 (August – November). Two further surveys, a 'livelihoods survey' and a 'water management survey' covering 44 landholders was conducted in December 2004. This provided additional information on irrigation practices and relations with the WUA.

We undertook a brief questionnaire survey in Ningxia, China supported by reconnaissance visits to WUAs in several provinces. These are reported in the annexes.

3.4.4 Water measurement

We have discussed the problems of water measurement at some length in Chapter 2. We faced the conundrum that we sought to improve equity of water management without necessitating detailed flow measurement – yet we needed to measure water supplies to individual farmers, in order to monitor whether we were able to achieve our objective. We involved the FOs actively in all aspects of measuring flows, and they encouraged the WUAs to become more active in flow monitoring.

We did not build any measurement structures, but relied on calibrating existing structures. Effective calibrations for the main canal had been set up at KIS at the time of establishing the WUA, but we checked this by flow measurement. At lower levels in the system (ie. within branch canals and outlets) we used float measurement, as structure calibrations were not possible and flow conditions in canals were very variable. At SMIP good structures had been built down to the head of the tertiary canals at the time of rehabilitation, and it was just necessary to ensure that these were flowing free at the time of measurement. At lower levels, we observed whether outlets or water courses were flowing or not, and depths of flow but did not make volumetric measurements. At both KIS and SMIP, we made qualitative or quantitative observations of field water conditions (ie either a depth of water, or perception of adequacy of water supply)

In Kyrgyzstan we installed some staff gauges in the canals which were calibrated and monitored by local hydrotechnicians. The legacy of the previous system of management is that there are a number of technicians who are able to make such measurements. We also recorded observations of frequency and duration of irrigation, and perceptions of depth and reliability

We made no measurements in the India case study, as the complete failure of canal irrigation made this impossible. Instead we relied on perceptions from previous seasons gleaned by discussion with farmers.

[77] Participatory techniques are not so well established in Kyrgyzstan as they are in Nepal and India, which were pioneering countries for the development and adoption of PRA techniques. The DFID-supported project 'Sustainable livelihoods for livestock producing communities' which included some irrigation activities (HTS 2002, 2003) also introduced some useful participatory techniques, which have proved useful for other work with WUAs in the Kyrgyz Republic.

Our assessment of equity of distribution was thus achieved by asking the FOs to make consistent observations observing the depth and frequency of irrigation, rather than by measurement of canal flows. Where we needed to measure canal flows for the purposes of our research to a greater degree of accuracy than was possible with existing structures, we used current meters or float gauging in order to avoid making unsustainable changes to the infrastructure or management system.

3.4.5 Identification and implementation of improved procedures

In order to make the study more acceptable to the local participants, and to verify our recommendations, it was important that we started to implement improved procedures on some projects. This in practice was not an entirely distinct stage to the evaluation and planning phase, since the participatory processes helped the water users and WUAs to understand their system better and start improving their way of working. However, on three sites (Sunsari-Morang in Nepal, and Jany Aryk and Obu Haet in Kyrgyzstan) we worked in a more formal way to introduce and evaluate improved water management procedures. The steps we followed were:

- Analysis of data (FO meeting outputs and water distribution measurements) with the FOs and WUAs to make a preliminary identification of improvement ideas, that we believed to be broadly acceptable to the users;
- Helping the WUAs to modify institutional arrangements or establish new institutions through which they can turn these preliminary ideas into practical measures;
- Facilitating preparation of actions plans, which could be implemented directly by the WUA, for undertaking all steps needed to introduce improvements; and
- Monitoring progress, observing outcomes, and assessing potential impact on livelihoods.
- Final field-level workshops to discuss observations, conclusions and recommendations.

In practice these steps overlapped and were not carried out sequentially. As we worked for a full season on this phase at SMIP, we were able to carry out these steps most systematically and rigorously there. In the case of the Kyrgyz sites, these steps were compressed into the last 1-2 months of the season (Table 3.2)

Table 3.2: Summary of activities in each site

	KIS	SMIP	OH and JA	SRSP
Study planning	November-December 2003			
Reconnaissance and development of methodology	February 2004	June 2004	January 2004	November 2003
Preliminary Studies		[undertaken through GGG]	Preliminary data collection Feb-Mar 04	Rabi season review December 2003-March 2004
Detailed evaluation: flow measurements, livelihood studies	February – June 2004 Daily flow monitoring Periodic FO meetings with focus group discussions (FGDs) and questionnaires to supplement livelihoods studies	July-November 2004 Daily flow monitoring Periodic FO meetings Additional FGDs and questionnaires to supplement livelihoods studies	April-September 2004 Daily flow monitoring Periodic FO meetings Additional FGDs to supplement livelihoods studies	Baseline study of 3 outlets October 2004

	KIS	SMIP	OH and JA	SRSP
Implementation of improvements		Facilitation of actions at WC, T and SS-canal level, involving local NGO	Facilitation of improvements in Obu Haet (June-September)	
Supplementary studies (additional livelihoods issues)		Livelihoods studies (Jan-Mar 2005)	Livelihoods studies (November-December) 2004	December 2004 (livelihoods and water management)
Feedback results to participants	January 2005, timed to influence manage-ment for spring 2005	January 2005	October 2004	March 2005

3.4.6 Analysis and development of a model for effective water distribution

Each step in the process was systematically documented as described earlier, and was used to help in synthesising and analysing the findings in order to prepare general guidelines (Chapter 11). Each field visit was systematically documented as described in section 3.4.1. As part of the process of implementing the research we also helped WUAs to improve their own record-keeping and documentation processes, and at the end of the season we helped the WUA to evaluate the changes that they had been able to introduce and to assess what further work needed to be done to strengthen the improvements or make them more sustainable. The final workshops at each site concluded our formal involvement with each WUA, and resulted in a strategy for each WUA to improve water management. Each national study team then synthesised the observations for each study site and prepared a report on this. These were then drawn together to prepare this overall report which aims to draw general conclusions on the process and achievements, and thereby provide guidelines for improving water management in other places.

3.5 Challenges and Caveats

3.5.1 General constraints

We believe that the methods described in this chapter are sufficient for the objectives of the study, although there are clearly some limitations. The main weaknesses were due to the short time frame for this study, and the need for slightly different methods in each site – in order to cope with different local conditions.

Key issues were that:

- Our findings suggest that changes in the social relationships amongst water users, and between water users and the WUAs are critical for any equity-promoting changes in water management. Such changes take time and we could only observe the initial stages of introducing changes during the period of our study.

- We could not observe either the actual impact of changes in relationships on livelihoods, or how they would be adopted and sustained over the coming years. In the case of SMIP, however, we could build on relationships which had been developed through running Water Users' Schools in 2003 (Mott MacDonald, 2004), but even here we believe that a longer time-frame is needed to ensure sustainable improvements.

- There were variations between the methods used by the teams in each case study country, and hence in the data collected, in order to suit the local conditions. This creates some problems for data analysis and comparability.

3.5.2 Water measurement issues

The difficulty in water measurement was one of the key reasons for initiating the study, and we aimed to identify pragmatic solutions to the problem for the purposes of equitable and sustainable management. This presented a dilemma. On the one hand, we did not want to set up complex systems which would not be sustained. On the other we did need sufficient data to assess the equity of water distribution and to evaluate the impact of the project. Furthermore our data were affected by the fact that flows were being observed and measured which often influenced the behaviour of those who manage the canals.

These difficulties have implications both for this study and for longer term management, since WUAs need consistent reliable data to use as a basis for planning water allocation and collecting resources.

With these implications in mind, we did not attempt to measure flows to individual farmers, but developed proxies which could be used for the purposes of the study by the farmer observers. In the case of KIS, we observed the depth of water in fields which is a simple indicator appropriate for rice cultivation. In Kyrgyzstan, we relied on a subjective perception of reliability of irrigation to individuals. We had hoped to use a metal probe as simple means of comparing soil moisture, but this proved to be impracticable. We made direct measurements at slightly higher levels in the system where this was within the capacity of the WUA and where they felt that this would be useful in the longer term. All measurements were made by the farmer observers and the WUA, who compiled and used the data for their own management purposes.

Our analysis in Chapters 7 and 8 reflects the difficulties in measuring flows. We were not able to obtain directly comparable data for each scheme, because of the nature of the infrastructure. But we are able to compare performance within schemes systematically as we used consistent methods internally. We however, believed that it was more important to use the existing infrastructure than to build new measurement factilities which would enable more accurate measurement but which would also influence the way water is managed.

3.5.3 Social and institutional observation

(i) General issues

Our research aims required us to collect reliable livelihoods information to assess the impact of water distribution on poverty. But as many researchers have found, the disclosure of some types of information is often very sensitive. This is especially true in relation to land and financial assets. We found it a challenge to get consistent information for quantitative analysis of livelihood assets such as land holding size, land tenure or household income.

The willingness of people to provide information, and the quality of the data our teams were able to collect, were influenced by a number of factors:

- Second guessing - villagers would 'second guess' what researchers wanted to hear, anticipated the benefits researchers might be able to offer, and couched what they said to researchers accordingly;
- Time constraints - researchers sometimes had too little time in the field to make in-depth participant observations;
- Focus groups discussions - were difficult to summarise and this sometimes resulted in overlapping and selectivity of reporting;
- Elite dominance – despite our efforts, we could not always control the tendency of the most influential and vocal to take part in meetings and other research activities. This could distort the information provided; and
- Engaging the poor and women - this could be difficult, as we discuss further below.

By being aware of these problems we tried to mitigate their impact, but our emphasis was on collecting data that was sufficiently accurate for the purposes for which we needed it. It would have been possible to collect more accurate landholding data but this would have been very time-consuming and might have been counterproductive if farmers became suspicious of our motives. We were able to collect more accurate lists of land owners and cultivators towards the end of the programme at SMIP when the WUA themselves needed the data in order to prepare systematic irrigation plans.

(ii) Engaging poor landholders in the study

As we set out in section 1.2, our research included the explicit aim of engaging the full range of stakeholders. We were particularly concerned to include water users who are commonly left out of discussions and decision making – the poor and women.

But we encountered a number of challenges to our ability to realise our intentions. The poor tend to have little time available to participate in meetings and discussions, and those who are not locally resident, (e.g. non-resident sharecroppers), or those who also work away from the irrigated area, are difficult to contact. The poor feel especially vulnerable to pressure and possible repercussions if they criticise others who are better off and more powerful, and so are reluctant to be forthcoming in their observations.

The main constraints which affected the involvement of poor and women irrigators in our research were:

- 'Invisibility': we relied on a arrange of key informants to help us identify all the irrigators. We stressed the importance of identifying every irrigator, from all well-being categories in our study sites. Nevertheless, and despite our field verifications, some irrigators, often the poorest, were overlooked.
- Time: because of their livelihood priorities they could not, or did not see any value in attending meetings or other activities organised by researchers;
- Politeness prevents candour: they were unwilling to say things that might offend researchers (what they thought would or would not be the benefit of the research activity to them; or what they thought about other water users in the community);
- Discrepancy between researchers' aims ('empowerment', 'self-reliance') and the aims of poor people in the study locations (immediate and observable gains, possibly through the leverage or patronage which can be offered by the researchers): poor people lost interest if they did not see a prospect of achieving these gains;

- Reluctance to speak: due to vulnerability and lack of confidence, social constraints on speaking in public, and before more powerful members of the community;
- Reticence of women: women could be particularly reluctant to participate in public meetings in front of men, especially on irrigation, which is considered to be a matter for men.

Through our action research process we made every effort to identify and involve poor and women irrigators, and to give them a voice. We verified our lists, made individual visits, held separate focus group discussions for men and women from different well-being categories. Nevertheless, we are conscious that we were not fully successful, and that the views and experiences of the poor and women may still not be adequately represented in our findings.

(iii) Indentification of and quality of data regarding landholders

It was difficult to get complete and accurate information regarding the landholders in the study season: particularly for poor and marginal landholders, let alone collect more comprehensive socio-economic data. Land tenure arrangements are complex and variable, and they may be concealed for a variety of reasons such as concern over the use of the data (for taxation or water charge collection), methods used to conceal true ownership in order to comply with land reform legislation, or a natural reluctance not to divulge personal data. Either or both of landlords and cultivators may reside out of the irrigated area, and may not be well-known to their neighbours. In some cases, the landlord is well-known but in others it is the cultivator who is better known. Sharecropping arrangements may be very short-term, and there may be different cultivators in successive seasons.

As a result the landholding and tenancy information is incomplete especially for poor landholders. For example, when our team prepared the original list at KIS a single name of household was recorded, without making it clear whether it is the owner or the cultivator. Sometimes both are recorded, and if someone owns some land and rents some more, there will just be a single entry. If the farmer was local but the owner was absent they tended to list the tenant, but if the tenant was not local then they listed the owner (often because they didn't even know the tenant). We do not generally include livelihoods information for non-cultivating landowners – even though these landowners may have an effect on the way irrigation is managed. Whilst more systematic procedures could mitigate this problem, there will always be some uncertainty over the data - but it still allows us to see patterns in the interaction between livelihood assets and irrigation.

(iv) Quality of land holding data

Concerns about taxation, government regulations on tenancy arrangements, and a wish for privacy always make it difficult to obtain accurate information from farmers about land tenure, area owned and area cultivated. Our data suffer from the common difficulties of inconsistency associated with the concerns of our informants when they provided this information. Farmers often understated the area they owned in total, and they also understated the area they were renting in or out – particularly if this was under an informal arrangement. It was not always possible to maintain a clear separation in our records between land owned, land held, and land cultivated. The arithmetic on these figures is often difficult to interpret because for practical and personal reasons many cultivators both give and receive land on a rental or sharecrop basis. It proved to be difficult, and tiring for our respondents, to provide information in a consistent manner for tabulation. They were probably more accurate in reporting the amount of area they cultivated within our study command area, as this was related to our ongoing interaction with them on matters of water distribution. Nevertheless, while the figures we used should certainly not be taken as accurate records in their detail, they do give us a helpful idea of overall trends[78].

(v) Cropping data

Our data for cropping was drawn from a combination of key informant sources and farmer interviews. As with the data on area owned, held, and cultivated, our data on area under different crops was not always complete and consistent. The data for Jany Aryk and Obu Haet on cropping reflects cropping plans and was produced by the WUA to conform to the requirement to conclude a water delivery contract. This was supposed to be based on farmers' intentions, but to some extent, it was also based on cropping patterns in the past not just the current situation. We are not able rigorously to determine to what extent actual cropping was consistent with these plans, but we feel confident that it did not diverge significantly. In KIS and SMIP only a single crop was grown, so this was fairly straight forward. But we do not have the figures to tell us about areas in the command of our study sites which were left unplanted. In SRSP data collection at a time of drought was clearly difficult, and significant areas were not definitely classified as either under a particular crop or fallow. However, it is likely that this land was left uncultivated or the crop was abandoned during this drought year. Despite these limitations, we feel that the data provide useful insights for our analysis of farmer incomes and livelihood strategies.

3.5.4 Institutional and social analysis

We used the livelihoods framework to structure our observations and analysis. This is a systematic and logical approach, but it did cause some difficulties with members of the team who were not very familiar with it, and there were several other factors which influenced the analysis. Issues included:

- The complexity of 'Livelihoods' framework - the difficulties of
  - Knowing what information to collect
  - Organising the information
  - Turning the information into a coherent and relevant narrative
- Selectivity of observations
  - Failing to report 'the obvious'
  - Overlooking the uncomfortable
- Intellectual and emotional exhaustion – ways of coping with 'reality' which colour the way observations are reported
  - Coping with complexity and contradictions by turning it into a simple story ('people just cooperate'; 'water is distributed by mutual agreement')
  - Coping with helplessness by externalising it or considering it inevitable ('the poor/women aren't involved in water management' [and so aren't relevant]; 'the poor/women are bound to be left out [because of their lack of resources or influence], so why insist on trying to draw them in?')

[78] There are some variations between sub-projects – for example, land holding figures for SRSP are for area **within** the study command area. But for other purposes landholders have been classified according to their **total** reported landholding – which included land holdings outside the study command area.

- Coping with power imbalances by acceptance or attack ('the powerful are bound to have their way, so let's not rock the boat'; 'the powerful will always act against the interests of the weak, there can be no improvement until they are deposed')

These factors did contribute considerable difficulties in the analysis of the data. Specific problems related to coping with:

- Inconsistent quality of data especially on sensitive subject of land ownership and land tenure
- Too much data
- Synthesis of qualitative data
- Extrapolation of findings from sample surveys.

The impact of these constraints are discussed in the analytical chapters, but we do not believe that they affect the broad conclusions although they may well influence some of the details.

4 Overview of case study sites

4.1 Introduction

The case study sites are listed below in Table 4.1. These projects are described briefly under the following headings in subsequent sections of this chapter:

- Overview: development history and agricultural objectives
- Social context
- Physical and natural resources
- Political and institutional context

Table 4.1: Case study sites

Country	Project	Total Area	Type	WUA Name	WUA Area	Detailed study areas
Nepal	Khageri (KIS)	3,900ha	Built 1969 small run-of river	KIS	3,900	Spring rice irrigation area (420 ha), focusing on BC-1 (Outlet 18 [O18]) and BC-2 (pilot gate west [PGW]and *pachas bigha kulo* [PBK]) which total 90 ha)
	Sunsari Morang (SMIP)	58,000 ha	Built 1975 rehab / CAD ongoing. Largest project in Nepal	Sitaganj (S9)	7,985	SS9E – T5 (140 ha), with more limited coverage of whole sub-secondary canal (722 ha)
India (AP)	Sri Ramsagar (SRSP)	265,000 ha	Built 1965 rehab on-going, reservoir backed, on major inter-state river	Kadam-bapur	1,023 ha	P2, P5 and P9 of M30R (69 ha)
Kyrgyz Republic	Obu Haet (OH)	1,803 ha	Built – unknown (Soviet era) rehab planned, run-of river augmented by inter-basin canal linking to reservoir	Obu Haet	1,803 ha	Buvakul on-farm canal (143 ha
	Jany Aryk (JA)	1,390 ha	Built – unknown (Soviet era) rehab planned, reservoir backed	Jany Aryk	1,390 ha	Khatta Khaz 1 on-farm canal (188 ha)

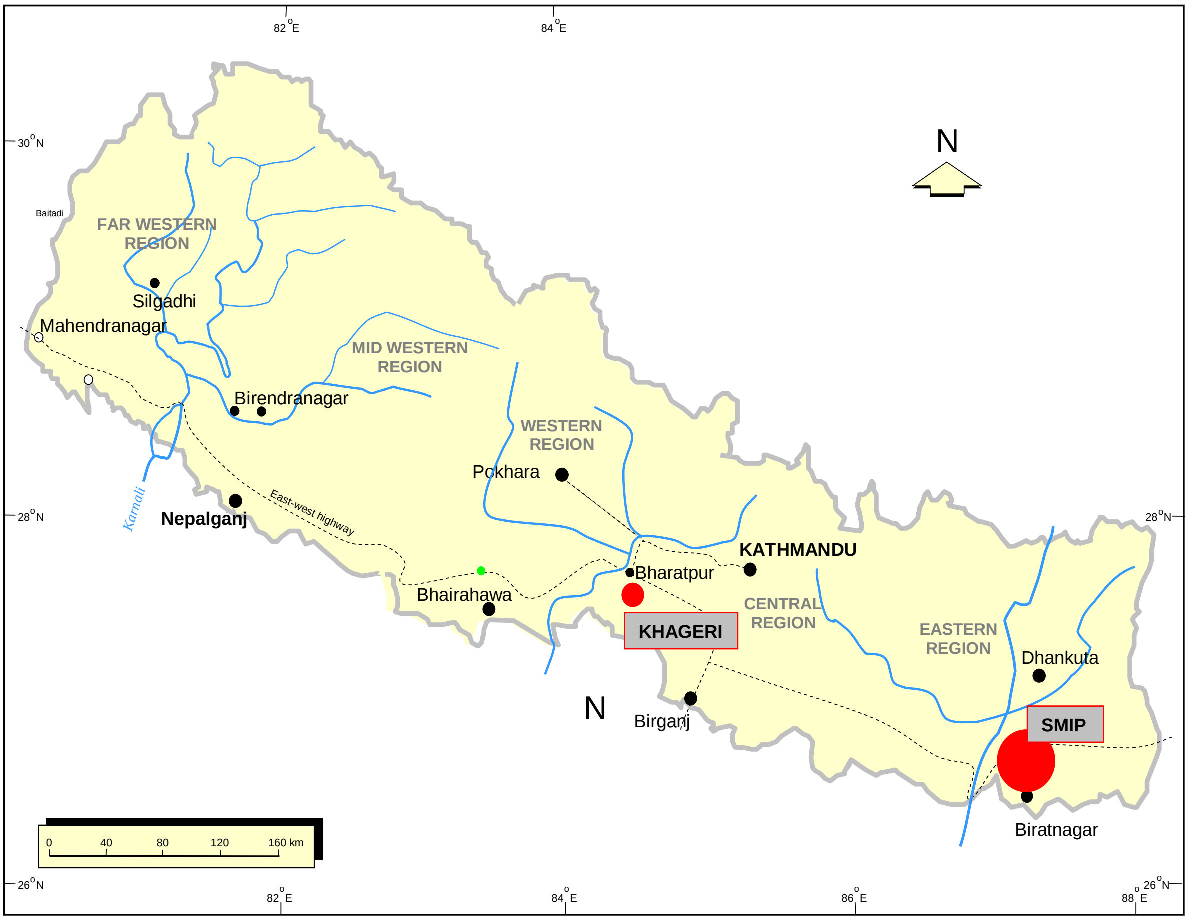
4.2 Nepal

4.2.1 Introduction

There are two strands to irrigation development in Nepal: traditional systems date back for several hundred years and irrigate up to 10,000 ha per scheme, although most are much smaller (Pradhan, *et al* 2000); modern irrigation started with the construction of the Chandra canal in the 1920s, which led on to construction of several very large schemes culminating in the 58,000 ha Sunsari Morang Irrigation Project in 1975. Exact statistics are lacking but there are about 500,000 ha in small FMIS and 300,000 in larger agency-built schemes (AMIS) (Mott MacDonald, 2002). However, performance on these large schemes was poor and this inspired a long-term programme to reform the irrigation sector. Nepal was a pioneer in instituting government policies to support and promote the formation of Water Users' Associations (WUAs) and to introduce joint management of irrigation schemes. This drew strongly on the perceived better performance of FMIS, although it has proved difficult to transfer the concepts when dveloping AMIS (Howarth, *et al* 2005).

The two projects selected in Nepal are indicated on Figure 4.1

Figure 4.1: Location of projects selected in Nepal

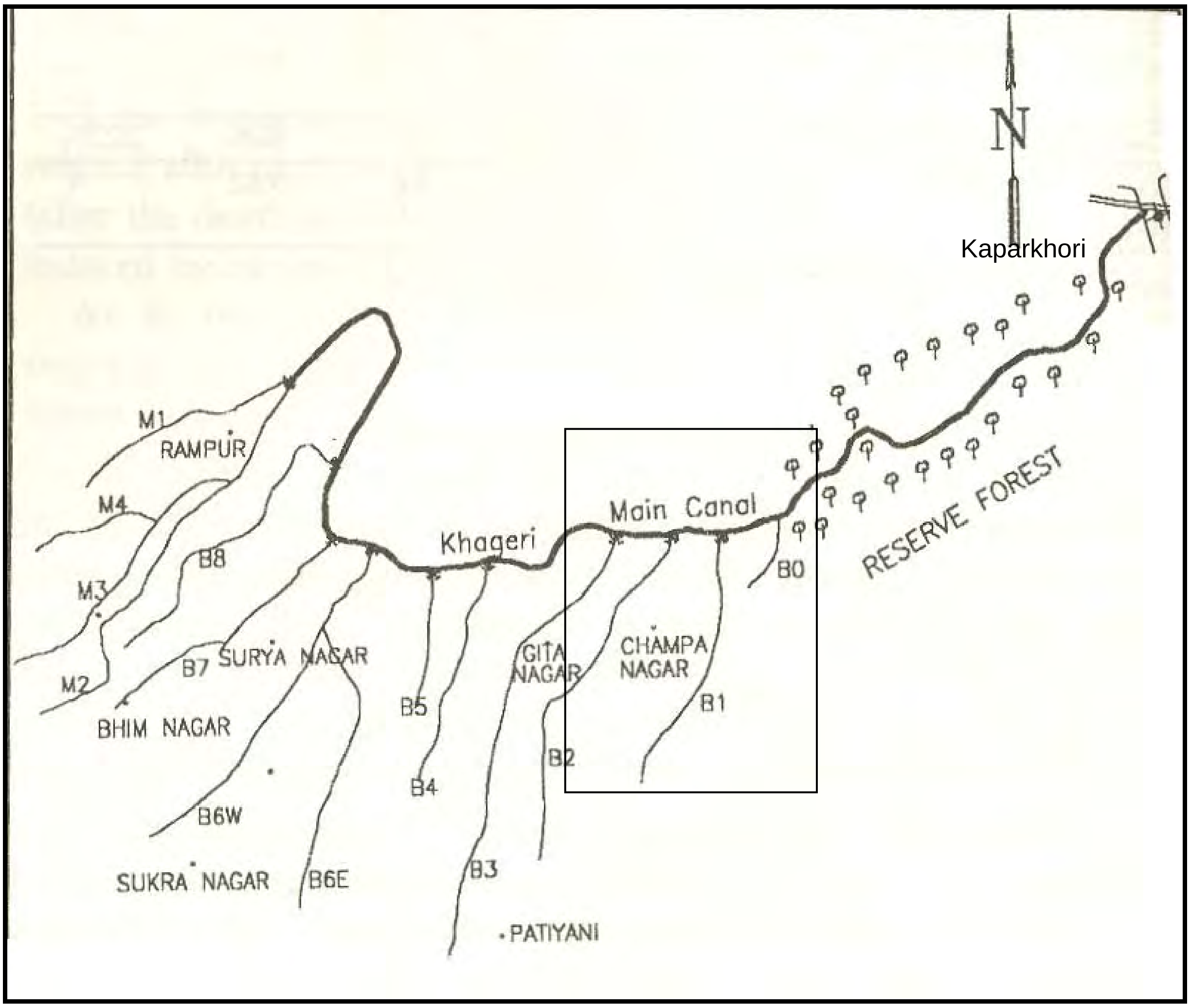


4.2.2 Khageri Irrigation System

(i) Overview

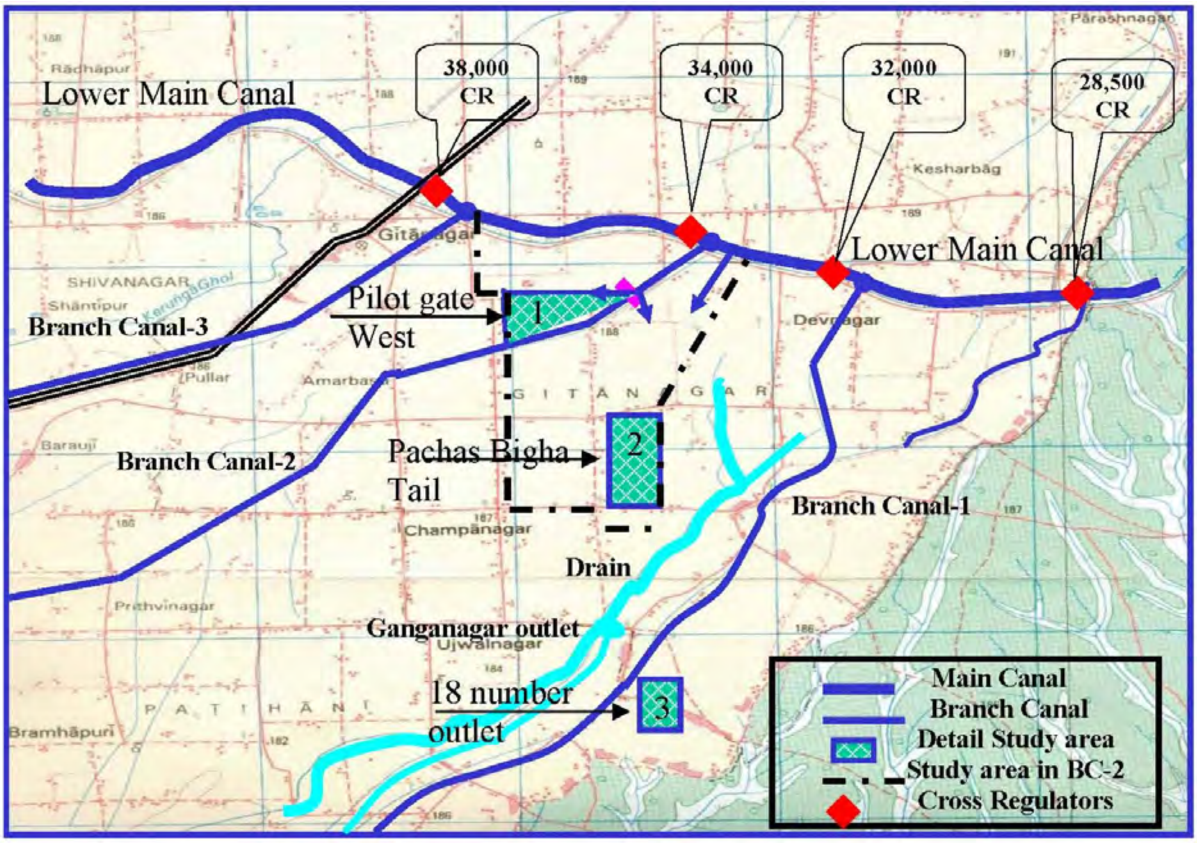
Khageri Irrigation System (KIS) was originally constructed in the early 1960s to provide irrigation to 3900 ha in a newly settled area in the Chitwan Valley. It is a run-of-the-river irrigation system, and has good road access. It has received much attention over the last 15 years, and has been under joint management since 1995. Rice is the dominant crop during the monsoon season and this is followed by wheat / pulses in the winter, with early rice and maize grown in the spring season in about 10% of the area. The project is adjacent to the Chitwan National Park, and many people at the head of the system (including our detailed study areas) are partly dependent on access to protected areas for forest products. The project layout is illustrated in Figure 4.2, and the part of the system selected for detailed study is illustrated in Figure 4.3. This is within the spring rice irrigation area, focusing on parts of BC-1 (Outlet 18 [O18]) and BC-2 (pilot gate west [PGW] and *pachas bigha kulo*[79] [PBK]). The total area irrigated in spring is about 420 ha and those selected for detailed study total 90 ha.

Figure 4.2: Canal Layout for Khageri Irrigation System



[79] *Pachas bigha* means 50 *bigha*, equiavalent to about 33ha, and refers to the command area of the canal, although the actual area is rather geater than this. *Kulo* means canal

Figure 4.3: Study canals and sites in Khageri Irrigation System



(ii) Social context

This whole area was originally royal forest and very sparsely populated with indigenous *tarai* groups, until settlement from adjacent hill districts was encouraged in the 1960s when land was distributed at a nominal price on the basis of 4 *bigha* (approx. 2.7 ha) of land for cultivation and 10 *kattha* (approx. 0.3 ha) as a house plot. Hill migrants (mostly Brahmin and Chettri[80]) now dominate the area, with the original inhabitants (mostly Tharu) being a minority located on the margins or outside the irrigated areas. They continue with their customary practices, but there is also a process of acculturation. There is a tradition of supporting neighbours and kin at times of emergency, and the *parma* system (labour exchange for sharing agricultural work) is popular.

This migration was after the enactment of land reform measures in 1964, and although further immigration and land sales has resulted in subdivision of plots (land holdings now average less than 0.5 ha), land ownership remains relatively homogeneous with few landless people[81] in comparison to many areas of the *tarai* (such as SMIP – see below), and few large landholdings.

As landholdings are small, few households can subsist entirely from the land that they farm. Livestock provide an important supplement to their income, and most have some other external income source (Table 4.2).

[80] There is also a small group of *dalit* (untouchable) migrants.

[81] This is as high as 30% in some parts of the project area. It is generally much lower although we do not have quantitative data on this

Table 4.2: Land tenure and other income sources

Class-ification	Total Nos	Average food sufficiency months	Owner-farmers	Give *share / contract /mortgage*	Take *share / contract /mortgage*	Receive water from canal	Income from livestock	Employment in village		Employment elsewhere	
								Agric	Other	Agric	Other
Poor	56	8.5	70%	7%	43%	70%	63%	43%	18%	0%	55%
Medium	64	11.2	73%	25%	11%	83%	58%	13%	14%	0%	64%
Well-off	27	11.5	59%	63%	0%	74%	67%	4%	0%	0%	74%
Absentee	28	8.6	4%	82%	0%	71%	21%	0%	11%	0%	86%
Total	175	10.1	59%	34%	18%	75%	55%	19%	13%	0%	66%

(iii) Physical and natural resources

The climate is sub-tropical, with a mean annual rainfall of about 2000 mm, about 80 per cent of which occurs in the monsoon (June-September). The project is a run-of-the-river irrigation system, taking water from the small but perennial Khageri River, a tributary of the East Rapti River in the Gandaki river basin, which has a catchment area of 118 km^2 and flows ranging from 900 l/sec in April to 12 m^3/sec in August[82]. There is a manually operated gated barrage, which diverts water into the 23km long main canal which has a design discharge of 7.24 m^3/s, of which the first 9 km passes through the buffer zone of Chitwan National Park. The detailed study area (Figure 4.3) covers part of the first two branch canals (BC-1 and BC-2, totalling 750 ha of which 320 ha receives water in the spring season) immediately downstream of the forest, although it is strongly influenced by a separate area (100 ha) at Kaparkhori close to the head works. There is a good network of gravel roads, as can be seen on Figure 4.3, ensuring reliable and easy access to markets

The main canal regulators are old gated masonry structures which are functional, although somewhat leaky. Some have been calibrated for measurement, although no structures were specifically designed for that purpose. The two branch canals where spring rice is grown each have a single cross-regulator very close to the head regulator. These divert water into what is referred to as 'pilot gate areas', comprising relatively high land close to the head of the canals. There are no other regulators, and all outlets from the branch canals are ungated pipes, some of which flow free and others are submerged.

A system of shares has recently been introduced by the WUA whereby farmers can buy shares in the system. Shares give an entitlement to water in proportion to the number of shares held. This has not been completely implemented - only around 50% of farmers have bothered to purchase shares - and the legal status of the rights is not clear. Water rights are not formally defined in any other way, but are assumed to be proportional to land area held.

(iv) Political and institutional context

The project was conceived and constructed in the days of 'panchayat democracy' in Nepal, and was intended to be centrally managed by the government with little involvement by the users. Poor performance coupled with international experiments elsewhere with more participatory modes of management[83] led to a series of programmes to improve management systems. These projects started

[82] 1 in 5 year reliable monthly average flows.
[83] Notably Gal Oya in Sri Lanka and the Upper Pampanga system in the Philippines

in 1986 and are still continuing. The national irrigation policy in 1992 specifically promoted participatory management. A Water Users' Association was set up in 1993/94, leading to formal joint management the following year. The restoration of parliamentary democracy in 1990 lent support to these moves, although the elected government became increasing unstable after the hung election of 1994, with many changes, until it was finally dismissed in 2002 and replaced by an appointed council of ministers. Water is such an important and valuable resource that it is not surprising that responsibility for water management was often contested along party political lines.

Management arrangements are described in detail in Chapter 6. There is a three-tier WUA responsible for management of the main canal (jointly with DIO), branch canals, and outlets, with general assemblies at branch and main canal level. Local government has no direct role in irrigation management, but may assist with conflict resolution. There have been numerous programmes to strengthen irrigation management, starting with the Irrigation Management Project (IMP) in 1986, which led on to the Irrigation Management Transfer Project (IMTP) and now SAGUN[84].

4.2.3 Sunsari Morang Irrigation Project

(i) Overview

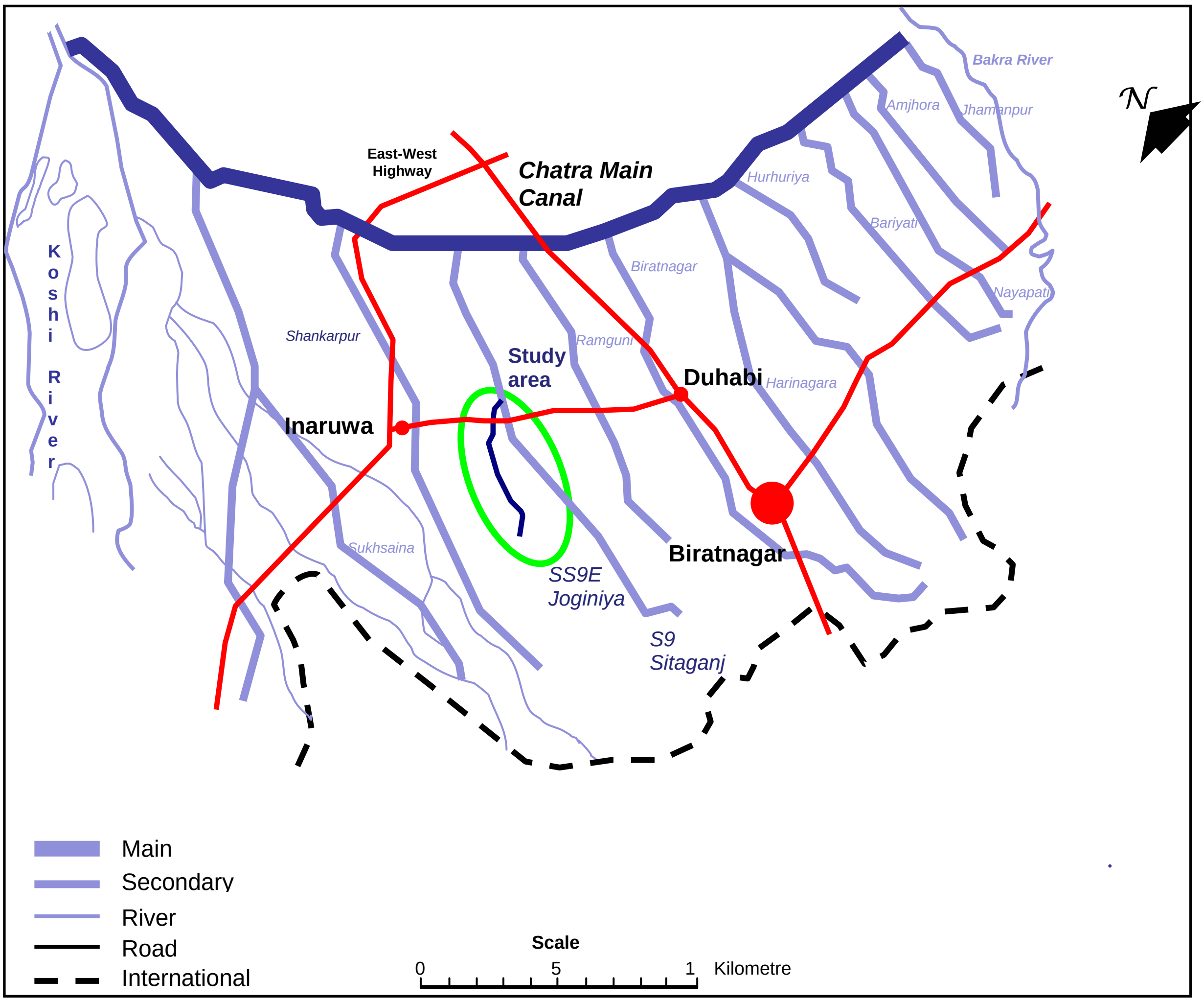
Sunsari Morang Irrigation Project (SMIP) is in south-eastern Nepal, near the industrial city of Biratnagar and about 500 km from Kathmandu. It was originally constructed with technical and financial assistance from India and is in an area which now has good road access both within the project area and linking it to external markets. Completed in 1975, it aimed to provide irrigation for about 58,000 ha (Figure 4.4), but due to water shortage and incomplete command area development it does not irrigate the whole area yet. The project was initially designed for extensive supplementary irrigation of monsoon rice. A rehabilitation and command area development programme began, with World Bank assistance, in 1978 and has so far covered about half of the total area.

A sample area which suffers from an unreliable water supply was selected from within the Sitaganj WUA in the central part of the rehabilitated area for this study (Figure 4.5). This WUA covers the whole secondary canal (S9, also known as Sitaganj, 7,921 ha), but the study focused on one sub-secondary canal (SS9E – 722ha) in the middle part of the command, and one tail-end tertiary canal (T5 - 140 ha, which has four quaternary canals, referred to as watercourses) from this sub-secondary canal. The sub-secondary canal covers part of two village development committees, Aurabani and Sattarejhora.

Rice is the dominant crop during the monsoon season, covering more than 95 % of the land. Rice transplantation is staggered over a long period, thus spreading the demand for water, but this still exceeds availability.Wheat is the main crop in winter, and is only lightly irrigated and small areas of pulses and vegetables are grown. Early rice is grown in the spring season on about 15% of the area where water is available. The cropping intensity of the study area is now more than 200 %.

[84] Strengthening Actions for Governance in Utilization of Natural Resources (SAGUN) is a USAID granted irrigation management support project being implemented in Irrigation Management Transfer Projects in the *Tarai*

Figure 4.4: Overall layout of Sunsari Morang Irrigation Project

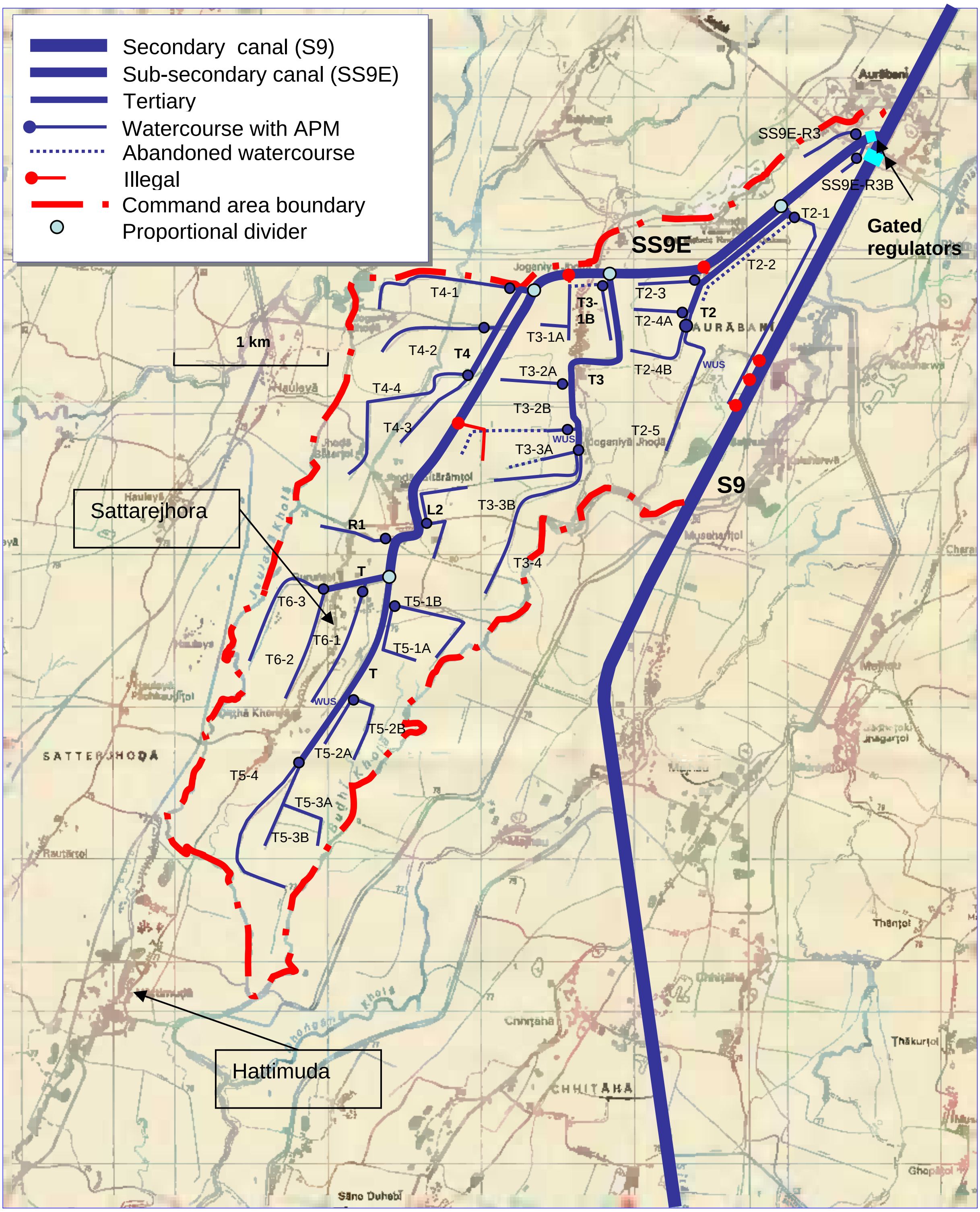


(ii) Social context

The area was originally thinly populated by Uraws and Tharus, Large-scale land development was encouraged by the government through large land grants (known as *birta* and *jagir*) to a few influential individuals who brought in other people to help develop and farm the land. The resulting skewed land ownership has persisted despite attempts at land reform. Immigration accelerated after completion of the initial construction in 1975.

The three tertiary canals in SS9E studied in the previous project now have around 750 resident households and 4,200 population. They are primarily dependent on agriculture and cover an area of about 420ha (out of a total command area of 722 ha). The majority of households owns and farms land, but about 30 percent of the population is landless. There remain a small number of wealthy landlords, many of whom are absentees and who still have a dominant influence over local social relations. The landholding size varies from 0.3 ha to 7 ha in T5. The large area owned by landlords creates opportunities for sharecropping or contract farming, but this is less often available to the landless as they have insufficient credit to purchase inputs and they are more dependent on working as agricultural labourers.

Figure 4.5: Sunsari Morang Irrigation Project: Sub-secondary canal SS9E



It is an ethnically heterogeneous area, with a mixture of migrant and indigenous, *tarai* and hill groups. Migrant Brahmins and Chettris are dominant, whereas the indigenous Tharus and, particularly, Uraws, are very poor. There are large numbers of other *tarai* groups, notably Yadavs and Sahs, who have an important influence. Villages or localities tend to be relatively homogeneous, but members of all groups have to work together within individual watercourses.

The literacy rate is about 40 %, but female literacy is low and the majority of households have no literate female member. This is important because of the high off-farm employment and seasonal migration by men leaving the women to take an important (often dominant) role in the household and on the farm.

As at Khageri there are many opportunities for off-farm employment, in nearby towns and factories, and many people migrate seasonally or send family members abroad on a longer term basis. Few people can subsist entirely from agriculture.

(iii) Physical and natural resources

The project takes water directly from the Koshi river – the largest river in the country which has a catchment area of 58,000 km^2. The average monthly flow ranges from 300 m^3/s in February-March to 4,500 m^3/s in August with an occasional peak of 10,000 m^3/s in monsoon. This is much greater than the design maximum irrigation flow for SMIP (originally 45 m3/sec, but increased to 60 m^3/s in 1996). These design flows are for extensive (rather than intensive) supplementary irrigation of monsoon rice in a 1 in 5 dry year, and are significantly less than the farmers actually desire. There is also a very high sediment load in the river, and it is sometimes necessary to close the canal to reduce the inflow of coarse sediment which clogs canals and reduces fertility.

The climate is similar to Khageri, although marginally drier and more seasonally divergent (average rainfall of 1,850 mm. with 90 % in the monsoon). There is also a high variability of rainfall even within the monsoon months, making irrigation important at critical growth stages of rice.

The project is designed according to the principles of structured irrigation (Albinson and Perry, 2002), with a network of secondary, sub-secondary and tertiary canals, watercourses (typically 30 ha) and field channels (typically 4 ha). There are gated water control structures along the main canal and secondary canals, which normally operate continuously. Flows to sub-secondary canals are rotated, nominally on a 4 day on 4 day off basis, and division of water within sub-secondary canals is on a fixed, proportional basis. All tertiary canals and watercourses should flow continuously when there is water in the sub-secondary canal, but outlets should be rotated (managed by the WUG, which is the lowest tier of the WUA). There are only flow measurement structures at the head of the sub-secondary canals.

Field channels were intended to be built by the farmers, but in many cases they have not been built. Instead illegal offtakes from watercourses or higher level canals have been cut instead so that most plots now take water directly from a watercourse. Attempts to access water via illegal routes cause pervasive and serious problems, which have undermined management.

(iv) Political and institutional context

Water users' groups were set up in SMIP from an early stage of rehabilitation, but they were not registered in this area until 1994: a formal joint management agreement was signed in 1996. There is a four-tier WUA responsible for management of the main and secondary canal (jointly with SMIP project office), sub-secondary and tertiary canals, and watercourses. The basic registered unit (WUA) is the water users' coordinating committee (WUCC), which is responsible for one secondary canal, with water users' committees (WUC) for each sub-secondary canal (which is also responsible for tertiary canals), and water users' groups (WUG) for watercourses. According to the joint management agreement, SMIP should operate and manage canals up to the head of the sub-secondary canal, and the WUA should manage canals within this area but the definition of responsibilities is not absolutely clear and has been disputed by the users. The nature of the infrastructure is such that the WUA should only need to manage water actively within watercourses, although in practice there are management demands within sub-secondary and tertiary canals as well. In addition there is a project level water users' central coordinating committee (WUCCC) responsible for coordination with SMIP project office.

Although the concept of joint management was introduced at the same time as at Khageri, it is both a more complex system to manage and rather less effort was put into institutional development. Agency involvement has remained much stronger at SMIP[85], and there is much greater misunderstanding over the role and activities of the WUA and mistrust of them, for reasons that will be discussed later in this report.

The overall political context is similar to Khageri; both are politically very active areas, and water management has been politicised to a similar extent. Local government has no formal role in irrigation management, and has less involvement in practice than at KIS. Management arrangements are described in detail in Chapter 6. There have been extensive programmes to strengthen irrigation management, as part of the overall project for rehabilitation and completion of the infrastructure. Among other specific institutional development projects, 'Guidelines for Good Governance' is particularly relevant. This was implemented by the same team as the present project and in the same area and laid some of the essential groundwork in terms of strengthening the WUGs and building awareness of management amongst the water users through a programme of 'water users' schools'.

4.3 India: Sri Ram Sagar Project

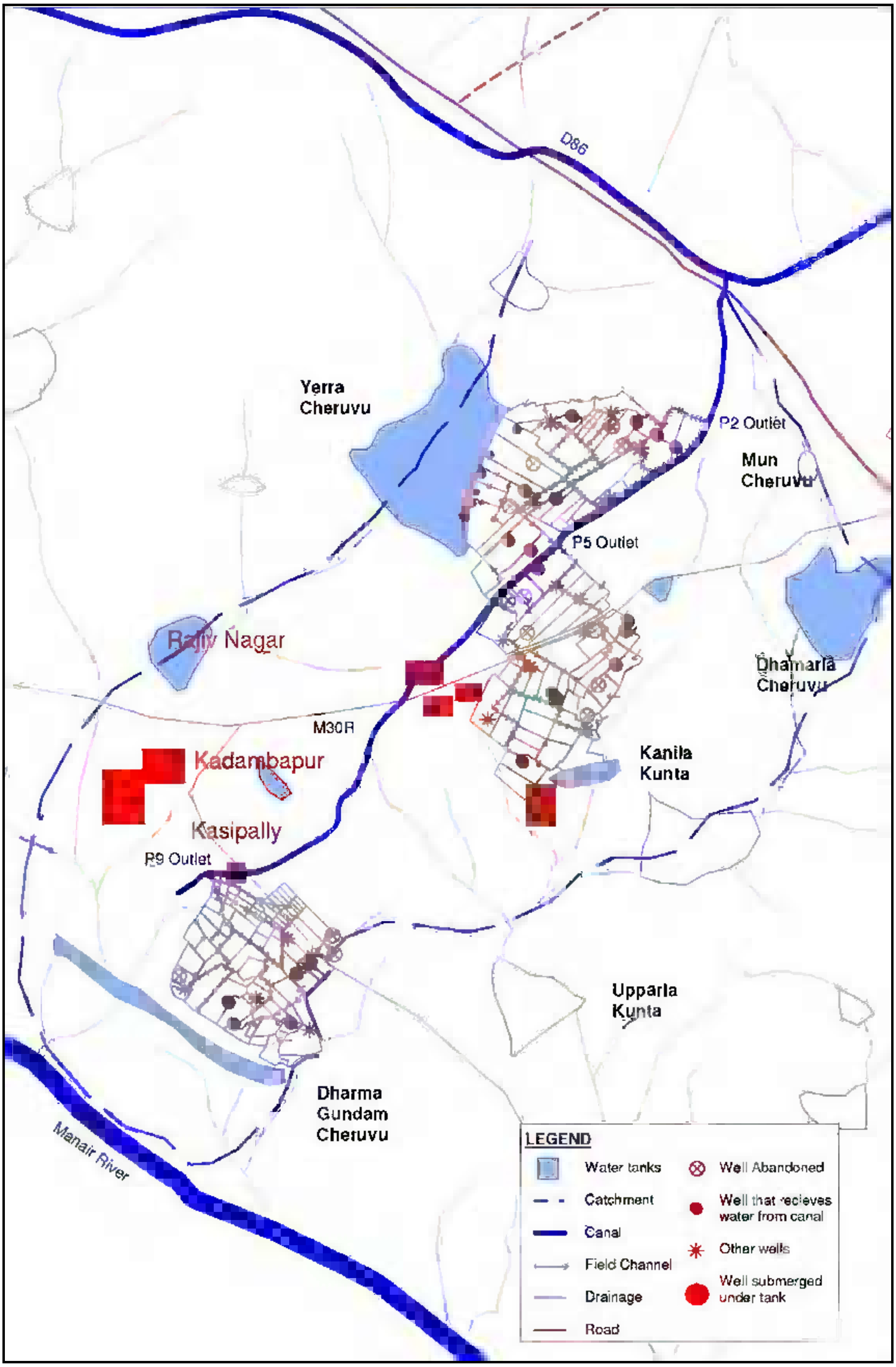
(i) Overview

The Sri Ram Sagar Project (SRSP) is located in the Telengana Region of Andhra Pradesh (AP) and is served by the Sriramasagar Reservoir (SRSR) on the Godavari River near the Maharashtra-AP State border. The first 113 km of the Kakatiya Main Canal (KKC) was built first to irrigate about 100,000 ha and this was extended up to km 234 (Warangal town) in the 1980s, with a supplementary reservoir formed by the lower Manair Dam (LMD) near the town of Karimnagar (Figure 4.6) It now serves an area of 265,000 ha. D-86 which serves Kadambapur WUA offtakes from KKC at km 122, a short distance upstream of the LMD. . There are two minors (M30R and M32R) which serve Kadambapur WUA, from which we selected three outlets (pipes) – P2, P5 and P9 – from M30R for detailed study (Figure 4.7). These have a combined irrigated area of 69 ha, out of the 1,023 ha for the whole WUA.

[85] rehabilitation has continued throughout the past 20 years in different parts of the system, so that project staff have been on hand to help sort out problems in the completed part of the system. However, institutional support has been patchy and incomplete

Figure 4.6: Map of Sri Ram Sagar Project (Andhra Pradesh)

Figure 4.7: Layout of selected pipe outlets in M30R



The climate is tropical with hot summers and dry winters, with an average rainfall of about 1,170 mm near SRSR and 878 mm at Warangal. There is marked inter-annual variation in rainfall and several consecutive years of drought are not uncommon. The topography of the gross command area comprises of a series of valleys with flat bottom lands which are separated by steep ridges and bare rock domes. The net to gross command area ratio is therefore only about 50%.

Rice is the preferred crop while pulses are grown extensively, as are maize, groundnut and chillies. The system is designed to allow for only irrigated dry (ID) crops[86] such as maize, sorghum, groundnut, and pulses. Two seasonal crops like chilli and cotton during *rabi* and *kharif* are also allowed. With this cropping pattern the system would irrigate 82% in *kharif*; 50% in *rabi* and 18% two seasonal crops (150% in total). However, in actual practice, more than 80% area is under rice cultivation while sugarcane is also grown in some areas. There is no formal crop restriction imposed by the department, though the water is supplied on the basis of requirements for an ID crop. It is assumed that more water intensive crops would be irrigated through use of groundwater. In 1999/2000 crops grown were rice (167,000ha), cotton (73,000 ha), maize (58,000 ha), groundnut (14,000 ha), with smaller areas of turmeric, chilli, mango, sunflower, jowar and sugar.

(ii) Social context

Traditional landlords and landowners from the Reddy, Velamma, Kamma and Kapu “Other Castes” have the larger land holdings and are dominant in the SRSP as a whole. But these groups are hardly present in our study site, where small-holding members of “Backward Castes” represent approximately 70% of landholders. Approximately 20% of landholders are Muslims who have very small holdings, and who rely heavily on wage labour as stone breakers, and may not cultivate their land at all. About 5% of landholders are from the disadvantaged “Scheduled Castes”. Settlements are in concentrated villages, with residents often having land scattered over the command of more than one pipe. Land holdings average less than 1 ha.

(iii) Physical and natural resources

The scheme has been rehabilitated to the same "structured irrigation network" principle as SMIP. This provides for no gated structures below the head of a minor canal serving 2,000-4,000 ha and which is to flow at full design discharge during each irrigation period.

D-86 takes water from the KKC at km 122, and irrigates 32,900 ha from a 54.2 km canal with a design discharge of 26 m3/sec. There are no regulators in this distributary canal and a very large number of offtakes, making it extremely difficult to manage. Three cross-regulators were planned, but have not yet been built. Offtaking canals are gated, but many of these are in poor condition and some flow measurement structures at the offtakes are incomplete or damaged. M30R is located at km 24 (about mid-way along the canal). The layout of the minor is shown in Figure 4.7.

Irrigated areas in AP are classified as "Irrigated Wet" (IW) and "Irrigated Dry" (ID) under a legal procedure known as "Localization". This allows I&CADD to prescribe the season of irrigation for a canal, and the cropping pattern, period of sowing and crop duration. In IW designated areas, all crops

[86] The SRSP was designed for ID crops, with a watering rate of 1 cusec = 100 acres. The watering rate for paddy is 1 cusec = 50 acres.

may be grown but farmers grow mostly rice and sugarcane. In ID designated areas, rice and sugarcane are specifically banned because farmers in the canal head reaches would prevent water from reaching the tail-end areas. However, as noted above these restrictions on crop choice are largely ignored.

Large-scale groundwater development is not feasible, even with large diameter hand dug wells, because of low well yields (allowing for additional recharge from canal seepage, the overall area irrigated by conjunctive use of groundwater is only about 15% of the net command area). Nevertheless, many farmers prefer to use groundwater. This preference for groundwater stems from the individual control that the farmer has over it, and also because the marginal cost for use of groundwater is zero. Farmers are charged a fixed cost for electricity regardless of how much they pump. The fee for a 3 hp pump is Rs 91/month and for a 5hp pump is Rs 210/month, payable for the entire cropping season.

(iv) Political and institutional context

There has been a well-documented programme of irrigation management transfer in AP, which is outlined in Chapter 6. WUAs were re-elected in this area at the start of the study (in November 2003), but they have still had little training, and the Distributary Committees (DC) have yet to be formed. The first WUAs and DCs were elected in 1997 and their term of office lapsed in 2002

The SRSP is headed by the Administrator-cum-Chief Engineer based at Hyderabad. There is a Deputy Chief Engineer and a Superintending Engineer (responsible for a project ‘circle’) based in Karimnagar. Each circle has 5 divisions, headed by Executive Engineers (EEs), which roughly correspond to one DC. These are further sub-divided into sub-divisions, which may have one or more WUAs. The EEs are assisted by Deputy EEs and Assistant Engineers. They are, in turn, assisted by Works Supervisors, one for every 4-8 *lashkars*. Finally, there are *lashkars*, or ditch riders, at the field level of the Irrigation Department. They are responsible for operation of the outlet gates, if any, and monitoring the water levels in the canals and for informing the I&CADD of any breach etc.

One Assistant Engineer (AE) is assigned as “competent authority” for each WUA to advise on the management, especially operation, of the canal system. Due to staff shortages one Engineer sometimes advises more than one WUA.

The WUAs and DCs are meant to be non-political, but elections are often contested along political lines[87]. Of the total TC members visited in this project almost 50% had been un-contested winners following negotiations within various parties and the 'purchase' of the un-contested post. In this case, the farmers’ contact and relations with the TC may depend on which party he belongs to. The TC members elect the WUA President and Vice President (one from each end of the WUA). The WUA leadership is thus characteristically drawn from the rural elite, the political stratum of the village. Very often, the WUA chairman or the present president of the WUA is the ex-*sarpanch*[88] of the village.

The effect of such a politically driven election process is still not clear. However, it does result in the selection of presidents and members who are political aspirants rather than farmers genuinely interested in better water management and irrigation. At the same time, the political influence in water distribution is apparent, as people approach local political leaders for assistance in accessing water.

[87] For discussions on various aspects and effects of multiple institutions at the village level, which is outside the scope of the present study, see for example Harriss (2001)

[88] village leader

The WUA does not appear to have an active role in water management, but it does appear to have strengthened the communication channels between the Irrigation Department and the people. The irrigation schedules decided by the department are communicated to the people better, and if these are not adhered to, the people find it easier to approach the TC member now than they could previously contact the Irrigation Department.

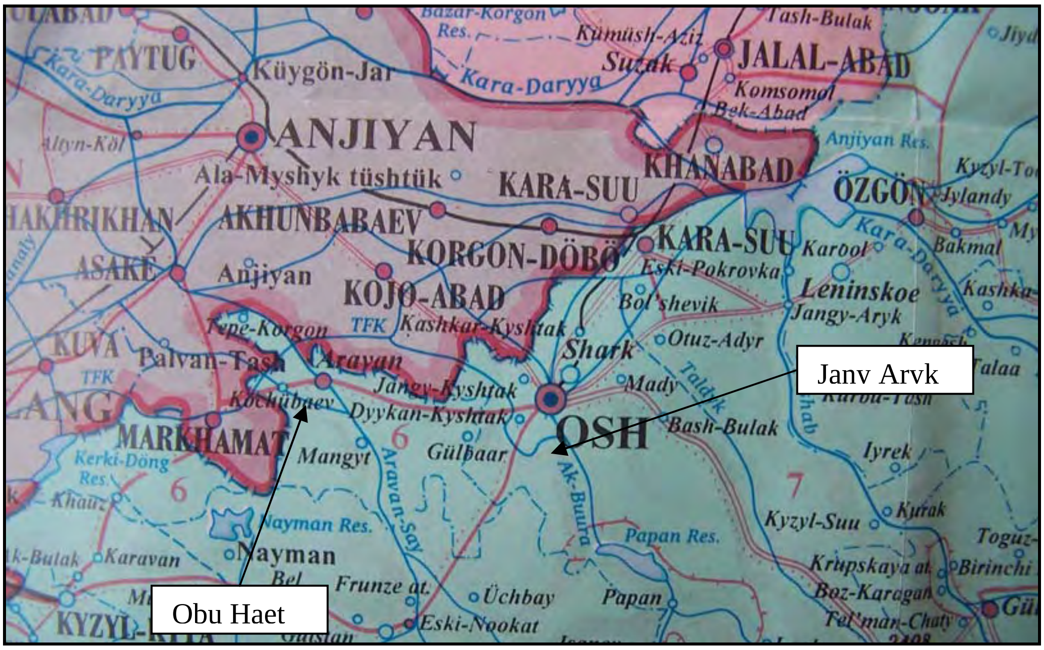
Water fees are collected by the Revenue Department, with the help of the village Panchayat Secretary on the basis of areas assessed by the WUA and the 'competent authority' (assistant engineer in the I&CADD). The water cess is Rs 200/acre for rice and Rs 150/acre irrigated dry crops: 50% of this goes to the Irrigation Department, 25% to the WUA, 10% to the DC, 10% to the PC and 5% to the Gram Panchayat (local government).

4.4 Kyrgyzstan

4.4.1 Introduction

Irrigation has a long history in the area that is now the Kyrgyz Republic, particularly in the Ferghana Valley in the south of the country (Figure 4.8). There are now over one million ha developed for irrigation, covering about 80% of arable land (Mott MacDonald 2000) in 631 irrigation systems ranging from less than 100 ha to 50,000 ha, of which 90% is supplied by gravity. 70% of systems are less than 1,000 ha, but 85% of irrigated land is supplied with water from larger systems. This sector is critical for the Kyrgyz Republic: the climate is arid, and more than 60% of its population lives in rural areas and are highly dependent on irrigated agriculture for their livelihoods. 95% of the available water is used by the agricultural sector (Herrfahrt *et al*, 2005).

Figure 4.8: Location of selected WUAs in Kyrgyz Republic



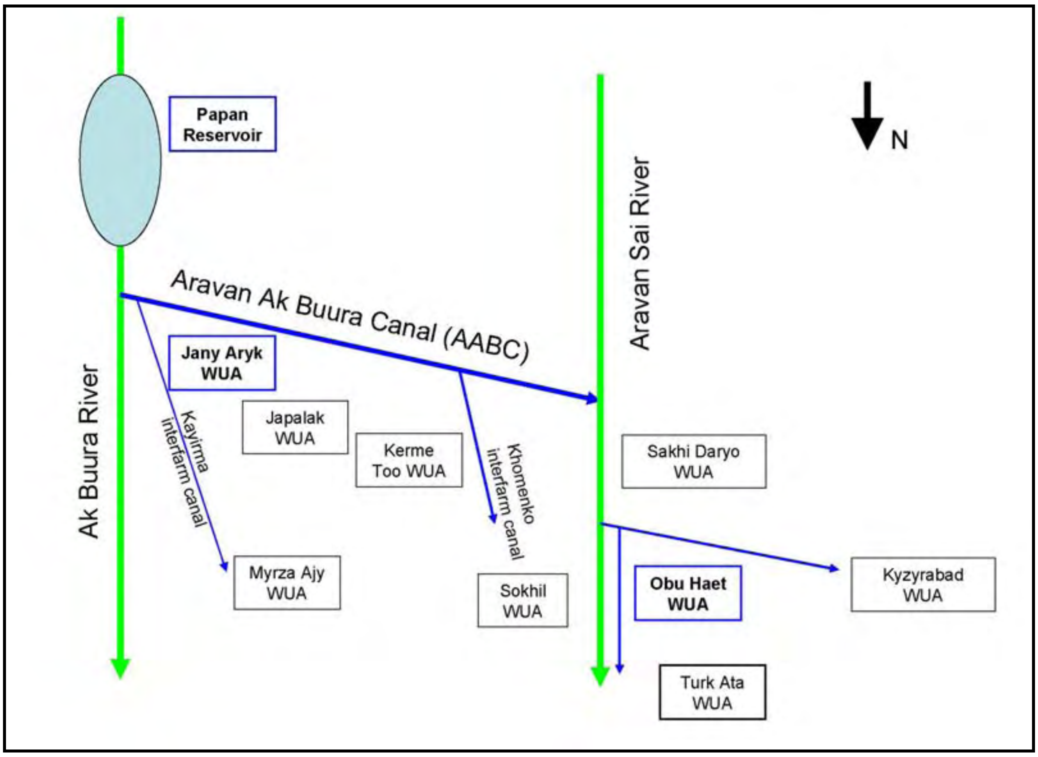
The government Department of Water Resources (DWR) is responsible for the operation and maintenance of the headworks and main and inter-farm canals of the larger systems. Before the collapse of the USSR, water was supplied to the head of on-farm canals which belonged to state (*sovkhoz*) and collective (*kolkhoz*) farms and which averaged around 2,000 ha in size. Following the collapse of the Soviet Union in 1991, the state and collective farms were dissolved and land was allocated to individual farmers who were free to decide how they chose to manage the land (as individuals, in cooperatives, as a joint peasant farm, or as a joint stock company). The new landowners immediately faced a serious problem for O&M of the on-farm system as there was no organisation responsible for the supply of irrigation water from the on-farm canal to the thousands of fields. This led to the formation of WUAs, starting in 1997.

4.4.2 Aravan-Akbura System

Osh Oblast is drained by several tributaries of the Syr-Darya river, including the Ak-Buura and Aravan-Sai. In order to alleviate local water shortages, some rivers are linked by inter-basin canals - the Aravan-Sai and Kurshab-Sai rivers are fed from the Ak-Buura – and there are also several large reservoirs including the Papan Reservoir (capacity 260 mln m^3) on the Ak-Buura river which was built in 1985 to irrigate 40,000 ha of land in Kara-Suu, Aravan and Alai *Raions* of Osh *Oblast* plus several districts of Uzbekistan.

The Ak-Buura River starts in the Alai mountain range, feeds Papan Reservoir, flows through Osh city and into Uzbekistan. The Ak-Buura head structure downstream of the Papan Dam.supplies water to the Aravan-Ak-Buura Canal (AABC - an inter-*raion* canal) which has a capacity of 25 m^3/sec to supplement flows in the Aravan-Sai river (Figure 4.9).

Figure 4.9: Layout of Aravan Akbuura Canal and WUAs supplied from it



4.4.3 Obu Haet

(i) Overview

Obu-Haet WUA serves an area of 1,803 ha in five villages in Aravan *ayil okmotu (a/o)* in Aravan Raion, 25 km from Osh city and at an altitude of 600-800m. The main crops are wheat (910 ha) and cotton (610 ha). It is fed from the Aravan-Sai via an interfarm canal which also serves 3 other WUAs. This is an un-regulated river fed by snow-melt and thus has large fluctuations in flow, but it can be supplemented from the Papan reservoir via the AABC as described above. As it is close to the Raion centre, there are some options of off-farm employment. One inter-farm canal – Buvakul – with an area of 143 ha was selected for detailed study. This is illustrated in Figure 4.10, and a schematic of the whole WUA is given in Chapter 7. The WUA was established in June 1999 and re-registered in November 2002, with 1,865 water users. It has a General Assembly with 73 representatives, each representing from 25-30 ha.

(ii) Social context

Aravan Raion is dominated by Uzbeks (66%), and villages tend to be fairly homogeneous – thus Birlik village which is the focus of this study is 97% Uzbek, whereas the nearby Oktyabr village is 85% Kyrgyz. Most households have less than 6 members, and 37% of the population are considered poor with an average monthly income per capita of less than KGS 400. Obi-Haet WUA coincides with Aravan *ayil okmotu* which has a population of 20,312 in 3,834 households.

There are a range of small community groups and informal organisations, including GVP (Self-Help Groups, formed under the UNDP Poverty Reduction Programme for micro-credit); *makhalla* (Neighbourhood) Committees, for village activities, such as funerals (if the family is poor), and conflict resolution (including some disputes over water, which they try to resolve conflicts jointly with *ayil okmotu*) and *aksakal* court (Elders Court) which is mostly concerned with household and street conflict resolution and may work with the local Police Department. The *aksakal* court is is a powerful organisation, and almost all negotiations between local government and the community go through it: the head of *aksakal* court is a highly respected elder in Birlik village.

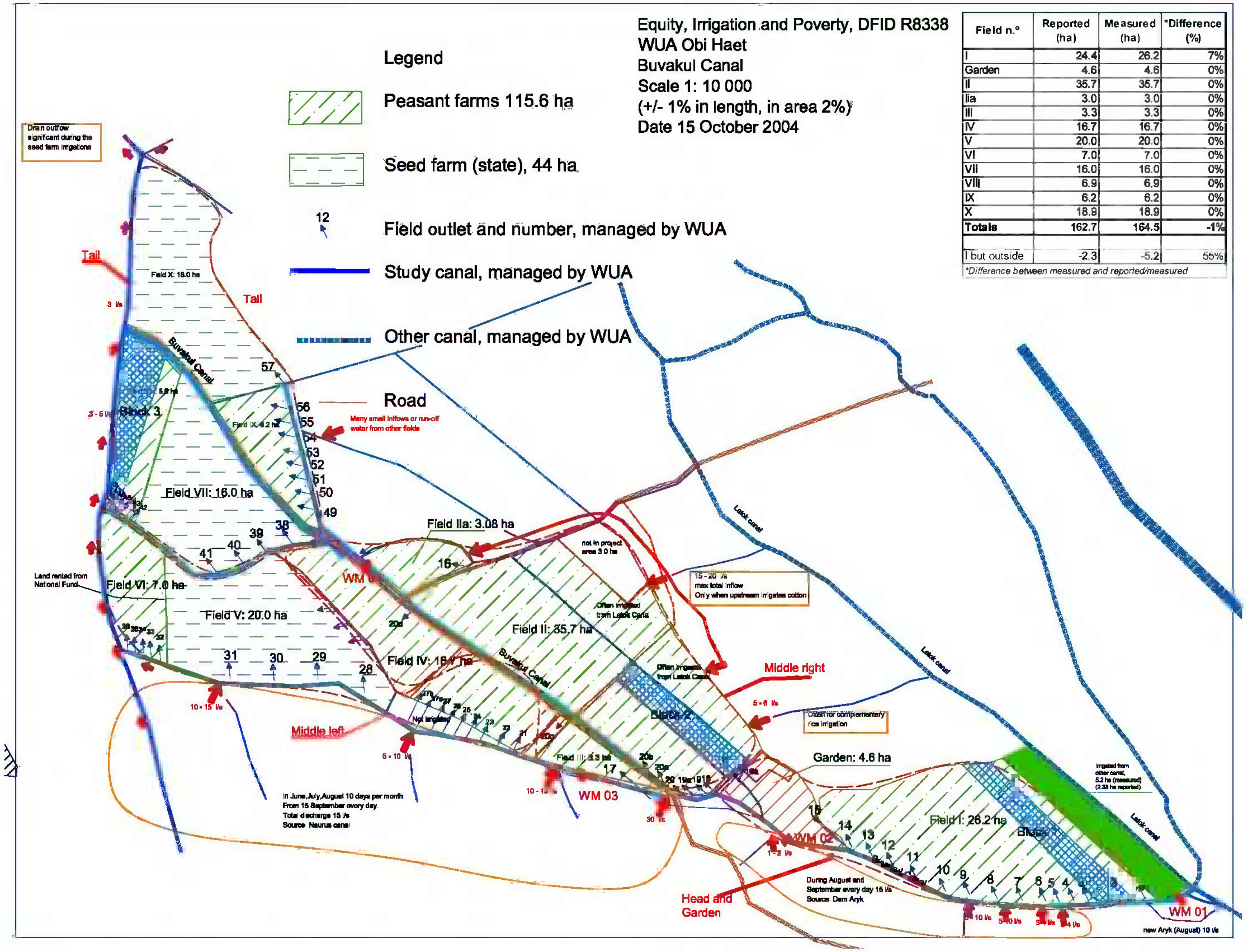
(iii) Physical and natural resources

Water supply in general is adequate but it is uncontrolled: it fluctuates fairly predictably on a daily basis but unpredictably on a seasonal basis. 70% of Obu Haet's water system is supplied from Papan through the Aravan Sai river and the Aravan Ak Bura Canal. As it is further downstream (along the AABC) than Jany Aryk it suffers from greater shortages and fluctuations in flow.

The Aravan Sai River is fed through melting snow and there are significant daily changes in discharge. There is no significant water regulation as is the case for the Papan Reservoir. The daily fluctuations in discharges result in difficulties in water distribution, as the system is sparsely equipped with water regulation structures. Nevertheless, in normal years (such as 2004) there is sufficient water for canals to flow continuously: in dry years a rotation system is used.

There are 22 canals in the WUA, each taking water from the RID-managed inter-farm canal. In general the condition of the canals is adequate, but these are due for rehabilitation under OIP.

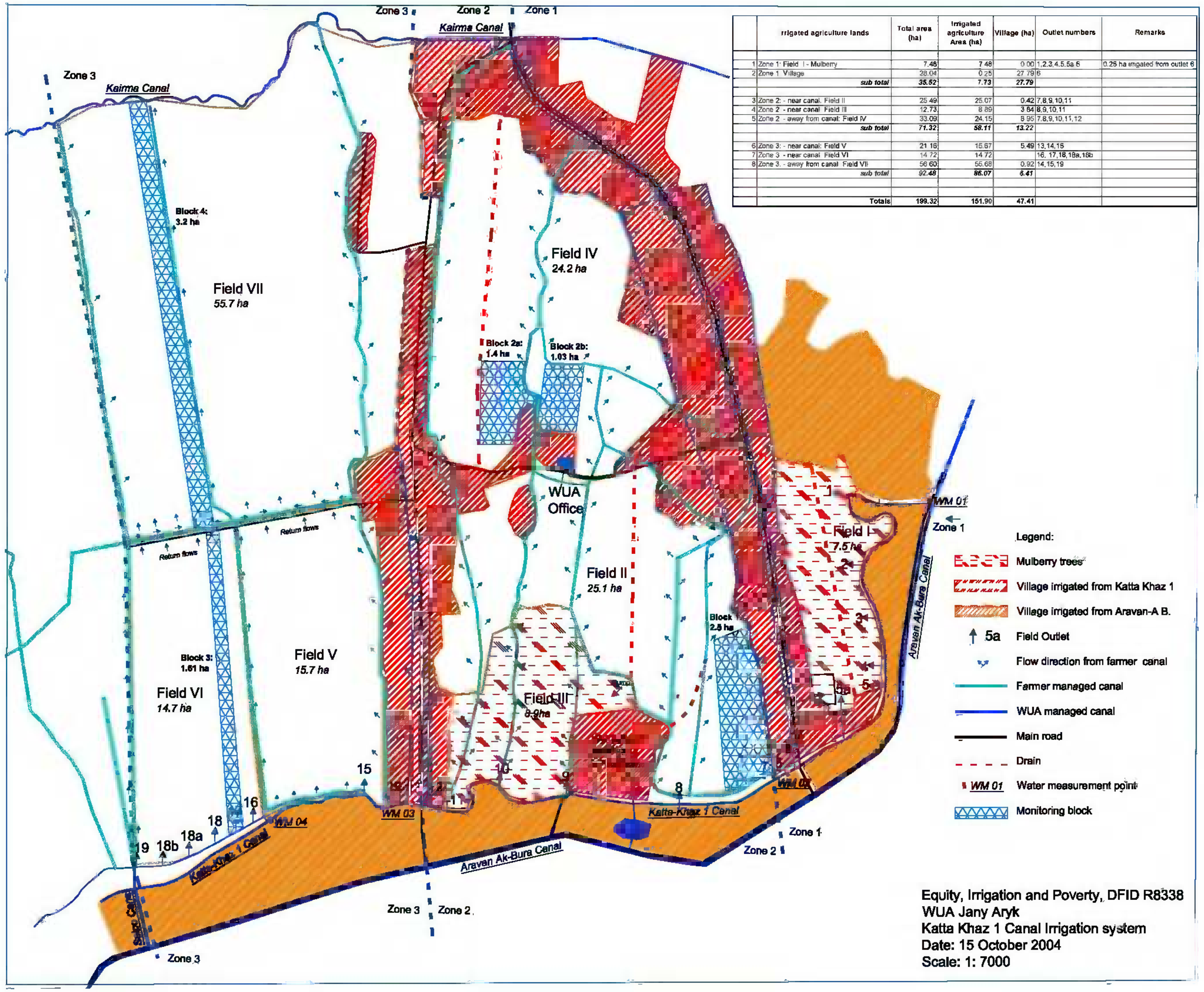
Figure 4.10: Layout of Buvakul Canal - Obu Haet WUA



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 4.11: 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	55.68	0.92	14,15,19	
	sub total	***92.48***	***86.07***	***6.41***		
	Totals	**199.32**	**151.90**	**47.41**		

4.4.4 Jany Aryk

(i) Overview

Jany-Aryk WUA is located within and almost coincides with the territory of Toloikon Aiyl Okmotu (A/O); it is at a higher altitude than Obu Haet (1,200 m above sea level), close to Osh city (5 km) and comprises 5 villages (Toloikon, Uchar, Ozgur, Dyikan-Kyshtak and Kyrgyzstan). The short distance to Osh city affects the level of off-farm activities of the people, especially the ones living in Uchar village, which is chosen as one of the two pilot villages and is the closest village to Osh city. Some villagers have permanent job in Osh, some work at the market there, and some study in the city: these farmers have better access to non-agricultural activities than those at Obu Haet. The main crop is maize. One inter-farm canal – Khatta Khaz 1 – with an area of 188 ha was selected for detailed study. This is illustrated in Figure 4.11, and a schematic of the whole WUA is given in Chapter 7. The WUA was established in 1999 and re-registered in October 2003, with 20,540 water users. There is a Representative Assembly, each representative represents about 10 ha, and there are 140 representatives in total.

(ii) Social context

Apart from one village dominated by Uzbeks, almost 100% of population are Kyrgyz.. There is a similar poverty level to Obu Haet (35%). A key difference is in the relative importance of agriculture (time devoted, crops, etc.) and livestock: there are 5,681 heads of livestock in Uchar village for a population of 4,291 (1.3 head of livestock per person) – this reflects the nomadic origins of Kyrgyz society.

As in Obu Haet, there is an *Aksakal* Court (Court of Elders) established in each village, and there is also Women’s Council. However, the *Aksakal* Court in Uchar was found to be much less important than that in Birlik village (Obu-Haet WUA). The Women’s Council is much more recent organisation, aimed at promoting women’s interests and mainly at mobilising various social and business activities of women.

(iii) Physical and natural resources

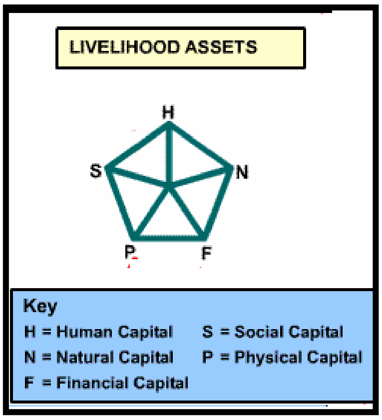
Water supply is relatively good in the main canal, as the WUA takes water directly from the Ak-Buura river or from the AABC near to its intake, and water levels are stable because of Papan reservoir. Despite this, the water availability and distribution in the lower parts of the system is not adequate – because of management problems and poor maintenance. The canals (15 in total) have not been maintained for more than 10 years and have inadequate capacity to deliver the required flow. They are scheduled for rehabilitation under OIP. The downstream part of this area can take additional water from the next canal (Selpo) from the AABC, and thus the extreme tail of this sub-system has a favoured water supply.

Despite being very close location to Osh town, there are serious deficiencies in the infrastructure: villagers take drinking water from the canals, which creates health problems, and there is no gas supply nor telephone line in the village.

5 Irrigation and livelihoods: the interaction of irrigators' livelihood assets with irrigation management

5.1 Introduction

5.1.1 General approach



In this chapter we examine farmers' assets and the place of irrigation in their livelihood strategies. We are particularly interested in understanding the assets and livelihood options of the poor. But it is the combined actions of all irrigators which bring about the management outcomes that affect the livelihoods of the poor. So we consider the assets and 'portfolio' of activities that make up the livelihood strategies of all irrigators, including those who are better off.

We use the Sustainable Livelihoods pentagon to structure our analysis. For each type of livelihoods asset[87], we first give an overview, comparing the general situation in each of our study sites -- identifying common features as well as differences. We then analyse the asset status of irrigators in different well-being categories[88]. We classify irrigators in this way to avoid treating 'irrigators' as an undifferentiated group – so that we can consider the specific circumstances faced by poor irrigators. For the purposes of our analysis we broadly classify irrigator households in our study areas as 'poor'[89], 'medium' or 'well-off'. The summary discussion and analysis tables in this section are based on the detailed information in Appendix F.

As we will see, the variations in assets and livelihood strategies have implications for the way irrigation is managed – and for the contribution that irrigation makes to the livelihoods of farmers in different well-being categories. This analysis provides the background for Chapter 6 where we consider Water Users' Associations and water users' understanding of the institutions of water distribution.

[87] Our discussion of landholders' access to water is not included in this chapter as it is analysed in detail in Chapter 8.

[88] The method we used for this classification is often referred to as 'wealth ranking' (cf. Grandin, 1988). We have chosen to use the term 'well-being' rather than 'wealth'. We feel that 'well-being' brings to mind a wider range of assets – including human, social and natural -- as well as others, whereas 'wealth', tends to be associated primarily with financial and physical assets. For practical reasons, we took a slightly different approach to classification of irrigators in SRSP. See Chapter 3 and Appendix F for a description of the method used for well-being classification in each of our study sites.

[89] In our study site in SMIP we know from earlier research under GGG that in the study command area there were very poor households, with no land at all. They live as squatters on government land and rely on labouring for their livelihood. As the focus of our research is on distribution of irrigation water we did not include these households in our analysis for SMIP; and we did not investigate very poor landless households in our other study sites. However, as we discussed in Chapter 3, in SRSP we did obtain information for a group of poor households with very small landholdings -- most of whom did not farm the land they own in recent years – although they had cultivated their land in the past.

5.1.2 Number of landholders[90] in study sites and well-being classification

There are between approximately 100 and 300 land holding households in each of our five study sites:

Table 5.1: Number of landholders and irrigable area in each study site

Study Country	Name of Study Area	Total Landholders	Irrigable Area (ha)[91]
Nepal	KIS	146[92]	90
	SMIP	157	140
India, Andhra Pradesh	SRSP	99	69
Kyrgyzstan	Jany Aryk	290	188
	Obu Haet	138	143

Source: Appendix Table F-17 and Table 4.1

The table below summarises the general characteristics our key informants used to classify landholders by well-being status in each of our study sites. We subsequently obtained more detailed information about the asset status of landholders in each well-being category[93]. We present our more detailed analysis of the livelihood assets and strategies of irrigators from these well-being categories in the sections which follow.

Table 5.2: General criteria used by key informants to classify landholders by well-being category:

Study Area	Poor	Medium	Well-Off
Obu Haet and Jany Aryk	Very small land share insufficient to feed family. No member of household has stable off-farm employment; cow (1); no house or house in poor condition	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.

[90] Landholder: this refers to 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. In our tabulations we do not include landowners who are renting out all the land they own in the study command area.

[91] These figures are from Table 4.1. Variations in reporting and recording of land areas mean that these figures are indicative.

[92] As discussed in Chapter 3, it was difficult to get complete and accurate information, particularly for poor and marginal landholders The KIS figure in this table includes poor *dalit* landholders, most of whom are sharecroppers in Outlet 18 in the spring season only. Detailed livelihood information is not consistently available for these landholders. This figure does *not* include *tharu* landholders, most of whom cultivate land as sharecroppers in *Pachas Bigha Kulo* in the spring. The *tharu* sharecropper landholders were not included in our livelihood listings, because they are not locally resident, and they were not known to the key informant. Our key informants provided information for the landowners for whom they had information - not their *tharu* tenants. Landowners who did not hold land in the spring study season are not included in this figure, or in Table 5.2. In the discussion below we will comment on the implications of data discrepancies where this is relevant to our analysis. We were able to get qualitative information on the experience of *dalit* and *tharu* landholders, and this is included in our discussion.

[93] The method we used for this classification and for detailed data collection in each site is described in Chapter 3 and Appendix F.

Study Area	Poor	Medium	Well-Off
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 share-croppers for spring rice. Little interest in active involvement in collaboration for management of irrigated agriculture because of their alternative income sources.
SMIP	Holding very little land; may be sharecropper or contract tenant on poor land; may have cattle.	Own up to 1 ha (some variations by WC) and may sharecrop more land, produce sufficient food for home consumption; may have other skills and employment within family (eg teacher, technician), may have shop.	Own more than 2 ha (very well-off have more than 5ha), may have more land elsewhere; may own heavy machinery (tractor, thresher etc), and also have family members with off-farm income (professional, business).
SRSP[94]	Very little land (less than 1 ha); may be tenant farmer. No well or shared well only; well may be dry. Rely primarily on off-farm employment; frequently in stone quarry. May be widow; with dependent children; dependent on relatives for support.	May have bullocks/cart or other livestock; access to well, but may be dry. House quality medium to poor; May be rent land in or out -- often with a relative. May have capital invested in a small business. May have a household member working as labourer; may also have a high dependency rate, with small children. May have some social influence; but less common than for well-off.	Well, tractor or bullocks, good house. Relatively good access to canal water. Off-farm employment by self or son. Hard working; educated family members. Self or family member may have political influence. May be a TC or related to a TC[95].

Source: EIP field study teams

Applying these criteria to our study populations yields the following distribution of land holding households by well-being category (Table 5.3). The distributions shown here suggest that there is the least polarisation of households in our sites in Kyrgyzstan where perhaps two thirds of households are in the 'medium' category. Comparing our two sites in Kyrgyzstan, Jany Aryk may have a higher proportion of households in the 'medium' and 'well-off' categories. This is consistent with greater off-farm income earning opportunities associated with being closer to the city of Osh, as described below. Our site in SRSP has the largest proportion of households in the poorest two categories. This reflects the caste composition and structure of landholdings in this area – the majority of households are from Backward or Scheduled castes, and 20% are poor Muslim households. It would appear that the proportion in the poor, medium and well-off categories are about equally distributed in KIS and SMIP. But this may reflect the procedure used when classifying households (respondents here tended to allocate households into three equal sized well-being groups).

[94] **SRSP** wellbeing characteristics were developed retrospectively by the research team, and the descriptions are presented here as general background. It was not practical to apply this classification to the baseline survey data used in the remainder of this chapter. In the rest of this chapter the following groupings by size of total landholding (including land NOT in the study command area) are used: Sub-Marginal: 0 – 0.2 ha; Marginal: 0.21 – 1.0 ha; Small: 1.1 – 2.0 ha; Medium+: 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

[95] Territorial Constituency (TC) representative; see Chapter 6 for an explanation of this position within the Water Users' Association.

Table 5.3: % of landholders by well being category and study sub-area

Study Area	Poor	Medium	Well-off		Total
Jany Aryk	13%	71%	17%		100%
Obu Haet	28%	60%	12%		100%
			Resident	*Non-Resident*	
KIS	50%	36%	11%	3%	100%
SMIP[96]	31%	46%	24%		100%
	Sub-Marginal	*Marginal*	*Small*	*Medium +*	
SRSP	22%	38%	22%	17%	100%

Source: Appendix Table F-18

In practice, all these figures must be considered as only indicative of a general pattern. Well-being classification is subject to uncontrollable influences from both the local informants and the approach of the study team. Also, despite our efforts, some landholders, particularly the poor and marginal, were left out when we were preparing our listings with the help of key informants[97]. But the broad groupings are helpful for our exploration of the interaction between well-being status and irrigation water distribution.

5.1.3 Land tenure history, settlement pattern and hydrological boundaries

(i) Overview

The differing settlement history of our study sites is reflected in their social composition and in the relationships between ethnic and caste groups.

In Kyrgyzstan our sites are near the city of Osh[98], which is located at the foot of the Pamir range of mountains. Osh, a city of 1.3 million people[99], has been an important trading centre for centuries, and the ethnic Kyrgyzs and Uzbek populations have been resident in this area for a very long time[100]. The Kyrgyzs have traditionally been nomadic pastoralists of the mountain areas, while the Uzbeks have been settled agriculturalists, living in the relatively dry and hot valleys. With the sedentarization of

[96] **SMIP**: key informants here may have been inclined to classify households into categories of roughly equal size and to overlook, and fail to list, some poor landholders. We would expect a larger proportion of poor households in SMIP than these figures indicate. We would expect a distribution more similar to KIS.

[97] See footnote 92 and footnote 96.

[98] Jany Aryk is 5 km away, Obu Haet is 30 km away.

[99] Estimate for 2005 [http://en.wikipedia.org/wiki/Osh_Oblast]

[100] "Other" national ethnic groups including Russians, Tajiks, Azerbaijanis, and Ukrainians are also present in relatively small numbers. The first migration of Russians took place at the end of the 19th century during the Stolypin Agrarian Reform in Czarist Russia. After serfdom in the Russian Empire was annulled (1861) many peasants were left landless. Under the Stolypin Agrarian Reform they were provided with land in Eastern Turkestan (a territory of modern Central Asia) and moved here supported by the Russian Czarist Government. Another reason for Russian peasants to migrate to Central Asia was Russia's interest in extending its political and territorial influence. The second stage of Russian migration took place during the Soviet Era (starting from 1917, and after WW II starting from 1945). A part of the Tajik population has been living in the area since ancient times, while another part migrated as refugees after 1991 during a period of civil war in Tajikistan. Aside from these migrations, a part of the presence of non-Kyrgyz and non-Uzbek elements in the population is a result of inter-ethnic marriages.

people of Kyrgyzs ethnicity, particularly in the twentieth century, these two groups have resided together in urban areas[101], but often villages are fairly homogeneous ethnically.

In Nepal, the residents of KIS were initially migrants from the hills who came to the sparsely populated area in the 1960s as part of a settlement programme. More recently immigrants have come to KIS from different parts of both the hills and the lowland Terai - “pulled” by the search for employment, and “pushed” by pressures of population growth and environmental problems (e.g. landslides in the hills).

In contrast, the land irrigated by SMIP was developed from around the 1940s through land grants to individuals (*jamindars*) whom the government wanted to reward for their service, under the *birta* system of patronage. These *jamindars* employed other caste groups to clear and cultivate the land. Prior to the 1940s the command area of SS9E was sparsely populated by indigenous Tharu and Uraw ethnic groups. With the development of irrigation under SMIP from the mid-1960’s, migrants from the hills and elsewhere in the Terai have also settled, resulting in a heterogeneous grouping of irrigators. The majority of residents in our study site are from ethnic groups that migrated to the area from the Terai (Yadav and Sah). Individual settlements are relatively homogeneous in their ethnic composition.

Our study area in SRSP, Andhra Pradesh lies within the Telangana region in the north west of Andhra Pradesh, an area which is relatively poorer and more arid than the coastal region of the state. Like SMIP, SRSP has a history of domination by landlords; although this extends further back in time. The rural areas of this region were historically dominated by a class of landed gentry under the *zamindari* (Hindu *deshmukh doras*) and *jagirdari* (Muslim *jagirdars*) systems. In the 1940s this area was the subject of political struggle which included mobilisation for redistribution of ‘land to the tiller’. Subsequent land reform led to the disposal of land to tenants, which particularly favoured cultivators from the Reddy, Kamma and Kapu castes[102] (these are classified as belonging to the ‘Other Caste’ category – OC). In the 1970s there was further immigration of members of these relatively privileged OC castes in search of fertile land and irrigation facilities. During the late 1970s and early 1980s members of the ‘Backward Castes’ (BC), such as the Munnuru Kapu, and Kurma (sheep rearing) castes were able to purchase land from other castes (Srinivasulu, 2002).

(ii) Implications for irrigation management

In our Kyrgyzstan sites holding size is fairly uniform across households within a WUA, and most landholders are owner-operators. As explained in Chapter 4 our study areas were once either a former communal farm (*kolkhoz)* or a state farm (*sovkhoz*) which was broken up in 1995 to create hundreds of small private landholdings. Variations in holding size from household to household were determined primarily by the number of members who had been eligible to receive land[103].

In both our Kyrgyzstan study sites the location of the village relative to the fields creates some problems for supervising irrigation distribution. The village of Uchar, in Jany Aryk WUA, is located more or less in the middle of its irrigated fields; but some landholders nevertheless give distance of fields from their homes as one of the reasons they have difficulty looking after their crops and

[101] While relations have generally been fairly harmonious, in 1990 tensions related at least in part to issues of land and housing turned into violence in Osh.
[102] Reddys predominate in the Telangana region (Srinivasulu, 2002, p. 6)
[103] Land was allocated individually to those who were over a certain age (those born prior to 1 June 1994) and who belonged to households whose members had worked in the former *kolkhoz or sovkhoz*

supervising irrigation to their fields. Also, we were told in Jany Aryk that an effort to be equitable in the sharing of land of different qualities resulted in some households being allocated land scattered across the command area of different outlets[104]. In Jany Aryk well-off and medium landowners report a significant area of un-irrigated land outside of the study area, and some say they have problems with allocating their time between looking after their rain fed and their irrigated fields[105].

Irrigators in our Obu Haet site have further to go to look after their fields – the village of Birlik is 5 km away from the study command area. But unlike our Jany Aryk site, there are no holders of multiple parcels within the study command area. Also unlike Jany Aryk, in Obu Haet irrigators do not report owning any pasture land. Here a combination of factors, including agricultural tradition, fewer off-farm employment opportunities, and better relationships with the WUA ditch rider (*mirab*), may contribute to better coordination of water distribution amongst landholders. Nevertheless, there are persistent complaints about lack of discipline, with downstream farmers accusing upstream farmers of interfering with water flows.

In both KIS and SMIP, Nepal tenancy arrangements and residence patterns are not helpful for coordinating irrigation management. The settlement scheme-based ownership structure in KIS was initially fairly uniform and land was mostly farmed by owner-operators. But this has changed with time and landlords, locally resident or absentee, have become a significant feature of land tenure in both KIS and SMIP. This has consequences for irrigation as the respective responsibilities of tenants and landlords in relation to irrigation operation and maintenance are often ambiguous. Also, settlements are concentrated and the irrigated land farmed by residents of a particular village is often not directly contiguous to the village. The land being managed by individual farmers could also be distributed across different watercourses or even tertiaries.

In SRSP, Andhra Pradesh generally, successive state-sponsored land reforms have not changed the overall dominance of the rural social structure by owners of relatively large landholdings, and these landowners have tended to dominate irrigation committees as well as local politics generally (Melkote, 2004, p.16). However, in our study site owner-operators of relatively small areas of land predominate. Farmers live in concentrated villages near to the fields they cultivate. But as in our Nepal sites, individual landholders may have acquired land such that they have holdings in the command area of more than one pipe. Fragmented landholdings can complicate coordination of water management.

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[104] The data we obtained indicated that just over a quarter of landholders in our Jany Aryk site had more than one parcel within the study command area. The figures are presented below (excluding 4 holdings where well-being not known) based on our household listing and WUA crop planning lists (Source: Appendix Table F-22)

Number of Parcels	% of Holdings - Jany Aryk			
	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%

[105] In Jany Aryk one well-off landowner was recorded as having a large area of land (about 70 ha). But he explained that he held this as part of a “peasant farm” holding that had a number of shareholders. So his personal ownership of land was less than this indicates – although we do not know how much less. On the other hand, poor landowners in Jany Aryk tended not to mention any pasture land they might have because they said they didn’t know about it, and didn’t use it anyway.

5.1.4 Ethnic composition

(i) Overview

The settlement history in our study sites has resulted in differences in the social homogeneity of landholders cultivating land within each command area. Our sites in Kyrgyzstan are ethnically homogeneous, while they are mixed in Nepal and India. In KIS and SRSP one group is in a clear majority, while in SMIP the Yadav and Sah are present in similar proportions. As we will discuss below, rivalry between the two larger groups in SMIP has expressed itself in irrigation issues. *Tharu*[106] are also present as sharecroppers in our KIS study site, but they are generally not locally resident and not known to our key informants and so their numbers are only estimates from the table below.

Table 5.4: Ethnic/caste composition - % in each study area

Study Area	**Ethnic/Caste Group: Percent of landholders by ethnic group or caste**					
Kyrgyzstan	*Kyrgyz*	*Uzbek*			*Other*	*Total*
Jany Aryk *(Uchar Village)*	100%					100%
Obu Haet *(Birlik Village)*		97%			3%	100%
Nepal						
	Brahmin/Chhetri	*Newar*	*Janajati*	*Dalit*	*Tharu ?*	
KIS[107]	81%	1%	3%	12%	3%	100%
	Yadav	*Sah*	*Chhetri etc*	*Dalit*	*Other*	
SMIP	33%	40%	8%	10%	9%	100%
India						
	Other Caste	*Backward Caste*		*Scheduled Caste*	*Muslim*	
SRSP	4%	71%		4%	21%	100%

Source: Appendix Table F-19 and F-20

(ii) Differences between well-being groups

In Kyrgyzstan each of our study areas is populated almost entirely by one ethnic group: virtually all landholders in Obu Haet are traditionally agriculturalist Uzbek whereas those in Jany Aryk are nearly 100% traditionally pastoralist Kyrgyz. Because of this homogeneity, and unlike our other sites, issues of ethnicity do not have a bearing on well-being status within the irrigator communities we studied. But, as we will discuss later the difference in traditions between ethnic groups in our two sites is reflected to some extent in their farming systems.

In KIS the irrigators in our study areas are predominantly from the socially dominant Brahmin and Chhetri ethnic groups who migrated from the hills. However, the irrigator population also includes

[106] See discussion of social context in section 4.2.2.
[107] Note: Information not available for *Tharu* landholders, mostly sharecropping in *Pachas Bigha Kulo*.

poorer ethnic/caste groups including *Janajati* (a general term used for all Tibeto-Burman groups) and *Dalit* ('untouchable' Hindus). The latter groups often have little of their own land, may live on government-owned *ailani* (common) land, and rely on agricultural labouring, and on farming land on a sharecrop or tenancy basis, for their livelihood. Some sharecroppers and tenants are non-resident and may have to walk for up to an hour from their homes to the fields that they cultivate in our study area. In KIS most of the indigenous Tharus were displaced when the irrigation scheme was developed. Tharus are still present on the margins of the irrigation system, and some Tharus have been able to sharecrop spring rice on land in *Pachas Bigha Kulo*, KIS. However, their main employment is as agricultural and construction labourers.

In our study area in T5 of SMIP Yadav and Sah groups who migrated from other parts of the Terai are dominant and represent approximately 73% of land holders. Chhetri/Gurung/Magar from the hills make up another 8%. Poorer groups, including Dalit and the indigenous Uraw (who are mostly landless), make up about 19%[108].

In our study area in SRSP 80% of the households are Hindu and mainly belong to 'Backward Castes' (BC)[109], with a small number of households from the disadvantaged 'Scheduled Castes' (SC)[110]. The Reddy[111] and Velama 'Other Caste' (OC) groups, which are socially dominant in SRSP generally, are hardly found in the areas which we studied[112]. Muslims[113] (20% of total households) and households from disadvantaged 'Scheduled Castes' were concentrated in Pipe 9 of our study area, at the tail of the minor (Figure 4.7).

[108] Indigenous Tharu are found elsewhere in the command area of SS9E, and indeed they are in the majority in T2, which is at the head of the sub-secondary. There are no Tharu in T-5, but see note 143 below for the influence of inter-ethnic relations on water sharing.

[109] The BCs comprise approximately half of the population in AP. Social and economic changes, including educational opportunities and the politics of patronage have raised the socio-economic position of some of these castes [Srinivasulu, 2002].

[110] 70 of the 99 households were from one of the seven following BC: BC Balija, BC Kummara, BC Kurma, BC Munnara Kapu, BC Sakali, BC Telugu, BC Vadla. 4 households were from the more disadvantaged "Scheduled Castes": SC Madiga, SC Mala (2 households from each).The traditional occupations of these SCs are agriculture and labour, and they comprise the bulk of agricultural labour in the state [Srinivasulu, 2002, p. 12] The SC households, and to some extent Muslim households were found to be the most disadvantaged in terms of education, employment and incomes in the state [World Bank. 2003, p. 42].

[111] The Reddys have historically developed control over land and water, and this has been an important source of economic and political power. They have traditionally controlled village life. The Velamas are a politically influential land-owning community present in northern Telangana, amongst others [Srinivasulu, 2002, p. 11]

[112] Only 4 out of 99 households are from Other Castes (3 Reddy, 1 Velama).

[113] Muslims constitute under 7% of the state's population.[Srinivasulu, 2002, p. 13]

Table 5.5: Ethnic/caste composition – % of landholders by ethnic group or caste and well-being category in each study area

Study Area	Ethnic/Caste Group	Poor		Medium	Well-off	Total
Kyrgyzstan	Kyrgyz-	Virtually all landholders in Jany Aryk (Uchar village)				
	Uzbek	Virtually all landholders in Obu Haet (Birlik Village)				
KIS[114]	Brahmin/Chettri	64%		96%	100%[115]	84%
	Newar	0%		4%	0%	1%
	Janajati	5%		0%	0%	3%
	Dalit	23%		0%	0%	12%
	Unidentified (Tharu?)	7%		0%	0%	3%
	Total	100%		100%	100%	100%
SMIP	Yadav	18%		37%	44%	33%
	Sah	39%		37%	44%	40%
	Brahmin/Chettri	4%		12%	7%	8%
	Dalit	20%		8%	2%	10%
	Other (mostly Uraw)	20%		5%	2%	9%
	Total	100%		100%	100%	100%
SRSP		*Sub-Marg.*	*Marginal*	*Small*	*Med +*	*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 (missing data)	0%	3%	0%	0%	1%
	Total	100%	100%	100%	100%	100%

Source: Appendix Tables F-19 and F-20

In our sites in Nepal and Andhra Pradesh, certain groups are disproportionately concentrated in the poor category of households. In KIS and SMIP these are the disadvantaged caste or ethnic groups such as the Dalit or Uraw. In SRSP these are the Muslims and those from Scheduled Castes. We give some examples from these categories in Box 5-1.

Box 5-1: Three poor categories of landholders - KIS and SMIP, Nepal and SRSP, Andhra Pradesh, India

KIS, Nepal	SMIP, Nepal	SRSP, Andhra Pradesh
Dalit, landless labourer	**Uraw of Satterjhoda Village**	**Muslims of Kasipally (P-9)**
Mr. L. Bd P. is a landless farmer. He is mainly engaged in agriculture work as a day labourer, though sometimes he gets construction work. It is easier to find agricultural work during the monsoon rice season. But spring rice also provides an opportunity to	Uraw are the indigenous people of the area. They were involved to clear the jungle and started the settlement, under the *Jamindar*, Lohani. They were entitled to get 50% of land from *Jamindar* but later all land was taken by *Jamindar*. There are still four cases	Kasipally is a hamlet inhabited by Muslims for at least 100 years. It is at the tail end of the minor; 21 out of a total of 42 landholders in the command of P-9 reside here. Residents of Kasipally are employed in stone breaking and all of them have very marginal

114 See footnote 107 .

115 Both residents and non-residents in well-off category are 100% Brahmin/Chettri

Box 5-1: Three poor categories of landholders - KIS and SMIP, Nepal and SRSP, Andhra Pradesh, India

KIS, Nepal	SMIP, Nepal	SRSP, Andhra Pradesh
work. Sometimes he is able to sharecrop land for spring rice. But it is difficult to get a tenancy because owners prefer those who have compost manure (i.e. who have livestock). Owners also want tenants who are hard working and who are active in canal works.	being considered by the Supreme Court related to tenancy rights. Out of 37 Uraw households in the village, only 4 Uraw have some land. It is difficult to get land for sharecropping.	landholdings (less than 0.2 ha). Agriculture is their secondary occupation, though only 15 of these 21 landholders (71%) cultivate their land if water is available in the canal. For the last 5 years they are not cultivating anything as they are not getting canal water at all. Two Muslim landholders have no occupation as they are very old and survive on their children's income.

The residence pattern is relatively homogeneous by ethnicity/caste in all of our sites and this has implications for communication of decisions regarding water management. We found that in our Nepal and SRSP, AP sites irrigators from different ethnic or caste groups cultivate land in the same irrigation command area, but they often do not live as neighbours. Farmers tend to communicate more frequently with their residential neighbours, although they say that they organise water management with their field neighbours. But as we will discuss in section 5.4.2, many are engaged in off-farm employment as well as farming so they do not always meet each other in the field. This means that it takes more of an effort to ensure that messages reach irrigators in all the settlements.

In KIS, Nepal sharecroppers may not only be from a different ethnic group, but they may not live locally (such as the *Tharu* of Pullar village). This also has an effect on communication on irrigation matters.

Box 5-2: Landholders' residence and communication - KIS, Nepal

Many sharecroppers in KIS are resident outside the study area. There are some *Tharu* from Pullar village, and others come from Lanka, Gaurigunj, Kesharbagchand, Ujjwal Nager and Radhapur village. It is more common for land to be given to sharecroppers for spring rice. Landowners are willing to let their land then because more labour is required, it is more difficult to get a reliable supply of irrigation, and it is more common to have problems with rain at harvest time.

Sharecroppers of *Pachas Bigha Kulo* -- Sharecroppers of *Pachas Bigha Kulo* live in Pullar village. They are mostly from the *Tharu* community and their main employment is as labourers in agriculture and construction. They are only able to obtain land to sharecrop for spring rice. They have 2-3 *kattha* of land for their house (about 0.01 ha). Their production from spring rice covers around 4 months of household needs, another 2 months are covered by production from house-yard land, and the other 6 months are covered by income from labouring. "Because most of us farm land on *ghol* (drainage land), which is irrigated by seepage water [there is no] need to maintain the canal. In *tandi* (high land) it is some times difficult to get water. For two years we could not get yields due to dry up."

The view of Resident 'Medium' Category farmers – As far as possible, landowners notify all sharecroppers about the provision made for water rotation. But it is not possible to invite all who live far. In most of the cases they do not have idea about the water turn. Even in the case of circulation of message, some tend to violate the rules and act as if they have no idea.

The view of a Sharecropper – A. M. G. (resident of Ujjwal Nagar – a neighbouring village; he is of Gurung ethnicity) is a sharecropper on 11 *kattha* (0.36 ha) of land. His plot has no direct field channel (FC) so he has to make temporary FC in order to irrigate his plot. He has no problem with this because his master has to coordinate with upstream farmer. The landowner has to manage all sorts of arrangements.

5.2 Natural and physical assets

5.2.1 Land tenure and land holding

(i) Overview

Land tenure[116]

In Kyrgyzstan all landholders reported that at least some of the land they hold is their own. About a third said that they have increased their holding size by renting land in, but very few landholders said that they rent land out. This suggests that those who rent land to others have opted out of farming all together, and are not included as landholders in our survey.

Box 5-3: A family tenancy arrangement - Obu Haet, Kyrgyzstan

Mr. O.A. is a 'medium' well-being landholder with a good water supply in Field I. He is 44 years old and lives with his wife and son aged 20 (who works as a lorry driver) and daughter aged 17. He owns 0.45 ha in the study command area. He is cultivating a total of 0.93 ha. He rented in 0.48 ha from his brothers, whose fields are located near his own. This is not really a rent and the agreement is as follows: 4 brothers merged their fields and this one field is farmed by O.A. From total income O.A. deducts production cost (covered at the beginning by O.A.) and net profit is split into equal parts and distributed among all 4 brothers.

In Nepal the difference in settlement history between our study sites[117] is reflected in the land tenure pattern. KIS has a higher proportion of owner cultivators than SMIP, particularly among the poor category of landholders[118]. On the other hand in KIS 43% of poor landholders are renting land in, compared with 65% in SMIP.

Despite the history of landlordism in SRSP, Andhra Pradesh as a whole[119], our study sites are characterised by a high proportion of 'Backward Caste' and Muslim owner-cultivators. As described below, there are a few small landowners who are letting their land to others, but they are in the minority. The Muslim households mostly own the very small areas of land that they occupy but report that they have not cultivated any land for the last five years because of difficulties with irrigation.

Box 5-4: An absentee landowner and a sub-marginal landowner - SRSP, Andhra Pradesh

P-5 & P-9– Mr G.M an absentee landowner: is a BC Kurma and has 2 sons and a daughter who are married. He has 8 acres of land altogether (3.2 ha). He has worked in Godavari Khani mines as a labourer for the last 25 years. He earns Rs. 150 per day. He works for 3 to 4 days a week. His parents gave him 15 guntas of land (0.15 ha) 25 years ago, and he bought the rest of his land from his own income. He bought 4 acres of land (1.6 ha) about 15 years ago. He bought another 2 acres (0.8 ha) 2 years ago at a cost of Rs. 50,000 per acre. He bought another 2 acres this year at Rs. 87,500 per acre. He has rented his land out on a 50-50 basis. He has land in P-5 (2 acres 10 guntas [0.9 ha]) and P-9 (5 acres 30 guntas [2.3 ha]).
P-9 - Mr. S. K R. Mohammed a sub-marginal landowner: is 30 years old and is illiterate. He has 2 sons and a daughter. His only occupation is breaking stones. Water has not reached his land for the last 4-5 years and therefore he has not been cultivating his land. When there was water in the canal they used to sleep on the canal bund to get water as otherwise they would not get water. In his opinion the government should appoint a person for monitoring the flow of water in the canal.

[116] see Table 5.7: % of landholders practising different forms of land tenure in study area
[117] See section 4.2.
[118] However, the proportion of landless sharecroppers in the poor category is still understated (see footnote 92).
[119] See section 5.1.3.

Holding size[120]

In all of our sites individual holdings within the study command area are very small, ranging from the smallest of under 0.1 ha to the largest of around 5 ha[121]. The overall average in our study sites is under 1 hectare. Thus water distribution in the command areas has to be organised amongst a multitude of quite small individual holdings.

Table 5.6: Average area of land held per landholder within study command area (ha) by well-being category in each study area

Study Area	Poor	Medium	Well-off		Total	Range
Jany Aryk	0.25	0.31	0.27		0.30	0.09 – 5.00
Obu Haet	0.57	0.52	0.81		0.57	0.26 – 5.31
			Resident	*Non-Res.*		
KIS	0.35	0.52	1.55	3.71	0.69	0.02 – 3.08 (1 non-resident has 8.80)
SMIP	0.48	0.53	1.07		0.64	0.03 – 5.42
	Sub-Marg.	*Marginal*	*Small*	*Medium +*	*Total*	
SRSP	0.08	0.57	1.00	1.36	0.69	0.03 – 3.05

Source: Appendix Table F-21

(ii) Differences between well-being groups

Our sites in Kyrgyzstan and SRSP, Andhra Pradesh show the highest overall proportion of owner-cultivators, with a tendency for the medium categories to rent land in.

In contrast in our Nepal sites it is poor landholders who are most likely to rent land in, generally from medium and well-off landowners. This can be seen for example in the maps of *Pachas Bigha Kulo*, KIS. The maps show that most land is owned by the well-off (Figure 5.1) and farmed by poor landholders (Figure 5.2): rental of land by better off landowners to poor cultivators is particularly prevalent for the spring rice season. Much of the land is rented for a single-season at a time -- often to people who are not resident in the same village, although the landlord is often locally resident. This means landlords may be on hand to help ensure the water supply to their tenants, although this is not consistently the case. In SMIP a larger proportion of poor landholders are not cultivating any of their own land, and landlords are more likely to be non-resident and to be less involved in irrigation matters.

In all of our sites a significant proportion of landholders from all well-being categories have land interests outside the study command area[122]. As would be expected, this proportion was greater among the better off groups who generally have larger land holdings, but as illustrated in the case study below, this is also often the case with poor landholders. The combination of well-being and tenancy status has a bearing on the nature of the relationship that cultivators have with their

[120] The difficulty of obtaining reliable data on holding size was discussed in Chapter 3. Our most reliable figures on land area relate to land held inside our study command area, so this is what we will examine here. This does not take into account any land owned and/or held (under whatever form of tenure) outside the study command area. It also combines all land, whether it was actually cultivated or not. But at least it gives an indication of orders of magnitude.

[121] Excluding a non-resident landholder in KIS with almost 9 ha.

[122] 'Land interests' refers to land owned or cultivated outside the study command area. Variation in the way data were reported means than for some sites we have information only for land owned outside the study command and for others only for land cultivated outside the study command.

neighbours in the field, as well as with the WUA. As we will discuss below in section 5.3.4, poor tenants tend to be in a weak position to exercise influence over their access to irrigation. The fact that a significant proportion of landholders have interests in more than one command area is also relevant. This situation calls for more complicated communication and collaboration arrangements than if landholders have all of their land within a single hydraulic unit.

Box 5-5: A poor sharecropper in WC- 1 - SMIP, Nepal

Mr. D. N. M. is a poor farmer having only 2 kattha (0.07 ha) of land as house-yard. He cultivates 1 *bigha* 5 *kattha* (0.85 ha) of land in WC-1 of T5 on contract. In addition to that he also cultivates land in T6-1. This year he irrigated twice in T5-1 and thrice in T6-1. For lowland area irrigation is not needed [because of drainage]. Other than sharecropping he is employed as an agricultural labour during his spare time. This is essential to feed his 6 member family.

Table 5.7: % of landholders practicing different forms of land tenure in study area during study season by well-being category in each study area

Study Area	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 area[123]	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 T5	73%	90%	100%	87%
	Cultivating land outside T5 and T6	40%	36%	38%	38%

Study Area	Form of tenure	*Sub-Marg.*	*Marginal*	*Small*	*Medium +*	Total
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 area	5%	37%	68%	76%	43%

Source: Appendix Tables F-23 and F-24

[123] **This relates to landholders in *Pachas Bigha Kulo* and Pilot Gate West only.** For KIS we only have information regarding landownership outside the study command area for landholders with land irrigated from these outlets; 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.

Figure 5.1: Land Tenure at Pachas bigha kulo (tail) – wellbeing of farmer

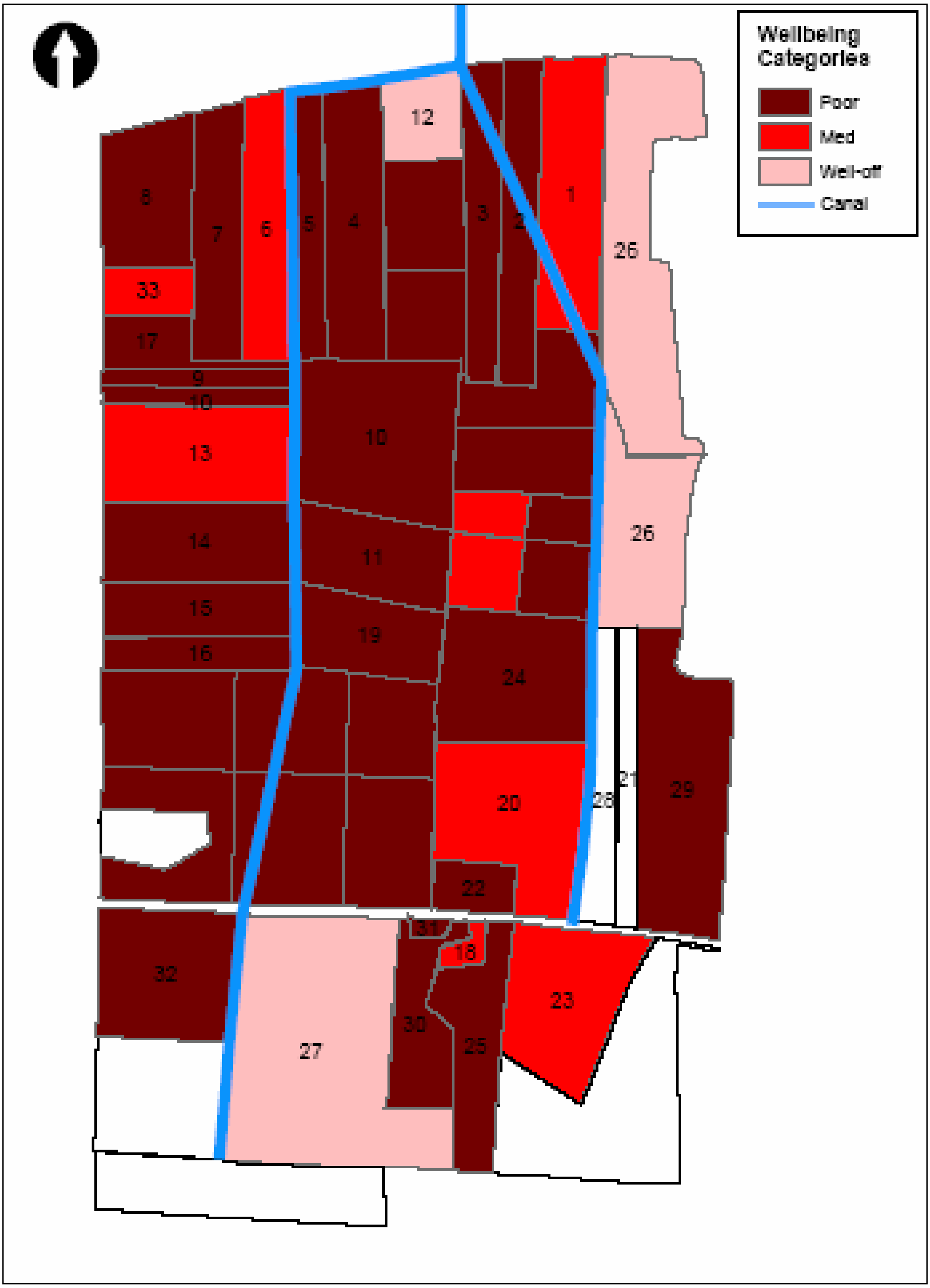
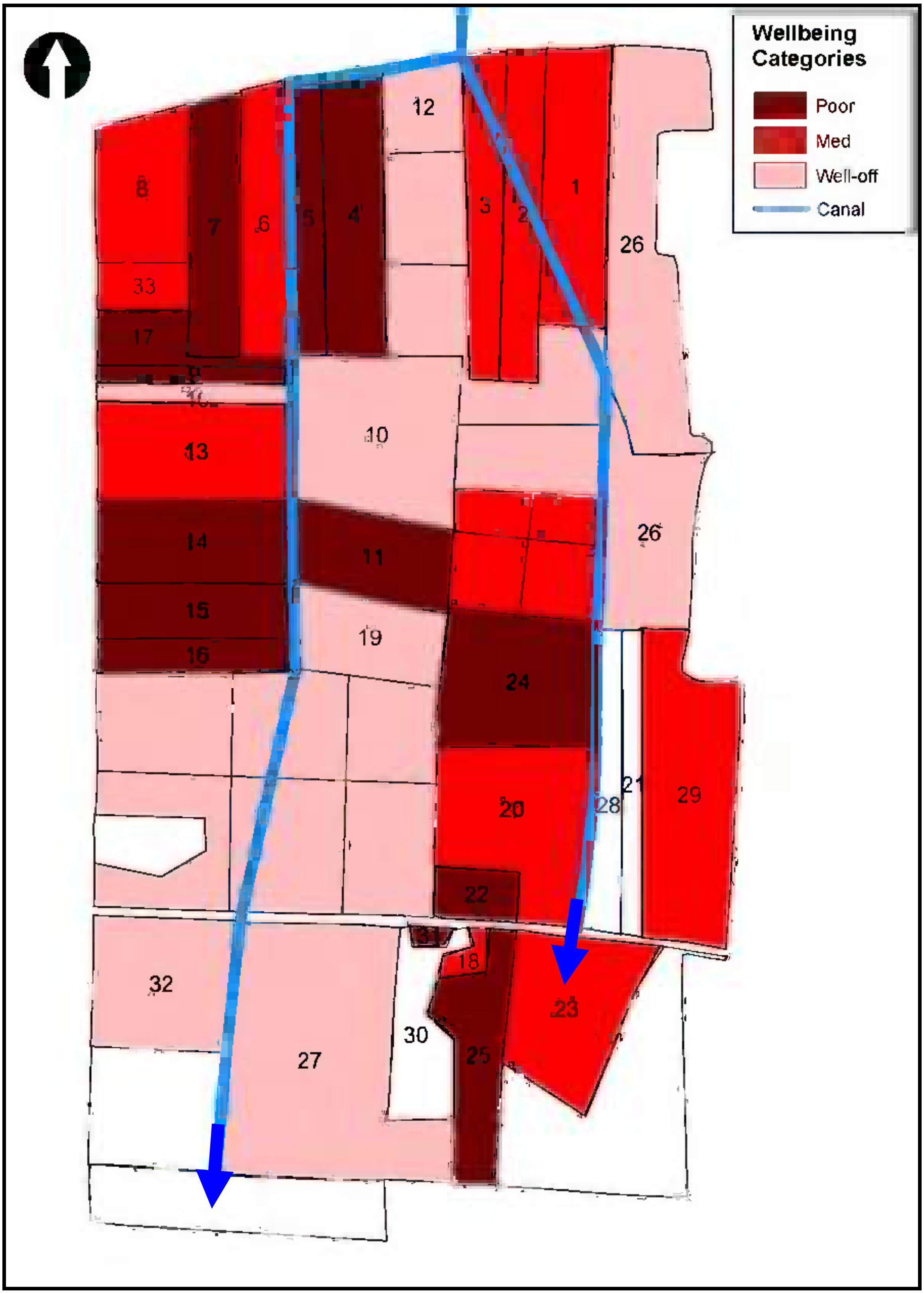


Figure 5.2: Land Tenure at Pachas bigha kulo (tail) – wellbeing of owner



5.2.2 Livestock ownership and traction

(i) Overview

Livestock are a source of food and supplementary income in all of our study sites. They may also be used for traction.

Most households in Kyrgyzstan have some animals, but these tend not to be used for field work. The history of state/communal farming has accustomed farmers to mechanised cultivation using fairly large equipment. Few farmers have their own tractor or other mechanical equipment so they tend to rely on contractors. In our Nepal and Andhra Pradesh sites there is a greater reliance on animal traction, although a few better off households have a tractor[124]. In our SMIP, Nepal site tractors are regarded as essential for wheat cultivation and a small number of tractor owners operate as contractors to prepare the land for all farmers. In fact, the chairman of the Water Users' Committee in our SMIP site is also the chairman of the tractor-owners' association and he has devoted more of his energy to this user group than to the Water Users' Association. These contractors also provide threshing facilities. However, for preparing land for rice cultivation animal power is considered better than a tractor. In SRSP farmers use both bullocks and tractors and employment as a tractor driver is important for a number of the smaller category landholders (see Table 5.10 for bullock and tractor ownership in our SRSP site).

Table 5.8: % of landholders owning livestock or gaining income from livestock

Study Area	Cattle	Sheep	Goats	Horses	Poultry
Jany Aryk	68%	18%	4%	2%	37%
Obu Haet	75%	5%	3%	3%	61%
Total-KR	70%	14%	4%	2%	45%
Nepal	*% of Households with Income from Livestock*				
KIS	61%				
SMIP	100%				
India	*Buffalo/Cattle*	*Goats*			
SRSP	35%	4%			

Source: Appendix Tables F-25 – F-28

(ii) Differences between well-being groups

In Kyrgyzstan the efficiencies associated with grouping together to organise machinery hire for cultivation and harvesting are a major reason given by respondents from all well-being categories for collaboration with other landholders. This need to coordinate for cultivation and harvesting also provides some motivation to coordinate on crop choice and timing of crop husbandry activities – which can help with coordinating irrigation.

[124] One of our respondents in SRSP with a "marginal" holding size had a tractor which he was able to acquire after having worked in Dubai. He was then able to work as a contract tractor driver, and he was considered to be in the "medium" well-being category.

The reliance on machinery for cultivation and harvesting means that livestock are kept for home consumption and sale of animal products only – not as a source of traction for field activities. Households in all well-being categories report that they own some cattle, sheep or goats; a few own horses for transport (and possibly for milk – a tradition among the Kyrgyz). But in Jany Aryk, where there is a cultural preference for livestock rearing, the better off use their greater resources to make use of the un-irrigated pasture land included in their land share. On the other hand, poorer household do not use the pasture land they were allocated, and some do not even know how much they own[125]. In Obu Haet a smaller proportion of the medium well-being category have livestock, suggesting that they prefer to concentrate on the cropping side of their agricultural activities, as well as reflecting their lesser access to pasture land.

Similarly in KIS the proportion of households with livestock is smallest amongst the middle well-being category, possibly also because of a preference for cropping activities and because of limited access to grazing. In SMIP all landholders report at least some income from livestock, but we do not have details of livestock ownership.

Table 5.9: % of landholders with livestock, by well-being category and study area

Study Area	Poor	Medium	Well-off	Total
Jany Aryk [1]	51%	96%	100%	91%
Obu Haet [1]	71%	57%	88%	65%
KIS [2]	60%	63%	58%	61%
SMIP [2]	100%	100%	100%	100%
SRSP [1]	*Sub-Marginal*	*Marginal*	*Small*	*Medium +*	
Buffalo or cattle	5%	32%	45%	71%	35%
Sheep or goats	0%	5%	9%	0%	4%

[1] Per cent of households owning cattle, sheep or goats
[2] Per cent of households reporting income from livestock

Source: Appendix Tables F-25 – F-28, (supplementary data in F-29, F-30)

In SRSP there appears to be a clear correlation between holding size and cattle/buffalo/bullock ownership. The availability of bullocks or a tractor suggests that the better off landholder categories are generally in a better position to arrange for their fields to be cultivated with animal or mechanical traction, more-or-less to suit their convenience. Poorer households who do not have their own animals for cultivation are more likely to find it difficult to complete field operations in a timely way. This could make it difficult to coordinate their water requirements with others in their command area.

In the March 2005 Farmer Workshop organised for our SRSP study site as part of this study, the adoption of livestock enterprises was identified as a potentially valuable supplementary income source for poor farmers. But participants in the 'Livelihoods through Animal Husbandry' discussion group felt constrained by insufficient knowledge and lack of capital or credit to purchase and look after animals. Under the strains of the drought conditions that prevailed in SRSP in 2004 many farmers were selling or considering selling their cattle and/or a tractor to compensate for the lack of crops. They also reported difficulties with feeding and watering their cattle.

[125] The SERA report noted that in their study villages, "most of the unirrigated land was not cultivated because farmers did not have the resources to invest in the land." (SERA, 1999, p. 11).

Table 5.10: Other physical assets - % of landholders owning traction [1]

		Sub-Marginal	Marginal	Small	Medium +	Total
SRSP	Tractor	0%	3%	0%	29%	6%
	Bullocks	0%	61%	73%	65%	51%

[1] Not available for Kyrgyzstan or Nepal.

Source: Appendix Table F-31

Box 5-6: Selling a bullock to get over the difficult times - SRSP, Andhra Pradesh

Mr. N.S has land in the command area of P-2.: last *kharif* he cultivated 2 acres (0.8 ha) of rice; last *rabi* - maize 0.5 acres (0.2 ha). This *kharif* (2004) he cultivated 30 *guntas* (0.3 ha) of rice -- this dried up totally. This *rabi* (2004/2005) he cultivated 2.5 acres (1.0 ha) of groundnut. Water reaches his field with great difficulty.

He is confused about what to do because he is also not getting labour work. The total expenditure has been up to Rs. 30,000 and he is worried about his survival. His well used to have 4 yards of water when water was there in the canal but now there is only 1 yard of water which is not sufficient for whatever he has cultivated. As his family belongs to potter caste he was thinking of making pots for survival but he does not have the traditional skill to make pots.

To cope with the situation he has reduced expenditure on clothing and festivals. Nobody is willing to give loans because people are not repaying. Another reason for not getting loans is less agriculture. In this situation he has to sell his bullock and land to tide over the crisis. In the worst case he will cultivate however much is possible with the little water in his well and somehow.

Box 5-7: The entrepreneur farmer, a sheep keeper - SRSP, Andhra Pradesh

Mr. M.R. cultivates 0.6 ha as a tenant sharecropper in P-5. Sheep rearing is his secondary occupation and he has 20 sheep. He started this business 20 years ago and has sold over 50 sheep in a period of 12 years. One sheep fetches him around Rs. 1000-1500. He considers sheep rearing to be a laborious task, needing at least two people. One has to live with the sheep day and night, irrespective of weather conditions, and migrate to wherever fodder is available. Sometimes one has to sleep in the fields, with its associated risks (snake bites, etc.). Sheep often get foot and mouth disease and the annual expenditure on this is around Rs. 2000-3000. Despite these problems, he considers sheep rearing more profitable than agriculture, which is why he concentrates on sheep rearing rather than on cultivating his land.

5.2.3 Cropping pattern

(i) Overview

Rice, a culturally important food staple, is produced in four of our five study sites. But its place in the overall balance of cropping is different in each country, and the way it fits into crop planning also varies. In our Nepal sites the allocation of irrigation water is intended to enable farmers to grow rice and it is virtually the only crop grown during our study seasons[126]. In contrast in SRSP surface irrigation water is allocated on the basis of providing for "Irrigated Dry" (ID) crops other than rice;

[126] Maize and other upland crops are grown in the un-irrigated portions of KIS during the spring, but our study site was selected because of the availability of irrigation for rice production, and rice was the only crop grown in our study areas. Rice is the only crop grown in SS9E of SMIP in the monsoon season.

given this allocation, farmers are free to grow the crops of their choice. Farmers have been encouraged to use water from wells to supplement canal irrigation.

A relatively abundant water supply from irrigation canals before the extension of the SRSP command area under the World Bank-funded projects of the late 1990s[127] encouraged farmers in our study site to grow rice, and some landholders levelled their land to make it more suitable for rice cultivation. They became accustomed to irrigating their rice using a combination of water drawn from the canal, wells, and drainage from neighbouring fields. In recent years, with the implementation of irrigation rehabilitation and the designation of the area for Irrigated Dry crops, the supply of water to their area has become less reliable[128], but farmers continue to feel tied to the cultivation of rice. They argue that the way water is managed within the system now compels them to cultivate rice as it is difficult to grow upland crops when fields are surrounded by wet rice fields. With few exceptions, farmers who grow a crop choose to grow rice, and almost all the cultivated area in our study site was under rice in *kharif* 2003. Perhaps not realising how the drought of 2004 would affect them, the large majority of farmers who chose to plant a crop in *kharif* 2004 planted rice rather than a less water-demanding alternative such as legumes, or maize.

In Kyrgyzstan, unlike our sites in Nepal and Andhra Pradesh, the climate and rainfall pattern mean that rice production is entirely dependent on the supply of surface irrigation. While no farmers in Jany Aryk try to produce rice, it is important in Uzbek culture to grow rice for cooking "*plof*" for the household. Farmers in Obu Haet try to include at least a small patch of rice in their cropping system if they can, and the WUA tries to develop allocation rules which allow farmers to do so while not unduly affecting irrigation for other less water-demanding crops.

Before land distribution, maize was the main crop in Jany Aryk and cotton was the main crop in Obu Haet; and these crops continue to predominate on individual farms in the respective sites. Wheat is grown by farmers in both Obu Haet and Jany Aryk. Sunflower, potato, or vegetables (particularly onions in Obu Haet) are grown by approximately one-third of farmers in Obu Haet and Jany Aryk.

(ii) Differences between well-being groups

In this section we simply describe crop choice amongst well-being categories, leaving our consideration of the interaction between cropping, crop productivity and irrigation for Chapter 8. The cropping pattern in our sites in Nepal was unvarying across well-being categories – the crop was always rice – so our focus will be on Jany Aryk and Obu Haet, Kyrgyzstan and SRSP, Andhra Pradesh.

Kyrgyzstan

Our Kyrgyzstan sites show only small differences in cropping pattern between well-being categories.

In Jany Aryk poor category landholders allocate a larger proportion of their cropped area to the production of maize, sunflower or wheat, compared with the better off groups. Medium and well-off landholders are the most likely to grow the more cash, labour and irrigation-intensive crops such as

[127] Associated with the rehabilitation implemented under APIP III and APERP, as discussed in section 2.2.2 (ii).

[128] Farmers remarked that lining of canals associated with the irrigation rehabilitation has significantly reduced the availability of water in their fields from drainage. This has led to practices such as tampering with the gate to the minor, *ad hoc* measures to divert water into fields and recharge wells, and intercession with influential parties in the WUA and the Irrigation Department in order to obtain the desired water supply. Interventions in canal water flows by upstream farmers make water availability in the canals erratic and unpredictable.

potatoes and vegetables. These latter crops are potentially the most profitable – with easy access to a market in Osh, but also the riskiest to grow.

Table 5.11: Jany Aryk: Cropping pattern during study season, by well-being category

Crop	Percent Landholders Growing Crops				Percent of Area Under Crops			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Maize, Sunflower Wheat	94%	84%	90%	86%	93%	82%	82%	82%
Potato Vegetables	9%	17%	20%	17%	4%	13%	12%	11%
Trees, perennials	5%	4%	3%	4%	4%	6%	6%	6%
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%

Source: Appendix Tables F-32, F-33, F-34

In Obu Haet the proportion of land area under the crops grown is remarkably similar across well-being categories. But in most cases the proportion of landholders growing each crop was greatest among the poor landholders. This suggests that the poorer landholders practice a more varied cropping pattern within their relatively small holding than the better off landholders. Poor landholders appear to cultivate their land slightly more intensively than the better off farmers, as indicated by the total cropping percentage for the first and second crops.

Table 5.12: Obu Haet: Cropping pattern during study season, by well-being category

Crop	Percent Landholders Growing Crops				Percent of Area Under Crops			
	Poor	Med	Well-off	Total	Poor	Med	Well-off	Total
1 - Cotton	94%	78%	75%	82%	74%	62%	67%	66%
1 – Onion	40%	31%	21%	32%	9%	10%	6%	9%
2 – Maize	32%	30%	21%	29%	2%	3%	1%	3%
2 - Rice	22%	31%	21%	27%	5%	7%	4%	6%
1 - Wheat	20%	22%	21%	21%	12%	13%	15%	13%
2 - Sunflower	8%	10%	8%	9%	8%	9%	9%	9%
2 – Carrot	8%	3%	0%	4%	1%	1%	0%	1%
1 - Potato	6%	4%	4%	5%	1%	1%	1%	1%
		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%

Note: 1 first crop; 2 second crop; column totals greater than 100% as some farmers grow more than one crop.

Source: Appendix Tables F-32, F-33, F-35

SRSP, Andhra Pradesh

As we have noted above, despite the fact that canal irrigation was intended to cater for Irrigated Dry crops, most farmers in our site have chosen to grow rice. The effect of the drought in *kharif* 2004 was dramatic. The proportion of landholders leaving their land fallow increased overall from under one-third to about one-half. Even among the medium farmers the proportion leaving land fallow increased from none to almost a quarter. The overall proportion of land under rice was reduced to one-third of the area in the previous year – from 74% to 24%. Although the overall proportion of land under Irrigated Dry crops remained below 10%, there was an increase in the proportion of the area sown under these crops in all but the sub-marginal size classes -- where the proportion of area under ID crops went down from 12% to 0%.

Table 5.13: SRSP: Comparison of crops Kharif 2003 and 2004, by size class

A. : SRSP – Percent of Landholders and Percent of Land Area Under Each Crop, by size class, Kharif 2003

Main Crop	Per cent of landholders growing crop [1]					Percent of Area Under Each Crop [2]				
	Sub-Marginal	Marginal	Small	Medium +	Grand Total	Sub-Marginal	Marginal	Small	Medium +	Grand Total
Rice	5%	74%	86%	94%	65%	5%	76%	70%	82%	74%
Irrigated Dry	5%	3%	23%	12%	9%	12%	2%	9%	4%	5%
Fallow	91%	24%	0%	0%	31%	83%	22%	21%	14%	21%
Total Farmers	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[1] Note: column percentages exceed 100% because some farmers had land under more than one crop and/or fallow. .

[2] Fallow includes land reported as 'fallow', 'not cultivated' and not reported as either under rice or Dry Irrigated crops.

B. : SRSP – Percent of Landholders and Percent of Land Area Under Each Crop, by size class, Kharif 2004

Main Crop	Per cent of landholders growing crop [1]					Percent of Area Under Each Crop [2]				
	Sub-Marginal	Marginal	Small	Medium +	Grand Total	Sub-Marginal	Marginal	Small	Medium +	Grand Total
Rice	5%	47%	59%	71%	44%	5%	24%	27%	24%	24%
Irrigated Dry	0%	13%	28%	24%	15%	0%	9%	10%	8%	8%
Fallow	95%	45%	36%	24%	51%	95%	67%	63%	68%	67%
Total Farmers	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[1] Note: column percentages exceed 100% because some farmers had land under more than one crop and/or fallow. .

[2] Fallow includes land reported as 'fallow', 'not cultivated' and not reported as either under rice or Dry Irrigated crops.

Source: Appendix Tables F-36, F-37

Box 5-8. SRSP, Andhra Pradesh: The effect of the drought of Kharif 2004 on three farmers in P-9

Mr. A.O. is a 60 year old 'marginal' farmer from the SC Madiga caste. He has 0.6 ha and his sources of income are his farm and agricultural labouring. There are only two people in his semi-*pucca* house [house with tile or iron sheet roof] - he and his wife. He does not have access to a well and he owns no livestock. One of his sons stays in Hyderabad and works as a labourer and sends around Rs. 200-300 per month. For the last 2 to 3 years water has not coming in adequate quantity so his cultivation as well as the yield is not good. He has left his land fallow since *rabi* 2003. When water was coming properly, he used to get 200-300 kg of maize from the land. The land is not very good and that is why he cultivated maize on it. 15 years back he planted *niligri* on 0.3 ha of land and 2-3 years back he sold all the wood for Rs 2000. Because there was no water, the trees also did not grow well. The trees were thin and short.

For the last 5 five years his financial position has not been at all good. He has a ration card (white card) and he gets 8 kilos of rice. His wife said that they are living on one meal a day. They mostly eat chilli (*karam*), tomato and pickles. In previous years he used to get more work but nowadays he does not get work. In the past he used to give groundnut, *babarlu* (field beans) and others to the people visiting his house. But now the situation has changed and he says he has to ask others for his survival (the situation is like- “can you give me something”). He told that there have been many instances when there were many quarrels among farmersget water first to their field.

Ms. G.E. is a ‘small’ tenant farmer from the BC Kurma caste. She and her 35 year old husband are sharecropping about 1.0 ha of land. She, her husband and two children live in a *pucca* house [house with a slab roof]. They have access to a well. They have no livestock. She cultivated rice in the last *rabi* (2003) and also in last *kharif* (2003), but in the *kharif* 2003 there was not enough water so the yield was poor. In *kharif* 2004 she also planted rice but on a smaller area. The expenditure for the cultivation was shared equally between the owner and her. The soil is ‘clayey’: if there is too much water is more then the soil becomes sticky; but if there is too little, it becomes hard. If there is no water in the canal she will have to give up farming and look for work as a labourer.

From the last 20 years water has come to their field and for 15 years they had good crops. But from the last 5 years less water is coming to their field and therefore yield is low. Earlier they used to cut the bund wherever they like and irrigate their field but after lining of the canal the quantum of water coming to their field has been reduced. The canal came to this area not because of farmers’ demand. It was a decision of the government for the construction of canal in their area.

Mr. N.C. is a 53 year old ‘medium’ farmer from the BC Vadhla caste. He also has a carpentry business. He, his wife and four children live in a *pucca* house. He has a total of 3.05 ha in the P-9 command area, of which 1.2 ha are irrigated by P-9. He also has an individual well. He has two bullocks, and 1 cow/buffalo. He owns a tractor but he is planning to sell it as there is no tractor work available. He had taken a loan of Rs. 2.5 *lakh* for the tractor and now the bank people are insisting that he should repay the loan as the interest is mounting. He thinks that he can repay the loan by selling the tractor.

In *kharif* 2003 he grew rice on 1.62 ha. and in the previous *rabi* 2003 he grew groundnut on 0.4 ha. In *kharif* 2004 he grew rice on 1.0 ha. He was sure that there would be no water release in this season, though people are talking about it. He said that farmers are going to use the water for irrigation in the next release of water even though it is meant for drinking and filling of tanks and wells. There will be fights between the farmers close to the canal and the farmers close to tanks in case there is a water release. Even if there is release of water then also it would not reach his field. Previously he used to employ people for around 300 man days for cultivating his land but this year the situation is so bad that he can manage everything on his own.

5.3 Human and social assets

5.3.1 Education, literacy and knowledge of agriculture

(i) Overview

The populations in our sites in Kyrgyzstan and KIS, Nepal enjoy relatively high levels of literacy compared to SMIP, Nepal and SRSP, Andhra Pradesh. In Kyrgyzstan virtually all adults, male and female, have completed at least middle school[129.] But prior to land distribution most land holders

[129] In 1989 the national literacy rate was 97%, males 99% and females 96% [CIA – The World Fact Book –internet].

were employees, and few had experience of acting as farm managers or independent entrepreneurs[130] As noted earlier, the Uzbeks of Obu Haet have more of an agricultural tradition than the Kyrgyzs of Jany Aryk, who historically were pastoralists. Aside from their different traditions, another contributor to greater interest in agriculture in Obu Haet than Jany Aryk is that Obu Haet is relatively more rural, whereas Jany Aryk is on the outskirts of Osh. However, in both areas the level of technical knowledge and experience regarding improved agricultural practices in general, and water management in particular is weak (TES Winrock, 2004).

The development of the settlement scheme at KIS provided for good infrastructure development, including schools; so the general level of education is relatively high here, with an average literacy rate among landholders of approximately 80%, compared with the national average for males in Nepal of 65.1%[131]. Landholders are nearly all male, and we don't have female literacy figures for our study area[132]. But the female literacy rate is no doubt lower than for males, although it is probably higher than for females in the country as a whole. Those living in the area have a tradition of agriculture, and they have benefited from various agricultural extension programmes, in addition to continuing support for the WUA, as we describe in Chapter 6.

For social and economic reasons, education has not been as easily accessible at SMIP as in KIS, and the level of literacy among males is also lower, at 55%[133]. Under various programmes related to the development of SMIP the area has benefited from some agricultural training and extension activities, including a few training programmes in Integrated Pest Management. However, as we discuss in Chapter 6, despite the publicity campaigns surrounding the formation of the WUA, most farmers have not developed an adequate understanding of the way the structured irrigation system is supposed to function, or of better on-farm water management methods. They also express a lack of understanding of the role of the WUA or of their own role in the irrigation system[134].

The level of literacy is very low amongst our study households in SRSP. Only 19% of heads of household ("cultivators") are identified as "literate". This is consistent with figures for 1993/94 which indicate that in AP as a whole only 21% of poor rural household heads (those in the bottom 20% of

[130] Fewer than half of our survey respondents in our Kyrgyzstan sites had been employed in agriculture before land distribution, either as *kolkhoz/sovkhoz* workers or as professionals (agronomist, veterinarian, zootechnician):

Kyrgyzstan: Previous Occupation of EIP Survey Respondent:

	Jany Aryk	Obu Haet
Agric	17%	43%
Skilled (e.g. driver, carpenter)	62%	50%
Prof and Admin	10%	7%
Other	10%	
Total	100%	100%

[131] **Literacy in Nepal**

	1981	1991			2001		
Region/District	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*
Nepal	23.3	54.5	25	39.6	65.1	42.5	53.7
Chitawan	33.7	65.7	40.9	53.1	78.8	62.8	70.8
Sunsari	30.8	59.1	30.2	44.7	70.6	50.0	60.4

Source: http://www.moe.gov.np/Educational%20Statistics/download%20pdf/literacy.pdf

[132] During our research personal information, including literacy, was only collected for landholders.

[133] This is lower than the district average for Sunsari, which includes several large towns. See footnote earlier for male and female literacy rates in Sunsari district in 2001.

[134] However, we observed in GGG that sometimes the expressed lack of awareness about how water is supposed to be managed and shared under the structured design system may be an unwillingness to accept the discipline the system requires for equitable water sharing.

rural households) were literate[135]. As we describe in Chapter 6, a mass programme of trainings was implemented in SRSP as part of the formation of the WUAs. However, at the time of our closing workshop for farmers in March 2005, the WUA President noted that effective water management had been hampered by a lack of proper training and awareness on the part of different stakeholders. An agriculture officer for the area confirmed that the agriculture department had not had sufficient involvement in promoting cropping practices that supported more efficient use of available water.

(ii) Differences between well-being groups

Although the difference is less marked in our Kyrgyzstan sites than in Nepal and India, the clear trend is for a smaller proportion of poorer landholders to be literate than of the better off. This means that they are less likely to be reached by communications that require the ability to read – such as posters, newspapers, or other publications. It also means that provisions to promote WUA accountability through measures such as written minutes of meetings and formal accounts will be even less meaningful to the poor than to better off, literate, members of the irrigator community.

Table 5.14: % of landholders literate by well-being category in each study area

Study Area	Poor	Medium		Well-off	Total
Jany Aryk [1]	95%	100%		100%	99%
Obu Haet [1]	96%	100%		100%	99%
KIS[136] [1]	61%	88%		84%	
SMIP [Males only[2]	37%	57%		74%	55%
SRSP [3]]	*Sub-Marg*	*Marginal*	*Small*	*Medium +*	
	0%	13%	18%	59%	19%

[1] % of all household members, male and female, who are literate
[2] % of male household members who are literate
[3] % of landholders (male or female) who are literate
Source: Appendix Table F-38

5.3.2 Household composition and labour availability

(i) Overview

All of our study sites have a tradition of living in extended families, although the average household size in our SRSP site is much smaller than in our Nepal and Kyrgyzstan sites. The smaller household size in our SRSP site may reflect the fewer off-farm employment opportunities in the locality – putting more pressure on adult family members to leave the area to find work. Despite the larger family size

[135] Our baseline survey in SRSP found that 13% of landholders had received 3 or more years of schooling and 7% were "functionally literate"; 80% were identified as "uneducated", i.e. had not received schooling. A 2001 DFID Strategy Paper observed that low literacy rates in Andhra Pradesh reflected low primary school enrolment, the poor quality of education, as well as gender and social inequalities in access to education at all levels. *Andhra Pradesh State Strategy Paper* DFID India 2001, quoted in (World Bank, 2003, p. 41). Overall literacy rates in AP have been found to be amongst the lowest in India (*ibid*., p. 46). However, our interviews with a sub-sample of households from our baseline survey found that the children are all going to school. Five boys were attending further education - one studying engineering, 2 in ITIs, and 2 in Degree College. One girl was in the 12th std., but only one girl was going to college; this reflecting the practice of marrying girls after puberty or at least after 10th Std. The only exception was a graduate daughter-in-law in a large farmer's family.

[136] Pachas *Bigha* Kulo and Pilot Gate West only - data are not available for Outlet 18 in BC-1, where there are many *Dalit* sharecroppers, and data also excludes *Tharu* sharecroppers in Pachas *Bigha* Kulo who are mostly poor, with lower literacy.

reported in Nepal our team observed a trend toward nuclear family residence. It might be expected that in Kyrgyzstan too economic pressures and social change may be pushing some farmers toward living in nuclear family units. Smaller households mean that fewer adults are available to manage agricultural tasks, including irrigation. Furthermore, as we will discuss below, the adults in the household are often combining off-farm occupations with their agricultural activities, and this affects the availability of household labour for agriculture – and for managing irrigation.

(ii) Differences between well-being groups

Despite the trends discussed above, average household size in four out of five of our sites is fairly large in all well-being categories. But as we will see for all our sites, off-farm employment is an important part of landholders' livelihood strategy. It is most commonly the males who take on this employment. This means that the adult females of the household may have to take on traditionally male activities, including irrigation water distribution, when males are absent.

Table 5.15: Average size of landholder household by well-being category in each study area

Study Area	Poor	Medium	Well-off	Total
Jany Aryk	6.8	6.7	6.6	6.7
Obu Haet	7.5	6.2	6.6	6.6
KIS [excluding non-residents]	6.9	5.5	8.0	6.5
SMIP	6.2	6.4	6.7	6.4
	Sub-Marg	*Marginal*	*Small*	*Medium +*
SRSP	4.3	4.4	4.9	4.8	4.6

Source: Appendix Table F-39

5.3.3 Role of women in agriculture and irrigation

(i) Overview

In all of our study areas women contribute a significant amount of labour for agriculture, particularly for traditional tasks such as transplanting rice, weeding, and harvesting. However, according to custom they are expected to be subordinate to men when it comes to practical decision-making – particularly outside the domestic sphere.

A feature in both locations in Kyrgyzstan is male migration for employment, particularly to Russia. The result in some households is that a woman is the effective household head and farm manager. Our survey results indicate that 12% of households in Jany Aryk and 6% of households in Obu Haet are headed by women for one reason or another[137] (Appendix Table F-40). Uzbek villages are more traditionally observant of Moslem restrictions on women than Kyrgyz villages, and women tend to rely on male relatives to represent them, including in irrigation matters. Women in Kyrgyz communities are traditionally more assertive and this may extend to being active in irrigation. But post-independence the combined effect of reduction in support services, such as child care, and some return to more traditional attitudes, was observed to be changing the atmosphere toward women's

[137] E.g. because the husband is away in Russia, has abandoned the family, or is disabled.

active involvement in public affairs, including in discussions of irrigation matters (SERA, 1999, p. 36). When our team held general meetings to discuss irrigation matters few if any women attended. Our team had to make a special effort to talk to women about irrigation either in their field or at their home.

Box 5-9: Two woman farmers - Obu Haet and Jany Aryk, Kyrgyzstan

Mrs. A M. 0.61 ha in Obu Haet

Mrs. A.M. lives in Aravan with her 15 year old son. She also has two daughters attending sewing courses and living in Osh, though they do come home for week-ends. For the past 2 1/2 years Mrs. A.M.'s husband has been working in Russia with two of their sons. Mrs. A.M. relies on the money sent by her husband. This has left Mrs. A.M. as the farmer and irrigator. She said she would like to grow more vegetables, but she has problems with water supply. She was of the opinion that it is more difficult for a woman to access water than for a man. She felt that men have better contact with the *mirab* and can approach him more easily. Her field is located within the lower part of Field IV, and she says a lot of water is diverted by upstream farmers in the same field.

Mrs. K.A. 0.30 ha in Jany Aryk

Mrs. K.A.'s husband became disabled a year ago and cannot walk, so Mrs. K.A. is the farmer and irrigator. Mrs. K.A. has a grown son who has been in the army since last year. Mrs. K.A. does not know if her family has any land in the rain fed area which once belonged to the *sovkhoz*. But even if she did have land there, she has no one in the household who can work on it. Mrs. K.A. said that she has had difficulties with water supply to her fields. During the past season she irrigated 2-3 times at night, but the flow would decrease during the irrigation. Since her son is away, and her husband is unwell, Mrs. K.A. has problems with labour for farming, and also with funds. This year her maize plants were small because the household couldn't afford to purchase fertiliser. Mrs. K.A. said that the household's income is from livestock and apples.

In Nepal women are generally subordinate to men and have less access to education, economic resources, and political power. Their plight, however, varies from one ethnic group to another. Among Hill migrant Brahman/Chettri communities, such as those that predominate in KIS, female status is relatively better than in the *Tarai* 'migrant' communities, such as the Sah and Yadav which are dominant in the SMIP study area. In SMIP female status is relatively higher among hill *Janajati* groups and *Tarai* 'indigenous' communities such as the *Tharu* who predominate in other parts of the system. In SRSP, as in our other study sites, women are not involved in formal decision-making about irrigation, even though they provide a large part of the labour for agricultural production[138].

Yet while irrigation is traditionally a male activity in all of our study areas, oftentimes women must manage the irrigation of the crops, particularly when there is no male in the household to do this task. This would be the case not only in female headed households, which seem to be in a small minority in our study sites, but also in households where the male is engaged in an off-farm occupation; something which, as we will describe below, is common. However, with few exceptions, decision-making on irrigation matters is dominated by men, and as WUA membership is associated with landownership or formal tenancy, this is also dominated by men.

(ii) Differences between well-being groups

While women are traditionally excluded from making decisions and negotiating for irrigation water, provided that a woman has the support of a male who can help her to ensure access to water, she may not be at particular disadvantage – other than her relationship of dependency. There are women in

[138] A study conducted in Telangana found that women participated in 80% of agricultural operations and contributed 70%-80% of the agricultural labour time (Shyamala, and Rao, 2002. p. 254).

each of our study sites who report that they are able to get help from male relatives or family friends to get the irrigation they need[139]. But some women in our study sites who do not have such support report that they find it difficult to get information about irrigation schedules, and to do the guarding of water delivery which may be necessary to ensure an uninterrupted supply to their crops. Poorer women, who are less likely to have influential male contacts, and who have the poorest level of education, find it most difficult to protect their water supply. This can have consequences for the crop performance, subsequent yield, and benefit to the household.

Box 5-10: Women farmers, four different experiences - KIS, Nepal: Branch Canal – 1 & Pilot Gate West

BC-1 Outlet 18

A Poor Dalit Woman at the Tail: I have 3 *kattha* of land (0.1 ha) of which 2 *kattha* (0.07 ha) is spring rice. We are sharecroppers. Water is scarce at the tail during rice transplantation. I do not know about [WUA] committee. If water is scarce I used to ask Mr. D. R. S. (Secretary of Outlet Committee for OL18 -- Male, Head, Medium WB). For women no difficulties to manage water if water is available at head of the canal.

A Medium wellbeing Woman at the Tail: I have 8 *kattha* (0.26 ha) of land but no spring rice this year. Last year we could manage water with difficulties. It is necessary to guard at night. Rotation is not regular. No systematic rules and regulations. Canal is also defective in Outlet 18. With low flow it is not possible to operate outlet. If water is not sufficient our labour will be lost. For tail enders it is difficult to manage water.

A Well-Off Woman at the Head: My plots are in head. We transplant 15 *kattha* (0.5 ha) of land. Water is applied from head to tail and we are privileged. We participate in canal cleaning. We prefer to clean the canal that is parallel to our plots.

Pilot Gate West

Poor Farmers in Pilot Gate West: No different behaviour for women in providing water. However, sometimes if there are only women wanting to irrigate, a male will request them to wait for some time. Women participants expressed that being women, they have to wait some time for irrigation. This is general practice in the area except some extremist women.

5.3.4 Formal and informal social groups and collaboration for water management

(i) Overview

Despite the variation in social composition in all of our study areas landholders describe their community as being fairly harmonious and collaborative. We observed that numerous social groups for mutual support in activities such as saving, religious activities and funeral societies, house construction, etc. operate in the villages where the landholders live. There are also informal traditions of cooperation for example to prepare rice nurseries or for labour exchange, such as *ashar* in Kyrgyzstan and *parma/urdi* in Nepal, to complete other tasks (Appendix Table F-41).

These groups provide evidence of a willingness of members of the community to collaborate. This could potentially be extended to collaboration in irrigation matters. In our Kyrgyzstan and KIS, Nepal sites the WUA draws on local tradition to mobilise labour for cleaning the branch canal/on-farm canals. But the WUAs in SMIP, Nepal and SRSP, Andhra Pradesh do not undertake such mobilisation. In all our sites any organisation by landholders for the cleaning of the lowest level canal (e.g. outlet canals or watercourses) is generally informal (Appendix Table F-42).

[139] It is worth bearing in mind that because of social and cultural constraints women may feel shy, or otherwise reluctant, to report that they participate in an irrigation activity that is supposed to be the responsibility of men; and they may also not wish to be critical of men, or admit that they have particular difficulties with accessing irrigation water.

In our Kyrgyzstan sites some landholders group together on a semi-formal basis to collaborate for a range of agricultural activities, including for the management of irrigation[140]. These groups have between 3 to 6 members, and they are usually made up of people related by kinship and/or by being neighbours in the field. Some had operated their land jointly as a 'peasant farm' in the period immediately after land distribution. They now operate their farms separately but they collaborate not only to organise access and sequence of irrigation, but also for other activities: most frequently for machinery hire, but also, in some cases for crop planning, planting and purchase of inputs. (Appendix Table F-43).

Otherwise, we found that only in KIS, where the SAGUN programme is promoting a range of interconnected livelihood activities, is there an overlap between cooperative organisation for irrigation and non-irrigation activities. Elsewhere the membership and activities of non-irrigation social groups have very little bearing on the way irrigation is managed.

We observed that landholders in our study sites share a number of common features in the way they organise water distribution to their fields. In all our sites the pattern is for landholders mostly to take individual measures to access and guard water supply to their field (Appendix Table F-42). Those landholders who do collaborate and/or negotiate with other irrigators tend to do so with a relatively small group, generally less than five or six, and often only 2 or 3[141]. Irrigators mostly collaborate on the basis of a combination of kinship[142] and field neighbours with whom they have established a social relationship. This collaboration is generally informal and situation-specific. Landholders say they join with others as they deem necessary – striking a balance between meeting their own water needs and the expedience of maintaining good relations with those around them. The main irrigation activities for which landholders say they would collaborate are:

- **Agreeing an order for irrigation to fields irrigated by a common outlet:** Landholders most frequently consult each other to agree on allocation of water once it is in the field already. Water is shared based on a pragmatic combination of considerations: who is in the field at the time, judgement about crop needs, maintenance of good social relations. The order of irrigation is sometimes agreed in advance, but more commonly it is negotiated in the field, when the water is actually flowing.
- **Taking measures to improve and protect the flow of water to a shared outlet**. This is the next most frequent reason to collaborate with others. This involves guarding the intake to the outlet, or going upstream to deal with diversions and assure the flow of water to the shared outlet. This might include measures such as removing obstacles placed in the branch canal, tertiary, etc. by upstream landholders, lobbying for a gate to be opened (or taking unauthorised measures to open the gate themselves).
- **Canal maintenance**: Landholders usually say that they collaborate with other landholders to clean a common outlet/watercourse delivering water to a group of fields. The number of people involved and the regularity of this collaboration varies. Often it is only those directly affected by the condition of the canal at a particular time. Among the factors influencing who is motivated to help with canal cleaning are: the layout of the fields, the extent to which individual irrigators depend on the particular canal for their access to water (irrigators who have independent access through a well or individual access to a higher level canal – often unauthorised, are less likely to participate in canal cleaning), and the nature of the social relationship between the irrigators.

[140] We were told that there were around 4 or 5 of such groups operating in each of our study sites in Kyrgyzstan. We obtained information about 4 of these groups in each of our sites.

[141] These are the figures for our Kyrgyzstan sites. Although we don't have the same statistics for our other sites, we have the impression that the figures would be similar there too.

[142] This tends to be with fairly close kin –e.g. brothers, uncles, cousins.

- **Management of water into individual fields**: On the whole landholders manage irrigation into and within their own fields independently – relying on their own time and efforts. Only in Obu Haet and Jany Aryk do landholders report employing an irrigator – and this tends to be done on an individual basis – mostly by a few of the better off landholders. (Appendix Table F-44).

Landholders rarely collaborate to approach someone from the WUA or the irrigation department regarding access to water. Except where there is a strong sense of a shared crisis or injustice, this tends to be done on an individual basis. Those who can do so, draw on their personal relationships and ability to exert influence with e.g. the ditch rider (*mirab*/*lashkar*) or WUA committee members. (Appendix Tables F-42, F-45 and F-46)As we will discuss in Chapter 6, landholders generally have a very limited engagement with the WUA.

(ii) Differences between well-being groups

As we noted above, the proportion of landholders collaborating with others varies by the type of activity.

In Kyrgyzstan around two-thirds of landholders say they frequently collaborate with an average of 2 to 4 others to coordinate timing and access to irrigation. For other activities less than half say they collaborate frequently, and this is generally with a smaller number of other people.(Appendix Table F-42). There appears to be a pattern for landholders in the medium well-being category to join most frequently with others to collaborate in irrigation activities (Appendix Tables F-47 and F-48). The majority of the members of the semi-formal networks we referred to earlier were in the medium well-being category. Poor landholders belonged to such a network more frequently in Obu Haet than in Jany Aryk (Appendix Table F-49). But aside from these groups, on the whole the poor tend to collaborate with others least frequently, with the well-off somewhere in between. There is a clear difference between Jany Aryk and Obu Haet in their reliance on the *mirab* for the management of water distribution. In Jany Aryk landholders hardly make contact with the WUA, with none of the poor in our survey reporting that they get help from the *mirab*. On the other hand, in Obu Haet landholders frequently contact the *mirab* to get authorisation for irrigation, and some poor irrigators note that the *mirab* helps them to assure their access to water (Appendix Table F-45).

In our sites in Nepal mutual support networks, such as coming together for religious ceremonies, savings and other support groups, are important for the poor. But the benefits of these networks do not extend to facilitating irrigation access. Poorer landholders report difficulty in getting permission to use field channels that go across the land of better off landowners in neighbouring fields. Poorer landholders also feel frustrated that better off and more influential landholders are able to take water with little regard for how it will affect others. The common refrain is ‘might makes right’ (Appendix Table F-42).

Box 5-11: Experience of poor irrigators - KIS and SMIP, Nepal

KIS - 2 Poor category landholders-Pilot Gate-west

"Always influential (well-off) landholders dominate the weak landholder. Even during rotation period, weak landholders are not able to use their turn. Those who are influential and strong (talkative, so called respected within the society and having more land) can use more water."

SMIP: A poor woman landholder at the tail of WC-4

Ms PDS was de-weeding in the rice field at the tail end of WC-4 when the team met her. Ms P and her husband R are from a poor family. They live in Hattimuda and cultivate 1 *bigha* of land ((0.68 ha) on a contract basis for the last two years. She could not grow rice last year due to poor health as she has a small child. She cultivated pulses since this did not need water for irrigation. This year she and her husband tried to grow irrigated crops, but they could not irrigate their field during the rotation period. The rotation time was fixed for them, but some one used the water upstream and they could not irrigate their field. Hence, the rice cultivation is totally based on rainfall. Since the rainfall is good since last month rice is good. However, it is not sufficient to mature it. Canal irrigation is essential she says.

Box 5-12: Some observations on collaboration for water distribution by well-off irrigators - KIS and SMIP, Nepal

KIS: A well-off woman landholder

Ms JA made the following observations about the way water is distributed:

- I cannot control myself seeing my cracked rice land. My sharecropper lives far from here and it is difficult to rely on him.
- It is wise to block all water for some time otherwise it will be misused and nobody is satisfied. Sharing of water is possible if there is more water in the canal. Once my field is irrigated, the next landholder will get all water. It depends upon the mutual agreement between neighbouring landholders. It is actually not a rule but we generally do so.

The study team observed that in fact Ms JA did not negotiate with neighbouring landholders in using water. Ms JA comes from a well-off family and has some influence in the society. Other landholders expressed the opinion that it is difficult to convince her not to block all water. But they also said that they have to stay in the same village so it is better not to make anyone unhappy. Interestingly, the team saw a small corrugated iron sheet in each house that is being used to block water. When the land is irrigated, they remove it and keep it for next time.

SMIP: WUG chairman of WC-3 and one of the most educated and so-called elite of the Hattimuda community

According to Mr. G.D.S.:

- They [the WUG] have tried to rotate water on the basis of 3 hours per *bigha* (0.68 ha). He also stated that every one in WC-4 could not get his or her turn of rotation and so some landholders asked for additional water to the WUA Chairman for SS9E.

The study team concluded that landholders have adopted an *ad hoc* rotation and not all the entitled landholders could get their chance for irrigation. This is also confirmed by the experience of Ms PDS at tail part of WC-4, who was excluded from irrigation despite having been assured of her irrigation turn.[see **Box 5**]

Amongst better off landholders in Nepal intra-caste networks are mutually supportive, and better off landholders are more likely to be able to use personal influence with WUA and ID staff to obtain information about irrigation schedules and to protect their access to water supplies. But power struggles between caste groups can be divisive and undermine collaboration within the wider irrigator community. In SMIP we learned that divisions between the Sah and Yadav caste groups sometimes combined with political divisions to prevent cooperation[143]. Caste/ethnic differences across tertiaries

[143] Within T-5, there are two villages -- Satterjhoda (*Yadav*) for WC1&2 and Hattimuda (*Sah*-dominated) (WC-3&4). Cooperation between the two villages is poor or non-existent.

within the sub-secondary have also aggravated water sharing problems between the head and tail of the canal in SS9E of SMIP[144]. In SMIP, and to a lesser extent in KIS, since many of the well-off landowners who are renting their land out to others are not locally resident, they tend to be less interested in promoting good water management, or in seeing to it that their tenants follow rules of water sharing. Yet according to the WUA constitution it is these landowners that are officially members and responsible for abiding by the rules.

Landholders in all size groups in our study site in SRSP described the system for distributing water at lower levels of the system and down to the field as being informal, generally 'from head to tail' and 'first come first served'. Some of the respondents in the poor category added that it was also from 'powerful to powerless and big to small landholders'. We do not have direct evidence from our study area of the effect of caste and sub-caste relationships on collaboration between irrigators. These relationships are likely to be changing under the influence of new agricultural technologies and developments in urban areas (Srinivasulu, 2002, p. 33). But residence patterns in our site combined with observations made in other studies of social relations in Andhra Pradesh suggest that, as in Nepal, caste and ethnicity will still have an important influence on how irrigators work together[145]. The Muslim landholders in P-9 are likely to be particularly marginalised. Poorer landholders may well depend on the patronage of landowners from more influential castes. As we noted earlier, the Reddy and Velama castes are the most powerful in SRSP generally and their members occupy important positions in politics and in the WUA. The president of the WUA for our study site is a Reddy, and the TC representative is from an OC caste, even though this group is a small minority in our study area.

5.4 Livelihood strategies

5.4.1 Contribution of irrigated agriculture to household food sufficiency

(i) Overview

We have taken a different approach to assessing the contribution of irrigated agriculture to household food sufficiency in each of our study sites – to take account of differences in the place of staple food production in the farming system[146]. In our sites in Nepal and Andhra Pradesh the first objective of landholders is to meet home rice consumption needs, with any surplus then made available for sale. So here we consider the proportion of annual household rice consumption needs which are met from own production[147]. On the other hand in our Kyrgyzstan sites a significant area is dedicated to crops

[144] As noted in an earlier footnote indigenous *Tharu* are in the majority in T2, which is at the head of the sub-secondary, but there are no *Tharu* in T-5. Ethnic differences between the *Tharu* at the head of the canal, and other *Tarai* ethnic groups (*Sah* and *Yadav*) at the tail may have contributed to problems in achieving agreement and discipline in water sharing between irrigators at opposite ends of the SS9E canal.

[145] Srinivasulu notes that the continuing importance of caste in social relationships and politics has been reinforced by i) the continuing role of caste identity in everyday life rituals surrounding birth, marriage, death, etc.; ii) the reinforcement of community interactions and bonds within caste groups; and iii) the political use of caste as a means to mobilise popular support (Srinivasulu, 2002, p. 33).). This may operate to separate, rather than unite, caste groups in both agricultural and non-agricultural community organisations in our study area.

[146] There was also variation in the data collected by our research teams. This means that the resulting figures are not directly comparable, since household income from sale of produce is considered for our sites in Jany Aryk and Obu Haet, but not for those in Nepal and Andhra Pradesh. In any event all of these estimates are subjective and biases in reporting cannot be controlled. Despite these drawbacks, the observations still provide some useful insights.

[147] In Nepal and Andhra Pradesh rice consumption was taken as a proxy for food sufficiency. In Nepal farmers and key informants were asked to estimate the number of months in the year rice consumption needs were met from own production. Farmers who produced enough to satisfy household needs for 12 month are considered to be 100% self-sufficient. In SRSP

which cannot be consumed directly by the household, so the relation between home production and food sufficiency is not so direct. In Jany Aryk and Obu Haet we asked respondents to estimate the proportion of their household income which they considered to come from irrigated arable crop production, considering both home consumption and income from sale of their crops.

In all of our sites less than 90% of household food needs were met from own production; but of course the examination of differences across well-being categories below will be more revealing than this overall average. The lower contribution of agricultural production to household income in Jany Aryk than in Obu Haet is consistent with Jany Aryk's closer proximity to Osh, smaller average holding size, and different agricultural tradition.

Table 5.16: Average food sufficiency/contribution of irrigated arable crops to household income (as reported by respondents) – Summary

Study Area	Jany Aryk [1]	Obu Haet [1]	KIS [2]	SMIP [2]	SRSP [3]
Total	33%	63%	84%	85%	86%

[1] Average percent of household income derived from irrigated agriculture (including both home consumption and sale)

[2] Average percent of year that household food needs are able to be met from home production

[3] Calculated as average annual per capita availability of home-produced rice retained for home consumption. Based on production in *kharif* 2003 and *rabi* 2003/2004. Household availability of 300kg or more of home-produced rice per capita per year considered to represent 100% self-sufficiency. 33 households who produced no rice for home consumption were not included in this calculation.

Source: Appendix Table F-50

(ii) Differences between well-being groups

In all of our study areas, poorer households generally have less land than better off households, so it is to be expected that the production from their farm will make less of a contribution to their household consumption needs than it does for the better off[148].

In Jany Aryk and Obu Haet the poor and medium well-being categories are most reliant on the income derived from agricultural production, with the well-off markedly less so. But in all cases it is clear that non-agricultural sources make a major contribution to total household income.

In KIS on average, medium and well-off landholders are able to meet almost all of their consumption needs from own production, while the poor, on average can only meet under three-quarters of their needs. Here the notable difference is between BC-2, (*Pachas Bigha Kulo* and Pilot Gate West), and the study site in BC-1 (Outlet 18). In *Pachas Bigha Kulo* and Pilot Gate West the supply and management of irrigation is most effective, and the average holding size irrigated is larger than in Outlet 18. In the former two outlets even the poor are able to meet 80% or more of their rice food needs from own production. On the other hand in Outlet 18, despite an apparently abundant supply of irrigation (see Chapter 8), water management makes for inadequate distribution and the average area

respondents to the Baseline Survey were asked how much rice they retained for home consumption out of their total production in *kharif* 2003 plus *rabi* 2003/2004. This was converted to an annual per capita rice availability (children were given a weighting of 0.5 in the per capita calculation). Households that were able to retain 300 kg or more per capita were considered to be 100% self-sufficient. In all three sites only households that produced at least some rice for home consumption were included in the calculation of the average.

[148] There appears to be an exception to this trend in SMIP in WC-3 and WC-4 where poor landholders appear to have more land, on average, than medium landholders. But in SMIP a large proportion of landholders – particularly the better off, have land outside the study command area, so the average area of land in the table does not reflect the total land available to the medium and well-off to produce rice for home needs.

of irrigated rice is smaller than in the other sub-areas. Here both medium and poor households are much less able to meet their food needs than the corresponding groups in the other sub-areas; with the poor significantly less able to do so. In SMIP medium and well-off landholders are able to meet most of their food needs from their holding, while poor landholders can only meet half to about two-thirds of their needs.

In SRSP it would appear that all landholding rice producers with marginal or larger holdings in all three pipes were able to meet 80% or more of their rice needs from own production in 2003/2004. The self-sufficiency of the Marginal + landholders in SRSP was comparable with medium and well-off landholders in SMIP, while that of the Sub-Marginal rice producer in P-2 was comparable to poor landholders in SMIP. This probably reflects the fact that the holdings of those in the Marginal + category in SRSP are comparable in size to the medium and well-off landholders in our Nepal sites (see table Table 5.6). We do not have data for the production from *kharif* 2004, but as is evident from observations throughout this chapter, landholders will have suffered a serious decline in their ability to meet their domestic food needs as a result of the drought.

Table 5.17: Food sufficiency/contribution of agriculture to household income (as reported by respondents), by sub-area and well-being category

Study Area	Sub-Area	Poor	Medium	Well-off		Total
Kyrgyzstan [1]	Jany Aryk	37%	35%	23%		33%
	Obu Haet	69%	65%	42%		63%
KIS [2]						
	PBK	80%	98%	67%		87%
	PGW	83%	95%	100%		93%
	O18	39%	76%	81%		56%
	Total	71%	93%	93%		84%
SMIP [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 [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 food needs were met from home production.

[3] Average percent of household rice consumption needs met from own production in *kharif* 2003 and *rabi* 2003/2004. Calculation based on annual per capita availability of home-produced rice retained for home consumption -- each child in the household given a weighting of .5. 33 households who did not report production of rice for home consumption were not included when calculating the average (see table below). Calculated on the basis of 300 kg per capita per year = 100% self sufficiency. Households declaring that they retained a quantity of rice for home consumption which exceeded 300 kg per capita were entered as 100% for the purpose of calculating the average.

Source: Appendix Table F-50

5.4.2 The place of off-farm employment in livelihood strategies

(i) Overview

As we have seen, few of the landholders in our study sites are likely to be able to meet all of their basic food needs from their own irrigated crop production. So they must engage in other agricultural activities as well as off-farm occupations, both to feed their families and to cover other non-food costs.

Table 5.18: % of landholders who were engaged in off-farm occupations, summary

Study Area	Occupation Description			
Kyrgyzstan	*Employee*	*Self-Employed*	*Casual Labour*	*Other*
Jany Aryk	45%	8%	14%	16%
Obu Haet	10%	3%	24%	13%
Nepal	*In Village*		*Away From Village*	
	Agricultural labour	*Other non-agric*	*Agric. labour*	*Other non-agric*
KIS	30%	15%	6%	58%
SMIP	22%	18%	9%	33%
SRSP	*Agric Labour*	*Breaking Stones*		*Missing/None*
Main Occupation	3%	16%		3%
Secondary Occupation	*Agric labour*	*Agric Other*		*Non-agric Other*
	41%	11%		7%

Source: Appendix Table F-51 – F-55

(ii) Differences between well-being groups

Labouring is an important occupation for the poor in all of our study sites. In Kyrgyzstan casual labour is particularly important for the poor in Obu Haet who don't have the benefit of proximity to the city of Osh. In Nepal poor landholders in KIS have more opportunities for non-agricultural employment away from the village than those in SMIP. But across our sites in Nepal and SRSP there is a striking similarity in the proportion of poor landholders who depend on agricultural labouring for some of their income – 50% to 60%. It is more frequently the men in the household who are involved in off-farm employment, and this means women must take on irrigation tasks when the men are away. Yet, as we noted earlier in section 5.3.3, women from poor households often find it difficult to get help to protect their access to irrigation. As might be expected, in all of our sites the well-off are least likely to depend on agricultural labour for an income. They are mostly employed or engaged in other non-agricultural occupations, often as professionals, such as teachers or doctors, or in some sort of business.

Table 5.19: % of landholders who were engaged in off-farm occupations, by well-being category

Study Area	Occupation Description	Poor	Medium	Well-off		Total
Kyrgyzstan						
Jany Aryk	Employee	32%	47%	45%		45%
	Self-Employed	0%	11%	0%		8%
	Casual Labour	14%	18%	0%		14%
	Other	41%	4%	45%		16%
Obu Haet	Employee	0%	13%	22%		10%
	Self-Employed	9%	0%	0%		3%
	Casual Labour	71%	6%	0%		24%
	Other	0%	6%	84%		13%
Nepal - KIS		*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%
Nepal - SMIP						
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%
India - SRSP		*Sub-Marginal*	*Marginal*	*Small*	*Medium +*	*Total*
Main Occupation	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%
Secondary Occupation	Agric labour	14%	58%	59%	18%	41%
	Agric Other	0%	5%	18%	29%	11%
	Non-agric Other	0%	16%	0%	6%	7%
	Grand Total	14%	79%	77%	53%	60%

Source: Appendix Table F-51 – F-55

Box 5-13: Irrigated agriculture and livelihood strategies: three landholders - Jany Aryk, Kyrgyzstan

Mr. AS, a poor wellbeing maize grower with medium access to water in Field II (owns 0.33 ha; holds 0.53 ha) is 30 years old. He lives with his 58 year old mother, his 28 year old brother, and his 20 year old sister. He works as a guard in a furniture factory. His brother works in a stone quarry. His sister is a student. His mother and sister also make traditional Kyrgyz hats. His family has two plots of land: 0.2 ha in the mulberry field is rented in from the local authority trust. This field is at the head of the canal and has a good irrigation supply. His family owns 0.33 ha in Field II. Although Field II is near the head of the tertiary canal, AS says he sometimes has trouble accessing water. He estimates that he relies on drainage for 50% of his water supply. Aside from the mulberry trees, this year he grew 0.20 ha of maize, 0.13 ha of vegetables, and 0.03 of home garden crops. The family has 2 cattle, 7 sheep and 5 poultry. He estimates that 30% of family income is derived from irrigated agriculture.

Mr. JA, a medium wellbeing maize grower with medium access to water in Field IV (owns and holds 0.17 ha) is 42 years old. He and his 38 year old wife have 4 children in school. JA is an artist and his wife is a school teacher. They have a small land share because they worked outside the *sovkhoz* before land distribution. He planted all of his irrigated land to maize. He says he wouldn't mind growing wheat, as he considers it easier to grow than maize, but he can't grow it because of difficulties with the water supply - during the season it is necessary to guard the water supply day and night. The maize crop is mainly fed to livestock. He has two cattle. He reports that 5% of household income comes from irrigated agriculture. He considers that the investment costs are high and the profit is low. He does not grow enough maize in his field to feed his cattle, so he has to buy in more to supplement their feed.

Mr. TS, a well-off maize producer with good access to water in Field II (0.33 ha in the study command area; land share in the rain fed area which he says he doesn't use; rents in 1 ha in another command area – and employs an irrigator for the rented field) is 27 years old. He lives with his wife, pensioner mother, and 6 other dependents. He is employed as a professional in the Institute of Natural Resources. His wife normally works as a teacher, but she is currently on maternity leave. He owns a tractor, which he sometimes hires out to others. This year in the study command area he grew 0.25 ha maize, 0.05 ha potato and 0.03 ha onion. There are apples both in his home garden and on the land he has rented. A part of the apples are for home consumption, the rest are sold. He also owns 3 cattle, 10 sheep, 100 goats, and 10 poultry. He estimates that 5% of household income comes from irrigated arable agriculture. Most income comes from his salary, livestock and horticultural crops.

Box 5-14: Irrigated agriculture and livelihood strategies: three landholders - Obu Haet, Kyrgyzstan

Mr. IA, a poor wellbeing wheat grower with poor access to water in Field II (owns and farms 1.06 ha) is 31 years old. He lives with his 25 year old wife and a child, as well as his pensioner mother and two sisters in their twenties. One of his sisters is disabled. All the household's non-farm income comes from IA's casual employment. This year he grew 0.85 ha of wheat, 0.11 ha of maize, and 0.1 ha of onion. He also has 0.05 home garden. He has 1 cow, 2 sheep and 3 poultry. He estimates 50% of household income comes from irrigated agriculture. IA says if he had a better water supply he would grow high-valued crops such as carrots, rice and cucumbers. He says he relies on drainage water more than he does irrigation from the canal because it is very difficult for him to access canal water. He says that even if he submits his water request in advance to the *mirab*, and the irrigation is authorised, the flow to his field eventually decreases because of water theft. The water supply from drainage is even more unreliable.

Mr. MM, a medium wellbeing mixed crop grower with good access to water in Field I (owns 0.4 ha; farms 0.8 ha) is 24 years old. He and his young wife live with his father and mother who are pensioners. He has 0.4 ha of his own within the study command area in Field I where he has a good water supply. He has rented in another approximately 0.4 ha in a neighbouring command area. This year he grew 0.4 ha of wheat, 0.2 ha of rice, 0.2 ha of sunflower. He would have gladly grown cotton, but didn't because of the need to practice crop rotation. The family also has 2 cattle and 3 sheep. 80% of the household income comes from irrigated agriculture.

Mr. BD, a well-off wellbeing cotton grower with good access to water in Field II (owns and farms 0.63 ha) is 26 years old. He, his wife, and his 18 year old sister live with his parents. There are also 3 children in the household. He works in a private oil processing factory and his father is an economist in a cotton plant. He only grows cotton in his field. The main constraint is time as he and his father are busy with other activities. He estimates that 20% of the family income comes from irrigated agriculture.

In SRSP marginal and small landholders have few alternatives other than to work in agriculture[149]. Thus this economically vulnerable group was doubly hit by the drought in *kharif* 2004 – it affected not only their ability to produce food on their own land, but reduced their employment opportunities. Better off neighbouring landholders reduced their cropped area -- and their demand for labour. As illustrated below, another source of income for some landholders is fishing from a nearby tank. The drought has reduced the water level in the tank and consequently this source of income too.

Box 5-15: A fisherman in P-9 - SRSP, Andhra Pradesh

Mr. M.K. is 40 years old. He belongs to the BC Teluga (fishing) community. He lives with his wife and a son and a daughter. He has only 0.4 ha, which receives very little water. In 2004 *kharif* he cultivated 0.1 ha of *babarlu*; the remaining land was left fallow. The output from his field supports his family's food requirement for one month only. P9 tail end gets very little water, and he feels that the WUA office bearers do not pay adequate attention to this issue.

Catching fish from the village pond is his secondary occupation. He catches fish for sale as well as for home consumption. The tanks are dominated by Teluga people and they don't allow others to come in. There are 45 families from the Teluga caste in the area. They have a caste union. Telugu fisherman earn up to Rs. 1000 per family from fishing. Due to less water in the tank this year they are catching less fish currently.

Agricultural labour work is another secondary occupations. This year due to lack of water, this opportunity is very limited. Males get Rs. 60 per day and females get Rs. 30 per day as wage rate for labour work.

5.5 Summary: irrigation and livelihood assets

5.5.1 Contribution of irrigation to livelihoods

Irrigation provides landholders in our study areas with the potential benefits of more intensive and more diverse cropping -- yielding products which could be consumed directly or sold for cash to purchase other household needs. In Jany Aryk and Obu Haet rainfall patterns are such that only with irrigation is it possible to grow the major crops – maize and cotton – reliably. Without irrigation yields for the other arable crops grown, such as wheat and sunflower, would be low, though they could still be grown. Rice could not be grown in Obu Haet. Vegetables, potatoes and fruit could certainly only be grown on much more limited areas which have easy access to wells, rivers or other natural sources.

In Nepal irrigation makes it possible to grow rice as a spring crop (and this is not possible without it, as is evident from the un-irrigated portions of KIS). Irrigation helps to protect the monsoon rice crop in SMIP from the vagaries of monsoon rainfall, and makes a spring crop possible here too.

[149] The Muslim community who pursue their traditional occupation of breaking stones are an exception.

Box 5-16: A sharecropper benefiting from improved access to irrigation in WC-1 - SMIP, Nepal

Mr. J.G. is a poor landholder in WC-1. He has only 4-5 kattha (about 0.15 ha) of land of his own and it is for house yard and kitchen garden only. But he sharecrops 15 kattha (0.5 ha) of land on contract. The landowner is F.P. who lives in Jhumka. J.G. has been sharecropping this land for the last 10 years. This year he got 4-hrs irrigation under rotation at the rate of 5.5 hrs per bigha (per 0.7 ha). Rotation from the tail is quite beneficial for him as he could irrigate all his land. After the Water User School which took place as part of GGG he has started to grow spring rice also, which was good.

When irrigation was readily available to landholders in SRSP they chose to grow rice, an important food staple, and they even changed the topography of the land in order to do so.

The more intensive cropping made possible by irrigation has generated an increased demand for labour. In Nepal and Andhra Pradesh, where the production of rice is still hardly mechanised, this has created opportunities for employment for poorer landholders (as well as for the landless) who rely on income from such employment for a significant part of their livelihood.

But just as irrigation makes these important contributions to livelihoods in our study areas, so an inadequate or unreliable supply creates difficulties for those who have come to rely on it. For some landholders unreliable irrigation causes them to risk not only failure of the crops but also the loss of their investment on seeds, seedlings, fertilisers, and other inputs. We saw how some landholders in SRSP have been forced to sell some of their land or livestock to get through difficult times; and we saw that faced with reduced water supply the better off cut back on their employment of outside labourers.

Box 5-17: A marginal landholder suffering from drought - SRSP, Andhra Pradesh

Mr. M.S. farms in the command area of P-2. He has 1.5 acres of land (0.6 ha), of which 0.5 acres (0.2 ha) is irrigated by canal water. He has a well. When there was canal water his well had a good amount of water, but now this is much less (1-2 yards is getting recharged). He has made three holes in the side wall of the well to try to get more water to the well. The investment for this was around Rs. 2,000. One acre of land (0.4 ha) is in the command of a tank and only gets irrigated if there is water in the tank. Last *kharif* (2003) he cultivated 0.5 acres (0.2 ha) of rice under that tank and got 10 bags and kept it for own consumption. He sold the rice he grew on his other land. In the current year *(*2004), he cultivated 0.5 acre (0.2 ha) of rice in *kharif* and 0.5 acres (0.2 ha) of maize in *rabi*. He will also work as a labourer.

This is the first time that he has faced a situation with no water. He has decreased his expenditure in all items including food, drinks and others. He said that now landholders are committing suicide because of inability to repay the loans, and it is also difficult to get loans. He will have to sell his bullocks and jewellery to cope with this situation, but now they will not get a good price for their cattle.

5.5.2 Social relationships and irrigation

We can summarise the effect on irrigation distribution of the social assets and relationships[150] of different well-being categories as follows:

Poor: this category of landholders has the least influence with anybody, and is often the least well connected with neighbouring landholders. In KIS temporary sharecroppers often come in from a different community (residential and ethnic) and so have even fewer local social ties with co-irrigators. In all of our sites the daily demands of survival, including the need to spend time away from their own farm while labouring or looking for work, means poor landholders have less opportunity to maintain contact with their neighbouring irrigators. Their lower level of education and

[150] The 'social capital' we referred to in Chapter 2.

more limited social contacts make them less confident than other irrigators, and so in a weak position to assert their claim to irrigation water. Poor women with no, or absent, male family members to help them, are particularly disadvantaged.

Medium: this category of landholder has more social contacts and influence and this can help them to increase the quantity of water that reaches their particular stretch of the canal. Factors such as kinship, caste, the amount of effort they put into their irrigated farming activities and into their relationships with neighbouring landholders, affect their ability to exert this influence. Those in this category are more dependent than the well-off on good relations with their neighbours for their immediate access to water (water from the watercourse reaching their field). So they are more likely to be collaborative in their activities. But their willingness, and ability, to give time to such collaboration is often limited by their off-farm activities. Often they act fairly individualistically, while occasionally cooperating with up to 5 or 6 other irrigators when this is expedient.

Well-off: landholders in this category not only have more physical and financial assets, but greater confidence, education and better social connections to enable them to exert influence and arrange a desirable supply of water for themselves. They are also better able to afford to supplement their access to water by putting in a well, if this is physically possible. They often have off-farm interests which reduce the time they are willing or able to dedicate to irrigation matters. These characteristics make this category least directly dependent on other irrigators for their irrigation -- and so less vulnerable to social pressure if they break water distribution rules.

5.5.3 Summary: livelihood strategies, social relations and irrigation management

In this chapter we have seen that landholders have mixed livelihood strategies which combine irrigated agriculture with other income-earning activities both off and on the farm. The details of landholders' livelihoods strategies affect the options they have to access water for their field, the time they have available to do this, and their willingness to get involved in collaborating with others to manage irrigation. Some individuals are better able to cope with poor irrigation management than others – unreliable water supply will favour those with the assets needed to capture and guard their supplies. Some mechanisms to cope with unreliable irrigation supplies may affect other irrigators – for example growing rice has a high demand for water but is tolerant of lax water management practices compared with less water-demanding crops. The latter crops may have a higher value but they may also need greater care in their cultivation and in their water management.Those who cannot capture the supply they need, or at least that they are entitled to, may be forced to adjust their cropping pattern, their land tenure arrangements, or the activities of household members.

The social homogeneity, land tenure relations and settlement pattern in our study sites have implications for the way irrigation is managed. Social composition and land tenure are quite homogeneous in our sites in Kyrgyzstan, and mixed in Nepal and India. The homogeneity in Kyrgyzstan should be conducive to good collaboration for irrigation, although as we will discuss in the next chapter, so far there has been little effort to promote this. In our KIS, Nepal site Hill migrants, particularly of the Brahmin/Chettri caste, predominate as landowner-cultivators. But there has been an increasing incidence of landlords, locally resident as well as absentee, who let their land both to middle-sized local landholders and to poor, often landless, tenant sharecroppers. A significant proportion of poor tenants are from the disadvantaged *Dalit* and indigenous *Tharu* groups. While locally resident landowner-cultivators take an active role in irrigation management, the involvement of landlords is variable, and often poor tenants are uninformed and otherwise marginalised from arrangements for the orderly distribution of water. The marginalisation of poor landholders is even more evident in SMIP where absentee landlordism is more common. Another factor affecting collaboration for irrigation in SMIP is the rivalry between ethnic/caste groups. In our SRSP site most of the landholders are landowner-cultivators from the Backward Castes, with a significant minority of very poor Muslim landowners concentrated at the tail reach of our study site. But in SRSP as a whole Other Castes are dominant and, as we will discuss in Chapter 6, this has an effect on the politics of water management. In all sites the landholders often live at some distance from their fields, and many landholders have fields which are scattered over a number of irrigation command areas. This affects their ability to supervise irrigation, as well as their communication and relationships with neighbouring irrigators. Holdings are very small – approximately half a hectare, on average – so water distribution must be coordinated amongst a large number of irrigators, even at the lowest level of the irrigation system. But in all of our sites irrigators generally take action individually or in small groups.

According to the options available these livelihood strategies and social relations have implications for water distribution in practice via:

- effects on on-farm water management measures: e.g. the time irrigators are willing and able to use to level their land, build in-field furrows, supervise water distribution;
- effects on relationships with other irrigators: e.g. the time they spend in the field, or in the village, and so the priority they give to cooperating with other irrigators;
- effects on the nature of their relationship with the WUA institution – its rules and obligations: e.g. their ability to receive communications about water distribution. They may also fail to be informed about other activities which affect entitlement to water or liability for punishment, e.g. canal maintenance activities, irrigation service fee collections, etc. Landholders whose primary interests are outside the immediate area are often less willing to pay cash or are less able to dedicate time to contribute labour for canal maintenance. As we will discuss in Chapter 6, poor communication, lack of interest and low confidence in the WUA, poor discipline in making contributions, in cash or labour, to irrigation system operation and maintenance often combine and contribute to deterioration in the performance of the irrigation system. This is both a cause and a contributor to poor water distribution.

In the next chapter we will examine how the relationship between Water Users' Associations and irrigators has affected water distribution in our study sites.

6 Irrigation management: institutional environment and WUA/water user relationships

6.1 Introduction

In this chapter we examine the institutional environment[151] for irrigation management in our study sites. Irrigation sector reforms have changed government organisations and mandates, and they have given Water Users' Associations formal responsibility for managing, or at least regulating, irrigation to the farmers' fields. So WUAs are the focus of our analysis[152]. We look at WUAs from two perspectives: the organisational – looking at the WUAs as irrigation service providers, and the individual – considering the expectations and understandings of the irrigation service users. We conclude this chapter by reviewing the implication of these observations for the way that water is distributed.

We begin with an overview of the legal framework which regulates WUAs in each site. Then we describe the structure of the organisations, and look in particular at the way water users' interests are supposed to be represented in the WUA. Against this background, we look at how WUAs have performed their functions. We consider four aspects of WUA irrigation service delivery: governance, communication, maintenance, and funding. In each case we examine the formal rules, and then how the formal rules are implemented – the actual practices of the WUA. These four aspects of service delivery interact with the fifth aspect; the one central to this study -- water distribution. But we leave our examination of water distribution itself to Chapters 7 and 8, where it is discussed in depth.

We then shift to consider how water users[153] view the WUA. What is their understanding and experience of the WUA and how does this shape not only their attitudes toward the WUA but also their expectations of the state as a provider of irrigation services. Also, what is their perception of the power they have to influence the way that water is managed, and the level of trust and cooperation that exists among different categories of water users, and between water users and the WUA committee members (an aspect of 'social capital' as we discussed in Chapter 2). These feelings affect how water users view what the WUA can and should do about water distribution, and what they consider to be their own role.

The current status of water management at a local level in our study countries is summarised in Table 6.1. There are, of course, many variations and exceptions to the summary presented below. But this general overview serves as an introduction to the more detailed discussion in the sections that follow. We include summary information for China in this table so as to provide additional context, which is relevant when we interpret the background information presented in Chapter 2 and use this for

[151] See section 2.5.4 for definitions of the terms we use to discuss institutional aspects of water distribution.
[152] See Chapter 2 for the history of WUA formation in our study countries. In Chapter 2 we also discuss the relationship between equitable water management and the institutional environment in which water management takes place. We note that the promotion of Water Users' Associations has been seen as an important institutional measure to improve the performance of irrigations systems. We refer to the concept of "path dependency" whereby the history of the development of institutions influences not only their formal content, but their practical expression – what people actually do given these institutions
[153] In this chapter we use the term 'water user' to refer to those who are making use of the irrigation services, in order to be consistent with the term 'Water Users' Association'. However, as our concern here is specifically with water distribution for irrigation, we are not including in our analysis users of canal water for non-irrigation purposes (e.g. washing, watering livestock, etc.) although we recognise that such users are important from a point of view of irrigation system management.

developing more general guidelines in Chapter 11. However in the remainder of this chapter we only discuss the sites included in the livelihoods analysis in Chapter 5.

Table 6.1: Status of WUAs and water management

	Kyrgyz Repblic	Nepal	India (AP)	China
Water supply to WUA	Managed by *Raivodkhoz* - seasonal contract with WUA for a particular volume	Managed by DOI in consultation with WUA; no contract for a particular volume	Managed by ID, nominally in accordance with pre-season agreement with WUA	Managed at canal / township level. Contract with WUA to limit supply
Responsibility for distribution within WUA	WUA manage; with field level imple-mentation by *mirab* (usually for planning / allocation/monitoring rather than direct control of flows). Village government may be involved	WUA and subsidiary committees; distribution at field level by individuals; no field staff within WUA. Local government only involved in very small farmer-managed schemes	Legal responsibility of WUA, but in practice by ID (AE and *lashkar* retain some involvement and responsibility)	WUA, sometimes with common water users employed for field implementation
Pre-season planning procedures	Formal system, leading to contract with water supply company. However, may not be strictly followed	Informal crop planning by individuals, watering plans rarely prepared but areas to be irrigated may be delineated by WUA	Localisation defines whether rice or other crops are expected to be grown. WUA supposed to prepare a plan to be used as basis for water distribution by ID	Some crop planning by WUA, but allocation of water essentially limited by supply management
Rules for distributing water	On-demand system, managed by WUA (farmers individually indent to the *mirab*)	Usually *ad hoc*. Time or order-based systems sometimes developed but rarely applied consistently except on some small FMIS	Intended to be strict *warabandi*, but *ad hoc* in practice due to indiscipline at user level and inconsistent supplies at system level	Unclear and variable, with common water users in Ningxia, and system of individual indenting in Xinjiang
Compliance with rules and enforcement systems	Variable compliance, but few substantial breaches of rules	Weak systems, flouted particularly by those with influence or physical strength or presence	Poor compliance associated with weak understanding and belief that rules are irrelevant until higher level problems are resolved	Relatively good
Equity of distribution	Slight head-tail differential, offset to some extent by alternative sources and drainage reuse	Marked head-tail variations, impact mitigated by rainfall, groundwater use and drainage reuse	Marked head tail differences, but offset by widespread use of wells	Relatively good within WUA

6.2 Institutional foundations of WUAs

The legal basis for the formation and operation of Water Users' Associations includes national or state laws and constitutional provisions, as well as the by-laws and regulations formally agreed by the WUA organizations themselves. These formal rules are significant because many proponents of WUAs consider that a suitable legal framework is a precondition for creating an 'enabling environment' for sustainable WUAs (Skogerboe *et al*, 2002; see also Svendsen *et al*, 1997; World Bank, 1998). But, as we shall see in later sections, formal rules may be necessary, but they have not been sufficient to create the conditions for WUAs in our study sites to perform effectively.

6.2.1 Constitutional and other formal provisions

In all three countries the WUAs have been formed according to fairly standard provisions. Legal and constitutional formulations set out the organizational structure of the WUA, its relationship with other irrigation service providers, its legal status, the basis for membership and the rights of members. In all three countries the WUA administrative boundaries, or service area, are intended to conform to hydrological boundaries.

Within their designated area WUAs are responsible for managing the delivery of an irrigation service. They are all charged with operating and maintaining the irrigation system, passing and enforcing the necessary rules, keeping the water users informed of water delivery schedules and of other matters relevant to the performance of the irrigation service, and with raising and managing revenues to finance the service. Except in Andhra Pradesh, they are authorised to collect fees from water users, and to generate funds in other ways[156], in order to provide this service. In Andhra Pradesh the responsibility for fee collection lies with the village revenue department.

6.2.2 General roles and relationships to other irrigation management organisations

In all cases the irrigation department is responsible for operating and maintaining the higher levels of the irrigation system, and delivering water to the WUA at a designated boundary[157]. The irrigation office is responsible for assessing the water supply and working with the WUA to decide on the allocation of this supply throughout the system. Irrigation legislation requires the government irrigation agency to support the WUAs in their delivery of the irrigation service.

Potentially the significant actors in irrigation service delivery could include not only the WUA, the water users it represents, and the irrigation department, but also local government and local non-government organisations and clubs. In practice, in our sites in all three countries, local government and non-government organisations have played little if any role in irrigation service delivery, although sometimes local politicians are lobbied to try to improve water deliveries to particular individuals, groups or localities. Among the factors that have tended to discourage local government bodies from performing the enabling and funding responsibilities formally given to them are local administrative boundaries that do not coincide with the hydrological boundaries, and lack of experience and resources. Government resources for irrigation are generally made available via WUAs rather than local government. Non-government organisations and clubs, such as savings groups or mutual assistance societies, may have an overlapping membership with the WUAs. But their activities have had little if any bearing on irrigation matters.

Andhra Pradesh is an exception to these observations: here local government has been involved in two WUA-related functions. The District Collector has been responsible for organising elections, and the Revenue Department collects water fees as part of land tax. Fee collection by the Revenue Department causes difficulties for the transfer of the correct amounts of money to each WUA[158]. It also has consequences for the cropping pattern because the revenue officials collect fees in accordance

[156] E.g. by providing contracting services, selling materials harvested from canal banks, tolls for use of canal bank roads, etc.
[157] There may, however, be more than one point of delivery to the WUA (there is a single point of delivery to the WUA at SMIP and KIS, but two at for Kadambapur WUA in SRSP and many points at the two WUAs in Kyrgyzstan, as there are several secondary canals taking water from a single inter-farm canal)
[158] At least one reason that these problems arise is because local government and WUA boundaries are different. Prior to the 2003 elections some of the TC boundaries were redrawn to coincide better with administrative boundaries. However in most cases the TC boundaries still do not coincide with administrative boundaries.

with their records and tend not to check these against the actual crops grown. This encourages rice cultivation and, with it, the associated higher levels of irrigation water use. On the other hand, in the Kyrgyz Republic and Nepal both elections and fee collection fall under the WUA umbrella[159].

6.3 Structure of WUA

6.3.1 Committee structure

The WUA committee structure in our study locations varies in complexity as shown in Table 6.2.

Table 6.2: WUA committee structure

	Jany Aryk & Obu Haet, Kyrgyzstan	KIS, Nepal	SMIP, Nepal	SRSP, Andhra Pradesh
Project level			WUCCC – (58,000 ha at present)	Project Committee (SRSP – approx. 265,000 ha) – not yet formed
Group of WUAs			WUCC – (5,000 – 12,000 ha)	Distributary Committee: 5-6 WUAs (max 12) – say 8,000 to 13,000 ha
WUA	WUA Council (1,000 – 5,000 ha)	Main Committee (3,900 ha)	Water Users Committee (300 – 1,100 ha [SS9E – 722 ha]	WUA Management committee (400 – 1,600 ha, to suit hydraulic boundaries)
Branch/Tertiary		Branch Canal Committee (180 – 450 ha)	-------[Tertiary sub-committee – never formed in our study site (140 – 150 ha)]	Territorial Constituency – 1 member (100 ha – 2 -3 pipe outlets)
Watercourse		Outlet Canal Committee (minimum of 13 ha)	Water Users Group (WUG) – (25 – 30 ha)	
Tenure of executive and working members	3 years	2 years	4years	6 years (previously 5 years)

The WUAs in the Kyrgyz Republic have the simplest structure with a WUA Council serving the entire service area and no other tiers of committees. The Soviet irrigation legacy includes secondary and tertiary canals which typically serve up to 900 ha of land, with turnouts every 40 to 60 ha. (Herrfahrdt *et al*. 2005, p.33). WUAs often follow the boundaries of the state or collective farms, and range in size from approximately 1,000 ha up to 5,000 ha, with an average of 3,000 ha (Johnson, *et al*. 2002, p. 8). The command area of Jany Aryk WUA is 1,803 ha, and that of Obu Haet is 1,390 ha. In principle each WUA is supposed to cover all fields receiving water from the same source, but this is not always the case, with boundaries instead conforming to administrative boundaries (e.g. village cluster -- *ayil okmotu*) or other criteria, such as machine delivery stations. The WUA Council has a minimum of 5 members – there are 9 in Jany Aryk and 7 in Obu Haet. The Chairman is elected by the council

[159] Interestingly, in both countries we encountered water users who would prefer local government to take a more active role in irrigation administration. Some water users in our SMIP site wanted local government to collect the irrigation service fee (it collects land tax). In our Kyrgyzstan sites some water users said they had more confidence in the *ayil okmotu* (village council) than in the WUA. See Box 6-7 and Box 6-11 for illustrations of these points.

members. The WUA Council is elected either directly by the WUA General Assembly, or in larger WUAs, such as those of our study sites, by the Representative Assembly. Members of the Representative Assembly are elected by the heads of the member-farm households. The WUA Council members serve a term of no more than three years. The WUA Council provides oversight and policy guidance to the WUA Directorate. In addition to electing the WUA Council, the General/Representative Assembly also elects a 3 member Audit Commission, which supervises the activities of the WUA Council, and a 5 member Conflict Resolution Commission, which is supposed to settle water conflicts among users (Herrfahrdt, *et al*. 2005, p. 41 – 47).

The WUA in KIS, with a command area of 3,900 ha, is next in order of complexity, with a three-tiered structure. It has canal committees operating at the main, branch and outlet levels. The Main Canal Committee has 15 members, including 12 representatives delegated from the Branch Canal Committees, plus Chairman, Vice Chairman and Secretary who are elected from amongst the General Assembly (GA) members. The Main Canal Committee (MCC), like the General Assembly, has a tenure of 2 years. Each branch canal has an autonomous Branch Canal Committee (BCC) with 7 members elected by the Branch Assembly (BA) from amongst its number. The members of the BCC are selected to represent the head, middle and tail portions of the canal – more or less proportionately. In principle the Outlet Committee (OC) is elected directly by the water users within each outlet, or group of outlets, covering approximately 13 ha (20 *bigha*). But both the functioning and the composition of the OC are rather vague, and OCs operate rather loosely, if at all[157].

SMIP, Nepal and SRSP, Andhra Pradesh are the largest systems, with command areas covering 58,000 ha and 265,000 ha, respectively, and their WUA structure has correspondingly more tiers.

The WUA in SMIP has committees operating at project, secondary, sub-secondary, and watercourse level. The constitution authorizes the sub-secondary Water Users Committee (WUC) to form sub-committees to deal with tertiary canal-level matters, but these have never been formed in SS9E. The WUC in SS9E serves a command area of approximately 720 ha. The *Toli* Committee/WUG[158], formed at the level of the watercourse, typically covering 30 ha, has 9 members, including a Chairman, a Secretary and seven outlet representatives. The WUC is made up of the 24 WUG Chairmen who choose a WUC Chairman and a Secretary from amongst themselves. The committees above the WUC, composed of the chairmen of the corresponding lower tier of committee, are supposed to liaise with the SMIP Project Office for system operation, and to have an advisory input on maintenance above the sub-secondary. Elections of committee members at all levels are supposed to take place every four years.

In SRSP the Project Committee has not been formed. Distributary Committees, each made up of around 8 WUA Presidents, were formed following the 1997 elections, but were not formed following the 2003 elections although no official reason for this was given. At WUA level and below the structure is simpler than the arrangement in SMIP. The WUA Management Committee is composed of 12 representatives (TC members), one from each Territorial Constituency (TC). Territorial

[157] When the WUA was first formed in KIS there was only provision for a two-tier organisation. By around 1998 some farmers in the WUA felt the need to form outlet committees. This was because the Branch Canal Committees found it difficult to co-ordinate water distribution among the outlets without formal organisations at outlet level. Outlet Committees were also seen as a way of improving water distribution within outlets. A further reason for Outlet Committee formation was to reduce the size of the General Assembly at Branch Canal level. (Khanal, 2003, p. 241). However, Outlet Committees have never been formally instituted by the WUA, and our observations indicated that at least in BC-1 and BC-2 the formation and functioning of Outlet Committees is still not well established.

[158] In SMIP the constitution refers to the *Toli* at the lowest level in the organisational hierarchy, but the name Water Users Group, or WUG, is commonly used.

Constituencies are delineated on a hydraulic basis, with half demarcated as in the Upper Reaches, and the remaining half as of Lower Reaches (GOAP, 2003a, point 2). Each TC covers approximately 100 ha, including 2 to 3 pipe outlets. The structure and tenure of the WUA governing bodies was changed by the 2002 amendments to the Andhra Pradesh FMIS legislation. While TC members are directly elected by farmers, the President and Vice-President of the MC are elected by the 12 TC representatives from among their number. The President and Vice-President are supposed to be elected such that both the head and tail of the system are represented. Each TC member will serve for 6 years, but the President and Vice-President are elected every two years. There will be elections for one third of TC members after 2 years and a second third after four years in order to establish a rolling system of TC member replacement. The President and Vice-President were previously also directly elected by farmers, but the new procedures are intended to help to de-politicize the way these posts are filled.

In all of our study areas, the constitution/charter[159] states that the WUA executive committee is supposed to meet regularly. In KIS, SMIP and SRSP the executive committee members are supposed to meet once per month, while in the Kyrgyz Republic the WUA Council is supposed to meet at least once every two months, unless otherwise specified in its Charter.

Only in Nepal does government irrigation policy stipulate the involvement of women and other minority groups in the governance of the WUA. National irrigation policy approved in 2003 states that "*user association shall be composed with at least thirty three percent of the women representation as well as there shall be representation of dalit, downtrodden and backward ethnic communities in such association*" [GoN, 2003, para 2.4.3]. In practice in all of our study areas there is very little female presence on the WUA representative and executive bodies. In KIS, there are no women on the Main Canal Committee. There are two female committee members in BCC-2 – one from the head, and one from the tail. There are no women on BCC-1[160]. Neither are there women in the executive committees in SMIP, or in our study areas in the Kyrgyz Republic or Andhra Pradesh. The APERP, Andhra Pradesh project appraisal document made a gesture toward "greater integration of women in WUA management" by providing for a study on "Opportunities for Women's Participation" to be mounted in project year 2 (Srinivasulu, 2002, p.25)[161]. A study of WUAs in Andhra Pradesh observed that in cases where women had become TC representatives, they had often been pushed to do so as a "token" gesture, at the instigation of a male whose interests they could serve (Shyamala and Rao, 2002, p. 257).

6.3.2 General assembly formation and water user involvement

In all of the WUAs the system of leadership is based on indirect elections, with members at each level selecting from amongst their number those who will represent their interests at successive levels up the committee hierarchy. In most of our study areas the selection of WUA representatives and committee members has taken place in "mass meetings". Only in Andhra Pradesh is the selection procedure based on secret balloting.

[159] This document is referred to as a "charter" in The Kyrgyz Repblic and as a "constitution" in Andhra Pradesh and Nepal.

[160] Following the elections of 2002 BCC-1 had a woman member elected as the vice-chair. However she resigned after a few days. She was a Nepali Congress Party member, and this became the minority party in BCC-1. The vacancy was filled by a male nine months later.

[161] The Director of WALAMTARI described the Andhra Pradesh FMIS Act 1997 as "gender-neutral", but noted that "among 10,292 WUA presidents, 98 are women and about 1,097 are TC members" (Prem, B. Guru 2002, p. 253). Another source suggests that there were 98 female presidents and 830 female TC members (Shyamala and Rao, 2002, p. 254). There were approximately 40,500 TC members in office after the first round of elections (Peter, 2001, p. 17).

"Membership" gives an entitlement to participate in the selection of WUA representatives and to attend general meetings of water users. It is linked to holding irrigated land within the WUA command area – either as an owner-operator or as a formal tenant, and each land holder household has one vote. It carries with it an obligation to pay an irrigation service fee, and make labour contributions, as per the regulations of the WUA. The ratio of representatives to irrigated area varies both within and between study sites, as shown in the table below. In all of our study areas land is conventionally considered to be held by males, and irrigation management has also been considered to be a male realm, so women have generally not been viewed as "members" of the WUA; the exception being a minority of households lacking a male head, for reasons of e.g. migration or death, and where there is a particularly assertive and confident woman at the head. The General Assemblies are expected to meet before each irrigation season, or at least annually.

Table 6.3: Water User representation in WUA decision-making

	Jany Aryk & Obu Haet	**KIS, Nepal**	**SMIP, Nepal**	**SRSP, Andhra Pradesh**
Title of directly-elected/selected representative	Zone Representative	Outlet Committee (5 – 7 members)	*Toli* Committee/ WUG (9 members)	Territorial Constituency Representative (1)
Area covered	JA: 10 ha OH: 25 - 30 ha	13 ha.	25 - 30 ha	80 – 180 ha
Average area held per landholder[162]	JA: 0.3 OH: 0.57	0.69	0.64	0.69
Estimated number of members per representative[163]	JA: 33 OH: 44 – 53	19	5 – 130, average 65	116 – 261
Frequency of meeting of General Body/Assembly	Representative Assembly should meet annually, with extraordinary meetings as needed	Branch Assembly should meet annually (no formal provision for Outlet Assembly meetings)	General Assembly should meet twice a year before the start of the monsoon and winter seasons	General Body should meet before each season or at least annually
Qualification for membership in WUA	Farmer heads of household who own or lease agricultural land in WUA service area	All landowners and tenants aged over 16 years	Farmers including tenants and owner cultivators[164] aged over 16 years	Registered farmers managing irrigated land (landowner or in lawful possession of land in a crop year) – aged 18 years or older

[162] From Table 5.6.

[163] Based on dividing area represented by average area held per landholder in study command area, except for SMIP where we have figures obtained under GGG. Zone Representatives in our Kyrgyz sites are selected as a group and do not represent a particular area.

[164] Although the constitution also states that the "General Assembly" formed at the watercourse level comprises all "farmers inside the irrigated area and using water for agricultural purpose".

	Jany Aryk & Obu Haet	KIS, Nepal	SMIP, Nepal	SRSP, Andhra Pradesh
Voting entitlements of members	Vote for Zone Representatives (Zone Reps. selected as a group at a mass meeting).	Select members of Outlet Committee and representatives to Branch Assembly at mass meeting.[165]	Select the Outlet Representatives (7) and the Chairman and Secretary of the *Toli* Committee/ WUG every four years. Participate in determining programmes and policies of the WUA at GA meetings	Vote in *Mandal* (sub-district) - organised elections in each TC where a member is a qualified land holder; Participate in General Body meetings

6.3.3 Relationship between governing body and executive staff

The WUAs in Andhra Pradesh and Nepal do not separate the functions of governance and day-to-day irrigation management.

In contrast, the organisation structure of the WUAs in the Kyrgyz Republic formally separates governance, provided by the WUA Council, from the day-to-day management of the irrigation system, which is provided by the WUA Directorate. The WUA Council, representing the water users, is supposed to provide oversight and policy guidance to the WUA Directorate. The WUA Directorate is responsible for tasks such as registering members and non-members, drafting budgets, elaborating plans for operation, maintenance and water use, recording irrigation requests, controlling the water delivery by the water supplier, and hiring WUA staff (Herrfahrdt, *et al*. 2005, p.41). The WUA Directorate includes the Director, a Chief Engineer/Hydrotechnician, an Accountant, and a number of *mirabs* (ditch riders). The salaries of the staff of the Directorate are paid for from the ISF paid by the member-households[166]. Often members of the staff of the Directorate were previously employed by state or cooperative farms and they have continued to perform similar functions in the same areas for the WUA.

In our sites in Andhra Pradesh and Nepal the WUA management committees could, in principle, employ staff to undertake administrative and managerial tasks, but they have not done so. Rather they continue to rely on the irrigation department to complete tasks which are considered to need employed staff. Thus in Andhra Pradesh it is the *lashkar* (gate operator) employed by the Irrigation and Command Area Development Department (I&CADD), one for each WUA, who in effect operates the canal system and assists farmers, when required, to distribute water below the pipe offtakes[167]. One I&CADD Works Supervisor supervises 4 to 8 *lashkars*. In both KIS, Nepal and SMIP, Nepal the *dhalpas* -- the only people who have a formal responsibility to manage water distribution -- are

[165] The composition of the Outlet Committee and the number of representatives sent to the Branch Assembly is quite variable. In BC-1 the same people are the "Outlet Committee" and the BA representatives. In BC-2 the "Outlet Committee" is rather amorphous and there does not appear to be a connection between being active at outlet level and participating in the BA or BCC. In BC-1 each OC is formed by one or more adjacent outlets to make up a command area of approximately 13 ha Approximately 20 bigha [1 bigha = .68 ha]. Each pipe outlet within the OC selects between 1 and 3 representatives, depending on the command area of the pipe. The number of representatives sent to the BA from each OC ranges from 2 to 11. In BC-2 the formation of OCs is much looser -- many OCs have fewer than 5 members, and those who are most active in organising water distribution and canal maintenance within the outlet are often not the members of the OC. BC-1 has 67 members while BC-2 has 65 members in its BA.

[166] This ISF also covers the bulk service charge paid by the WUA to RID

[167] However, in our study site he was rarely present in the field to provide such assistance.

employed by the Irrigation Department. In KIS *dhalpas* (ditch riders) work in close contact with the *karyadal*, a working team made up of representatives of the water users[168]. There are three *dhalpas* -- two at the headwork and one at the main canal. In SMIP *dhalpas* work in coordination with the chairman of the WUCC. They operate gates of sub-secondary canals as per the instructions of both the chairman of WUCC and technical staff of SMIP Duhabi sub-division.

6.4 WUA Governance

We begin our examination of WUA service delivery with a discussion of the governance of the WUA – how rules and sanctions are supposed to be developed, documented and publicized and who has the authority, and with what powers, to enforce the rules and resolve disputes. In each case we first consider the formal provisions, and then look at how the WUA has performed in practice. This discussion of how rules are developed and enforced provides the context for examining the rules that apply to communication of information, implementation of maintenance, and funding of the irrigation services.

6.4.1 Rule development and regulation

(i) Formal institutions -- entitlements and obligations

In our study countries, the WUA executive committees[169] are supposed to operate in accordance with the provisions of the WUA legislation[170] and their WUA charter or constitution. In each case, the executive committee is then authorized to develop specific by-laws or rules, as well as to set policies for the way the service is to be operated. This includes the authority to set financial penalties or other sanctions against those who break WUA rules. The by-laws are supposed to be approved by the General Assembly/Representative Assembly[171]. The WUAs are supposed to maintain records of their meetings and decisions, which would include documentation of the by-laws and rules on sanctions. The WUA is supposed to take whatever measures are necessary to inform the water users of these rules. There is an implicit presumption that water users will know about these rules either through their direct participation in General Assembly meetings, or when there is indirect representation, through information disseminated to them by the elected members of the General Assembly. Other methods to publicize these decisions may be necessary, but these are not explicitly mentioned in the legal provisions. The activities of the WUA are supposed to be monitored and regulated by the relevant government regulatory body[172].

[168] The *Karyadal* members receive a payment from the irrigation department for the work they do, but only for their activities in the monsoon season – not in the spring. In the spring only BC-1 and BC-2 are formally entitled to receive irrigation, and an informal, unpaid, *Karyadal* is said to function. Essentially it is the BCC Chairmen of these two branches who perform this function.

[169] WUA Council in the Kyrgyz Republic, WUA Committee operating at each relevant level within the system in KIS and SMIP, and Managing Committee in Andhra Pradesh.

[170] The history of WUA formation and the relevant legislation are presented in section 2.2.3.

[171] The formation and basis of the General Assembly/Representative Assembly/General Body, and the qualifications for WUA membership, were described in section 6.3.2. Throughout this section we use the expression general assembly to refer to this general body, whether it is made up of all water users, or by elected delegates of water users.

[172] The Department of Water Management (DWM) in the Kyrgyz Republic, the Department of Irrigation (DoI) in Nepal, and the Irrigation and Command Area Development Department (I&CADD) in Andhra Pradesh.

(ii) WUA performance in practice – application and enforcement of rules

In all of our study areas the WUA executive committees and general assembly have, at least on paper, been formed as per the legal requirements for their registration. However, on the whole the executive committees have not been very active in developing formal by-laws and rules for the operation and maintenance of the irrigation service, and the general assemblies have not functioned as a forum for water users to have an input to the rules that will affect their service.

In the Kyrgyz Republic, the Representative Assembly (RA) is supposed to hold elections for the WUA Council every three years. In our study areas the first election was held after the WUA was registered in 2002. Since then the RAs in our sites have not demonstrated an active interest in on-going issues of WUA policy and management, and they have only met annually, as per the formal requirements of the WUA Charter. In Obu Haet and Jany Aryk at the time of our study we were told of WUA intentions to impose fines for water theft, but the only formal rules in existence were those included in the WUA Charter approved in 2002. In both cases the Charter was generally the same as the provisions of a standard charter provided to WUAs by the On-farm Irrigation Project-funded WUA Support Unit. One possible explanation for the inaction of the RAs is that they rely almost entirely on the WUA directorate to take care of practical and policy aspects of running the irrigation system. Aside from this, water users look to the village elders (*aksakals*) to take care of irrigation issues. In fact, often the WUA representatives are *aksakals*. In our field work, we found that whenever we issued a general invitation to water users to meet to discuss our activities, attendance was predominantly by *aksakals*. Our survey of water users indicated that water users had very little contact with their WUA representatives. Hardly anyone knew who was on the WUA Council, or knew the identity of their Zone Representative.

In Nepal 10 years after the WUA legislation was passed in 1992 it was observed that on most projects WUAs had a very limited role in system operation and maintenance, with most still considering the government to be responsible for management. It was also apparent that on many schemes WUA members were generally unable to define clearly their responsibilities for routine O&M (Mott MacDonald, 2002, p. 19).

The WUA at KIS has probably been among the more active ones in Nepal as it has received a great deal of project attention at varying levels of intensity, since its formation - currently through the SAGUN programme. It has also received a lot of support and attention from numerous researchers[173]. The WUA in KIS has held elections every 2 years since its formation in 1992[174]. A study conducted in KIS by HR Wallingford in 2001 found farmers expressed a high level of satisfaction with the WUA, with 72% of respondents saying that the WUA committee was "doing a good job", and 80% saying that there was good cooperation between farmers and the committee. However the findings of the study also suggested that the direct involvement of farmers with the WUA was limited - 57% of respondents knew if general assembly meetings were held, 53% considered themselves to be a member of the WUA, and 42% considered that most members were active in the WUA (quoted in Khanal 2003, p. 240). In our observations, although most farmers know about the WUA, they vary in their satisfaction with its performance, particularly in relation to organising water distribution at the branch and outlet levels. Most, even those who seem to benefit from the WUA's laxness when enforcing water distribution and other rules, criticise the WUA for not exercising

[173] These are reviewed in the literature review, section 1.3 of the EIP Khageri Irrigation System Case Study Report. (Mott MacDonald, 2006a)

[174] Khanal (2003) mentions elections in January 1993, 1995, 1997, and 1999. The last election prior to our research was held in 2001.

sufficient discipline and not promoting good system operation and maintenance at the branch level and below.

Although an attempt was made to involve water users in WUA establishment at SMIP, in practice the process focused too much on a small number of farmer leaders. At the time of the first election/selection in 1994 the WUA leaders were not chosen by the mass of their "constituency". Rather, the leadership appears to have been drawn from a small group of influential members of the community. There was little engagement of the mass of water users even though they were expected to lend their support to the WUA. There has not been a WUA election since 1994 and very few General Assembly meetings have been held. The WUC of SS9E has met irregularly throughout its tenure. It has not passed any formal rules related to the operation and maintenance of the sub-secondary. The WUGs have met even more irregularly and rely entirely on informal understandings between water users for the operation and maintenance of their watercourse. Ten years after the initial formation of WUGs some Chairmen are not even resident in the locality and those who are resident show little interest in the irrigation organisation. Meetings at watercourse level are irregular and informal. Some farmers reported that when they tried to dismiss certain influential members of the WUG, they were unable to do so. Others expressed the view that their executives were more interested in getting themselves construction contracts than in working for the WUG members (Mott MacDonald, 2004b).

In SRSP, Andhra Pradesh throughout the first period of the WUAs' tenure between 1997 and 2002 Management Committees have been almost exclusively engaged in the management of infrastructure contracts and works, with little if any attention given to developing and enforcing rules related to system operation and ongoing maintenance. Although in SRSP there were examples of particularly well performing WUAs (Raju, 2002, p. 92), on the whole these matters continued to be left to I&CADD staff. It was observed that in SRSP generally Management Committees did not meet regularly. There were no committees in operation between 2002 and the elections in 2003, and at least at the initiation of our study period the newly elected committees were still untrained and inactive[176]. It would appear that in our study areas the "General Bodies" have hardly met formally or even informally (e.g. mass meeting for information) to perform any governance or practical functions, and the attendance at the meetings that have been held has been poor. Less than half of the respondents (45%) in our Livelihoods Survey considered themselves to be 'members' of the WUA[177]. Although the TC elections are supposed to be non-political, in the last two elections it was not unusual for the posts to be filled along party lines. Our team observed that many of the people who obtained the post of TC member did so without contest.

This is usually a result of negotiations and agreements amongst various party contestants with the 'purchase' of the un-contested post. In this case, the farmers within the TC may know the member well

[176] Although our study team noted that the WUA President and the TC members were enthusiastic and active when they participated in the Farmers' Workshop organised by the team in March 2005.

[177] It isn't clear what they considered to be an indicator of 'membership'. This is simply the proportion who stated that they were 'members'. Nikku points out that the rules for demonstrating ownership of land has excluded many people who are cultivating land, and so they have not been recognised as WUA members with an entitlement to participate in WUA Activities (2002, p.7).

- or may not know him - depending on the village/Party which he belongs to and the number of villages falling within the TC[178].

6.4.2 Enforcement and dispute resolution

(i) Formal institutions - entitlements and obligations

While all of the WUAs have been given authority to make rules and specify sanctions, the provisions, and legal backing, for their enforcement vary. Only the WUAs in our Nepal study sites -- KIS and SMIP -- have developed formal by-laws to supplement the provisions of their constitution/charter. The formal provisions which apply to each study site are summarised in the table below.

Table 6.4: WUA enforcement and dispute resolution mechanisms

	Jany Aryk & Obu Haet	**KIS, Nepal** **SMIP, Nepal**	**SRSP, Andhra Pradesh**
Source of authority to penalise	WUA given legally binding powers of enforcement. Law includes specific arrangements for dispute resolution.	WUAs legally authorised to pass by-laws and to set the "conditions of service" water users must comply with. WUAs are not given legally binding powers of enforcement. Legisation does not specify arrangements for dispute resolution.	WUA legally authorised to regulate the use of water among pipe outlets of its area according to *warabandi* schedule and to plan and implement maintenance works.
Who has authority to penalise	General Assembly authorised to fine a member or withdraw membership from those who do not comply with the WUA Charter or by-laws: for e.g. failure to pay fees, damage to structures, breaking water distribution rules and plans. Dispute Resolution Commission has the power to impose sanctions in accordance	Each committee is supposed to impose rules and regulations on its members, to specify penalties for infractions, and to take action against those who violate the rules. Under Joint Management Agreement WUA is fully responsible to manage the canal and command area under its jurisdiction. Authority to penalise lies with Chief of the Project Office/Irrigation Department. This officer can stop service delivery to anyone who is in default of paying service charges, or who acts in contravention to the conditions of service. The authorized officer is also empowered to impose a fine on anyone who breaks the rules, who causes damage, who steals or misuses water, or who otherwise uses water without authority SMIP Chatara By-laws provide for "Judiciary sub-committee" formed by "Water users' coordination committee and main committee". To implement the provisions of the constitution and to punish "members in case of any legal mistake, etc." By-laws also authorise each Water User Committee or	The WUA is empowerd to regulate the behaviour of members who violate rules. Offenses can be enforced by the police.

[178] In our SRSP Water Management survey, hardly any respondents said that they would contact the WUA/TC for help with dealing with their water management problems during the drought.

	No	%
No problem	1	3%
Contact WUA/TC	2	7%
Lobby neighbours	3	10%
Well	24	80%
Total	30	100%

	Jany Aryk & Obu Haet	KIS, Nepal	SMIP, Nepal	SRSP, Andhra Pradesh
	with the provisions in the charter and by-laws approved by the General Assembly.	HM government (HMG) staff to form a "Working Team" responsible for operating the canal. Water users are required to obey the directions of this team, and there is a specified schedule of fines for those who are disrespectful or injure a member of the team.		
Rules passed	No formal rules passed since adoption of constitution	Rules at main system level: re. water sharing between branches, infrastructure protection, administration of the ISF. Branch level and below, 1993 rules covered water stealing, waste disposal into the canal, damage of canal by livestock. Same fine for all. Constitution amended in 1998 with provision to discipline "member" or "executive member" "of the WUA". Since that time most rules informal and undocumented.	Chatara Main Canal By-laws (2002) apply to SS9E.	No formal rules passed since adoption of constitution
Dispute resolution mechanism	Dispute Resolution Commission is the arbiter of disputes and sanctions	According to respective constitutions WUA committees are required to sort out problems at respective level of authority. Refer to higher level committee if necessary.		According to APFMIS the WUA is supposed to 'resolve disputes if any between the members and water users in its area of operation'.
Individual Complaints procedures	Individuals are entitled to make a written complaint to the Commission Chairman if they think there has been an infraction of WUA rules.	The JMA gives the WUA responsibility to manage internal conflicts and disputes, although the WUA "can seek assistance from DOI for technical consultation." DOI can "request government agencies to support WUA in managing law and order".		No formal system established.
Appeals procedure	Decision of the Commission can be appealed through the courts.	Decisions of the Project Office can be appealed in court.		No formal system established
Role of local government and traditional dispute resolution authorities	Local government executive bodies (*ayil okmotu*), village heads (*ayil bashi*), and traditional elders (*aksakal court*) may sometimes get involved in water management issues, including the resolution of disputes.	Sometimes traditional *panchayati* procedure (drawing on respected members of the community) used to resolve conflicts. Local government and courts rarely involved in conflict management or resolution.		Village elders and *Gram Panchayat* (Village Council) representative/s, especially the *sarpanch* (president of the village) may get involved.

(ii) WUA performance in practice – application and enforcement of rules

In all of our study areas the WUA committees have left the enforcement of rules to the government irrigation authority, or, in the case of the Kyrgyz Republic, to the WUA Directorate. This has generally been by default as committee/council members have been reluctant to take any action against rule breakers. Indeed, as we will discuss below, often water users hold the view that the committee members themselves are the worst rule breakers.

In our study areas in the Kyrgyz Republic the WUA Council has relied heavily on the WUA Directorate for all aspects of irrigation service delivery, including maintaining discipline amongst water users. Similarly, in Nepal the WUA committees have considered that rule enforcement was the prerogative and responsibility of the irrigation department/project office, and in SRSP, Andhra Pradesh the Management Committees have left enforcement to the I&CADD.

While the WUA organisations have tended to be inactive in rule enforcement and dispute resolution, sometimes locally respected individuals, who often have other roles which overlap with membership in the WUA, are called on to help when problems arise. The Kyrgyz Republic, Nepal and India all have some form of traditional institutions for dispute resolution (the *Aksakal* Court, *panchayati* in Nepal[179] and the Village *Panchayat* in India). The members of these institutions are sometimes rather conservative and may resist reforms. But they have the advantage that they can draw on their social status, authority, and connections to enforce WUA rules and mobilise water users to act. Nevertheless, they are only very occasionally called on to help resolve local water-related disputes. Water users in all of our study areas generally reported that on the whole differences between water users were informally sorted out by the interested parties; only very occasionally did they take the matter to traditional or formal authorities for dispute resolution. We will consider the equity outcome of these informal arrangements in later discussions (Chapters 7 and 8).

In his study of the process of irrigation management transfer in the *Tarai* of Nepal, Khanal observes that the WUAs found it difficult to enforce their rules because of the practical difficulty of applying sanctions on those who broke the rules. One possible sanction is to stop the delivery of irrigation. But WUAs could not stop a particular farmer or group of farmers from receiving irrigation water for a number of reasons:

- "*In unlined canals, where seepage and leakage are common, sanctioned farmers can have access to this water.*
- *Field to field irrigation is practiced in rice cultivation and control of flow from one field to another is usually absent.*
- *Small farm plots, due to which water moves quickly from one plot to another belonging to different farmers.*
- *Specific features of the land topography… due to which water applied to one field automatically reached to adjoining field at lower levels.*" (Khanal, 2003, p. 205)

Furthermore, Khanal observes, the WUAs he studied did not feel that the legislation gave them sufficient power to resolve disputes, impose fines, or collect fees. Even though the provisions of the Irrigation Regulations affirm the entitlement of WUAs to set fines and other penalties, in Nepal the Irrigation Department continues to have the power of enforcement. In principle a WUA can refer to a local government authority (the Village Development Council, District Development Council, District

[179] This is a traditional form of dispute resolution which is still in common use at village level, and is totally different from the village *panchayat* which was the lowest level of government before 1990

Administration Office, as appropriate to the dispute). But Khanal found that WUAs have felt that the provisions of government acts and regulations did not provide either the legal framework or the obligation for these agencies to help the WUA to collect fines and fees it has imposed. In Khanal's assessment, the legal provisions have failed to empower WUAs to exercise their enforcement authority (Khanal, 2003, p. 207)

While Khanal's observations relate to the *Tarai* of Nepal, they are relevant to all of our study areas. As we will discuss below, in all cases the WUAs have found it difficult to carry out their service delivery functions, or to enforce any formal rules that do exist. But, as we will explore in section 6.8, water users' understanding and social relationships are at least as important as the legal powers of the WUA when it comes to influencing how rules are observed and enforced. Despite the training programmes described below, water users' in our study sites had insufficient awareness of how the majority of water users were expected to be involved in the activities of "their" WUA, and little commitment to the obligations and entitlements associated with WUA 'membership'.

6.5 Communication of information

In order to be effective the WUAs must not only have the rules and authority to perform their function; they also need to maintain good communication links with their member/service users. Here we discuss the formal provisions and actual practices for documenting and disseminating WUA rules, plans and activities, for providing technical support and training for WUA management, and for water management at all levels – including on the farm.

6.5.1 WUA documentation and information dissemination

(i) Formal institutions - entitlements and obligations

All the WUAs are expected to keep written minutes of meetings, a written set of internal rules and regulations, and formal accounts of income and expenditure. WUA accounts are supposed to be subject to a formal audit, with financial records submitted to the regulatory authority for monitoring. The duty of maintaining up-to-date records of WUA members and irrigated areas is given to the WUAs in the Kyrgyz Republic and Nepal, but it has been given to local government, through the Revenue Department and the village *Panchayat* Secretary, in Andhra Pradesh. Only in the Kyrgyz Republic does the WUA law stipulate that the WUA should "guarantee free access to information for WUA members about its activity". The laws in Andhra Pradesh and Nepal give WUAs the duty to maintain records and to promote "participation" by water users, but they do not specify water users' entitlement to access WUA documentation.

All WUAs are expected to have a close relationship and good communication links with the irrigation department that provides bulk supplies of water to the WUA and maintains the portions of the irrigation system which are outside the WUA's responsibility. The irrigation department is supposed to inform the WUA of expected water schedules and flows, and it is also supposed to liaise with the WUA to plan and coordinate the maintenance program for the area. The formality and regularity of arrangements for these contacts varies.

In the Kyrgyz Republic the amount of water to be delivered is formally documented in a water supply contract, and actual deliveries are also supposed to be recorded in writing. During the irrigation season a representative of the WUA Directorate is supposed to be in regular communication with the

Raivodkhoz (Raion Irrigation Department - RID) staff to monitor and record water flows into the WUA command area, and to adjust requests for water needs in each ten-day period ("decade"). *Raivodkhoz* and WUA staff are also supposed to agree on maintenance activities, including the requirement for labour to be provided by water users for the maintenance of inter-farm canals (*ashar*)[183].

In Andhra Pradesh and Nepal irrigation department staff members are supposed to communicate with the WUA executive committee members on water delivery scheduling, maintenance plans, and finances. Under the APFMIS reforms, the engineers of the Irrigation and Command Area Development Department (I&CADD) were made formally accountable to the Presidents of the new Water Users Associations and Distributary Committees, while remaining on the Department's payroll. An Assistant Engineer is supposed to be assigned as "competent authority" for each WUA, to advise on the management, especially operation, of the canal system. But due to staff shortages one Engineer sometimes advises more than one WUA. In KIS, Nepal an engineer and an overseer from the Chitwan Irrigation Division of the Irrigation Department are assigned to coordinate with the WUA. In SMIP, Nepal the Water Users Central Coordination Committee coordinates with the SMIP Project Office.

In all cases it is expected that WUA executives will make the arrangements necessary for information on water distribution, maintenance requirements and fees to reach water users in a manner consistent with achieving good service delivery.

(ii) WUA performance in practice - application and enforcement of rules

All the WUAs keep some form of documentation, albeit to a varying standard. On the whole documentation is erratically maintained and is incomplete at best. None of our study WUAs has an accurate, up-to-date, list of its members[184], or reliable maps and records of areas irrigated. Regardless of the standard of documentation and reporting, in all cases the lists, maps, minutes of meetings, and other documents such as the constitution and by-laws, do not act as either practical reference documents or as a means of informing water users on matters that affect them. Few water users are aware of the documents that might be available, and even fewer consider that they may want to consult them for any reason. All WUAs prepare and submit some form of accounts, but these too are rarely scrutinized by general water users – who, in any event, are likely to have trouble interpreting them.

Whatever the content of the documentation maintained by the WUAs, in all of our study areas water users are sceptical of the transparency and probity of at least some aspect of WUA operation and management. Water users observe that many of the decisions, transactions and communications of WUA executive committee members are made informally, are never recorded, and the committee members make little effort to communicate their decisions, and other information, to water users. In particular there is a general attitude of suspicion of the way both the WUA committees and the government agency manage and account for finances – particularly ISF. This suspicion is cited by

[183] As will be discussed below, in section 6.6, water users are supposed to contribute a certain amount of labour every year, free of charge, for canal maintenance. The labour provided by the WUA to the *Raivodkhoz* in this way is set against the amount that the WUA is supposed to pay RID. Beyond this, some water users choose to participate in additional *ashar* so that the value of their labour contribution is deducted from the ISF that they are due to pay the WUA.

[184] Indeed, as we discussed in Chapter 3, this was one of the challenges we faced when preparing a listing of water users to include in our investigation.

many of our respondents as one of the justifications for failing to pay the Irrigation Service Fee[182], particularly in SMIP (Mott MacDonald, 2004a).

The most important means of communication between water users and the WUA is through personal contacts. When such communication does take place, it primarily deals with irrigation schedules, rather than governance issues such as rules and penalties, maintenance plans, or fee collection. In the Kyrgyz Republic the RA members have often not been very good at informing water users[183] about WUA activities, and most people depend on the *mirabs* (ditch riders) for information, especially during irrigation periods. In our survey of water users in Obu Haet and Jany Aryk, less than half our respondents reported that they had contact with anyone from the WUA other than the *mirab*, and the main reason for contacting the *mirab* was to get irrigation information or make a request for water.

Our study team observed that during the first WUA tenure in SRSP, Andhra Pradesh the Territorial Constituency members helped to improve communication between the irrigation department and water users by informing water users about the irrigation schedules decided by the irrigation department. Local newspapers have also been used to inform water users of details of water levels in SRSP. But access to information published in newspapers relies, of course, on the water users either being literate or having access to someone who is literate; and as we discussed in Chapter 5, the literacy levels in our SRSP study site are very low, particularly amongst the poor. Occasionally information has also been provided on television and radio. Water users were also able to approach the TC member if irrigation schedules were not adhered to. However, at the time of our study the newly elected TC members had not benefited from the flurry of orientation, training, and introduction to the irrigation department that followed the first round of elections in 1997. Although there was a training activity for TC representatives conducted in Rabi 2004/5, it was very informal and appeared to have taken place simply to satisfy a target program. TC representatives complained that they did not have a direct link with the irrigation department, and that they were unknown to the department officers.

In SMIP, Nepal water users feel that the WUA has not done enough to keep them informed of irrigation schedules, and of any changes that the Project Office makes to those schedules. Water users learn about water distribution plans through informal channels, rather than from concerted or systematic communication measures taken by the WUA leadership.

KIS, Nepal has the best record of communication between water users and their WUA committee members. Water users find it easy to contact the *dhalpa* and the *karyadal* members, as well as members of their Branch Canal Committee, to find out about water distribution schedules.

6.5.2 WUA management - technical support and training

(i) Formal institutions - entitlements and obligations

All the legislation and regulations pertaining to the establishment of WUAs acknowledges that WUA executives and committee members will need training and continuing technical support for WUA and irrigation service management. In the Kyrgyz Republic the WUA law states that the regulatory agency “has a right” to “provide advice and assistance to WUA in respect of legal, accounting and technical issues”. In Nepal it is irrigation policy to provide user associations with training for irrigation

[182] Another justification is that users haven’t received the service delivery they expect. We will return to this argument in our discussion of funding in section 6.7.2.
[183] As we noted earlier, few of our respondents even knew the identity of their Zone Representatives.

service management, and the joint management agreements (JMA) for both KIS and SMIP state that the WUA is entitled to request support for training, research, and engineering related services.

(ii) WUA performance in practice – application and enforcement of rules

Training and technical support for WUA committee members

All of our study areas have been supported by internationally funded projects and they have been the subject of a concerted effort of training and capacity building for the members of the newly formed WUA executive committees, especially during the initial periods of infrastructure works and WUA development.

In the Kyrgyz Republic under OIP the government has established WUA Support Units (WSU) at regional and district level. These units, staffed with small teams comprising a WUA support specialist, a water management specialist and an engineer, are supposed to promote the creation of WUAs, and provide training and advice, particularly on financial and technical matters (Johnson, et. al., 2002). In Andhra Pradesh capacity building and fostering of WUAs and Distributary Committees in SRSP was supported through both the World Bank funded projects APIP III (World Bank, 1997) and the Andhra Pradesh Economic Restructuring Project (APERP) (World Bank, 1998). Under APERP the Water and Land Management Training and Research Institute (WALAMTARI) was made responsible for the Participatory Irrigation Management Campaign and the training of I&CADD staff and WUA office bearers [184] (Srinivasulu,. 2002, p.12). Comprehensive training modules were developed in association with an NGO associated with I&CADD (World Bank, 2005b, p. 5). An extensive program of training camps for irrigation staff and for Water Users' Associations was implemented as part of the WUA establishment campaign (Raju, 2002, p. 90). Training and support programs for WUA members and officers were also a part of IMTP in KIS and SMIP II and III.

Continuing support

While all of our study areas have been the subject of a concerted WUA promotion and training program in the initial years of their existence, they have differed in the continuity of training and management support they have received. In some cases the membership of the executive committees has changed following elections, or simply with the passage of time. The turnover in membership, as well as the failure to refresh and reinforce the training messages, has sometimes diluted the capability and understanding of committee members to fulfil their roles.

KIS has been best served in terms of continuing training and technical support. Here a concerted programme of WUA support was combined with an opportunity to negotiate water rights and representation between branches in the system. This helped to transfer water users' attention from construction to the WUA's operation and maintenance functions (Khanal, 2003, p. 114). Most recently the USAID-funded SAGUN project has included institutional development training for WUA committee members and other water users in its program.

In the Kyrgyz Republic the WUA Support Units (WSU) have been established within the DWM structure, with a view to the Units' continuing operation beyond the life of the project. So far the

[184] This would be a massive state-wide program with an expectation that, "In all, about 100,000 WUA representatives and various departmental officers would be given continuous training. Training of senior government officers and trainers would take place at WALAMTARI, while that of field staff and WUA functionaries would be carried out in DTUs [District Training Units], or sub-centres of the district, or in strategic places in the major project command areas" (Srinivasulu, 2002, Annex 2, p.10).

training given to WUA Council members and Directorate has focused on administrative and technical topics, such as accounting, preparation of annual O&M plans, and execution of maintenance works. But in 2005 the training specialist of the Central WSU said he was preparing training materials on the role, tasks and responsibilities of the Zone Representatives (Verheijan, 2005, p. 24).

In SRSP at the close of the APIPIII project, the completion report observed that:

> "*The Water and Land Management Training and Research Institute (WALAMTARI) Farmer and Staff Training subcomponent was unsatisfactory. This part of the sub-component was to strengthen WALAMTARI central and field facilities and to implement a major training program for staff of both Irrigation and Agriculture Departments and for Water User Associations (WUA) members. While farmer training targets were largely achieved, performance in terms of staff training was poor.*" (World Bank, 2005b, p. 5).

It would appear that many of the trainings were conducted primarily to fulfil targets, with little genuine commitment or interest on the part of either the trainees or the trainers. The training addressed the provisions of the PIM Act, and some agronomic training. But there was little on practical management of the WUA, such as business and financial management, or on the governance and service provision functions of the WUA (Lele *et al* 2002, p. 306). The elections in 2003 brought about a turnover in the Management Committee membership such that many of the newly elected TC members in our study area were not clear about their roles and responsibilities. They were also not well informed about the design principles of their irrigation system or the determinants of the amount of water that their minor should receive.

In SMIP, Nepal there has been no training for WUA committee members in recent years. As there have been no elections since 1994, and many committees have unfilled vacancies, any lack of understanding has less to do with turnover in committee members, and more to do with lack of reinforcement and the committees' lack of interest and motivation to fulfil their WUA responsibilities.

In the next section we will discuss how the mass information programs which accompanied the launch of the WUAs have had a very limited impact on water users' understanding of how the irrigation system should be managed, or how they can make the best use of the irrigation water that reaches their farm.

6.5.3 Water management and agriculture – technical support and training

(i) Formal institutions -- entitlements and obligations

All WUAs are expected to promote efficient water management and to support improved agricultural practices amongst their members. The Kyrgyz WUA law states that WUAs should promote new irrigation techniques among farmers and undertake measures to *"prevent soil erosion and salinity"*. In Andhra Pradesh the WUA is supposed to encourage "the modernization of agriculture in its area of operation". The Irrigation Policy and the Joint Management Agreements for both KIS and SMIP in Nepal give the WUA the task of organizing agriculture training for its members, and it requires the irrigation department and the Department of Agricultural to respond to requests from the WUAs for training to be provided to their members.

(ii) WUA performance in practice – application and enforcement of rules

WUA orientation and information for water users

In addition to trainings for WUA officers, mass meetings for water users were also a common activity when WUAs were being established. Andhra Pradesh probably implemented the most comprehensive public information effort. This included massive propaganda through media, public meetings, posters, and the government's *Janmabhoomi* (motherland) programme aimed at creating mass awareness and grass roots support for the PIM programme. Meetings to inform farmers also took place in Obu Haet and Jany Aryk in Kyrgyzstan, and KIS and SMIP in Nepal.

However, although the initial publicity programmes no doubt generated "awareness" that something was happening to the irrigation service, the formation of the WUAs was generally associated with funding for physical improvements to the irrigation systems. Water users' expectations and interest tended to focus on how they would benefit from the construction activities. They gave less thought to the longer term management implications of WUA formation. This was observed by commentators on the PIM programme in Andhra Pradesh (Vekhateswarlu, 2002**,** p. 172 – 173) and we could see evidence of similar focus of attention in SMIP, Nepal and Obu Haet and Jany Aryk, Kyrgyzstan. Also, financial rules which restricted the proportion of loan cost that could be used for Technical Assistance (TA), training and follow-up meant that insufficient effort went into implementing a coherent and effective approach to WUA development[185].

Water distribution and on-farm water management

The need for improved water management and better agricultural practices has been recognised in all of our study areas. Each of their respective projects included some sort of provision for agricultural extension training for farmers. But on the whole the training water users have received has had very little water management content, and water users have not been provided with advice and encouragement to link better agricultural practices to more careful and efficient use of irrigation water. None of our study WUAs has taken any measures to inform and encourage their members to adopt improved water management and agricultural practices.

KIS is a possible exception. The relative intensity of project activities, combined with good educational resources and communications, have meant that water users have a relatively good level of knowledge of both water management and agricultural practices.

In contrast, in the Kyrgyz Republic many small holders who received land under the post-independence land distribution programme have limited agricultural knowledge and experience. Furthermore, the Soviet legacy of water use has been one of un-restrained irrigation, with consequences for inefficient use of the water available[186]. The design of the On-farm Irrigation Project in the Kyrgyz Republic envisaged that the WUA Support Units would work with the Rural Advisory Service (RAS) to organise training and technical advisory services for WUA members. But

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[185] Under the original project components of APIP III Agricultural support services which included not only WUA promotion, but also irrigation agronomy R&D and farmer training were allocated around £11 million or 2.5 % of base costs. Had this been spent it would have represented a budget allocation of approximately US $35/ha. Actual estimated expenditure at project completion was approximately US $ 2.5 million, or US$ 8/ ha for all three activities. This compares with the irrigation development and rehabilitation works component, which was originally allocated US $346 million, or 80% of base cost. This would have represented an expenditure of approximately US $1,100 per ha. At project close the per ha costs for the irrigation component went up to approximately US $1,200 per ha. (World Bank, 2005).

[186] Although water logging and salinisation -- problems nationally -- were not observed in our study areas.

so far in Obu Haet and Jany Aryk this has remained only an intention. A survey conducted in Obu Haet in 2004 found that only 2% of respondents had participated in training on agriculture or irrigation management. However, the survey found farmers were keen to receive training, including on water saving technologies (TES Winrock, 2004, sect. 13.2). Water users here have the advantage of the highest literacy rate among our study areas, with virtually everyone over the age of 7 considered to be literate.

When rehabilitation projects were implemented in SRSP, Andhra Pradesh and SMIP, Nepal water users were accustomed to the uncontrolled water distribution which prevailed during the initial operation of their irrigation system. The new projects required them to be more efficient in their use of water.

Accordingly, the APERP project in Andhra Pradesh included a massive agricultural extension and training programme for farmers in the APIP III project area (Srinivasulu, 2002, Annex 2, p. 9). Several tens of thousands of farmers received training in irrigated crop agronomy and improved water management (Srinivasulu, 2002, p. 5, World Bank, 2005b). But the trainings did not succeed in orienting farmers to choose crops based on both land suitability and water availability. There was poor coordination between the irrigation and agriculture departments, and water wastage continued to be observed in the head and middle reaches of irrigation systems. There was little significant change in crop diversification to increase the irrigation area, especially in *rabi* season (Lele, *et al*, 2002, p. 221, 305).

In SMIP, Nepal the Irrigation Sector Project included a provision for the District Agricultural Development Office (DADO) to promote improved agricultural practices in the irrigation command areas. It was fairly effective in extending information on agronomic practices, but the project completion report noted that "*Whilst farmers appreciate the chance… mini-kits give to try out new varieties, there is no evidence that they have led to any sustained change in farmer practices. There was insufficient coordination between DOA and DOI under this project activity*". Little training was provided in on-farm water management practices (World Bank. 2005a, p. 10). Whatever the content of these training programmes, our earlier study in SMIP showed that many water users failed to understand the structured irrigation design which was introduced as part of the rehabilitation of their system -- or its associated principles of equitable water distribution (granted that in some cases this lack of understanding may be wilful) (Mott MacDonald, 2004b).

6.6 Maintenance

6.6.1 Overview of responsibilities

The WUAs are supposed to organize the maintenance of the irrigation infrastructure within their area of responsibility. In the Kyrgyz Republic this applies to the whole command area for which the WUA is responsible. In SRSP, Andhra Pradesh the WUAs are responsible for operation and maintenance (O&M) of the minor canals and below. Distributary Committees and Project Committees are responsible, at least in principle, for the O&M of canals above minor level and for liaison with I&CADD. In KIS the WUA is responsible for the maintenance of the branch canals and outlets, while in SMIP the WUA is supposed to maintain the sub-secondary, the tertiaries and the watercourses. Farmers are supposed to organize themselves to build and maintain field channels as necessary for the efficient and equitable distribution of water at the field level.

In practical terms the WUAs' maintenance responsibilities involve cleaning of the canals, repair to the canal banks, outlets and other physical structures within their jurisdiction, and protection of the infrastructure from damage, e.g. from illegal access to the canals or from obstructions placed in the canal to facilitate the diversion of water. The WUAs are supposed to use a combination of their share of the collected water user fees, and labour contributed by water users, to complete these works.

In Nepal the Irrigation Regulations 2000 stipulate that WUAs are required to establish a separate maintenance fund into which they are supposed to deposit at least 90% of the irrigation service charge and other income they receive. Furthermore at least 90% of the money in the maintenance fund is supposed to be allocated for the maintenance of the canals for which the WUA is responsible (GoN, 2000). The WUAs in the Kyrgyz Republic and Andhra Pradesh. are not under any obligation to allocate a specific level or proportion of funding to cover maintenance.

6.6.2 WUA maintenance performance in practice – main system to field

(i) Main system

One of the criteria for scheme selection for our study was that the physical condition of the main system should allow control of the distribution of water to the WUA and should make it possible for the WUA to expect a fairly predictable supply of water. This is the case in all of our systems. In three of our systems, KIS, SMIP and SRSP, the main system and downstream canals were rehabilitated as part of the preparation for turnover of the lower systems to the WUA. The physical infrastructure was in adequate condition; any defects, such as damaged structures or scour around structures, did not significantly affect the hydraulic performance of the systems. In Obu Haet and Jany Aryk it was judged that the system was in operable condition to the tail of the WUA, even though the main system had not been rehabilitated under the World Bank Irrigation Rehabilitation Project. Rehabilitation under OIP was planned but not yet implemented.

This meant that the main system in all our study cases was in relatively good condition. However one of our study systems in the Kyrgyz Republic and our study systems in Nepal are subject to fluctuations in the source, and these make for an erratic water supply. In the Kyrgyz Republic, Jany Aryk (JA) receives water from the Papan Reservoir, and so fluctuations are fairly well regulated. But Obu Haet (OH) receives water from the Aravan Sai River, which is fed by snow melt and is subject to significant daily changes in discharge. In both KIS and SMIP, fluctuations in the river require adjustments to the gates. In Jany Aryk, Kyrgyz Republic and SRSP, Andhra Pradesh the water is drawn from a reservoir, and so should be manageable according to an established arrangement to share the water available; if necessary a rotation arrangement should be used to share limited supplies. However, as we will discuss in subsequent chapters, actual delivery is subject to fluctuations caused by "illegal" interventions by water users, sometimes with the active or tacit collusion of the system operators.

In KIS, Nepal the Main Canal Committee has played an active role in working with the Irrigation Department to see to it that the main canal is well maintained. This has included a contribution to clean out the main canal, grease and fix the gates and for structure protection works. This contribution was estimated to be worth the equivalent of 15% of the costs[187] (Khanal, 2003, p. 271). In the other study sites the organisation of main system maintenance is entirely left to the irrigation department. The WUAs have had minimal formal involvement in deciding on maintenance although they are

[187] However, as we will note in section 6.7.2, the WUA had not made cash payments toward main system maintenance.

supposed to be consulted. However in SMIP and SRSP some committee members have had a personal input through informal understandings and by undertaking contracts for the completion of some of the maintenance works (sometimes there has been ambiguity over whether committee members have been acting in their capacity as members of the WUA committee or as private contractors).

(ii) Branch

The branch canals/sub-secondaries/tertiaries/minors were rehabilitated in KIS, SMIP and SRSP as part of the irrigation investment projects, and they are in fairly good condition. However they do require a programme of routine maintenance to remove silt, weeds, and other rubbish that may enter the canal and prevent the efficient distribution of water. The WUAs in Obu Haet and Jany Aryk in the Kyrgyz Republic were awaiting rehabilitation under the OIP programme. For Obu Haet the structural improvements anticipated included the reduction in the number of offtakes from the branch canal (currently 57), and the construction of regulation and water measurement structures to make it easier for the *mirab* to manage distribution between the fields along the 4 km length of the branch canal. For Jany Aryk the canals had not been maintained for more than 10 years, so some of them are badly silted and were reported by the WUA staff to have inadequate capacity to deliver the required flow. The WUA staff reported to our team that the branch canal in Jany Aryk needed mechanical cleaning and lining of some canals, and the WUA submitted documentation for rehabilitation under OIP in 2004.

The WUAs in KIS, Nepal and Obu Haet, Kyrgyzstan have been fairly active in organising water users to clean the branch canals at the start of each irrigation season, and water in these canals flows adequately.

In Jany Aryk the WUA was less effective in organising water users to clean the branch canal. The poor condition of the branch canal and the expectation of imminent external help for rehabilitation of the canal no doubt contributed to this attitude. But as we will discuss below, other factors also have had an effect.

In SMIP, Nepal and SRSP, Andhra Pradesh the WUAs have not taken any action to organise water users to maintain the canal at branch level. Although the canals, which are lined, are in adequate condition, a build up of silt and weeds reduces the efficiency with which water is conveyed down the system. But as we will describe below, of greater significance than a lack of routine maintenance is the failure to control “illegal” measures to access irrigation water; these measures have the side-effect of damaging the structural integrity of the canals.

(iii) Below the branch

Maintenance at this level essentially requires water users to look after earthen canals that direct water between fields within the command area of the lowest level outlet. While in Nepal (KIS and SMIP) there is provision for water users to formally organise themselves to plan and implement this task, through Outlet Committees or Water Users’ Groups, in the Kyrgyz Republic and Andhra Pradesh it is simply left to the water users to organise themselves to do this as they see fit. In practice in all our study areas, including KIS and SMIP, the completion of field-level canal maintenance depends on the nature of the relationships between water users at that level. If everyone with an interest in maintaining the canals has the necessary mutual influence, and willingness and ability to do so, then water users cooperate to ensure that the canals are kept up well enough to meet their needs. But water users who lack the influence or connections may either have to do all of the work themselves, or accept a poor or even non-existent flow of water to their field. We observed such cases in all of our study areas.

(iv) Illegal outlets and bunds

In all of our study areas we observed the use of illegal outlets, including cuts in the canal banks and the insertion of unauthorised pipe outlets. We also observed unauthorised pumping from the canal and the use of temporary bunds. The bunds, which are used to head water up into authorised or unauthorised outlets, are not necessarily removed after they are no longer needed by the person who installed them. In the Kyrgyz Republic and Andhra Pradesh the ditch rider (*mirab*, *lashkar*) is supposed to police the canals, and see to it that these unauthorised interventions are removed. But the ditch riders often lack the time or motivation to be conscientious in their monitoring and strict in their enforcement of the rules against these measures. In KIS the WUA committees have rules against these measures, but they have not put in place systematic monitoring systems, nor have they done anything to prevent or punish the people who adopt them. In all cases the lack of enforcement is often seen as a tacit acceptance of these practices. Sometimes the WUA appears to have given its approval to outlets even though they undermine the ability to manage the canal for equitable water distribution.

6.7 Funding

6.7.1 Formal entitlements and obligations

In all of our study areas water users are expected to make a financial contribution toward the cost of operating and maintaining the main system. This is made in the form of a specified share of the Irrigation Service Fee (ISF) collected. The WUA, using a combination of its share of the ISF, other funds it may generate, and labour contributions from water users, is expected to organise the operation and maintenance of the infrastructure that it is responsible for.

The WUAs in the Kyrgyz Republic and Nepal have more financial management responsibility than WUAs in Andhra Pradesh. The WUAs in the Kyrgyz Republic and Nepal are fully responsible for generating and managing the resources needed to operate and maintain the portion of the irrigation system for which they are responsible, and to run the WUA. The WUAs are authorized to generate funds from specified alternative income earning activities, such as harvesting trees on canal banks, charging for the use of access roads, and other service activities. They can also organize water users to contribute labour and materials. But their primary source of cash income is the Irrigation Service Fee (ISF) collected from water users. The WUAs in Andhra Pradesh rely more heavily on government funding, most of which has come from the World Bank project so far, to pay for the maintenance activities that they have undertaken, although water users are supposed to look after the canals below the pipe.

The amount of ISF charged to water users is a combination of government and WUA-set requirements. In the Kyrgyz Republic, the payment to the *Raivodkhoz*, was until recently set by parliament[188], and the amount of money the WUA pays the *Raivodkhoz* is based on the volume of water delivered to the WUA. WUAs are entitled to decide for themselves how much they will charge water users to cover their own operating costs. In SRSP, Andhra Pradesh the government sets the level of ISF. Fifty percent of the collected fee goes to the Irrigation Department, 25% to the WUA,

[188] This was changed by the Water Code of 2004

10% to the Distributary Committee, 10% to the Project Committee and 5% to the *Gram Panchayat*. In SMIP, Nepal the district Service Charge Fixation Committee, of which the WUA chair is a member, has the authority to fix the level of ISF. According to the SMIP handover agreement (SMIP, 1995) the WUA is required to pay 50% of the collected ISF to the government; while 25% of the fees should go to the WUG, 12.5% should go to the WUC, and 12.5.% should go to the WUCC. The WUG may choose to increase the level of ISF it charges its members. In KIS, Nepal the Joint Management Agreement authorizes the WUA to decide its own rate of ISF (KIS, 1995). According to Irrigation Policy, the WUA is required to pay the government 25% of the service fees collected; 20% goes to the Main Committee, and the remaining 55% goes to the Branch Committee (Khanal, 2003, p. 279).

The basis on which water users are charged also varies across our study sites. In the Kyrgyz Republic although the amount the WUA is required to pay the *Raivodkhoz* is based on the volume of water released to its system at the gate, water users pay the WUA on an area basis and the rate of ISF is the same for all crops.. In SRSP, Andhra Pradesh and Nepal there is no direct link between fees paid and water delivered at any level, except that in Nepal farmers who do not receive water are exempt from payment[189]. In SRSP the charge is supposed to be by crop and area, with a higher charge rate for *kharif* rice than for *rabi* rice or for irrigated dry crops in both seasons. In KIS and SMIP the fee is charged per hectare, per irrigated season, without distinguishing the type of crop being irrigated. In addition, in all study areas water users are supposed to contribute a specified amount of labour for canal cleaning and desilting of the branch canal and below, as organized by the WUA committees.

The WUAs in four of our study areas are fully responsible for collecting ISF from water users. In our two sites in the Kyrgyz Republic the WUA Directorate is responsible for organising ISF collection, in KIS, Nepal it is the Branch Canal Committee, and in SMIP, Nepal it is the Water Users Committee (sub-secondary level). As we have noted earlier, in Andhra Pradesh WUAs rely on the Revenue Department to collect the service fee[190].

6.7.2 WUA performance in practice – fee collection and labour mobilization experience and its consequences

(i) Fee collection experience

Of our study sites, those in the Kyrgyz Republic have been most successful in fee collection and labour mobilisation. Here WUAs are receiving continued technical back-stopping from the WUA Support Unit and the WUAs are anticipating improvements to their infrastructure under the On-farm Irrigation Project. KIS, Nepal with its history of intensive external support and its relatively small size, has also been relatively successful in collecting ISF and mobilising labour, although it has faced some difficulties in recent years. SRSP, Andhra Pradesh and SMIP, Nepal, the largest schemes with the most infrastructure investment and the weakest support for WUAs, have the poorest ISF collection and labour mobilisation performance.

In our sites in the Kyrgyz Republic the bulk supplier reported some problems in receiving payments from the WUAs in 2003, but the WUAs reported 100% payment by their members, with 10% delayed payments. Fees are collected by the *mirab*, with up to 85% of ISF paid in kind. The WUA organises

[189] This, of course, is difficult to monitor – and is a cause for disputes over obligation to pay ISF.
[190] In 2000 the Government of Andhra Pradesh announced that the availability of maintenance/rehabilitation funds was going to be made dependent on the collection of water rates by WUAs. This was supposed to be introduced in the 2001-2002 agricultural year (Mollinga et. al., 2001, p. 377). It is not clear to what extent this has actually been put into practice.

the vehicles necessary to make this collection, usually at the time of harvest, and at the prevailing market price. The bulk water supplier *(Raivodkho*z) accepts payment in kind. In addition each water user household is required to contribute a certain amount of labour each season for branch canal maintenance. Both study sites report that water users contribute *ashar* for the maintenance of the branch canals, although this is less evident in Jany Aryk. Some water users also participate in additional *ashar* labour tasks as a partial offset against their ISF obligations.

The WUA in KIS, Nepal has been collecting ISF since 1993/1994. The Branch Canal Committees are responsible for collecting ISF and paying 20% of the fee collected to the Main Canal Committee. In practice, the collection of fees has mostly been relevant to main canal operation and maintenance since there are no major structures to operate and maintain on the branch canals. The only maintenance task to be carried out on a branch canal is cleaning and reshaping the canal and cleaning weeds; and this has been done by employing labour contributions. The ISF collection efficiency between 1993/94 and 1999/2000 averaged 60% (Khanal, 2003, p.280). However, focus groups during our study reported that cash ISF payments had not been collected since 2002, at least in the branches we studied. But water users said that they provided labor for annual and seasonal canal cleaning as called for by the BCC.

In SRSP, Andhra Pradesh water fee collection was reported to be 54% during 1997 -98, and increased to 60% during 1998-99 (Raju, 2002, p. 100). However, at the time of the APIP III completion report in January 2005, the ratio of water charge collected to assessment in SRSP was 10%, as compared with an SAR projected target at end of project of 90% (World Bank, 2005b, Annex 1(a) p. 14). It was also reported that most of the WUAs had not made any serious attempts to mobilize the prescribed 15% farmer contribution toward the cost of rehabilitation works funded under APERP (Raju, 2002, p. 97). In our study sites the WUA has not made any effort to organise water users for canal maintenance works. The few respondents who said they made contact with WUA committee members said this was mainly related to improving the delivery of water to their area. They said farmers organised themselves informally to maintain the the pipe canal and field channels (and not everyone participated in this).

In SMIP, Nepal in 2003 the rate of ISF collection was said to be 23% (Facon, 2003, p. 58). At the completion of GGG in November 2003, the WUA for SS9E had not collected ISF. Furthermore, the WUA had made no effort to organise water users to provide labour for canal maintenance at any level. In 2005 the authors of the project completion report for SMIP III observed that “there has been almost no regular improvement in the payment of irrigation service fees”. The commentator remarked that “without adequate funds, maintenance of these facilities in the future, as in the past, will depend almost entirely on voluntary labour which may not be sufficient in all situations (World Bank. 2005a, p. 9).

(ii) Factors affecting fee collection

Mistrust of WUA financial management, dissatisfaction with the irrigation service delivered by the WUA, and a general feeling that no one is able to enforce rules are the main factors undermining water users’ willingness to pay Irrigation Service Fees in our study sites.

Although the rate of collection is reported to be quite high in the Kyrgyz Republic, the payment of a proportion of the fees in kind rather than cash has created an opportunity for dubious practices by some WUA officials[191]. Furthermore, as noted by one observer, the use of inducements and influence can also undermine confidence in the way water is distributed:

> *"In fact, bribing seems to be a usual tool for getting access to irrigation water. Thus, better-off farmers generally dispose of the means to gain preferential access to irrigation water: "It is just the elites, the 'crème of the community', who get water easily, those who have enough money. Simple people do not get water this easily", a group of farmers in the South complained. The better-off farmers are also likely to be the most influential persons in the local community, adding further to their privileged access. In addition, kinship plays an important role in water delivery: family ties with WUA staff can provide guarantees for water supply. All these informal mechanisms decrease the transparency of allocation decisions and risk contributing further to the disadvantaged stance of the poor…*" (Herrfahrdt et. al. 2005, p. 85)

While our team heard no complaints or evidence of such practices in our study areas, the Chairman and the *mirab* in one of our sites were perceived to be more active and "transparent" in their dealings than those in the other. It is conceivable that practices such as those described above could contribute to a feeling of distrust and disrespect for those WUA staff who water users perceive not to be "transparent" in their transactions.

In KIS, Nepal Khanal reports that the Branch Canal Committee objected to paying the 20% share of ISF to the Main Canal Committee, on the grounds that this money was used mostly to pay for administrative costs. As of his writing in 2000 the MCC had not been required to give any money to the government for main system O&M, so any cash collected was retained by the MCC for its own use. Furthermore, the Branch Canal Committee members felt that without legal strength they were not in a position to enforce fee collection and they complained that many farmers evade paying ISF by saying that they do not need the canal water (Khanal, 2003, p. 281). Our team found that farmers were continuing to resist making cash payments to the WUA on the grounds that the WUA either could not justify its need for the money, or that it would not manage the money properly if it did receive it. The BCC and the MCC did not appear to be willing or able to collect a fee.

In SRSP, Andhra Pradesh and SMIP, Nepal the government is almost the sole source of funding with little (or no) efforts made by WUAs to mobilize their own resources. In Andhra Pradesh it was observed that part of the reason for the poor ISF payment rate is that downstream farmers feel justified in defaulting on payment on the grounds that those at the head are taking water far in excess of their allocation (Factual Note, 1997: 8, quoted in Jairath, 2002, p. 225). Our SMIP, Nepal team found that farmers used the same arguments for non-payment of ISF – excessive water use by those upstream, and poor access by those downstream. In SMIP water users also expressed their distrust of the way WUC executives manage the fees that were collected. In both sites inequities in water distribution can be expected to lead to continuing poor performance in ISF payment. A further contributor to poor levels of fee payment in Andhra Pradesh has been the severe drought facing the state in 2001, 2002 (World Bank, 2003, p.5) and 2004 (Mott MacDonald 2006).

[191] Herrfarhrdt, et. al. (2005) observe that nationally in 2004, on average 60% of total fees (ISF and WUA fees) were paid in kind, 30% in cash, and 10% as labor. Verheijan (2005) remarks that, "the payment of ISF's in kind is causing problems for the WUAs and the Department of Water Resources (DWR) due to costs related to the transport, storage and sale of the payments in kind" (p. 40). Herrfahrdt, *et.al.* remark that the persistence of in-kind payments to DWR may be motivated in part by the rent-seeking opportunities this offers water management staff (*ibid.*, p. 81). However, we do not have evidence of rent-seeking behaviour in our study sites.

(iii) Consequences of deteriorating collection rates

In all our study sites the individuals who are formally responsible for in-field water distribution (*mirab*, *dhalpa*, *lashkar*) are seen to be underpaid and vulnerable to inducements, although there is individual variation in our study areas. The *mirab* in Obu Haet is considered to be conscientious and basically honest; while the *mirab* in Jany Aryk is elusive, at best, and rarely consulted. The *lashkar* in Andhra Pradesh could hardly be found by our researchers. In KIS, Nepal water users express confidence in the *dhalpa*, although some accuse him of being vulnerable to inducements. In SMIP, Nepal the *dhalpa* who operates the gate to the sub-secondary in SS9E is remote to most users, although individual influentials are reported to be able to make special arrangements for the gate to the sub-secondary to be opened. One observer noted that operators in SMIP made uncoordinated adjustments to gates along the main and secondary canals, and that there was poor communication among operators and poor feedback for decision-making (Facon, 2003, p. 16).

Poor management practices by field staff, along with inadequate resources for canal maintenance and for system operation, make for less efficient water distribution. This, in turn, is associated with unreliability and inequity in water sharing, which discourges payment of fees. And, as other observers have also noted, poor discipline in fee collection reinforces other rule breaking activities, such as interference and damage to infrastructure and unauthorised use of irrigation water (Verheijan, 2005., Herrfahrdt *et al*. 2005).

6.8 Water users' understandings of the WUA, and social relationships for water management

6.8.1 Introduction

The introduction of WUAs to our study sites represents a fundamental change in the expected role of water users in management of the irrigation service. Prior to the establishment of the WUA the irrigation service was wholly provided by a government irrigation agency. Certain individuals, through their position in the state or communal farm in the Kyrgyz Republic, or because of their social and political status in Nepal and Andhra Pradesh, may have had privileged influence on the delivery of the irrigation service. But generally the service was managed without the formal involvement of the majority of water users. In this context, individual water users found their own particular ways to arrange their access to irrigation water, within the constraints of their livelihood assets and strategies[195].

For various reasons which we discussed in Chapter 2, this arrangement was not considered satisfactory. Among the arguments for WUAs is that these organisations will enable water users to improve the rules and the implementation of service delivery through their 'participation' in the WUA (see e.g. FAO, 2001, Overview Paper, Closing Statement; Svendsen, *et al*, 1997)[196]. Participatory Irrigation Management is expected to "empower" water users in their relationship not only with their water users' organisation, but also with the irrigation department and other support service providers such as the agriculture department (see. e.g. Srinivasulu, 2002, p. 31, for Andhra Pradesh). The expected outcome is efficient and transparent delivery of irrigation services in the interests of all water

[195] See Chapter 5 for an examination of water users' assets and strategies during our study period.

[196] Indeed, this is often the justification for the 'hand-over' to users, or some other form of privatisation, of a range of services which are being provided by government – not only in the water sector (e.g. drinking water supply), but also education, health, etc.

users. Behind these expectations is an implicit assumption that all categories of water users will be well-informed and will be equally willing and able to influence the governance of the WUA.

In this section we examine water users' attitudes toward the WUA, and the extent to which water users themselves consider that they are able to influence water management in their irrigation system.

6.8.2 Water users' current understandings and assessment of WUA performance – an aspect of 'human capital'

(i) Water users' view of the role of committee members

In Obu Haet and Jany Aryk water users generally identify the WUA with employed staff on its Directorate; most particularly with the *mirab* who is responsible for managing and supervising the distribution of water. They have much less of an idea of the activities of the WUA Council, or indeed who the WUA Council members are. They view the WUA, in the form of the Directorate, as the manager of the irrigation service – responsible for the distribution of water and the maintenance of the canals, and they judge it according to its effectiveness in providing them with irrigation as and when they need it. Water users in both Jany Aryk and Obu Haet recognise that water is not equitably distributed, and that some water users take water when they shouldn't, causing other water users to suffer the consequences. But on the whole the water users in Obu Haet have more confidence in their WUA Directorate than do water users in Jany Aryk. Water users in Obu Haet appreciate the efforts of the *mirab* in trying to manage the unruly behaviour of some water users. To water users in Jany Aryk the *mirab* is seen as irrelevant; particularly as he is rarely encountered in the field.

Box 6-1: Water users' attitudes toward the WUA and the *mirab* - Jany Aryk and Obu Haet, Kyrgyzstan

Observations in Jany Aryk

Zonal representative don't know themselves that they are the representatives. WUA Accountant explained to the farmers the system of zonal representation.

There are usually some cases of illegal water offtakes since there is not any control and supervision over water distribution. The *mirab* does not regulate the process of water distribution between the farmers. In case of conflicts farmers try to solve it themselves, without involving third parties. Usually one of the conflicting farmers concedes.

Observations in Obu Haet

None of interviewed farmers from the head, middle or tail knew about zonal representation system. WUA Director explained the essence of it. Farmers said that while in theory the zonal representatives might help to improve water distribution in practice these zonal representatives are also farmers who are very busy in the field.

Farmers agree on introducing operable rule enforcement mechanism, since this will be a help to farmers in the middle and tail in water allocation. In 2003 the WUA General Assembly made a decision to impose a penalty for illegal water intake. Some farmers claimed that the penalty rate is low and rules are not enforced at all. The farmers refuse to report or sign a charge against someone taking water against the rules. Since all farmers are neighbours, it wouldn't be nice to report on the neighbours. They think that the *mirab* should do it. His role has to be strengthened more, so that farmers would listen to him and be afraid to take water without permission.

In KIS and SMIP water users see the WUA as the organiser of water distribution and maintenance for the branches (KIS) or tertiaries (SMIP). Water users in KIS have a stronger sense of identification and confidence in the WUA – particularly the Main Canal Committee (MCC) – than in SMIP. The water users in KIS are generally satisfied with the way the MCC organises water distribution between branches in the monsoon season, and they report that the Branch Canal Committee (BCC) organises cleaning of the branch canal. They are less happy with the way the BCC organises water distribution within the branch canal. But while they criticise the BCC members (particularly the Chairman), they are also aware of the difficulty of finding people willing to take on WUA leadership responsibilities.

In SMIP, water users consider the WUC and the WUG to be totally inactive both in ensuring equitable water distribution between and within tertiaries, and in organising maintenance at any level within SS9E.

Water users in both KIS and SMIP seem to consider that the WUA committees should play a role in organising and enforcing the fair distribution of water down to the individual water user, and they complain that the committees are either not sufficiently active, or they are biased in the measures they take. They feel that any rules which have been agreed by the committees about water distribution are not properly communicated or enforced. A common accusation is that the most influential water users, sometimes WUA committee members themselves, ignore the rules if it suits them to do so.

Box 6-2: Water users' observations about the WUA - KIS, Nepal

Some farmers' opinion of the BCC-2 Chairman

- In several focus group discussions farmers expressed their dissatisfaction with the BCC-2 Chairman. They say he has a number of bad characteristics such as drinking, selfishness, and rent-seeking behaviour. But at the same time they respect him as a pillar of water management in BC-2. They consider that there is no one who is an able substitute for the Chairman as leader for water management in BC-2. No one wants to replace him.

FOs and KFOs of BC-2

- Branch Canal Committee-2 (BCC-2) is not strong. The office-bearers are not active and aware about their roles and responsibilities. So, BCC should be mobilised to work in the favour of farmers.

Some farmers from Pachas Bigha Kulo (BC-2)

- The farmers expressed that they have no direct linkage with BCC-2. They try to visit WUA Main Canal Committee if they have any problem. In past, they visited several times to BCC-2 but they did not get any support from them. As farmers of Pachas Bigha Kulo they feel neglected. That is why they do not collect ISF since last year. They got less water and there is partiality in water distribution. They have no representation in the WUA (BCC or MCC). They are in dilemma -- to whom they should express such issues.

Some farmers from BC-1

- They have no idea about the outlet committee. If there is scarcity of water, they used to meet a member of the Main Canal Committee. If the problem persists, they used to visit upstream in the group otherwise the upstream farmers will threaten them. During monsoon, they have to go upstream for about 5-6 times to steal the water. They have to visit even *Kaparkhori* [194] to increase water.
- Several times they organised meeting to set a system of rules and regulation like in Ganganagar canal, but the farmers in BC-1 do not follow the rules.
- Farmers have no ideas what sort of rules and regulation the committee has for water theft and defaulters to pay ISF and penalty.

[194] See section 7.2.3 for an explanation of the relation of *Kaparkhori* to BC-1.

Box 6-3: Water users' observations about the WUA - SMIP, Nepal

SMIP: Observation from T-5 Water Users' School (Guidelines for Good Governance)

- Participants told that they are not aware how the existing WUG formed.
- Participants reported that they were not aware about the records of WUG & WUC. It was reported that there was no any record keeping system in WUG. Also reported that due to lack of proper recording system the activities were not transparent
- Participants suggested that rules & regulations should be formed and imposed for those who have kept illegal outlets and are involved in cutting the canal for irrigation.

The observations of our SRSP study team suggest that water users identify irrigation management with the *lashkar* (Irrigation Department ditch rider), rather than with their WUA representative. However, the *lashkar* is in the field only infrequently. He is considered ineffective in controlling unauthorised activities such as the placing of obstructions in the canal and in outlets, unauthorised diversion of water at night, and pumping water out of canals. These activities are common, and slow the flow of water down the canals and reduce the amount of water reaching the tail.

Water users in our SRSP site say they need "good leadership" to address these problems. At the time of our study the newly elected TC representatives had not been trained to take on their duties, and they had only had one introductory meeting one month following the elections. They were then faced with the challenging, and no doubt unrewarding, task of dealing with water distribution during a drought. Possibly, with suitable training and encouragement, the newly elected TCs could provide leadership to meet the wishes of water users as expressed to our study team. But it would seem that such leadership was not forthcoming during our field work[195].

Box 6-4: Water users observations about the WUA - SRSP, Andhra Pradesh

Farmers' opinion: 'WUA is not playing its role in fulfilling the responsibilities'

- Lack of proper data with the WUA members within the minor on the extent/increased wet land for which water is being used.
- The tail end farmers are suffering due to lack of irrigation to their fields for the last 3-4 years due to non-functioning of WUA role in water distribution and lining of canal, due to which even the seepage water is also not reaching their wells.
- Lack of communication on water release to the farmers. It should be streamlined and announced one month in advance with proper planning by the irrigation department. Same information is to be shared in the WUA meetings at the village level.
- Officials should delegate more powers to the WUAs.

Findings of EIP Farmers Workshop

(ii) Committee members' view of their own roles and responsibilities

On the whole, in all of our sites the WUA Chairman and committee members do not see their role as requiring them to get involved with "hands on" work in the field. They do not actively manage or

[195] However, during the Farmers' Workshop organised by our study team at the end of its field work in March 2005, the WUA President and TC members were active and enthusiastic participants. The President said he would do all that he could to improve water distribution. He proposed that the WUA would employ a 'community organiser' to help water users to improve their water management and to adopt more appropriate agricultural cropping and other practices.

monitor actual water distribution within the branch canal, leaving this to the *ad hoc* decisions and actions of the water users. Only in our Kyrgyz sites does the WUA employ staff who are charged with attending to practical irrigation management tasks in the field.

In Obu Haet and Jany Aryk the WUA Directorate is active, while the Council members seem satisfied to play a fairly passive role, leaving virtually all decision making and implementation to the WUA Directorate. The staff members on the WUA Directorate are well aware of their technical responsibilities for operating and maintaining the irrigation infrastructure. The *mirabs* acknowledge that they are responsible for allocating water and monitoring the distribution of water to individual water users. At least so far, the staff of the Directorate has not taken on the role of actively engaging with water users to make and observe rules that could bring about more equitable water distribution.

In KIS the Main Canal Committee (MCC) members are serious and committed in their role in managing the main canal, which they administer via the irrigation department-financed *karyadal* committee and the *dhalpas*. However, at the level of the Branch Canal, most decisions and actions are taken by the BCC Chairman, often with little if any consultation with other committee members. The lack of consultation is particularly evident in BC-2, but there are also some complaints in BC-1. The Branch Canal Committee members themselves express frustration with the duties they are expected to carry out.

Box 6-5: Opinions of two WUA committee members in BC-1 - KIS, Nepal

Chairman of BCC-1

- All BCCs are functionless. Only the WUA MCC is active.
- Water is sold for Rs 500 per night. Some farmers also paid Rs 500 to the *dhalpa*. He is influenced by liquor.

Secretary of BC-1 - Outlet 18

- To be an office bearer of the Outlet 18 committee is itself a challenging task. He said that being a secretary of the Outlet Committee, farmers used to come to his home to request water. He has no authority to increase water. If the canal was not defective then outlet 18 would have enough water. He has requested to improve the canal several times but no one is ready to do so.
- Water is diverted from BC-1 to BC-0. Who did it, farmers have no idea. There were no discussions among the farmers. He suspected that even Chairperson of BCC-1 had no idea. This is a symbol of manipulation of water turn and violence of rules.
- The Chairperson of the BCC should be representative to the WUA MCC. But in the case of BCC-1 there is no such provision. We should change our constitution.
- Water is lost due to seepage problem. If there is lining, it is in control.
- Outlet committee is also functionless. The committee has no legal rights to punish against defaulters.

In our study site in SMIP the committee members lost interest in the WUA once the project-supported rehabilitation work on canals finished. Since that time they have hardly met.

Similarly in Andhra Pradesh, it appears that the focus of WUA activity, since the passage of the APFMIS Act, has been on physical rehabilitation and maintenance. They were hardly involved in ongoing operation or maintenance tasks.

Box 6-6: Observations on some WUA officers - SRSP, Andhra Pradesh

The WUA Officer/Contractor

Mr. X.X., President of the WUA MXXR was the sub-contractor for the lining work of MXXR. The quality of work is poor. Also 3 kms of canal at the tail end of the minor is choked with silt and bushes. But no one (TC members and farmers) wants to take these matters up with Mr.X.X. directly due to his political and financial clout. He has [allegedly] bribed 5 to 6 TC members in order to become the WUA president. This in turn ensures his eligibility to contest to be president of the respective distributary body. Whether the allegations are true or not, the first impression is – local politics and dynamics are likely to be significant factors in MXXR

The Newly Elected TC Member

He got elected as TC member by a margin of 40 votes. Only the registered farmers are entitled to vote. He spent almost 20 thousand rupees for election. The president told him that he will pay him 30 thousand if he votes for him; but till now he has not paid that money to him. The president is also not giving any work to him so that he can get back the money he spent on getting elected. Before the election he promised farmers to put a pipe under the road. But the president has not given any pipe to him. Farmers are asking him to keep his promise. Since winning the election water has come only once. When asked about when water will be coming he told that officers are also not telling the TC representatives and therefore he himself could not tell us.

(iii) Water users' view of their own role

Water users generally recognise that they are supposed to make a contribution to the maintenance of the system, and most report that they take part in labour works whenever asked to do so by the WUA committee. They generally report that they engage in field level canal cleaning "by mutual understanding" with their neighbours. They also realise that they are required to make a payment for water, and to pay any penalties set by the WUA. However, they often accuse the WUA committees of failing to inform them of the timing and arrangements for fee collection, as well as of rules and penalties that have been passed. They generally claim that when properly informed they pay their fees, as well as any penalties charged against them. But many give the opinion that other water users do not. They often accuse the better off and more influential of failing to contribute labour when required, and evading payment of fees and penalties. This discourages everyone.

Box 6-7: Water users' views about Irrigation Service Fee collection – KIS and SMIP, Nepal

KIS: Views expressed at a meeting of Farmer Observers and Key Farmer Observers BC-2

For the collection of ISF, still they have negative thinking. Unless there are strong rules and regulation, it will be difficult to collect the amount. Big landowners are reluctant to provide ISF. In this situation, they suggested that both HMG and VDC should take lead role for the collection of ISF.

SMIP: water users' explanation for reluctance to pay ISF (participants in T-5 WUS – GGG)

- Reluctance to pay ISF due to scarcity of water
- Lack of transparency
- Lack of inventory (of farmers and their irrigated land area)
- Collector and venue for ISF payment is not clear
- Lack of clear rules
- Lack of penalty system
- Inactive SMIP (state irrigation project management staff)

(iv) The role of the state

Complaints against the state service provider

Water users have an ambivalent attitude toward the role of the state service provider and the transfer of responsibilities to a WUA. In all our sites at least some water users complain about the way the state provider performs its water delivery and irrigation system maintenance duties. They consider that water is not delivered predictably and that mismanagement by state employees sometimes deprives them of their fair share of the available water. They also often consider that the state service provider does not do what it should to maintain the canals, outlets, and gates. While the specific complaints vary from system to system, the concerns expressed by water users in our SMIP and Obu Haet, Kyrgyzstan study sites are characteristic of the tenor of the views expressed across our sites. If management by the WUA improves on this, then water users do not object to the establishment of a WUA.

Box 6-8: Water users' view of water management performance by the state service provider - SMIP

Water users feel that their sub-secondary is not receiving its "full supply". This is causing problems with water sharing, and particularly affects water users in the branches at the tail reaches, such as T5 and T6. Water users also feel that the high silt load in the irrigation water is causing problems both for canal maintenance and for the quality of the land on which the silt is deposited. Since the intake is remote from SS9E, and water delivery to the sub-secondary is managed by the SMIP *dhalpa (*ditch rider), water users tend to see the quantity and timing of water supply to their part of the system as purely a management matter, removed from the natural vagaries of the river. Water users want "SMIP" (the state project management organisation), whom they see as the service provider to their sub-secondary, to ensure that everyone receives more advance notice of how much water they will receive and when. This applies both to information that relates to anticipated supplies for the coming season, and also to timing and quantity of delivery within the season. The communication system which has been used in the past has favoured those who are well connected. It failed to reach poorer and more marginal members of the community, and women. This affects their ability to plan their cropping, and to organise themselves to ensure that they are on hand to guard and manage the water delivery to their fields.

Source: Guidelines for Good Governance, DfID KAR 8032

Box 6-9: Difference of opinion over water entitlement: an example of poor communication between the WUA (*mirab*), the RID, and farmers? - Jany Aryk, Kyrgyzstan

01 July 04 : Observations on the view of farmers at the Tail

For the last 15 days there are regular disputes occurring between farmers over the water. They believe that the core problem is in the AABC (Aravan Ak Bura Canal) Department management. Farmers are facing significant difficulties with water delivery: After half their field is irrigated water flow has significantly decreased and no water is coming into the middle and tail zones. They say that this leads to high water losses, since after they go and lift the gate it takes time for water to reach their fields. Another round of conflicts may start in a couple of days when the mulberry garden will require water for irrigation.

Farmers have reported to the *mirab* that there is a decrease. The *mirab* goes up to the head structure and lifts the gate so more water is released. Since there is no bolt to screw, it becomes very difficult to lift the gate. Still AABC Department staff keeps closing the gate. For instance on 30 June at 7:00 pm *mirab* went to control the gate, lifted it and by 11:00 am next day the gates were shifted down again. Often farmers go themselves and open the gate. The WUA Accountant and *mirab* stated that there should be 150 l/s discharge into Katta-Khaz-1, but AABC Department lets only 50 l/s to flow.

02 July 04: Observations on the view of the Head of AABC Department

The Department's staff stated that the water request from Katta-Khaz-1 canal for the 10 day period was for 50 l/s, but the WUA keeps opening the gates and taking more water. The study team saw the request, which was really for 50 l/s. It is surprising why the WUA keeps opening the gates if they know that they requested 50 l/s. However, farmers and WUA Accountant were saying that there should be 150 l/s coming into the canal.

Views on the financial implications of 'hand over' to the WUAs

Water users are less happy about the responsibilities, particularly the financial responsibilities that "hand over" to the WUA entails. They prefer the state to continue to finance the service, while allowing them to influence the quality of the service they receive. Water users recognise that the contribution the state makes to operating and maintaining the irrigation service is fluid and subject to the vagaries of politics. So they continue to hope that whatever finance the state is currently providing, it might provide more in the future.

Box 6-10: Water users' view on funding of system operation and maintenance - SMIP, Nepal

The irrigation system is still in relatively good physical condition, and the requirements for external resources to maintain it, other than the regular cleaning, are still relatively limited. Nevertheless, the water users looked to "SMIP" ("the project"), or some other external source, for funds to pay for what they consider special activities, such as the salary for a *dhalpa*, correcting damaged or incorrectly positioned structures, removing silt from a badly silted tertiary, or to access an alternative source of water for portions of T5.

Source: Guidelines for Good Governance, DfID KAR 8032

Box 6-11: Water users' view of the WUA Zone Representatives and Irrigation Service Fee (ISF) payment - Jany Aryk, Kyrgyzstan

Farmers at the Tail: Stated that it would be good if the system of Zone Representation worked, but it does not. They are quite indifferent as to whether the WUA Zone Representatives can do anything to improve water distribution. Maybe because they don't believe in it. They are rather more optimistic about representatives in the *aiyl okmotu (*village council*)*. Another reason may be that the WUA is not doing a proper job. Many farmers think that it is not ISF they are paying to the WUA, but 'water tax' as they call it. They tend more to have confidence in the *aiyl okmotu*, rather than on the WUA.

6.8.3 Levels of trust and cooperation in water distribution – an aspect of 'social capital'

(i) Overview

The observations in the previous section and in Chapter 5 show that irrigators do not feel that they can achieve equitable water distribution on their own. They, and particularly the poor, look to the WUA or some other powerful source of authority (e.g. 'the government', 'the project') to ensure order in the way that water is shared. They look to the WUA to provide the leadership to introduce and enforce acceptable and respected rules for improved water distribution. Without such leadership they doubt that it is in their interests to support the WUA or to conform to its rules. At the same time, the WUAs are unable to exercise such authority without the cooperation and respect of the water users.

But in SMIP and in SRSP, and to a lesser extent in KIS and our Kyrgyzstan sites, the performance of the WUA has often discouraged water users from having confidence in it.

One complaint is that the WUA does not keep water users adequately informed about their entitlements and obligations to access the irrigation service. As we observed in Chapter 5, a number of social factors make it difficult for WUAs to establish good relations and effective communication and coordination with water users. WUA administrative boundaries are based on hydrological boundaries, and landholders frequently have land scattered over several hydrological areas – sometimes under the jurisdiction of different WUAs. WUA committees and staff have to make a special effort to communicate effectively in these circumstances. Also, tenancies change through time, and it is difficult for the WUA to maintain contact either with the landowner (who may not be locally resident) or the tenant (who might change from year to year, or season to season). This changeabilty not only affects communication; it also makes it difficult for WUAs to maintain accurate records of water users. Furthermore, landholders who are commonly involved in off-farm employment as well as irrigated agriculture may be reluctant to take time to be active in multiple WUAs (e.g. attending meetings, getting communications, participating in labour mobilisation, etc.).

Even to the extent that water users are informed, they continue to be unhappy with the service they receive. They have mixed feelings, at best, about the willingness and ability of WUA committee members to improve water distribution. Some grudgingly accept that the WUA committee, or at least the Chairman, President, or WUA Director, may take action to improve water delivery from the main system to the WUA command area. In KIS water users acknowledged that water distribution between branches in the monsoon season is fairly well managed by the WUA MCC. But most are unhappy with the way the WUA manages, or fails to manage, water distribution within the WUA – generally at branch canal level and below[196].

Box 6-12: Monitoring of water discharge from Gitanagar to Devnagar - KIS, Nepal

Upon arrival in the field, the study team monitored the situation of water discharge from Gitanager to Devnager. There was a rumour that BC-4 has stolen the water without taking account of the concerns of upstream farmers. As a result, there is a problem of water for transplantation work. On the way to Devnager, we met Mr. C. P. T., a local farmer and discussed this issue, and expressed the following:

- BC-4 has stolen water on 24th March
- Normally they do such kind of activity in the name of cleaning the dirt and flush the water
- He wanted to know who ordered the gate to be opened, and why couldn't the *dhalpa* stop such illegal work. It is due to poor supervision of the *dhalpa*.
- Why is the Chairman of BCC-2 silent and reluctant to discuss the facts with the farmers?
- Because of the extreme water scarcity problem both oxen and labour have had to return from the field. Who will compensate those farmers? Is the BCC-2 Chairperson able to pay that amount of money for those victimized farmers? It was done secretly, otherwise there would have been a fight among the farmers.

While expressing these dissatisfactions with the WUA, most water users in our study areas say that they try their best to cooperate with their neighbours for water distribution. But, as we reported in Chapter 5, cooperation to share water in an orderly way tends to be limited to small groups of water users, often with fewer than 6 others.

[196] In Kyrgyzstan this would be within the branch canal; in Andhra Pradesh within the minors in the WUA command; in KIS within the branch canal; and in SMIP within the sub-secondary.

Most water users feel unable to do anything to make water distribution more orderly and systematic throughout their branch/tertiary/outlet, especially when there isn't enough water available to their portion of the irrigation system, and when water delivery is unpredictable. In these circumstances the selfishness and indiscipline of some people makes it difficult to share water fairly. Although they think "water theft" is wrong, even those who suffer from it have some sympathy with the motives of those who take water in this way – particularly when this is done to protect a crop.

Drawing on the concepts we referred to in our discussion of social capital in section 2.5.2, and the findings in Chapter 5, we can summarise these observations in terms of three features of 'social capital' for irrigation management:

- **Bonding**: farmers operate either individually or with small groups of water users with whom they share bonds of kinship or with whom they are field neighbours.
- **Bridging**: farmers tend to have very weak ties across portions of the irrigation system. The relationship tends more frequently to be one of competition for water, rather than collaboration for equitable sharing. In SMIP the possibility for collaboration is weakened by ethnic rivalry.
- **Linking**: patron-client (e.g. relationships between landlord-tenant, well-off influential farmers and poor farmers) are important in our Nepal and SRSP, Andhra Pradesh sites. They are less evident in our Kyrgyzstan sites, although personal relations between water users and the *mirab* are important. These links are sometimes useful to poor water users if the landlord or well-off farmer chooses to champion the interests of the client. But we also found that they discourage poor farmers from voicing complaints or taking action about the rule-breaking of the more powerful farmers.

On the whole the WUA organisation has done little to promote bonds, bridges or links that can make for more reliable, predictable or equitable water distribution to the farmer's field. Water users do not have a relationship of confidence or respect in the WUA's ability to protect the interests of all farmers in a fair way. Instead they rely on their individual resources.

(ii) Differences between well-being categories

Given this individualistic environment, the effect on water users in different well-being categories, with different livelihood assets and strategies, as we described in Chapter 5, is:

Poor: poor water users who are either informal tenants (Nepal) or not officially registered as landholders (SRSP) are not officially members of the WUA. But whether officially recognised as WUA members or not, these water users generally have little formal involvement in decisions about irrigation matters, are poorly informed about irrigation schedules and WUA activities and have little confidence that the WUA looks after their interests. They are in a weak position to take individual actions to protect their access to water.

Medium: medium water users are likely officially to be members of the WUA, but often they have little confidence in or respect for the WUA. They tend to disregard rules which may be passed by WUA committees, even if they hear about them. They are more likely to collaborate with a small group of other water users, but they tend to be pragmatic and to take actions as they see fit to access and to distribute the water available to them from the canal.

Well off: well-off water users are most likely to have influential contacts within the WUA. But, despite or because of their possible connections with the WUA, they are often willing and able to break water distribution rules without fear of punishment. Their actual, or rumoured, behaviour undermines the confidence that less well-off water users have in the WUA.

6.9 Summary and implications for water distribution

This chapter has shown that the WUAs in all of our study areas were established against a background of laws and constitutions that spell out their entitlements and obligations. They have a clear organizational structure, and they have full responsibility for the operation and maintenance of the portion of the irrigation system which has been allocated to them. They are authorised to generate funds and to organise the labour of water users to fulfil these responsibilities. They are required to develop and enforce the rules for equitable water distribution.

But we have found that while the legal framework has been in place, in practice in all of our study areas the WUAs have only met their formal obligations to a limited extent. In all cases the WUAs hardly engage water users in the governance of the system – including in the adoption of rules for its orderly operation and maintenance; and the WUAs do not enforce rules or help to resolve disputes. Communication between WUAs and water users is poor. Only in KIS, Nepal and in our Kyrgyz sites does the WUA make an effort to organize water users for canal maintenance. In SMIP, Nepal and SRSP, Andhra Pradesh WUA committees have operated primarily as contractors, using government or project funds to complete maintenance works. Fee collection is inadequate.

The WUAs on the smaller schemes we studied, KIS in Nepal, and the two in the Kyrgyz Republic are doing relatively better. KIS has had the advantage of receiving the most continuous backstopping. It enjoys the greatest level of grass roots interest and commitment to the ongoing functioning of the WUA compared with our other, less well established and supported, study areas. Those in Kyrgyzstan are still at the early stages of project-based support for WUA establishment. Farmers here are not yet disillusioned and they are still willing to pay fees and to cooperate with the WUA, but the WUAs have so far established only weak ties with their members. In contrast, the WUAs on the large schemes at our sites in SMIP, Nepal and in SRSP, Andhra Pradesh have received superficial attention as part of sweeping project-based campaigns of WUA promotion. Farmers have little confidence in a WUA leadership which has hardly taken on practical responsibility for operating and maintaining the irrigation system, let alone delivering an adequate and equitable irrigation service to the WUA members.

The obligations and performance of the WUAs we studied is summarised in Table 6.5.

We would argue that an important contributor to this poor performance is the way that the WUAs were set up. In all cases “Participatory Irrigation Management” (PIM) was introduced from the top and was associated with externally funded projects: three of our study sites have received major funding under World Bank Projects. One (KIS) received ADB and USAID funding and other external support. This funding provided for infrastructure rehabilitation as well as training of government officers and WUA committee members, and some sort of mass information effort. But the infrastructure activities have dominated both in terms of funding, and in the attention given to them. As a result WUAs have not been socially embedded in the irrigation systems which they are intended to serve.

Table 6.5: Summary of WUA obligations and performance

Aspect	Jany Aryk & Obu Haet, Kyrgyz Republic	KIS, Nepal	SMIP, Nepal	SRSP, Andhra Pradesh
GOVERNANCE				
Rule Development				
Obligations	To operate in accordance with legislation/constitution; to develop rules/bylaws; to approve rules (by General Assembly); to inform users of rules. WUA to be monitored by Government			
Performance	'Elections' held in 2002. No new rules formed by WUA executives since passage of WUA Charter in 2002. Little contact between users and WUA representatives – rely on directorate to impose discipline on water users.	Elections held regularly every 2 years. Some new rules developed by WUA regarding protection of physical infrastructure and punishment for water theft. WUA leaders are known and considered to do a good job at main system level – less so at lower levels. Rules formed and approved	Elections not held for more than 10 years. Main system by-laws passed in 2002, but with little user involvement. Few meetings and no rules passed at WUC level and below. Little contact between WUA committee members and users. Rules formed and approved, but not known by users who were not involved.	Elections held in 1997, then in 2003 (gap of approx. 1 year with no WUA representatives). Rules not formed by WUAs. APFMIS defines legal offences and penalties related to physical damage, pollution, and unauthorised tampering with the irrigation system. Little contact between water users and representatives – few meetings, poor attendance
Enforcement and Dispute resolution				
Obligations	Fine or bar members who break rules (by dispute resolution commission of WUA – can be challenged in courts). *Aiyl okmotu* may be involved	Each tier to enforce rules. No procedures for dispute resolution, WUA has no binding power. Must inform DOI of misuse	Judiciary committee defined, and WUC/HMG working team. Schedule of fines exist at some levels for some offences.	WUA authorised to fine persons who break the rules set out in APFMIS. Managing committee to resolve disputes between water users or organisations (e.g. lower level committees) within its area of operation.
Performance	Enforcement by directorate not council. *Aksakal* may be involved	Enforcement by Government not WUA. Traditional institution (*panchayati*) sometimes used.	Enforcement by Government not WUA. Traditional institution (*panchayati*) sometimes used.	Enforcement by Government not WUA. Local government institutions sometimes involved (*Gram Panchayat*)
	Practical difficulties in imposing sanctions – physically impossible to stop water, insufficient powers to resolve disputes or impose penalties. Insufficient awareness of obligations and responsibilities.			
COMMUNICATION				
WUA documentation and dissemination				
Obligations	Keep minutes, written set of rules, formal audited accounts, records of membership			
	Free access to information by users	Duty to maintain records and promote participation, but no right of access to information by users		Local government responsible for WUA records. but no right of access to information
	Good relations and communications with irrigation department, information on water flows to WUA. WUA expected to pass information on to users			
	Formal contract for water supply and records of delivery. Agreement of users contribution to main system maintenance	CID coordinate with WUA	WUCCC and WUCC coordinates with SMIP	AE designated as competent authority to advise WUA. I&CADD engineers formally accountable to WUA

Aspect	Jany Aryk & Obu Haet, Kyrgyz Republic	KIS, Nepal	SMIP, Nepal	SRSP, Andhra Pradesh
Performance	Erratic recording of information, incomplete and out of date member lists and area data. Users unaware of information available and see no need to refer to it – even the accounts. General scepticism of transparency (especially related to finance). Decisions often informal, undocumented, with little communication to users. Personal contacts most important means of communication – mainly related to irrigation schedules, not rules, fees or other contributions			
	WUA do not communicate with users. Only contact is with *mirab*, and only related to water distribution	Relatively good communications, good access to DOI field staff and WUA/BCCs	Users dissatisfied with amount of information given by WUA; rely on informal channels	TCs communicated between ID and users in first period of tenure (97-02) but new TCs inactive. Some information published in papers, TV,radio.
WUA management - technical support				
Obligations	Need for support and training acknowledged in all study countries and sub-projects			
	Regulatory agency has the 'right' to provide assistance	Policy to provide support and training – spelt out in Joint Management agreements		'Competent authority' appointed by government is responsible to WUA for implementation and execution of all decisions taken by farmers organisation.
Performance	Training given to new WUA committees, especially at initial stage of construction and WUA formation			
	District level support units formed. Training given to council and directorate on technical matters. Training of representatives now planned.	Long-term support and training through succession of projects	Some training at early stages, but little recently	Campaign managed by WALAMTARI, NGO involved, and training given to ID and WUAs. Targets achieved but poor performance
Water management and agriculture - technical support				
Obligations	WUAs supposed to promote efficient water management and improved agriculture in all sub-projects			
	To promote new techniques and reduce soil erosion/salinity	WUA should organise training, and DOI/DOA should respond to requests		WUA expected to promote economy in the use of water allocated.
Performance	Need for training recognised, but little done – particularly to relate agriculture to water management			
	Many people new to farming, poor technical knowledge; traditional water management very wasteful. Little training given (2% coverage) despite good literacy	Possible exception to above statement – relatively good training given	Users not reoriented to requirements of newly rehabilitated system, and to the formal reduction in availability of water to head and middle parts of system. Lack of awareness of design principles. Agricultural practices have not changed.	
MAINTENANCE				
Obligations	ID responsible for main canals, so that predictable supply can be delivered. WUA responsible for maintenance in their area (cleaning, repairs, protection) using a proportion of water fees and by organising labour contributions; farmers responsible at field level			
	No specific fund	Deposit 90% of money into a maintenance fund		No specific fund
Performance	Main system in adequate condition, capable of delivering required flows (this is limited more by fluctuation in supply in river)			Rehabilitated, so adequate condition except for key cross regulators yet to be built. Fluctuation in supply from river, despite reservoir.

Aspect	Jany Aryk & Obu Haet, Kyrgyz Republic	KIS, Nepal	SMIP, Nepal	SRSP, Andhra Pradesh
Main system	Recently rehabilitated	WUA contributes in kind to main system maintenance, in lieu of ISF	WUA may act as a contractor (using government funds?)	
Branch	Branch canal cleaning and some rationalisation of outlets needed (by OIP). Routine maintenance by WUA at OH but not at JA	BCC organises canal cleaning each season	Water users may work informally to clean sub-secondary and tertiary canals. WUA does not manage this.	Little work done or needed as recently rehabilitated
Outlets	Outlet channels cleaned informally by users	Outlet committees manage cleaning; sometimes relies on informal arrangements	Variable – some WUGs are active, collect fees and clean WCs, others rely on individual users	Managed by individuals
All levels	All levels: little monitoring, control of illegal structures, or canal protection; WUA may give tacit approval to illegal activities			
FUNDING				
Obligations	WUA to generate and manage resources for O&M of system, including a contribution for bulk water supply and main system O&M (to be paid to the supply agency). Rates set by government, but WUAs may levy additional maintenance charges.			Village revenue department to collect funds, WUA to manage expenditure jointly with I&CADD.
Performance	Most successful performance, may be paid in kind (crops+labour)	Declining collection rates (from 60% in 2002 to almost zero now), but users contribute labour for maintenance		Very low

WUA shortcomings in the interrelated functions of rule formulation, communication, maintenance, and fee collection have repercussions for water distribution[197]. The providers of irrigation services, facing resource constraints, look to water users to increase their contributions in order to keep the service going. But water users, who have experienced a decline in services, have poor expectations of the service they will receive. Because of these poor expectations they are less willing to pay fees or to contribute their labour for the operation and maintenance of the service. Further, lacking confidence or respect for the service provider, they are also often reluctant to observe the water distribution rules of the WUA. The irrigation service continues to be poorly resourced. Irrigation water continues to be poorly distributed or even gets worse. Water users have poor expectations, and so the cycle continues.

We can now bring together the findings presented in Chapters 5 and 6 to answer the social and institutional questions we posed in section 2.7:

- We have found that water users' livelihood assets and stratetegies, and water management are not conducive to equitable water management. The poor are particularly at a disadvantage in their ability to exert influence, and to adopt measures to gain equitable access to irrigation. But even better off water users feel frustrated with the way water is managed – and so they take expedient measures to at least meet their own needs.
- The history, rules and relationships governing the WUA have not resulted in organizations that are effective in performing their responsibilities, including the responsibility to ensure that water is distributed equitably in the field amongst all entitled water users, including the poor.

[197] In fact it has frequently been observed that poor performance of these tasks, together with poorly managed water distribution often interact to produce a deteriorating cycle of irrigation service delivery (e.g. FAO e-mail conference on IMT, 2001, Chambers 1988, Jairath, 2002).

As a result the three institutional requirements we proposed for equitable water distribution (section 2.5.4), have been only partially satisfied:

- **Rules**: according to the formal rules which establish WUAs, they should manage water so that it is distributed equitably. But no indicators have been defined, at any level, for judging if water has been distributed equitably.
- **Organisations**: WUAs have been established. But they have not been willing or able to apply and enforce rules for equitable water management amongst water users. State, local government and traditional mechanisms for dispute resolution are also ineffective, on the whole.
- **Willing and able water users**: despite what they say, in many cases water users are either unwilling or unable to enter into institutional arrangements so that water is distributed equitably – especially when water is in short or unpredicatable supply.

In the following two chapters we will look more closely at how the institutional environment has interacted with the structural characteristics of the irrigation systems, and actual water distribution practices, to bring about particular equity outcomes.

7 Water distribution - existing formal systems

7.1 Introduction

This chapter describes the existing systems and procedures for distributing water to the users, in accordance with the requirements for their crops (and other uses of water). It starts with a description of water rights and allocation (section 7.2), the suitability of the infrastructure for delivering water in accordance with these rights (secion 7.3) and concludes with a statement of the formal rules and procedures which should be followed by the water managers when managing the existing infrastructure at each level of the system (section 7.4). This is a description of what *should* happen. We report on our observations on what actually happens in the next chapter (Chapter 8)

7.2 Pre-season planning: water rights and allocation

7.2.1 Introduction

The focus of this study is on the practice of field-level water distribution, and we did not consider in detail the planning process behind this[201]. But it is clear that planning for water distribution is weak in some places, so we will touch briefly on water planning practices here.

Rational distribution of water depends on having a plan against which actual distribution can be monitored. This may be, and often is, a very simple plan – such as sharing available water proportionate to land area - and it may not be formally documented in advance of the season. In other cases it may be developed on the basis of a systematic process of crop planning, assessment of resources, negotiation over cropping and preparation of a formal contract. The plan is likely to be dominated by irrigation requirements, but there may be additional demands – for example the need to ensure continuous availability of water for domestic purposes. Canal closures for maintenance may also be built into the plan.

Such a plan may not always be followed or monitored, but it is a pre-requisite for rational distribution. If there is no plan there is no reference for how water is supposed to be distributed and this makes monitoring for management difficult or impossible. Problems also arise if there is a plan, but farmers do not comply with it. Some farmers may try to take more water than they have been formally allocated – and this affects water availability for other farmers. Thus we examine the situation in the case study sites here as a basis for evaluating the performance of the distribution system and identifying potential for improvement.

All the WUAs in our study are required to promote the most efficient use of the water available, with an expectation that they will encourage water users to make the most appropriate choice of crops to promote this. The context for crop planning differs between the Kyrgyz Republic, where an unlimited supply of water was assumed when the irrigation systems were designed, and India and Nepal, where from the outset it was expected that a limited supply of water would be spread relatively thinly across the system. However, in all cases farmers are now free to choose the crops they will grow, with some limits on the area of rice that is permitted.

[201] We do, however, consider the social and institutional relationships that influence farmers' willingness to adhere to a plan. This was discussed in Chapter 5.

7.2.2 Water rights and entitlements

It is first necessary to consider water rights. These are not usually rigorously defined on public irrigation systems in Asia, and are guided more by the design principles adopted for the irrigation system than an absolute right to water: farmers do not have enforceable rights to water. There may also be restrictions on what types of crops (particularly rice) that are permitted to be grown, in order to limit the amount of water required.

There is a system of allocating water rights through a licensing process in Nepal, but virtually all non-industrial uses are exempt from licencing. There is a ranking of priorities in allocating licenses, in which domestic uses are first, followed by agricultural uses (including livestock and fisheries) and then hydropower, industry, navigation, recreation and other uses. This is largely academic to the present discussion as most of these uses are exempt, but it suggests that domestic uses should also be given in priority *within* the irrigation system. Such licenses, if they were given, would be for the irrigation system as a whole (and thus might include a number of WUAs) and would not confer individual rights.

Registration of WUAs does not serve the same purpose as a water use licence, but is required for administrative purposes and to ensure accountability of the WUA to both the government and the users. However, it does provide for obligations to be met by the WUA. They are required to ensure '*a fair and equitable share of the irrigation water*' to their members in the Kyrgyz Republic [202], and '*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*' in Nepal[203]. The WUA in SRSP/AP is supposed to distribute water among water users on agreed terms of equity and social justice (based on APFMIS Act 1997 and Rules issued by the Government of Andhra Pradesh). These policy commitments are reflected in individual constitutions: both KIS and SMIP stipulate a commitment to distributing water on an equitable basis. For example, at KIS the WUA is required to "*distribute water proportionally within its command area and stop its misuse.*

Although in SRSP/AP, as in India more generally, there has been an ongoing discussion of the social justice of linking water rights to land size (Chambers, 1988, p.37), in all of our study areas equity is essentially defined as proportionality of water rights to land size. The *warabandi* principle of water sharing, commonly used in northwest India, was strongly promoted in AP in the late 1970's and early 1980's (Chambers, 1988, p. 93) and was formally established in SRSP in 1997. SRSP and SMIP are both structured irrigation systems (Albinson & Perry, 2002) where water is supposed to be automatically distributed in proportion to irrigated area down to the level of the pipe or watercourse. KIS in Nepal was not designed in accordance with this system, although it has been added retrospectively as an operational requirement. Irrigation systems in Kyrgyzstan were also not designed on this basis although the *warabandi* system has recently been introduced on an experimental basis in the Kyrgyz Republic and is being pilot tested in Jany Aryk (but not in our study area).

The joint management agreement at SMIP in Nepal has some further provisions related to entitlements to water. The agreement for SS9E between the WUC and the Project Office allocates a specified volume of water but not the duration that it will flow for - "*the Canal will run regularly in full design capacity of 931 lps in all rotational periods of the schedule*". However, the schedule is not defined in the agreement and cannot be specified in advance as this depends on availability in the river. The irrigation department is thus not committed to deliver any particular total amount in the course of the

[202] WUA Law article 9
[203] IR 5

season. An overall projection may be made, but this is subsequently adjusted to suit availability during the season. The flow may be monitored by the WUA or Irrigation Department but there is no legal recourse if the flow is different from planned, nor (unlike in the Kyrgyz Republic) is any payment calculated on the basis of these flows. The WUAs are responsible for keeping water users informed of the delivery schedule, and any changes to it. This is "*determined with consideration of water availability at Chatara Main Canal (CMC) and appropriate distribution to all water users of the project area…. and is informed through WUA prior to operating the canal in each season." The agreement states that "this is fixed in consultation with WUA*" although there is some ambiguity over the precise role of the "WUA" in this agreement as it is made with one of several WUCs in the registered WUA[204], which itself only covers part of the whole system. Factors to be taken account of when deciding the schedule include location, area, water available in the source, type of crop, nature of soil, capacity of the structure and other technical matters[205].

Both KIS and SMIP were designed to provide supplementary irrigation for monsoon rice under conditions where the water supply from the river source is highly variable both within and across seasons. When the Joint Management Agreement at KIS was initiated in 1995, spring rice was cultivated only in BC-1 with an irrigated area of 192 ha, with most of the remainder of the land being fallow in this season. Subsequently the interest in growing spring rice grew and the WUA Main Committee made a decision to allocate the available water between BC-1 and BC-2 in a ratio of 75:25. The remainder of the KIS command area would continue to have to manage with rainfed (or no) crops in the spring. In SMIP Under typical rainfall conditions the Chatara Main Canal can irrigate only 50% of the area in the monsoon season (out of 58,000 ha), especially during the period of peak water demand (SMIP, 1995). The system was designed on the assumption that each individual farmer will get assured irrigation for 50% of his land, and in the remaining 50% the farmer takes the risk with rice cultivation. Although this is written into the operation manual, it is not acted on – nor is it clear how this principle could be applied in practice. Field to field seepage makes it impossible for farmers to grow non-rice crops and thus almost all grow rice on all their land in the monsoon and make personal decisions on how to distribute water within their plots[206].

In AP irrigated areas are classified as Irrigated Wet (IW) or Irrigated Dry (ID), under a legal procedure known as 'localisation'. In IW designated areas, all crops may be grown. In ID designated areas, rice and sugarcane are specifically banned under the provisions of the 1984 Irrigation Utilisation and Command Area Development Act. Under APIP III a Government Order was issued to 'de-localise' SRSP to change it from an IW to an ID regime. However, these provisions only apply to the use of water from surface irrigation. There is no formal restriction on the crops an individual may choose to grow, but it is assumed that more water intensive crops would be irrigated through use of groundwater. Indeed one of the tasks given to WUAs is the promotion of groundwater development – although the close link between the availability of surface and groundwater does not appear to be formally recognized.

When considering entitlement to water, a potentially contentious issue is the significance of

[204] The registered WUA (the WUCC) covers the entire secondary canal and there are several WUAs in SMIP, which are co-ordinated by an umbrella organisation – the WUCCC (see section 4.2.3)

[205] IR, rule 21(2).

[206] Local topography, soil type and configuration of the field relative to the watercourse or field channel will influence whether a farmer attempts to irrigate all or part of his plot. There is no awareness by either the WUG or the users that they should stop once they have irrigated half of their plot at times of shortage. Instead, they believe that each farmer's share should be a standard duration per unit area at such times (ie a *warabandi*, rather than defined order of irrigation as defined in Table 7.5)

"membership" in the WUA. In all our study areas the legislation requires WUAs to supply irrigation water to their members[207], but only in the Kyrgyz Republic and Andhra Pradesh is there explicit provision for the supply of irrigation water to non-members. The Water Law in the Kyrgyz Republic states that members should receive water on the basis of annual agreements between the member and the WUA, while non-members can enter into a contract with the WUA to receive water, provided they own or use irrigated land within the WUA service area. In Andhra Pradesh, the WUA can allocate water to members and non-members, and tradable water rights can be transferred to any user within the WUA operational area. On the other hand, in Nepal, when referring to the supply of irrigation water WUA legislation and the WUA constitutions only refer to water *users*, without explicitly linking water entitlements to "membership". There appears to be an implicit assumption that all water users who qualify for membership (i.e. owners or tenants) are automatically members of the WUA, and are entitled to receive water. Indeed the Joint Management Agreement between DoI and KIS WUA (1995) states that "*all farmers [who have been using water for several years] will have right to use water*". This wording has created ambiguity about the rights and obligations of non-member water users, such as sharecroppers, informal tenants, and landless water users informally occupying government land (*ailani*).

The Kyrgyz Republic is the only study location where the WUA enters into a formal contract which makes the irrigation agency (the *Raivodkhoz*) responsible for supplying a fixed amount of water to specified division points in the irrigation system[208]. Although WUAs are expected to share water equitably (with the implicit assumption that there will at least occasionally be shortages, irrigation systems in the past were operated under an expectation that the supply of water would satisfy total demand. This has left a legacy of a belief that users are entitled to as much water as they want: water users believe that they are only expected to submit their cropping plans so that these can be aggregated by the WUAs and used as a basis for the water supply contract with the *Raivodkhoz*. However, WUA legislation does makes WUAs responsible for ensuring that water is used rationally, and for preventing over-watering of irrigated crops.

In conclusion, farmers do not generally have a right to a specified quantity of water. They have a right to a proportion of the available water (usually proportionate to the area of land farmed, in some cases adjusted to suit crops grown) – which is constrained by the availability of water in the source and the nature of the infrastructure. Reliability of water in the source differs between sites. In Nepal, there is no storage, and streamflow is largely dictated by rainfall - but high rainfall brings high sediment loads which may necessitate closing canals. In AP, there is a large storage reservoir for SRSP but low rainfall in the catchment of this reservoir as well as large diversions further upstream which meant that it was unable to provide irrigation water in 2004. The Kyrgyz Republic sites have the most stable flows, as these are controlled by snow-melt and partially regulated through the Papan Reservoir

In all of our study sites, water users believe that they are entitled to as much water as their crop needs.

7.2.3 Allocation of water

Allocation of water is the process of specifying, in advance, how much water each WUA (or sub-unit) and farmer is scheduled to receive, and when it is due to get this[209]. Approaches to pre-season

[207] The definition and qualifications for membership are discussed in section 5.2.2

[208] At the time of water delivery a receipt is supposed to be signed by the *Raivodkhoz* and the WUA representative, and the WUA pays only for the amount of water actually received.

[209] The concept of water allocation is closely related to water rights, particularly given the very loosely defined rights in the case study areas

irrigation planning vary significantly between countries and projects. In some countries, strict crop plans and hence watering plans are drawn up in advance and irrigation water is delivered in accordance with this plan, but in most cases there is no formally documented plan.

Allocation can be done on a volumetric or area basis. Volumetric allocation has theoretical advantages for optimising use of water, but it is much more difficult to monitor because of difficulties in measuring flows. It is used for allocation of water from the *Raivodkhoz* to WUA in the Kyrgyz Republic, but not to individual farmers. The study sites in India and Nepal use purely area-based systems of water allocation.

(i) Sunsari Morang Irrigation Project

At SMIP in Nepal, there was traditionally a single season of rice monoculture, which made water allocation simple as everyone requires the same amount of water per unit area[210]. There is still almost a rice monoculture in the monsoon[211] but now there are large areas of wheat in winter and rather smaller areas of rice in spring. A slightly more sophisticated method of allocating water is needed for these seasons, but the planning systems have not evolved accordingly so farmers simply assert an informal claim to water by planting a crop.

The project office is required to develop a rotational schedule for secondary and sub-secondary canals in consultation with the WUA for each season. This basic schedule is different in winter, spring and monsoon seasons, and may need to be modified during the season if there is a drought. The canal flows are intended to be constant and full design flow or zero – the only decision to be made is the duration and timing of flow, and not its magnitude (which is defined in the joint management agreement). A ‘normal’ duration (4 days out of 8 days) is now accepted practice but this may be varied by the project office in consultation with the highest (project-wide) level of the WUA to suit availability of water in the river (and sometimes if sediment loads mean that diversions need to be reduced). This information is not always made available to the lower levels of the WUA, and the farmers are therefore often unaware of when water will be made available.

No planning is needed for allocation between tertiary canals and watercourses since this is defined by the infrastructure. Allocation within the watercourse is the responsibility of the WUG, but this is simply assumed to be an equal entitlement per unit area for all farmers. The detailed arrangements for timing and order of irrigation are left to the farmers to negotiate with each other.

Water allocation at SMIP is thus simple and essentially defined by the infrastructure, but it is inflexible to cope with local variations in water requirements. There are also problems here caused by the farmers’ understanding and acceptance of the design principles.

(ii) Khageri Irrigation System

Khageri is also traditionally an area of single-season rice monoculture, and thus allocation of water in the monsoon is simple. There is increasing demand for winter and spring season cultivation for which

[210] Although as we will discuss later the water delivery requirements per unit area do vary according to topography and soil type, even for the same crop – some water may be received by sub-surface seepage rather than directly from the canal system
[211] The freedom to choose alternative crops is limited by seepage from neighbours’ land which will usually damage non-paddy crops in these areas.

there is insufficient water, and thus a water allocation system is needed. In this study we focus on the spring season, which is the most critical[212].

At KIS, a standard allocation for the spring season was made some time ago by the WUA: 75% of available water is allocated to BC-1 (including BC-0) and 25% is allocated to BC-2, and procedures (gate openings and times) have been agreed to achieve this allocation. These are areas of rice monoculture, but there are significant variations in water requirements with low-lying *ghol* land requiring much less water than the relatively higher *tandi* land.

The WUA also lack formal systems for sharing water *within* branch canals, which is the responsibility of the BCC.

- In BC-1 the BCC allocates water to all farmers in all outlets equally by area, but with the knowledge that they will not be able to deliver water to all – the tail areas of large outlets and the tail of the branch canal will inevitably suffer from shortages. This means that some farmers do not know in advance whether they will receive water (they can only speculate, on the basis of past experience, as to whether they will be able to irrigate). This approach leads to frustration, conflict and waste of resources in abandoned crops.
- In BC-2 the key decision is which outlets will be allocated water: this is decided by the branch committee although the decision process is neither transparent nor well-communicated to the farmers. The selection of these outlets was disputed and referred to the main canal committee in 2004 as there was some disagreement over an outlet which received water in 2003 but not in 2004. In this branch canal, there are relatively large areas of *ghol* land which uses seepage or return flows and needs much less water per unit area. There has been no formal calculation of the relative water requirements, but the BCC decided in 2004 to allocate a small flow to the *ghol* area rather than one outlet irrigated in 2003 as the believed that the same amount of water would benefit more farmers.

The process within branch canals is thus informal, but so far it has been possible for the WUA to negotiate a consensus. This is supported by the local social convention that once someone has transplanted rice he or she will have a right to sufficient water to protect it against crop failure later in the season. However, this convention does not give any protection to someone who has only managed to plant a rice nursery – some farmers in BC-1 abandoned nurseries in 2004 because they were unable to get sufficient water to prepare land and transplant the crop.

There have been two further developments which affect the water sharing rights in the system as a whole:

- Some branch canals (notably BC-4), further downstream in the KIS system, now want to use irrigation water in the spring season, particularly for irrigated maize which has recently become a popular and profitable spring crop. This requires release of some water through the cross-regulator at RD 38,000 and thus takes water away from BC-2's share.
- A direct offtake close to the main intake at Kaparkhori (ie far upstream of BC-1) now takes a significant amount of water. This does not directly affect the agreement between BC-1 and 2 as they are only required to share the available water. But as the Kaparkhori offtake is further upstream, the farmers in this area are physically able to take as much as they want without regard to the needs of downstream users (see Figure 4.2).

The long-established allocation between branch canals is thus now increasingly being contested, and the weak allocation systems within branch canals are leading to conflict. These are not as yet serious

[212] Winter wheat requires little irrigation in this area, and is largely grown on residual moisture supplemented by rainfall.

issues and are being resolved by negotiation between individual farmers and the WUA, but the WUA will need to take a lead in improving the allocation system to cope with increasing demands for water in the future.

(iii) Sri Ram Sagar Project

The allocation process is slightly more complex at SRSP where the system is much larger, the main canal acts as the raw water source for urban water supplies, and there is (or should be) diversified cropping[213]. The Irrigation Department first assesses the area that can be supplied with water, taking account of the availability at the system level which can be estimated from the storage in the Sri Ram Sagar reservoir. This should then be discussed with the WUAs for planning within their command area (taking account of the localisation). Water demand can then be calculated and the water supply schedule discussed and finalised in a meeting with the WUAs.

As noted in chapter 6, the objectives of the WUA include promoting distribution of water among its users, optimising agricultural production, and protecting the environment. As part of this they are required "*to prepare and implement a* ***warabandi*** *schedule for each irrigation season; consistent with the operational plan, based upon the entitlement, area, soil and cropping pattern as approved by the distributory committee, or as the case may be, the project committee*"[214]. This requires them to give guidance to the farmers before each season on which crops they should grow and the area that can be irrigated, given the water available in the system. TC members and farmers are expected to draw up a schedule of the crops they want to grow and when they want water; this is then consolidated at the WUA level. The DCs then decide the rotation and draw up a water schedule, and then discuss and finalise with the EE. Finally, a meeting of all DCs with EEs and the SE is conducted to decide overall water rotation/schedule.

In practice, this has not happened: there were no WUAs from 2002 until 2004; and even after the new elections the officers had not taken over charge of the WUAs, nor had they received any training on how to conduct the tasks of the WUA by the time we completed the fieldwork in 2005. Although the DC existed before 2002, they were not formed after the new WUA elections. The procedures were not even followed before 2002 under the old WUAs, since the farmers grew rice despite this being localised as an ID area. A precedent of growing rice in this area dates back to the time when the scheme was smaller and water was more readily available: they are now very reluctant to grow ID crops.

(iv) Kyrgyzstan

Even in the Kyrgyz Republic, where there is a formal pre-season crop and irrigation planning process, the actual practice is often looser and more informal than it would appear. The crop plan (and associated watering plan) may only be finally completed after the crops are sown[215]. Nevertheless, preliminary plans are used as a basis for planning bulk water supply agreements to the WUA, and for

[213] This area is intended to be cultivated with irrigated dry (ID) crops but is in fact cropped with more water-demanding paddy. The added water needs of paddy are supposed to be met from groundwater, but it is often irrigated directly from surface irrigation, or via shallow wells which are supplied directly from canals. Even wells which are not directly filled from the canals are dependent on seepage from canals and fields: surface and groundwater are inextricably linked here but this is not formally recognised or allowed for in planning

[214] APFMIS Cl 17

[215] This was the practice we found in our study sites.

agreeing a water delivery contract for the season. Plans may be updated during the season, or there may be a system of indenting for water as needed by the individual water user.

Nevertheless there is presumed to be ample water and the farmers are free to grow the crops of their choice, with the exception that only 0.1 ha/household of rice is permitted in Obu Haet. The formal procedure is that the WUA should draw up a crop plan before the start of the season, usually in March. This is then used for preparing a watering plan. Fairly simple methods are used, but more rigorous procedures are being introduced through OIP. In practice, the plan is drawn up by the *ayil okmotu* and is known as the *Indicative Plan on Agricultural Crops*. This represents a preliminary plan or assessment of the crops that they are planning to cultivate in the following year. Such kind of plan, however, reminds people of the rigid croping plans that were prepared during the Soviet Period. It is now considered as “paper plan’ rather than something to be followed[216]. Each farmer now owns his own plot of land with full rights to plan and to grow any crop he desires: users do not expect the WUA to influence their crop choice[217].

The watering plan forms the basis for the WUA to negotiate a contract with the *Raivodkhoz*, specifying the volume of water to be delivered (and paid for) in each 10-day period. The WUA buys this water by volume and sells it to farmers on an area basis. Thus, in principle, it has an incentive to maximise water use efficiency by farmers[218]. In practice, however, the initial watering plan is very crude, the water supply contract is based largely on the previous year’s contract (adjusted by *Raivodkhoz* to suit their estimate of supply availability) and the crop plan is not in fact finalised until the crop was planted

There is normally 10-20% difference between the planned and actual cropping, therefore the irrigation plan does not fully reflect real cropping patterns and water needed. However, rather than make further adjustments to the pre-season contract, the WUA revises its requests to the *Raivodkhoz* prior to each decade. This is nominally done on revised requests submitted by each farmer to the *mirab* 3-4 days in advance, but in practice is done by the WUA on the basis of its own estimate of needs.

(v) Conclusions

Crop planning and water allocation is thus fairly crude in all of our case study sites, for a variety of reasons. It is rarely done systematically or documented. Kyrgyzstan has, on paper, the most systematic process and the WUA do prepare some formal crop plans. However, even here, the plan is subject to considerable uncertainty and modification and it was not clear in our study areas exactly what crops the farmers were going to grow until the crops had been sown. Some key observations on water allocation is summarised below:

- In SMIP (Nepal), the joint management agreement specifies the amount that will be supplied (expressed in m^3/sec), but does so in a way that allows the supply agency to reduce the duration of supply if the availability in the river declines. In practice, there is an agreed ‘normal’ duration of rotation, but this may be reduced by the project office after some consultation with higher echelons of the WUA (but not with the users or their immediate representatives). A similar system is applied at SRSP (India);

[216] The *ayil okmotu* should analyse the implementation of *Indicative Plan* at the end of the season and use this as part of the following year’s planning process.
[217] In theory, farmers’ crop plans may be adjusted by WUA but in practise this does not happen: farmers assert their rights to water by planting a crop rather than by having a crop plan approved.
[218] the difference between the buying and selling prices comprises the net revenue available to the WUA for salaries and other expenses

- At KIS (Nepal) each branch canal is assigned a pre-defined percentage of the flow – but there is no agreement (or advance knowledge of) the magnitude of this flow, which is dependent on climatic factors and out of anyone's control;
- In Kyrgyzstan a contract is prepared at the start of the season, specifying the volume that will be supplied in each 10-day period. This is nominally prepared on the basis of a crop plan, but in practice is more commonly based on the previous year's plan; and
- In China, a similar approach is used to Kyrgyzstan although there is a greater restriction over planned supplies to the WUA as there is insufficient water to meet the demand.

There are many reasons for the *laissez faire* approach adopted in the study countries, including:

- A lack of understanding of the reasons for preparing a crop and watering plan, and the ways that this should be used;
- Poor systems for planning for and coping with droughts: these irrigation systems are designed to provide water during a 1 in 5 dry year – irrigation water shortages are expected in drier years. In supplementary irrigation schemes, however, this is precisely the time that farmers expect a reliable irrigation supply;
- A desire to conceal unauthorised cropping (notably rice at SRSP, where it is intended and planned that ID crops should be grown);
- Because monoculture makes sophisticated planning unnecessary. Rice is almost universally grown at SMIP and KIS, and there is little recognition of the need or value of agreeing in advance the order of transplanting. In practice this is influenced by many factors (such as labour availability, cash flow considerations) and cultivation thus starts in a 'patchwork' rather than systematically along the canal;
- A wish to break with unpopular past practices associated with the Soviet regime. In Obu Haet and Jany Aryk, where rigid crop plans were a feature of the old system, farmers now believe they should have the right and freedom to choose what crops to grow and when, and that it is their right to whatever water they need for these crops; and
- Weak procedures for coping with significant drought, which cannot be predicted but can be expected to occure once in five years.

7.2.4 Implications of entitlements and water allocation for water distribution

It is apparent that water allocation is to a large extent decided in advance by the irrigation department or WUA: farmers simply need to plan how to cope with this. It is only in Kyrgyzstan that there is, even on paper, any systematic process of crop planning and developing a water supply schedule to match this. In all cases, however, there is a perception (held by both farmers and officials) that actual water distribution is not related to allocation and that there is little need to devote effort to an exercise which is seen to be theoretical.

This weak planning and allocation process has important implications for subsequent management of water distribution:

- These weak systems give people no confidence in their entitlements – they have no legally enforceable rights, nor confidence that the system would deliver whatever these entitlements are;
- People incorrectly assume, however, that they are entitled to whatever their crop needs: they consider anything less than this to be a system or management failure – not an inevitable feature of the irrigation system which they must cope with;

- Variations in water requirements between fields in a single system (due to soil type, drainage conditions, quality of land levelling etc) mean that farmers do not all want the same duty per unit area. This can be compensated for by manipulating notional areas but this has implications for fee collection and maintenance. In SMIP some farmers are 'recorded' as having two different areas of land – one for ISF purposes and one for water distribution; and
- Illegal crops (eg rice in SRSP) can be masked by making sketchy plans, or vague assumptions about use of alternative sources of water, but subsequently farmers will try to take water from the canal system for these crops.

Thus there is an important need to improve the understanding of entitlements and the crop planning and water allocation processes. A common problem in all the study countries is that farmers are not aware of or do not agree with the plan, or they do not believe that it will be followed. In this situation they sometimes take more water than they need (or want) as an insurance policy against possible delays in future deliveries – depending on the crop and irrigation methods they may be able to store water in the soil or on flooded fields.

As there are inevitably restrictions on supply (either because of canal capacity or limitations at the source), the crop planning and water allocation processes must involve higher level management organisations. There needs to be some form of contract between the main system manager and WUA that the end-users are prepared to accept. Planning on the use of this water internally needs to be managed by the WUA, but certain principles may need to be defined at a higher level (eg. localisation in AP, restrictions on rice in the Kyrgyz Republic, etc)

To resolve these problems, the WUA must negotiate and agree on the principles for allocation between users within the WUA, taking account of local variations in requirements. But its success will depend on strengthening the relationship between the water users and ensuring that water users are willing to accept the rules and penalties. We have seen that 'institutional development' of the WUA has failed to achieve this so far, but this is something we endeavoured to resolve during this project, using the measures we describe in Chapter 9.

7.3 'Fit' between physical layout and management system

7.3.1 Introduction

Irrigation systems comprise a complex network of canals and structures which need to be carefully operated and managed. They were designed (whether explicity or implicitly) to suit centralised management, and we should not assume that the management system can be changed without making changes to the canal layout or structure types. In this section we look at the existing layout of the irrigation schemes and at how well-suited this is for the new decentralised management systems which have been introduced.

Changing the responsibilities for management is often problematic. As well as potential distrust over motives which we have referred to in Chapter 2, there may be a mismatch between the physical layout and the proposed new management system.

7.3.2 Change management

Managing change is difficult in most contexts, and irrigation is no exception as it affects the interests and livelihoods of so many stakeholders. It is more curious, perhaps, that the experience of change management in other business sectors has not been applied to such a large and important enterprise as irrigated agriculture[219].

There are examples of successful and largely spontaneous management transfer, but these are extremely rare and have only occurred on a relatively small scale. A notable success is at Pithuwa in Nepal, which was built and managed by the government for a short time before being taken over by the farmers. This was a small underperforming scheme where the farmers were both influential and committed to the irrigation system. They initiated and led a process of reforms to both infrastructure and management systems. This included modifying the system to make it suit the way they wanted to manage it (Pradhan, 1996)[220] .

Farmers usually request rehabilitation before they are willing to take over a scheme, but the change in management may require more than simply rebuilding what has collapsed - as in the case of Pithuwa, a change in type of offtakes or other control structures may be needed. Usually there are limited resources available for this: the West Gandak scheme in Nepal had a complex layout which was difficult to manage, yet transfer was attempted without solving the basic problems resulting from the layout[221]. In this case, there are many variable controls in the main system, which require strong management to ensure equitable distribution and there are a large number of branch, secondary and direct tertiary canals, of varying sizes (50 – 2,000 ha) from the main canal. This made it particularly challenging for the users, and ultimately management transfer failed (HR Wallingford 2002).

Management transfer SMIP in Nepal was part of a more coherent package of modernisation, rehabilitation and management reform: there was a comprehensive review of the system (Nippon Koei, 1995), which led to extensive reconstruction, including replacement of the gated structures with weirs and fixed controls. Unfortunately there was not sufficient consultation with the farmers (and possibly also with DOI) during this process, and hence many farmers and managers either do not agree with or are unaware of the reasons for (and consequences of) these changes. An intermediate approach was adopted during rehabilitation of Khageri: the need to simplify the system was recognised, but they did not have the resources to replace the gates with fixed control structures. However, there was a better process of consultation, and the farmers are better able to cope with this compromise layout.

In SRSP, there was also a combined physical rehabilitation and institutional reform, but this was less comprehensive than at SMIP – possibly because of the scale of the system, but also there was probably less acceptance of the innovations by I&CADD (at all levels). In both cases there was inadequate consultation with the users – which is an enormous task on such large systems.

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[219] Martin Burton discusses this in detail in his MBA thesis (Irrigation management transfer: a study of change management, Henley Management College, 2003). He stresses the need for strong leadership, but also the importance of delegating and creating local leadership at a number of levels. He found that success was more likely in case where institutional aspects have driven the programme and cautions against using IMT as an excuse for rehabilitation without any intention of transferring responsibility. He also found that IMT needs to seen in the context of democracy and empowerment in society in general. Finally he warned against ‘declaring victory’ too soon.

[220] Whilst this is an interesting successful case study, it is unfortunately unlikely to be replicated spontaneously on a much larger scale in Nepal, due to the small size and simple nature of the system, with strong social homogeneity and good links with DOI which enabled them to get timely assistance.

[221] Other complexities are that the headworks are on an international boundary, and are managed by India rather than Nepal. There is also a very high sediment load, which could not be resolved during rehabilitation (measures to exclude sediment failed, and the resulting requirements for excavation of sediment from the canals exceeded the capacity of the WUA).

7.3.3 Comparison of farmer-managed and agency-managed irrigation

As successful farmer-managed irrigation is one of the sources of inspiration for irrigation management transfer in Asia, it is instructive to consider first the differences between farmer managed irrigation and agency managed irrigation. Despite some problems, Farmer Managed Irrigation Schemes (FMIS) are one of Nepal's clear agricultural success stories, and it is tempting to assume that transferring management of agency-managed schemes to the farmers will automatically solve the problems. This is clearly an over-simplification, but there are some lessons which can be learned from FMIS. As Zwatreveen (2006) notes: "*FMIS studies have in fact been, and continue to important in feeding the strong belief in the importance of local institutions for irrigation management. They have served as an important source of inspiration for theorizing about the principles, conditions or rules that characterize successful irrigation institutions*."

A key feature of FMIS is that the physical infrastructure is consistent with and was developed in parallel with the management system, but there are many other factors which also influence their better performance. Some of the main differences which are relevant here are summarised here[221], so that we can draw out some lessons for IMT:

- Agency-managed schemes tend to be larger, newer and built to hydrological, rather than social, boundaries (the average Agency Managed Irrigation Scheme in Nepal is more than 10,000 ha, the average Farmer Managed Irrigation Scheme on the Tarai under the ISP programme is 200 ha) and the canal boundaries are more likely to match social boundaries.
- The water supply on Agency Managed Irrigation Schemes is often worse, as they are built to command the maximum conceivable area, with optimistic assumptions of irrigation efficiency. Farmer Managed Irrigation Schemes tend to enjoy a more generous supply (6 l/sec/ha on Rajapur FMIS, compared to 1 l/sec/ha on Sunsari-Morang scheme, and less where a system of *warabandi* operates). Farmer Managed Irrigation Schemes are often gradually enlarged as demand increases.
- Management arrangements on Farmer Managed Irrigation Schemes were developed in parallel with the physical system, whereas agencies are now trying to transfer under-performing government systems. The FMIS institutions are embedded in the communities, while AMIS WUAs are externally imposed on groups of people who may not have traditional social relations;
- Traditional irrigation relies on labour (particularly off-season labour at times of limited alternative employment opportunities) and local materials, rather than cash. The process is very transparent since labour is contributed as and when required, without administrative or transaction costs which may be misunderstood or resented. Defaulters are immediately apparent by their absence - strong compliance systems are important features of common property management. Modern irrigation has a greater dependency on cash, which is more difficult to collect and to manage soundly. This situation is gradually changing on Farmer Managed Irrigation Schemes and is one of the emerging challenges for their management;
- New management or maintenance skills are not needed for Farmer Managed Irrigation Schemes, whereas they need to be introduced and developed on Agency Managed Irrigation Schemes; and
- The layout and systems for control are very different from many AMIS: Farmer Managed Irrigation Schemes are commonly well suited to decentralised management of essentially independent units. On the other hand, most Agency Managed Irrigation Schemes were designed for centralised management. Management change may then involve major expenditure. These differences are described further below;
  - AMIS are usually designed as a branching network, with (ideally) a logical hierarchy of canals (as at SMIP) or (less desirably) with a large number of outlets off a long main

[221] See Howarth and Lal (2002) for further discussion of these issues

canal (as at SRSP, or Jany Aryk)[222]. Many FMIS, by contrast, have separate systems from the source for each village or community, resulting in many long parallel small canals irrigating small areas farmed by socially homogenous groups. This appears inefficient, but localises management. Some of the very large agency-managed systems such as those in the lower Indus basin and the Nile follow an analogous layout to FMIS, perhaps because they have been gradually developed from indigenous systems over very long periods of time and since it would result in smaller canal flows, making water control easier;

- FMIS may have elaborate proportional division devices (although the basis for sharing is not always area of land irrigated) at the higher levels of the system which are physically remote from the village, and have more flexible controls at a lower level. AMIS reverse this pattern, with adjustable controls in the main canals and fixed controls (often proportional dividers) at lower levels.

There may be good (or pragmatic) reasons for designing AMIS in these different ways: we cannot assume that the FMIS model of management is better, as there are many other differences between the context of the schemes. But this comparison does highlight some of the limits to transferring the lessons learned from studies of FMIS when attempting improvements to management of conventional ‘modern’ irrigation layouts. Again quoting Zwarteveen (2006), “*much early FMIS writing was aimed at convincing bureaucrats and engineers of the benefits of farmer participation. As a result, many tended to emphasize the positive aspects of FMIS and were less interested in uncovering internal problems of social differentiation and power within FMIS*”.

Some of these differences and problems can be resolved during a management transfer programme - relevant lesons are that:

- There should be realistic expectations and a clear understanding of what the system can deliver;
- Management and infrastructure should be consistent with each other, and together able to supply the farmers needs;
- Local management systems should be accepted by and well-embedded in the community; and
- The costs of management should be commensurate with the benefits of irrigation, and there should be a well-defined and transparent way of collecting the resources needed.

7.3.4 Layout of systems

This comparison of farmer and agency-managed irrigation reveals many differences in the type of infrastructure needed for centralised and for decentralised management. There are several fundamental requirements, in terms of physical layout and infrastructure, which simplify management by WUAs. These include:

- Ensuring that each WUA is physically and hydraulically independent, with command areas and populations which are within their management capacity. For administrative reasons it may be easier to have WUAs which coincide with village boundaries, but this will make theme less suited to water management. It is often difficult to achieve this on modern irrigation where a canal system was imposed on an existing village layout – but this depends on how the system was designed;

[222] They even be a combination of these two (as at KIS, where a simple structure down to branch canal level contrasts with the very large number of outlets from the branch canals)

- Minimising the number of sources of water for WUA, and the need for transit of flows on to other WUAs – it is easiest if each WUA obtains water from a single point, requiring a single supply contract or agreement and a single point ot monitor flows, but often the layout and command area of canals makes this difficult to achieve – as in the case of our case studies in Kyrgyzstan;
- Enabling effective control and measurement of flows at points of transfer to and from WUAs. WUAs need to know how much water they receive and it should be possible to control and adjust this quantity – they must be able to refuse water if they do not want it; and
- Making sure that there are no conflicts between the hydraulic characteristics of the infrastructure and the management system

These are summarised for the five case study sites in Table 7.1

Table 7.1: Physical characteristics influencing management by WUAs

Characteristic	KIS	SMIP	OH and JA	SRSP
Physical/hydraulic independence of WUAs	WUA covers whole system, BCCs cover branch canals ranging from 120 to 500 ha	Each tier covers a canal system in a logical hierarchy from project (58,000ha) down to watercourse (25ha)	WUAs often follow the boundaries of the state or collective farms and range in size from approximately 1,000 ha up to 5,000 ha, with an average of 3,000 ha; sometimes boundaries match administrative boun-daries (e.g. *ayil okmotu*) or other criteria, (eg machine delivery stations).	Some WUAs match minor canal commands, others comprise a number of adjacent minors/ direct outlets, or part of large minors. Distributary canal very large
Multiple sources for WUA, transit flows on to other WUAs	Single source, no flows on to other WUAs	Single source, no flows on to other WUAs	Many sources; interfarm canal serves several WUAs. Water delivered to each WUA at about 20 points	May be several sources, may need to pass water on to other WUAs. Kadambapur has two points of transfer.
Control/measurement at points of transfer	Measurement into branch canals possible	Measurement into sub-secondary canals possible (thereafter proportional division)	Formal measurement is difficult but rely on current metering at key locations, supplemented by the 'eye' method which can be accurate but lacks transparency	Measurement difficult at most points of transfer of responsibilities
Conflicts between infrastructure and management	Large number of outlets along branch canal with different hydraulic characteristics	None if operated as designed, but long-established deviations mean that the *de facto* boundaries of units have changed. [There is also a problem of inadequate understanding of the management system]	Large number of outlets along branch canal with different hydraulic characteristics	Large numbers of very variable sized outlets along a long distributary canal which makes logical sub-division into hydraulically independent units impossible

(i) KIS (Nepal)

KIS has a branching network down to branch canal level. Thereafter, there are a large number of small outlets from the branch canal - there are very few sub-branch canals. This is at least partly due to topography as there is a pronounced natural drainage pattern which largely dictates the location of branch canals. It would not be practical to change this now by combining outlets and constructing parallel canals. As a consequence these branch canals each need to be managed as single units. This requires a strong BCC (commanding the respect of the water users). A further complication is the failure to include the direct outlet from the main canal for Kaparkhori near the headwork in the management structure: this is in effect another small branch canal but it was ignored in operation planning by the WUA until recently.

These problems can be illustrated by considering the practices for distributing water from the branch canal BC-1 through its outlets. This is dominated by individual effort and there is rarely any negotiation between farmers in adjacent outlets: water is distributed mainly on an *ad hoc* basis, and there is little involvement by the WUA or its subsidiary committees (BCC or outlet committees - OC), partly because of a lack of clarity in, or inappropriate allocation of, responsibilities.

We examined the structure of the outlet committees in relation to the irrigation infrastructure, especially their role in managing water distribution from BC-1 to outlets. We found a mismatch which makes it difficult to distribute water equitably: outlet committees cannot manage distribution of water from the branch canal to their outlets, as envisaged by the BCC. There are 13 outlet committees (OCs) for the 53 outlets on BC-1, each managing from 6 to 29 ha in 2 to 11 adjacent outlets[223]. However, the infrastructure does not permit the available water to be divided into 13 parts to match the 13 outlet committees, nor to design a suitable rotational schedule so that each OC could manage water separately. Thus the BCC (rather than the OCs) needs to manage water actively to each outlet. But the BCC also faces the problem of managing a large number of outlets with inadequate control.

This problem was identified by the farmers and the BCC during this study but they could only suggest partial solutions. These included dividing the canal into three sections for management, hiring water guards, and forming sub-committees. They still need to develop a set of rules for distributing water to outlets under varying flow conditions, a mechanism to implement these rules, and monitoring arrangements. Whilst previously they regarded management of these outlets as the responsibility of the outlet committees, the farmers and the BCC have now recognized that the OCs cannot manage this task and the BCC need to be actively involved.

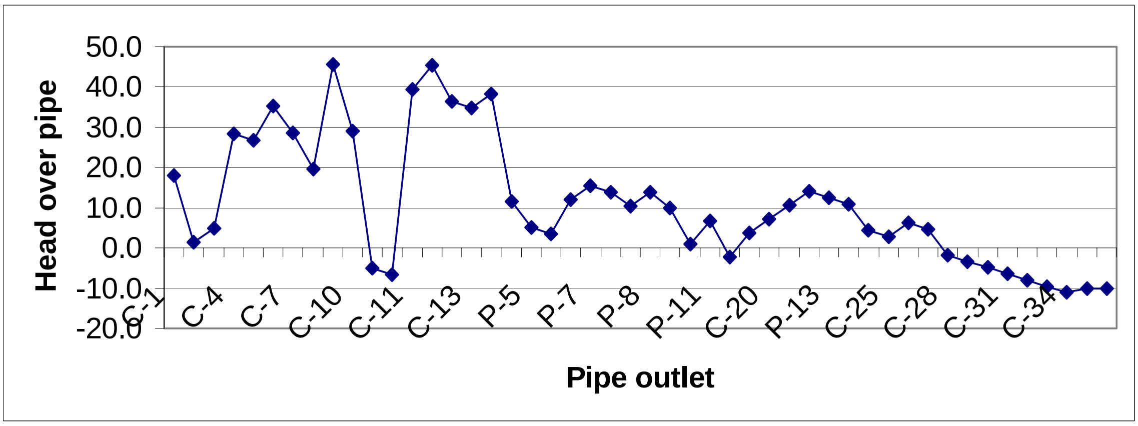
The rules will need to take account of the outlet hydraulic characteristics. These are all pipe outlets, but are of different sizes, at varying levels relative to the canal bed (and hence water level), and some operate under conditions of free flow whereas others are submerged[224]. The most important of these variables is the outlet level, and Figure 7.1 illustrates how this favours the head outlets[225]. It is always easier for head farmers to take more than their fair share of water, but at KIS they are doubly-favoured since the head available over the outlet pipes is greater.

[223] Composition and area covered by the Outlet Committees were defined jointly by the farmers and agency personnel (DOI) during the implementation of the Irrigation Management Transfer Program in mid 1990s but were not included in the original WUA structure: this gap has been resolved informally but remains a weakness in the institutional structure and responsibilities (Khanal, p. 241).

[224] Free flow means that the flow through the outlet is independent of downstream conditions, in other cases the flow will be reduced if the downstream water level rises.

[225] P-5 etc denote small polythene pipe outlets, and C-1 etc denote concrete pipe outlets, which are generally of larger diameter

Figure 7.1: : Hydraulic head over outlets of BC-1



This is not always the case in irrigation schemes, as the first outlets often irrigate small patches of relatively high land[226], but a gated cross-regulator has been provided near the head of both BC-1 and BC-2 to avoid that problem. The canal cross-section towards the tail of BC-1 is large for the design flow, resulting in shallow depths of water but there are no regulators to offset this problem. It is 'illegal' for farmers to place informal checks in the canal, yet it is impossible for them to irrigate without doing so.

Changes in flow and water level occur frequently in BC-1[227]. Regulation of flow at one point immediately changes the flow condition at upstream and downstream locations requiring further regulation of flow at these points – farmers continually make individual adjustments to meet their requirements but these destabilise the whole canal. This calls for well-coordinated management for distributing water from BC-1 to its outlets, and this requires the BCC to become more active..

Additional regulation in the branch canals would greatly simplify management but this would only be effective once the BCC has resolved how it wants to manage this canal. There is no point in planning the type and location of any structure in advance of planning a new operating regime – indeed it would be counterproductive as, paradoxically, it would in the short-term make it easier for the head farmers to take even more water.

(ii) SMIP (Nepal)

SMIP has the most systematically planned layout of the schemes which we studied, and has been devised as a logical branching network, with each level of the canal system serving similar areas. This should make it relatively simple to manage, but has been achieved by ignoring many non-technical factors (and also the previous small-scale farmer managed irrigation systems[228]). The concept adopted was theoretically sound, but either was not communicated effectively to the farmers or they do not agree with it (as it does not meet their individual needs as accurately as they expect it should).

[226] This can be seen in the case of SMIP SS9E-T3.
[227] These changes may be sudden caused by human intervention [e.g. putting an earth bund in the parent canal to head up the water] or gradual caused by siltation or weed growth.
[228] Although most of the land was rainfed, there were several small FMIS in the SS9E are

As a consequence, the layout is modified informally by the users to solve local problems as they arise. For example, the design provides for watercourses and tertiary canals parallel to the higher order canals, in order to avoid a large number of direct outlets. As these are at a flatter gradient than the parent canals they are particularly liable to sedimentation (SS9E-T2, for example is particularly vulnerable, making it very difficult for water to reach T2-3, 4 and 5)[229]. This makes maintenance difficult or time-consuming, so farmers have elected to cut illegal outlets further downstream on the parent canal rather than maintain the parallel canals. They regard these problems as design faults to be solved by others, rather than weaknesses in maintenance arrangements – thus they feel justified in breaking the rules by cutting illegal outlets through the canal banks[230].

In other places, designing a logical branching layout required the canals to cut across natural drainage channels. In many cases, these cross-drainage works have collapsed for lack of maintenance so that farmers have had to replace the official channels by alternative illegal ones[231]. Considerable thought was given to the management of the system when it was designed and, as noted earlier, it follows the structured irrigation system: simplicity of operation was believed to be more important than flexibility. Whilst some may dispute the merits of that system there is a consistency between infrastructure and management. However, it requires the understanding and cooperation of the water users – which in practise is lacking[232]. The logic or suitability of the design, which was strongly promoted by the World Bank is also questioned by some in DOI.

There were meant to be seven outlets from watercourses, so that all the water would flow to each outlet in turn for one day per week. The four farmers (on average) who used that outlet would construct field channels so that water could get to their land, and agree a way of sharing the water. In practise, most farmers have cut their own individual outlet into the watercourse so that they can directly access water. For example, T5-1 is 1.54 km long in 2 branches, with 9 authorised outlets each intended to take all the water for one day with a one week rotation cycle (although the inherent contradiction in that rule has not been resolved formally). However, at the start of this programme there were 30 outlets of which 5 were observed to be operating at a time. Thus although roughly the ‘correct’ area was being irrigated this was through 5 outlets rather than one. The stream flow through each outlet is thus very low and will decrease through successive outlets. This means that it will take longer than intended to irrigate a unit area of land and more water will be wasted (the same problem that we will discuss later in the context of Outlet 18 of BC-1 at KIS).

The WUGs could solve problems related to outlet and field channel locations themselves, as was demonstrated in this project. The number of outlets needs to be reduced so that the streamflow through an individual outlet during irrigation can be increased to make irrigation more efficient. These outlets then need to be linked to individual plots through field channels (which may be permanent channels, or farmers may simply come to an agreement to construct temporary channels when needed). These issues can be resolved by negotiation at watercourse level as described in Section 9.2..

However, gross inequities in access to water within a watercourse are inevitable until the WUG becomes more active in controlling illegal activities and manages operation. The consequences are

229 The sediment carrying capacity is influenced by canal size and slope in a way which means that the offtaking canals are more liable to silt up than the parent channel

230 They may then need to check the parent canal in order to divert water at an appropriate level through the new illegal outlet.

231 For example the tail of T3-2 beyond the field drain crossing has been abandoned and replaced by a direct outlet from SS9E which makes use of an old channel from the previous FMIS.

232 We found in GGG that despite a programme to establish WUAs, the design concept was not adequately communicated to the users.

mitigated by the fact that irrigation is supplementary to rainfall, and that there are considerable drainage and seepage flows from upstream areas which can be used for irrigation. But those whose land does not benefit from these topographical advantages often suffer from a very unreliable water supply.

The underlying technical problems are not, however, very serious: they could be resolved by negotiation among farmers and with support from the relevant tiers of the WUA and SMIP. There is little inherently wrong with the design – small changes could be made, for example by installing small pipes to solve the few genuine problems rather than leaving them unresolved so that farmers resort to making large uncontrolled cuts in the banks. Such measures were discussed and some were implemented during this project, as described in section 9.2. The problems arose because the farmers were not involved in the past in preparing the design and did not agree with the principles (at least in so far as they understood them)[233]. Their lack of involvement also meant that their local knowledge was ignored – resulting in outlets being built in inconvenient locations; watercourse alignments ignoring complexities of land tenure (some farmers individual plots are irrigated by more than one outlet, or even more than one watercourse in the case of T5-3 and T5-4); and the complexities of cross-drainage being neglected[234].

(iii) SRSP (Andhra Pradesh)

SRSP has a layout which is very difficult to manage: the main canal is 234 km long with 131 outlets, and D-86, which includes the WUA studied in this project, is itself 54 km long with 60 outlets and irrigates 32,900 ha. This distributary alone serves over half of the total command area of SMIP. This is one of the largest distributary canals in SRSP – the average area commanded by D-canals is around 2,000 ha. The outlets from D-86 include direct pipe outlets, small minors, and large minors serving several WUAs. Three cross-regulators are planned for D-86 but these have not yet been built and there are only a few drop structures which can provide any degree of control over water level. The lack of control structures along the canal makes it difficult to subdivide into logical management units, and the large number of outlets means that it is difficult to ensure that any specified amount of water reaches the tail.

SRSP is supplied from a large reservoir on the Godavari river - the Sri Ram Sagar reservoir - which should provide a secure supply of water. However, flows to the reservoir are strongly influenced by operation of the Jaikwadi reservoir, further upstream in Maharasthra State. Despite an average rainfall in 2004/05 (463mm which is marginally less than the five-year average of 496mm), reservoir inflows were the lowest on record and this was only the second year in the last decade that the reservoir did not fill. This suggests that there is an increasing demand further upstream which is likely to result in continued water shortages for SRSP.

WUAs typically manage around 1,000 ha, and are based around hydrological units – but they comprise a varied combination of direct outlets, small minors or parts of large minor canals. Many do not have a single source of supply, and some have to pass a proportion of the water that they receive on to the next WUA downstream – the canal layout makes it difficult to avoid this. Kadambapur WUA, however, is relatively simple, comprising just two minors (M30R and M32R, at Km 24.45 and

233 These issues were, however, addressed more systematically in the rehabilitation of the third stage of SMIP, covering areas further downstream and it is to be hoped that performance here is better than in the older parts of the system.

234 The tail of T3-2 crosses a drain, making it difficult to maintain. Irrigating this land by a small additional direct outlet is thus almost inevitable.

27.00 respectively), without any downstream WUA on these minor canals. Boundaries were changed in 2003 to reduce the number of WUAs – for administrative reasons. This affected Kadambapur WUA since M30R was previously in the same WUA as M29R; the chairman is the same person as previously but the community served has changed.

Minor M30R has few physical problems in the canal, and was lined as part of the rehabilitation programme over the past five years. It is now in relatively good condition, with the important exception of the intake from D-86 which is incomplete, damaged and lacking a measurement structure. There are no regulators but this is the best arrangement, as additional regulators would make it easier for head farmers to take more water (as noted for KIS).

M30R serves 320ha from 12 pipe outlets (three of which are from the one sub-minor); there are no individual direct outlets and apparently few illegal cuts – although there are many illegal interventions by individuals. Some people raise the water level (by placing impromptu checks) to increase flow through their pipes or they may close other people's pipe outlets. Some also pump water from the minor to fill wells. TC boundaries follow pipe boundaries, with five TCs covering the whole minor. Pipe areas range from 15 to 40 ha, averaging 25 ha – similar to the watercourses at SMIP – and all pipes are intended to flow simulataneously all the time there is water in the minor canal. The minor runs along the ridge, with pipes irrigating on both sides. Excess water flows away from the minor to drains on either side, where there are several tanks, and to the Manair River at the tail.

There are eight tanks in or adjacent to the minor canal command area (Table 7.2). Some of these also capture drainage water from adjacent minors, but the area that can be irrigated from the tanks that are supplied by drainage from M30R is about 220 ha. This is probably an overestimate of the actual irrigated area as the small, long tank at the tail of P9 has a nominal command area of 120ha, but in fact rarely if ever irrigates this much land. Allowing for this uncertainty in the areas, M30R needs to irrigate 320ha directly and further 100-200 ha via the tanks.

Tanks predate the canal system and have their own independent command areas. Originally they were recharged by rainfall runoff from a relatively large area. Most of these catchments have now been developed and irrigated, thus depriving the tanks of their natural recharge. Although, this natural runoff is more than offset by increased drainage from irrigated land, this does mean that in effect the irrigation system has to serve a significantly larger area than its nominal command; this is achieved by capturing and reusing losses via the tanks. The tanks have an even more important local role for domestic uses and livestock in villages. For this reason, it is considered particularly important that they have water in them, and thus they may be filled directly from the canal system. Neither the design nor management principles take explicit account of the tanks. Filling tanks from the canals is officially illegal but is unavoidable; it is thus a source of considerable conflict and also stress amongst the Irrigation Department officials who authorise it as will be seen in section 8.4.5.

Table 7.2: Tanks in M30R

Name	Water status (Nov 2004)	Recharge	Dam dimensions (m)	Command area (ha)	Nos wells
Yerra Ceruvu	negligible	Pipe 2 and rainfall	L = 700 m D = 6 m	50 ha	8
Kanila Kunta	none	Pipe 5. all the land under its command belong to Rajivnagar hamlet.	L = 150 m D = 3 m	4 ha	15

Name	Water status (Nov 2004)	Recharge	Dam dimensions (m)	Command area (ha)	Nos wells
Papya Kunta	none	Pipe 9 and rainfall.	L = 120 m D = 2 m	3 ha	
Upparla Kunta	none for 4 years.	Spill from Kanila kunta; previous channel from canal was diverted by farmers 3 years ago.	L = 180 m D = 3.5 m	12 ha	60 when tank was operational
Mun Cheruvu	Partly diverted but could not succeed	Sub-minor 1L.	L = 180 m D = 3.5 m	40 ha	20
Damerla Cerevu	none	Sub-minor 1L.	L = 150 m D = 2.5 m	15 ha	
Gola Kunta	none	Directly from D86.	L = 150 m D = 3 m	80 ha	15
Dharmagundam Cherevu	none	Overflow from Gola Kunta and from pipe 9.	L = 1,000 m D = 3.6 m	120 ha	40

A further complication is the presence of a large number of wells – about 60% of farmers have access to a well (Table 7.3) – which may be owned individually or by a group. Some farmers sell well water to their neighbours. Some can be filled directly from the canals, and act effectively as on-farm storage[235], others are adjacent to tanks and are recharged by seepage from the tank bed; the remainder are scattered around the command area and are mainly recharged by seepage from rice fields and channels. Recharge has reportedly declined since the minor and distributary canals were lined. The wells are in effect a means of capturing and reusing losses from water which originates from the canal system. These are located within and irrigate the SRSP command area – many farmers thus get water both directly and indirectly from the canal system, yet the management system does not fully reflect this. Irrigation from wells is increasingly popular, and this is encouraged by the very low electricity charges (and which are fixed regardless of the amount used). In the three pipes studied, a total of 18 wells are located adjacent to these field channels and are directly filled with canal water – these are mainly owned by rich farmers. Nine of these are at the end of the field channel – ie they serve as a means for storing excess water to be used later or at other times of the year. The remaining seven 'on-line' wells are near the head of the *chak* (command areas of an individual pipe outlet) and should just receive water in accordance with the *warabandi* schedule for the field containing the well.

Table 7.3: Wells in the study area

Pipe	No of wells	Abandoned	Wells in use	Wells fed by canal	Other wells	Submerged by tanks
P2	24	5	19	5	8	6
P5	21	6	15	8	7	0
P9	14	4	10	5	5	0
Total	59	15	44	18	20	6

Not all farmers are equally able to dig wells – poor farmers finding it particularly difficult to do so (see section 8.6.5). Quite apart from the cost, many wells have very low or zero yield (for reasons related to topography and geology). Wells may be dug but abandoned during or after construction for a variety of reasons:

[235] in some cases there is seepage from these wells ***to*** groundwater, rather than the more normal recharge of the well ***from*** groundwater

- because the yield in some old wells (which were dug before the canal system) was built was too low to make them worthwhile now that the canals exist;
- if they encountered hard rock during construction of new wells
- because lining of the minor canal reduced the recharge

Some low-yield wells are filled directly from the canal system by gravity or pumping and some farmers attempt to increase the yield of wells by deepening them or by lateral boring from the base of the well.

There are field channels[236] to facilitate irrigation within the *chak*. These are small earthen channels with no structures, usually branching into two or three channels in order to deliver water directly to most plots (about 80% of land is irrigated directly from a field channel, with the remainder dependent on water flowing through a neighbour's field). Those with indirect irrigation do face greater difficulties; this may not be so easy to resolve as in Nepal where the field channels are very short; the process of negotiation adopted for SMIP would need to be adapted to suit the local context in Kadambapur. These field channels are supposed to be constructed by the farmers, although the irrigation department is often involved: it appears that wealthy farmers are able to influence the layout to ensure that they get a better supply (land owned by the rich is not concentrated in the head of the *chaks*, but is scattered – possibly reflecting other favourable conditions such as access to groundwater, or proximity to a tank).

The field channels are shown schematically in Figure 7.2, and are indicated on the outlet map in Chapter 4 (Figure 4.7). Further details of these outlets are marked on the maps in chapter 8, showing the location of fields and field channels (and hence fields which are not directly served by FCs), wells (distinguishing seepage wells, canal-fed wells, tank-fed wells and abandoned wells), and rice and ID crops grown in *kharif* 2004. The relationship with land ownership (distinguished by well-being category) is also discussed in chapter 8.

There is a good network of field channels covering most of the fields (85% in P9, 80% in P5 and 75% in P2). Distances are short, and thus flow times from the minor are quick – fewer than 15% of farmers report that water takes more than 3 hours to reach them from the pipe outlet (assuming obviously that no one diverts water further upstream on the field channel). Field channels range from 500m up to 2.25 km long (with the longer channels being especially common in P9). Wells are also widely scattered through the command area, with 50% having a well either in their field or adjacent to it (whether owned collectively or by the neighbour). Farmers do sell water to their neighbours, but give priority to their own crops. Coverage of wells in P9 is however, much sparser than in the other two pipes (only 20% of farmers in P9 have access to a well as compared with 70% in P5 and 85% in P2) – reflecting the fact the groundwater recharge is dependent on canal and field losses – unlike in Nepal it is rarely an option for tail-end farmers who suffer from poor canal supplies. Many residents in P9 are stone quarry workers rather than farmers, and several say that they have not received water for the last five years: there is an area of relatively high land which is particularly badly affected.

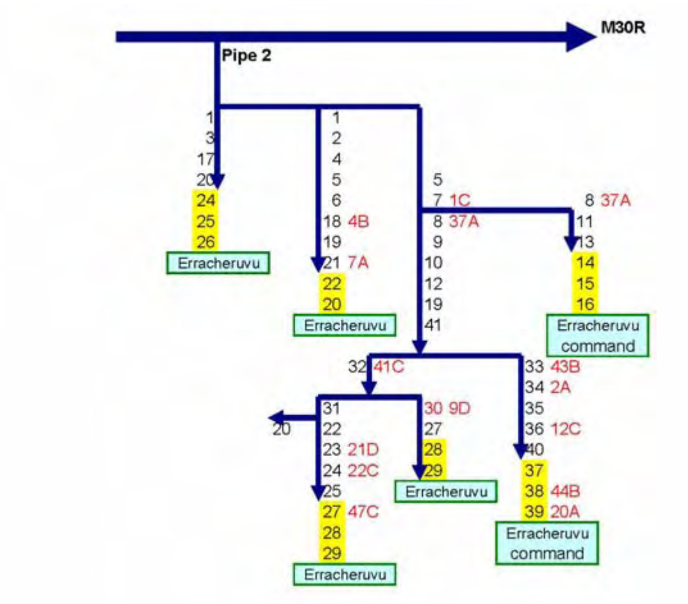
There are several ways that these channels can be managed. Excess water in P2 for example flows into Yerra Cheruvu, but there are several different routes by which this tank can be filled. The most direct is via the right hand branch, but this takes water away from the left hand branches - which irrigate the

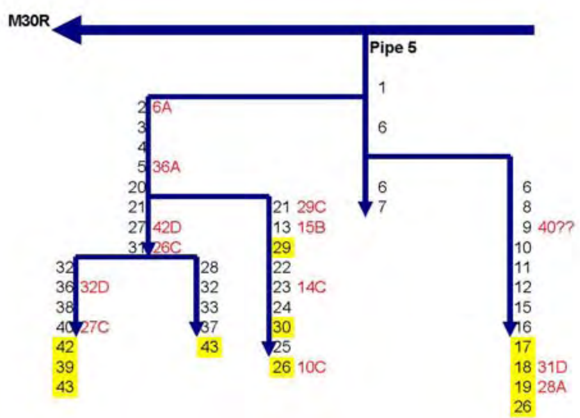
[236] these are more equivalent to watercourses than field channels at SMIP, and typically serve about 10ha; they would need to be extended further with some small branch channels if they are to reach all fields in the *chak*. There is no concept here of limiting the number of outlets from a field channel at SRSP as there is in the case of watercourses at SMIP, and all fields adjacent to a field channel expect to be able to take water directly from it.

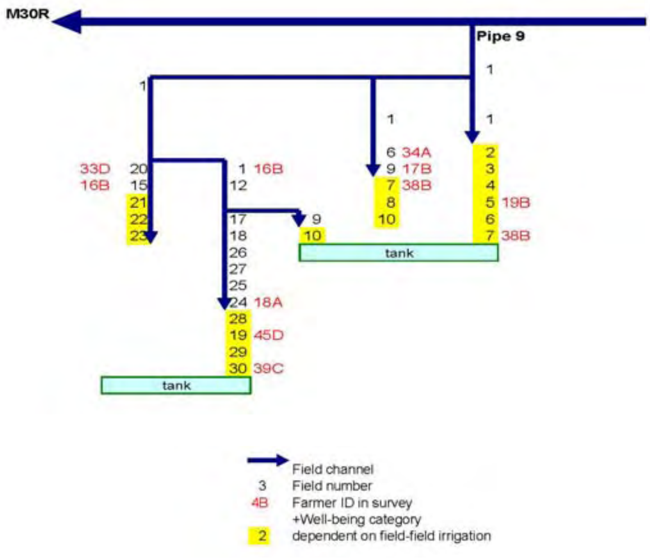
largest number of plots through the longest field channel (with up to 16 upstream plots), and where most of the land which is not fed by a field channel is located. None of that tail-end land was irrigated in 2004, despite having several wells.

The geographical distribution of plots irrigated in P5 in *kharif* 2004 is interesting, and is discussed further in Section 8.5 (Table 8.9). Fields in which there are wells filled directly from canals were all cultivated – even though there had been no canal supply since February and there had been a water shortage in *rabi*. Fields with wells recharged by seepage were also cultivated although half of this was with ID crops rather than rice. Fields without direct access to wells were mostly uncultivated, but 25% had ID crops. Only one small low-lying plot was able to grow rice.

Figure 7.2: Layout of field channels at SRSP







(iv) Kyrgyz Republic

The irrigation systems here were designed to supply water to large collective or state farms (*kolkhoz* or *sovkhoz*) which each operated a number of large fields (10-20 ha per field), and WUA boundaries are also guided by former *kolkhoz/sovkhoz* boundaries as much as by hydraulic requirements. There was originally one outlet per field, and distribution within the field was managed by the farm. From a system management point of view this was very simple, but now the fields have been subdivided into many small fields, each under different individual management. These should share water from the original outlets (one outlet per 'pre-reform' field), but in practice many individuals have obtained additional outlets, so the number of outlets has now increased from 10 to 57 outlets at Obu Haet (now commanding 2.5 ha on average). The WUA is supposed to coordinate the individual management by farmers., but the large number of farmers and the lack of control structures on either the main canal or the outlets can make distribution of water somewhat arbitrary[237].

Although Obu Haet is logically supplied by a single offtake from the Aravan Sai river, where there is good control and flow measurement is possible, there are three downstream WUAs (Turk Ata, Sakhii Daryo and Kyzyr Abad) which depend on water flowing through Obu Haet, as shown on Figure 4.9. The main (inter-farm) canals flowing through Obu Haet to these WUAs are managed by the *Raivodkhoz*,and the *Raivodkhoz* delivers water to the WUA at the head of each of 17 different inter-farm canals (as shown on Figure 7.3 - although it has a single contract covering all of these). Few of these transfer points can be measured accurately. From the point of view of the *Raivodkhoz* this is the only practical method, as it gives it control over supplies to each WUA, rather than relying on Obu Haet WUA to pass on sufficient water to the downstream WUAs. For Obu Haet it means in practice that it has a large number of small semi-independent systems to manage, each of which have a *mirab*.

[237] Both Obu Haet and Jany Aryk are due for some rehabilitation under OIP; much of the work will be for canal lining to reduce seepage losses, but outlets will be rationalised and the ability to control water improved. Until this is done, neither WUA is willing to devote much effort to maintenance which is the main problem within the areas studied. There is clearly scope for rationalising the outlets: outlet 16 in Obu Haet serves a large area, but parts that are close to Buvakul have cut additional outlets which take a disproportionate amount of water. As in the case of SMIP, such rationalisation needs to be done in close consultation with the users and to be linked to a management plan so that any rotations needed at times of shortage can be implemented.

An even more complex situation applies at Jany Aryk, which is served by five offtakes from the Ak-Bura river, some of which continue to supply other WUAs (Figure 7.4). These canals include the inter-basin Aravan Ak Bura Canal which augments the supply in the Aravan river from the Ak Bura River (and Papan reservoir) and partially feeds Obu Haet and several other WUAs. There are nine offtakes from the AABC in Jany Aryk, which can only be monitored by current metering and which are effectively independent sub-systems. Thus, again, it is very difficult for Jany Aryk WUA to know exactly how much water it is receiving or how well this matches the allocation as contracted with the *Raivodkhoz.*

Figure 7.3: Obu Haet WUA: schematic layout

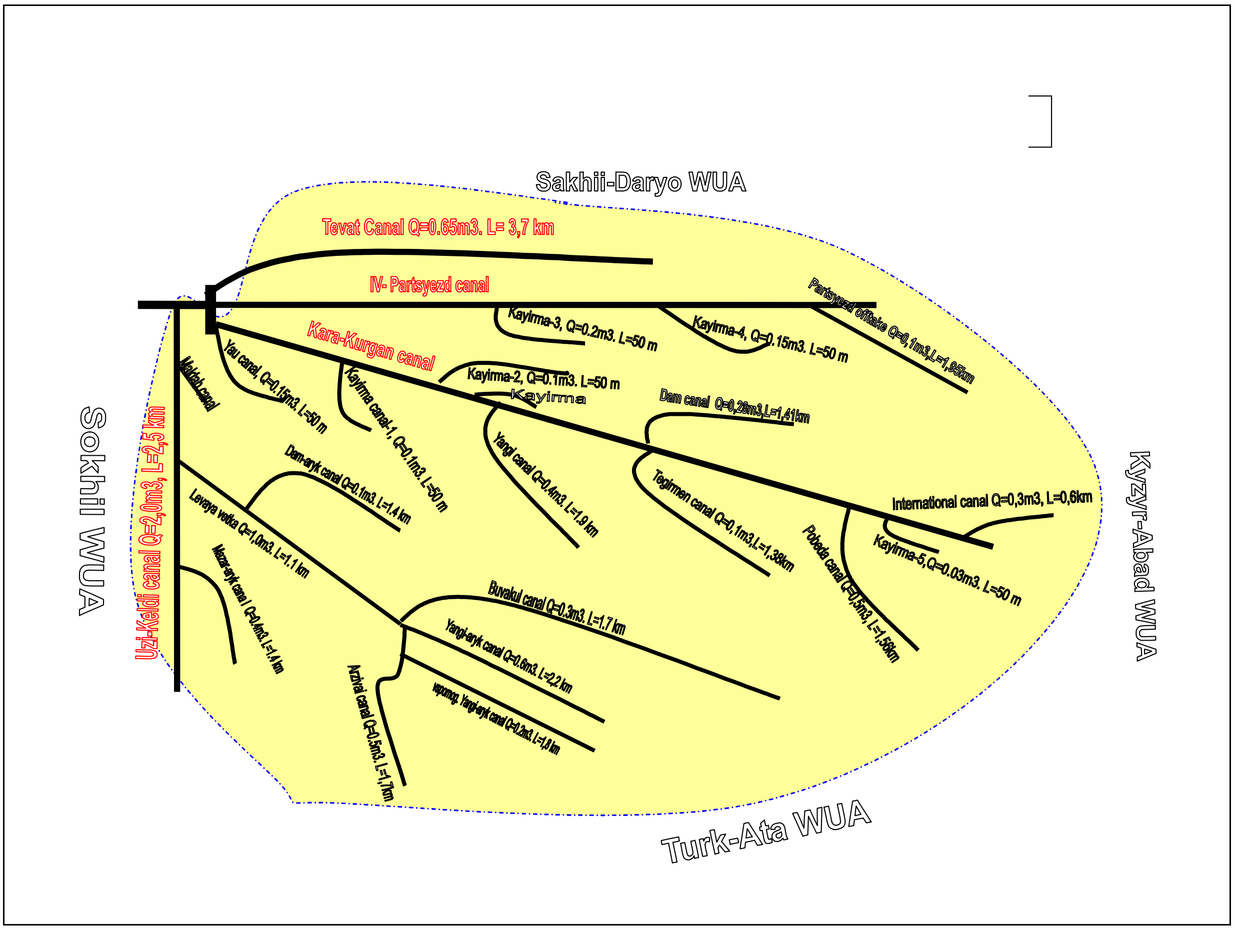
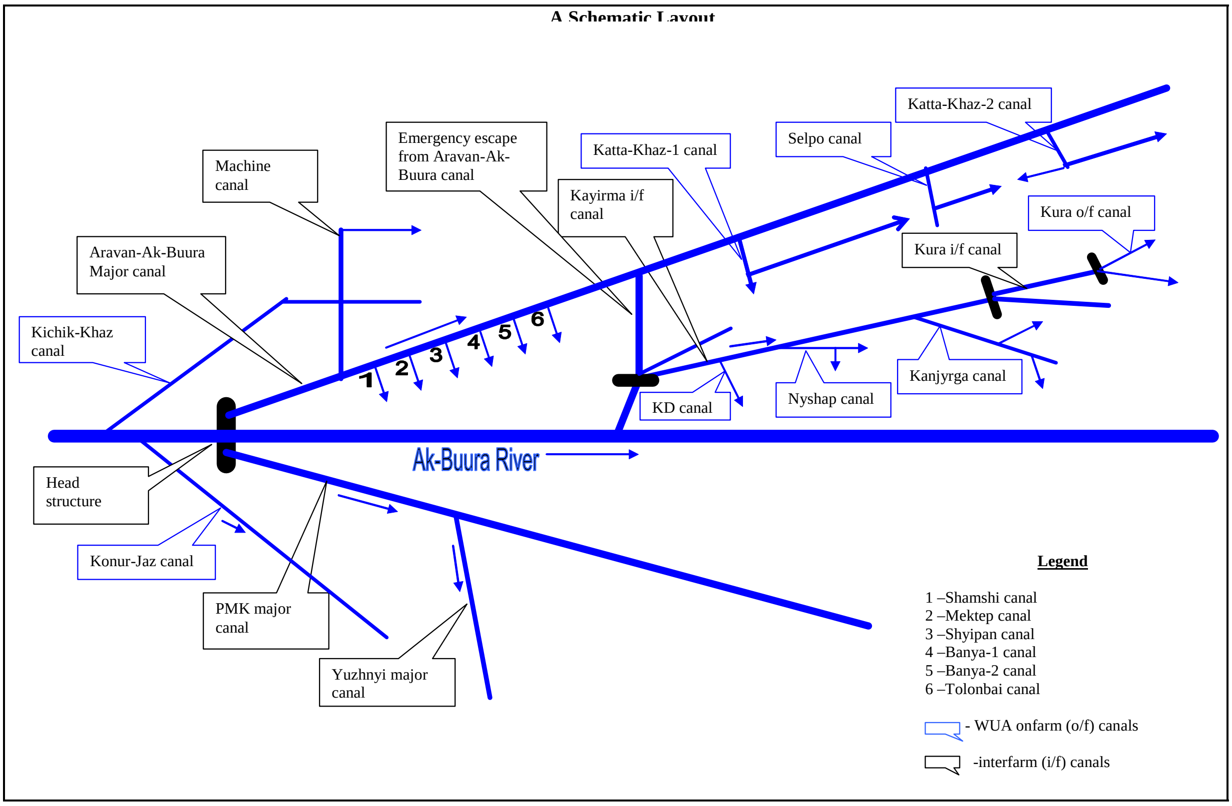


Figure 7.4: Schematic layout of Jany Aryk WUA



7.4 Procedures for distributing water and monitoring distribution

7.4.1 Responsibilities, rules, enforcement and sanctions

WUAs and farmers are responsible for operating the irrigation system below the designated boundary, with the irrigation department taking charge at higher levels. WUAs in Nepal also have a coordinating or joint management role at higher levels in the system, but there is single point of transfer of responsibilities in the other countries. The boundaries are defined as follows, with the ID being responsible for the gates on the structures at the point of transfer:

- SMIP/Nepal: the head regulator for the sub-secondary canal
- KIS/Nepal: the head regulator for the branch canal
- SRSP/AP: outlet from distributary to the minor canal (although some WUAs may comprise several small minors, and large minors may serve more than one WUA).
- Kyrgyz Republic: gate from the inter-farm canal to the WUA (or part of WUA).

The systems at SMIP and SRSP are designed according to the principles of the structured irrigation system. The irrigation office is responsible for managing water distribution, on a rotational basis, down to the “structured level” and then water should flow without obstruction or management down to the level of the watercourse (SMIP) or the pipe outlet (SRSP). Where gates exist, these are opened and closed, under instruction from the irrigation office, by government-employed ditch riders (*dhalpa* in Nepal, *lashkars* in SRSP/AP). The WUAs are supposed to make sure that their water users are aware of the rotation schedule (and hence know when their field outlet is entitled to water) and that water users only take water according to this schedule and from designated pipe outlets/watercourses, in keeping with the principles of equitable water distribution.

In SRSP no formal sanctions apply either to ID for failing to deliver an agreed quantity and timing of water, or on water users who take water from unauthorised outlets or in unregulated quantities. In SMIP the Chatara By-laws specify fines that can be charged against those who take water from a canal without prior approval by the concerned committee. Specific levels of fines are set for the main canal, secondary canal, and sub-secondary or tertiary canal. The concerned committee is entitled to collect the fine – with 25% of the fine to be deposited with the WUCCC. In SRSP the *lashkar* (an employee of the I&CADD) is officially responsible for ensuring that there are no unofficial outlets/pumps/cross bunds, etc. used during the irrigation period. In SMIP the WUA is formally responsible for this monitoring and enforcement.

In principle the WUAs have no responsibility for actively managing distribution of water. Irrigation department officials determine the water distribution schedule for the forthcoming season across the whole system in consultation with the WUA. ID officials are supposed to consider water availability, local agro-ecological conditions, cropping pattern, and the principles of equitable distribution. They are supposed to follow a *warabandi* type of rotational water schedule, with water distribution conforming to a stipulated schedule of opening and closing of gates. Taking into account all the relevant considerations, the ID officials are supposed to decide the rotation and draw up a water schedule which is agreed with the WUA Distributary Committees (SRSP)/Water Users Coordinating Committees (SMIP).

The WUA is, however, supposed to provide the authority and leadership to ensure that water users comply with the rules of structured system operation and do not use illegal outlets or place unauthorized obstructions in the canals. The WUC at SMIP is fully responsible for policing the operation of the sub-secondary and tertiary canals, while in SRSP the WUA Management Committee is supposed to attend to its command area. In SMIP the Water Users Group is responsible for organizing water distribution within the watercourse and deciding what sanctions will be imposed on those who do not share water according to the rules agreed. At SRSP it is expected that farmers will organize themselves to share water within the pipe outlet command (*chak*) as they see fit – although as TCs at SRSP generally comprise a group of adjacent pipes, it would be expected that the TC member would play an important role in planning water distribution.

In KIS both the Main Committee and the Branch Committees have developed water distribution rules and penalties. The Main Committee is jointly responsible for day to day system operation of the main canal with the Irrigation Department but in practice works directly in liaison with government-employed ditch riders (*dhalpas). Dhalpas* manage the gates on the main canal, releasing water to the branches under the instruction of a specially designated WUA sub-committee – the *karyadal* which determines the distribution schedule based on the water flow at the entrance to the main irrigated area (ie at Devnagar rather than at the headworks – see Figure 4.3). The delivery pattern in the monsoon is adjusted to take into account changes in the discharge, with continuous flow when water is abundant, and a schedule of rotations between branches when water is scarce. Because of the uncertainty of water supply at the intake, the *karyadal* meets frequently during the monsoon season. Only the *karyadal* has a right to adjust the gates, directly or through instructions to the *dhalpa*, along the main canal. In the spring season, the available water is supposed to be shared between BC-1 and BC-2 in a ratio of 75:25, and the *dhalpa* is responsible for managing the gate so as to implement this ratio.

The members of the *karyadal* receive a monthly salary from the irrigation department for their services during the monsoon months[238]. No payment for the *karyadal* is made in the Spring and so the sub-committee is not formally functioning. However, some members of *karyadal* from BC-1 and BC-2 may act informally – although this was not in evidence during period of the EIP field work in 2004. One *dhalpa* is responsible for operating the gates on the main canal in the spring season.

The BCCs are supposed to organise operation at branch level, while the OC is supposed to do the same amongst farmers within the outlet.Within the branch, in BC-1 there are no gated outlets on the canal and water is authorised to flow for the full length of the canal, and all 53 outlets are intended to be fully open. The BCC makes no further decisions with regard to use of this water[239] . Informal but mutually agreed principles are supposed to apply to operation and water sharing at branch canal level and below. For example, one should not obstruct flow in the branch canal.

Within BC-2, the Chairman of BCC-2 has been solely responsible for deciding which areas should receive irrigation in the spring season. For spring rice in 2003 only two outlets operated, *Pachas Bigha Kulo* (PBK) and Pilot Gate West (PGW), plus some very small direct outlets from the main canal. Within the outlet there are no formal rules for water distribution, although rotation of water distribution from head to tail is the generally accepted principle. Sometimes, during critical periods of irrigation, a rotation from tail to head may operate.

In the Kyrgyz Republic the WUA is fully responsible for the operation of its system, and this includes the employment of the ditch riders (*mirabs*) who are supposed to manage the distribution of water to outlets along the full length of branch canals down to the individual farmer. Water users are required by law to comply with watering schedules and to take water only in accordance with those schedules. In both Obu Haet and Jany Aryk the same formal process is supposed to be used to prepare water scheduling plans, and for water distribution. The formal steps to be followed are:

- WUA staff collects information on cropping patterns within on-farm canals' command area;
- Water Management Plan is prepared by WUA staff on the basis of cropping patterns information collected;
- Based on Water Management Plan, WUA estimates total amount of water required for forthcoming irrigation season and signs Contract on Water Delivery with the Raion Irrigation Department;
- During irrigation season the decade requests (every 10 days) are submitted to the *Raivodkhoz* in order to consider all changes in water amount required (for instance, if there is a lot of rainfall WUA may decrease the volume of water required for the next 10 days; or vice versa – if days are hot and dry and more water is needed, WUA makes corrections in its decade water requests);
- Farmers submit water request in writing a couple of days in advance, so that the WUA has time to estimate and ensure supply of the required water volume;
- *Mirab* distributes water to the farmers;
- Each farmer receives a coupon authorising irrigation for required period of time. The irrigation time is controlled by the *mirab*; and
- Farmers organise between themselves and irrigate by sequence within an outlet.

238 The *Karyadal* was established in 1998 when it was trained by the irrigation department to carry out canal operation activities. The *Karyadal* is paid from the government O&M fund for the main canal.

239 There used to be a rotation in this part of the *canal* to share water between outlets 2-30 and 31-53, but this was abandoned after IMTP, presumably because canal repairs made it easier to manage continuous irrigation. This avoided the need to open and close the large numbers of small ungated outlets each week.

WUA members in the Kyrgyz Republic are supposed to be entitled to compensation if they suffer damage to their crops or to their land plots as a result of the WUA's operation and maintenance activities. The Water Code of 2004 defines the levels of compensation which should be paid if the water supplier cannot fulfill the contractual arrangements. However, in situations of drought, water shortage or emergency, water permissions can be suspended without compensation. Provisions referring to the timing of water supply remain unclear. In Obu Haet in 2004 the General Assembly decided on a schedule of fines for first and second instances of using illegal outlets, with the sanction of taking away WUA membership if someone steals water a third time. In Jany Aryk the WUA Charter provides for a fine for the use of illegal outlets or water theft.

In general, WUAs have the authority to impose penalties on those who breach the rules, but rarely do so. In many cases they have not defined the penalties and even if they have been defined, they may be reluctant to impose them for fear of causing social disharmony.

7.4.2 Water distribution in canals

The rules governing management of the canals and enabling individuals to access water are summarised in Table 7.4. This describes the situation at the start of the study in each sub-project.

Table 7.4: Water distribution in practise

	KIS	SMIP	OH and JA	SRSP
Classification of levels of canals				
First order:	*Main (3,900 ha)*	*Main+Secondary (58,000+7,900 ha)*	*Main (970-9,250ha)*	*Main+Distributary (32,000 ha)*
Second order:	*Branch (120-500 ha)*	*Sub-secondary (722ha)/ Tertiary (125ha)*	*On-farm canal (140-180 ha)*	*Minor (300 ha)*
Third order:	*Outlet (1-50ha)*	*WC (30ha)/Outlet (4ha)*	*Outlet (0-20 ha)*	*Pipe (20-30 ha)*
Formal Rules for control between levels of canals and actual practice				
First Second	Managed by DIO, in accordance with schedule planned jointly with WUA – fixed proportionate share between BC-1 and 2 (75:25, independent of crops grown). Some variation in practice, but generally close to plan	Secondary sub-secondary: Managed by project office in consultation with WUCC. Discharge fixed, duration of flow may be adjusted. In practice some fluctuation, mainly due to fluctuations in source and complex hydraulics of main canal, but generally close to design figure. Duration is more variable, and this is not well-communicated to farmers	Managed by *Raivodkhoz* in accordance with contract with WUA, jointly monitored by RID and WUA. At JA closed briefly at request of WUA chairman to reduce need to pay for water. At OH structure is in poor condition and cannot be used to control or measure flow	Main Distributary: Managed by ID, gate and measurement structure in good condition
		Sub-secondary tertiary: Intended to flow continuously without adjustment. In practice individual upstream farmers inter-vene to increase flows into tertiary canals or cut illegal outlets		Distributary Minor: Managed by I&CADD (*lashkar* operates gate). Gate damaged, and measurement structure incomplete

	KIS	SMIP	OH and JA	SRSP
Primary Tertiary (direct outlets)	Ungated, uncontrolled. Flows affected by WL; individuals lobby directly with gate operator to adjust water level (whilst complying with rule above). This is done on individual basis without involving OC or BCC	None designed, but many illegal individual interventions as described above, some have been semi-formalised (eg by provision of a pipe by project office or some other Government agency	Rare, but illegal, ungated, uncontrolled and may lead to considerable wastage (eg through damage to canalet upstream of Buvakul intake	Distributary illegal outlet: illegal but reported to be common – observed in *rabi* 04/05
Secondary Tertiary	In theory continuous, without any interference in branch or outlet but hydraulic conditions mean that farmers must intervene. This is done on individual basis without consultation. The BCC does not plan or control such interventions, although it may monitor intermittently	Tertiary to watercourse: also intended to be continuous, but also many interventions by individual farmers but no consultation between adjacent watercourses	OH, authorised by *mirab* at request of individual farmers. Each farmer has to contact *mirab* individually rather than manage as a group. JA Upstream outlets managed individually by farmers, middle outlets flow contin-uously, downstream outlets managed through individual requests to *mirab*	Minor pipe outlet: nominally managed by *lashkar*, but thease are ungated and intended to flow free. In oractice managed by farmers on *ad hoc* basis
Tertiary farmers	Water taken roughly in order from head to tail, each farmer takes as much as they need. If main rotation ends before completion of outlet irrigation, turn reverts to head rather than continue from previous person. There may be negotiation between farmers, possibly with mediation by outlet committee. Farmers may take action at branch canal level to secure additional supplies to the outlet whilst they are irrigating	Watercourse to outlet/farmer: In theory all flow to each outlet for one day in turn. In practise many outlets flow simultaneously, and there are many extra unofficial outlets so that most farmers now take water directly from the outlet rather than via a field channel. There may be some informal consultation between farmers within watercourse but the WUG does not get involved and does not plan or monitor the order, duration or depth of irrigation Outlet to farmer: most outlets now serve single farmers	OH: in accordance with mirab requests as above, except at times of abundance when farmers take water at will. JA: Individual basis, but may be some internal negotiation in large outlets	pipe outlet farmer: branching network of field channels, typically 4-20 farmers per channel. Most farmers take water in turn from FC, but some are reliant on water flowing through neighbours fields. The order is generally head-tail, but strong farmers may take out of order; farmers generally take water until they have met their needs or a neighbour asks them to stop, rather than in accordance with a schedule. Water may be diverted to fill private wells adjacent to FC

7.4.3 Management of water at a field level

There are various different rules applied in different locations for controlling water to distribution from an outlet to individual farmers. There are four approaches in common use

- *Ad hoc*
- Defined order
- On demand
- *Warabandi*

We first describe the characteristics of these four arrangements, and then we will consider how they are applied in the case study sites.

***Ad hoc* (individual discretion)** – farmers take water as and when they need it, subject to availability, and they may negotiate on an individual basis with others. They may also work together in small informal groups. This method is applied in Nepal at times of relative water abundance. At some times, particularly in less well-managed systems, they may also take illegal actions (cut canal banks or block channels, or steal water out of turn) to augment their supply. They may guard their supplies and use violence against those who attempt to prevent them.

Defined order of irrigation – farmers take water in turn, with order defined in advance. The duration of irrigation for a farmer in successive turns is not constant and will depend on the flow through the outlet; it will also depend on his land and practises (soil type, land levelling, depth of water desired) which will be constant for that farmer through the season but will differ between farmers. Individuals guard their turn and will close the immediate outlet to their field at the end, but they will not make any adjustments upstream to ensure that closing their individual outlet does not cause problems elsewhere – they assume that the next person to irrigate will take appropriate measures. In situations, such as Nepal, where the order is simple and goes to the adjacent field this rarely causes problems, but is difficult to apply in the Kyrgyz Republic, where the order would be much more complex and variable.

On-demand – farmers request water in advance from the *mirab* (or equivalent) and are allocated a turn with duration depending on the crop and area. If the flow is insufficient to irrigate the whole plot in the time allocated in the time available, they will be granted an extension. The corollary of this system, is that irrigation intervals will increase at times of shortage, but farmers will always be able to irrigate to the required depth once they do receive water[240]. The irrigation interval will also depend on personal access to the *mirab*.

Warabandi – this is a system with a fixed order and duration of irrigation according to area, as discussed in section 2.3.3. Each plot has a precisely defined time when it is entitled to the entire flow in the watercourse which feeds it. This is usually on a weekly basis so that a farmer should always receive water on the same day and same time. It was developed and is most rigorously applied in the Punjab, but has been transferred to other areas including Nepal and Andhra Pradesh with varying degrees of success. In Nepal the demand for water is variable (for reasons of climate and soils) and thus such a rigid system is not very easy to apply: it is most likely to work as a system to be applied occasionally at times of severe shortage rather than as a normal rule.

The arrangements are not rigorously defined in any of our study sites, with the result that there is a considerable degree of individual discretion in each case: water is managed on a fairly casual basis in all sites with few systematic rules, little monitoring and weak enforcement. Individuals are responsible for managing field applications.The methods for each case study site is summarised in Table 7.5.

[240] The impact on irrigation frequency is particularly significant for cotton which is very sensitive to irrigation timing

Table 7.5: Water distribution practices at field level

	KIS	SMIP	OH and JA	SRSP
Ad hoc - at individual discretion	Normal arrangement	Normal arrangement	Commonly in JA, some farmers at OH. Common in both schemes if water abundant	Normal arrangement
Defined order / depth of irrigation	Outlet 18 at times of shortage, but order returns to beginning at start of rotation cycle even if whole area has not been irrigated	Informal arrangement at start of study, introduced on more formal basis for periods of relative abundance during this study	Not used	Not used
On demand	Negotiated for land preparation	Negotiated for land preparation	Normal arrangement in OH	Not used
warabandi	Various past attempts to establish *warabandi*, but now abandoned	On paper, but not followed in practice. Introduced for periods of relative shortage during this study	Not used (being introduced on adjacent project on experimental basis by IWMI)	On paper, but not followed in practice

This essentially *ad hoc* approach to water distribution is widely recognised to be unsatisfactory – although it does benefit the strong and influential, who thus may resist changes. Nevertheless we did find a consensus that the existing systems are inefficient as well as being unjust, and that there is a need to improve water management. Farmers in the study sites proposed several potential solutions. In all sites, farmers felt the need for better water distribution rules – the key challenge is how to implement the rule, and more specifically how to pay for the costs of implementation.

The following options were proposed:

- Individuals apply water in accordance with rule, with no formal monitoring
- Individuals apply water in accordance with rule, a water guard observes compliance – particularly with regard to rules governing interventions in canals
- A water guard delivers water to the outlet, so that individuals can manage field activities
- A common irrigator manages all field irrigation activities

Such measures need to be considered in the broader context of irrigation management, and our more comprehensive ways to improve the situation are discussed in chapter 9.

Although we note above the essentially informal nature of water management at a field level, there is a degree of cooperation between farmers over many aspects. We found that farmers often stated that they worked on an individual basis for most activities, but that in practice that they frequently collaborated with friends, neighbours or relatives in small groups. We documented this most systematically in the case of the two WUAs in Kyrgyzstan. This is presented in Appendix F, where we summarise information on the nature and frequency of cooperation, and the composition and size of groups. Such collaboration has important impacts for the way water is managed at a field level, as we discussed in section 5.3.4.

7.5 Conclusions

In this chapter we have highlighted a number of difficulties with the formal systems for managing irrigation

- Water rights are not clearly defined. WUAs and farmers do not have an absolute right to water, but they have to negotiate an allocation each year on the basis of weakly defined entitlements - yet they believe they are entitled to as much water as their crop needs;
- The procedures for allocating water are weak – farmers either see little point in planning or are reluctant to do so;
- The infrastructure is often difficult to manage, and it may not be possible to divide into hydraulically and physically distinct units which can be independently managed;
- The hydraulic characteristics of outlets and control structures may mean that actions by one WUA or sub-committee of a WUA may influence another management unit. The WUA or higher level management organisation may need to be active in management to prevent such conflicts;
- WUAs and farmer may not understand or accept the technical basis of the management system, and they may seek to modify it without fully understanding it. This can lead to unanticipated problems or create opportunities for greater inequity in water distribution unless rules are better enforced;
- Large schemes in arid areas serve highly diverse interests, with water supply and livestock being as important as irrigation uses. A times of drought, these secondary uses may take priority and be managed with little reference to the irrigation-focused WUAs. Such schemes often have many different (albeit linked) water sources – including tanks and wells as well as canals; and
- WUAs have rarely developed systematic rules which they can enforce, although they may have made some attempts to design suitable rules. Unfortunately rules tend to be too simple to be applied consistently, and thus farmers make numerous informal, *ad hoc* adjustments.
- Farmers do work in small informal groups for many aspects of irrigation, which do help individuals to cope with unreliable water supplies. The ability of individuals to draw on the cooperation of the neighbours and relatives has an important impact on their access to water. In the absence of effective formal management organisations, those without access to informal networks are significantly disadvantaged.

In the next chapter we will examine how these factors have influenced actual water distribution and hence the equity of access to water by different categories of water user.

8 Water distribution in practice – observations from this study

8.1 Introduction

This chapter describes the actual water distribution at the start of the study. This was observed using participatory techniques in the Kyrgyz Republic and KIS, as described in Chapter 3, and using similar techniques in an earlier project in SMIP. Water distribution was only observed in SRSP during the reconnaissance study during *rabi* 2003/04 because of the total failure of irrigation in *kharif* 2004 and *rabi* 2004/05.

These observations aimed to test various hypotheses regarding the equity of water distribution, which we outlined as the three 'technical questions' in section 2.7. In this chapter, we focus on physical aspects of water distribution and test the hypothesis that it is not neutral with regard to socio-economic status or location. These observations also provide a baseline for testing the second set of hypotheses – that improved monitoring of water distribution could improve equity of distribution. We examined the social and institutional situation in chapters 5 and 6.

In this chapter we first expand on these technical hypotheses (section 8.2), and then describe our observations of water distribution at different levels of the system

- Bulk supply: Irrigation Department to WUA (section 8.3)
- Supply from WUA to outlets, involving one or two levels of controls, depending on physical layout and organisational structure (section 8.4)
- Supply from outlets to users (section 8.5 and 8.6)

These are not independent, as individual users can exert influence at higher levels to ensure better supply, and this may also benefit their neighbours. However, distinct operating rules apply at each level and thus they are considered separately here.

We recognise, also, that many users have access to alternative sources of water and do not necessarily rely on the official source. The access to such sources does depend on location and socio-economic status, and we analyse the equity of this access in section 8.5.

8.2 Equity of access to water: definitions and hypotheses

8.2.1 Definition and understanding of equity

There are many different interpretations of equity, and we have discussed various understandings of the concept in Chapter 2. As Chambers notes: "*Equity is a difficult concept, implying equality, fairness and even-handed dealing*." (1988, p. 37).

We need to distinguish between equity of distribution and equity of allocation. Equity of distribution is only achieved if the actual delivery of water in time and space matches the allocation of water (ie if all farmers receive what they are entitled to), ***and*** if the allocation is equitable[238]. Equity in allocation is in itself quite complex as there are many possible interpretations of equity in places where there are no formally agreed water rights.

Equity in formal rules is a "normative" concept: it says how water *should* be distributed in keeping with what is considered to be a fair, or even-handed way of sharing water. Most public irrigation systems in the study countries are designed to deliver water uniformly with respect to land area, according to crops grown. This basic principle of distribution of water proportionate to land is the most common arrangement and is the perception of farmers in each of our case study sites (although it does not apply universally on irrigation - FMIS in Nepal often follow other concepts[239]

Following the example of many FMIS, the WUA at KIS has reached a consensus through a process of negotiation on what rules to apply for water allocation. This is not necessarily equitable, but in distributing water they aim to meet this allocation rather than specifically try to achieve equity. These rules are generally accepted even though they were not developed by all users in a participatory way and accepted by the majority of the users belonging to different sections of the society. This leaves open questions of the inclusiveness of the participatory processes and the nature of the acceptance of the conclusions by all users.

We have noted in Chapter 7 that entitlements to water are not explicitly defined in any of the case study sites, but there is an implicit assumption (both in common understanding and in formal legal documents) that farmers have equal right to water regardless of their location or socio-economic status[240]. Thus we would expect each farmer to receive water proportionate to the area of crop and the crop water requirement for the approved crops on his land.

8.2.2 Hypotheses regarding equity of access to water tested during this project

Our hypothesis at the start of this study was that access to water is not equitable: we believed that both the socio-economic status and the location of water users influenced their access to water. We further believed that access could be made more equitable by improved systems of monitoring. These two hypotheses will be examined separately.

(i) That access is not neutral with respect to socio-economic status or location

In the context of projects where water is only provided to a part of the command area or where different crops are grown on different parts of the command area, this hypothesis needs to be subdivided:

- Not all farmers are equally involved in the decision on which areas to authorise for irrigation, which crops to grow and when to irrigate them, and poor farmers may be disadvantaged; and

[238] It is possible for distribution to more equitable than allocation: this was observed in the Jurung Sate project in Lombok, Indonesia (Mott MacDonald, 1988), where field staff were able to respond to farmers needs and distribute water more equitably than would have been the case if they had strictly followed the plan.

[239] For example, water may be allocated according to the share a farmer owns, to the resources a farmers contributes for up-keep of the system, to the investment made earlier in building the system, or with respect to crop grown, and so on – equity is not necessarily an objective. (Pradhan et al 2000) Pradhan goes on to criticise those who attempt to introduce equity on FMIS where it was not previously an objective of management.

[240] With the proviso that there may be some restrictions on which crops may be grown in any specific area - in this situation the water allocated to such areas will be dependent on the type of crop.

- Within the areas which have been authorised for irrigation, the timing and duration of irrigation favours the relatively well off.

These hypotheses can be tested by examining the socio-economic characteristics of the areas authorised or excluded for each crop type (see section 5.2), and then by assessing the actual supply to fields which will be described in the later sections of this chapter (section 8.6). The relationship between access to water and the livelihoods of the water users is also analysed in this chapter.

(ii) That better monitoring of water distribution will improve equity

If we define monitoring as collecting information which will enable the system managers to improve performance against the indicators which are being used for monitoring, then the hypothesis can be rephrased as:

- Existing systems of monitoring are inadequate;
- Water user behaviour and WUA management structure and governance can be modified so that the improved monitoring systems can be designed (including identification of better indicators) and implemented effectively; and
- These improved procedures could increase equity and hence the livelihoods of previously disadvantaged water users.

These three hypotheses will be examined separately:

- The impact of existing monitoring systems (which were described in chapter 7) are analysed in this chapter.
- Procedures for improving these systems as tested during this project will be described in Chapter 9
- The outcomes of these measures will be analysed in Chapter 10.

The analysis of fieldwork undertaken in this project will then lead onto more general guidelines for improving access to water and hence livelihoods in Chapters 11 and 12.

8.3 Water distribution in practice: bulk supply from Irrigation Department to WUA

8.3.1 Introduction

In this section we will consider water distribution at the following levels:

- KIS – supply from the river to the main canal (which is jointly managed by DOI and WUA)
- SMIP – supply from the river via CMC and S9 to SS9E (which is managed by WUC)
- Obu Haet and Jany Aryk – supply from the *Raivodkhoz* to WUA (ie to a series of on-farm canals managed by WUA)
- SRSP – supply from D86 to Minor 30R and comprises part of the WUA (which also includes Minors 32R which is separately supplied from D86).

8.3.2 Khageri

At KIS, the entire flow is diverted into the main canal except at times of flood or when water is not required by the WUA. There is no contract or formal agreement and no records of what is supplied – indeed there is no means of measuring the flow. KIS is the last system on the Khageri river before it joins the East Rapti river and has no requirement to leave any water in the river. Informal return flows are here sufficient to ensure adequate environmental flows. There are however, schemes further upstream – notably Panchakanya (600ha) which have some impact on KIS. There may be some negotiation with these users to increase the flow down to KIS, but there is no information available on the impact that this may have had.

8.3.3 SMIP

There is a formal agreement at SMIP to deliver 931 l/sec to SS9E. The duration of this flow is not formally specified in the documents but it is commonly believed to be for 4 days in every 8 days during the crop growth stages, except when the canal needs to be closed to limit sediment entry.

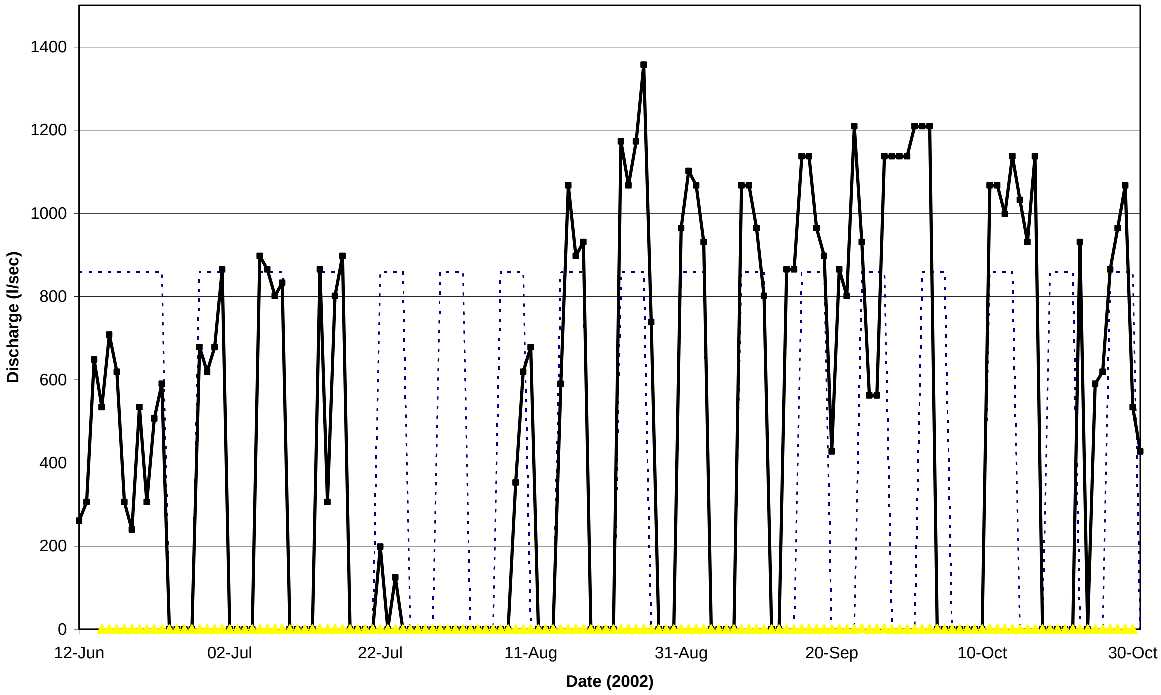
The rule at the start of the season during land preparation is not clearly defined, although continuous flow is normally practised until the end of June so that all farmers get the opportunity to transplant rice. This is not fully satisfactory and shorter more intense flows in the sub-secondary canals would be both more efficient and more equitable. Although the river water level is high by June, the amount that can be supplied to SS9E is limited by main canal capacity and the need for continuous flow throughout the system: this results in an average flow well below the design discharge, which must result in a much lower flow reaching T5: this rule is therefore not equitable. It is possible to reach a consensus on land preparation within a watercourse (although even that appears to be slightly inequitable as noted below), but consensus between sub-secondary and secondary canals could only be reached by active involvement of the WUCCs and WUCCC - who do not attempt this in practice.

The flows were observed in 2002 to be as shown in Figure 8.1. A broad similarity between design and actual flows can be seen, although there is rather less than design in the early part of the season. This is reported not to be a problem in general since there is a slow build-up of land preparation, but anecdotal evidence suggests that farmers at the tail end may face difficulty in preparing their land on time. The capacity of the system insufficient to deliver the design flow on a continuous basis – and this is the reason behind the design principle (see section 7.2) that farmers can only be guaranteed sufficient water for 50% of their land – whether they have sufficient for the remainder will depend on rainfall. The prolonged closure in July/August is due to high rainfall, when there was no demand for irrigation water. For most of the remainder of the season the flow was above design – by up to 50% and the duration of flow was also longer.

The total amount of water supplied between 15th August and 30th October was 134 % of design, but much of this was not needed by the farmers – because it came at times of rainfall or late in the season when water was not needed. The total number of days that the canal was flowing in this period was 52 rather than the design 40 days, and the average flow on these 52 days was 960 l/sec. However, if we look at the 40 days when it should have received water, it was only actually flowing on 34 of these days. The flow on these 34 days averaged 990 l/sec (6% above design) but on 6 scheduled days there was no flow – giving an average of 90% of the design flow over the 40 scheduled days. In addition the canal received water on a further 18 days, at times when it was not scheduled to receive water. These variations indicate that although there may be adequate water overall, it was not delivered on the days scheduled. This made it very difficult to plan water distribution at lower levels and as a result a very small proportion of this flow reached the tail of the sub-secondary canal (as we will discuss later - see section 8.4).

By improving the timing without changing the overall volume of water it should be possible to achieve much greater equity in distribution: this was one output we hoped to achieve in this project and which will be discussed in Chapter 10.

Figure 8.1: Flows into SS9E in 2002



8.3.4 Obu Haet and Jany Aryk

The WUA comprises in practice a series of independent sub-systems, supplied separately by the *raivodkhoz* from the inter-farm canal. Our focus in this study was on the sub-systems, rather than the WUA as a whole: Buvakul in the case of Obu Haet and Khatta Khaz 1 at Jany Aryk, which we discuss in section 8.4.

8.3.5 SRSP

(i) Sri Ram Sagar Reservoir

We first need to consider the inflows to and operation of the Sri Ram Sagar reservoir, as this has a critical influence on system operation – as became apparent in 2004 when water levels were so low that virtually no water was released for irrigation. As noted above, there is a large reservoir further upstream on the Godavari river at Jaikwadi, which controls inflows to the SRS reservoir. The annual rainfall since 2000 is shown in Table 8.1. Differences between the years are minor, and there is no indication of an exceptional drought in 2004/05.

rainfall since 2000 is shown in Table 8.1. Differences between the years are minor, and there is no indication of an exceptional drought in 2004/05.

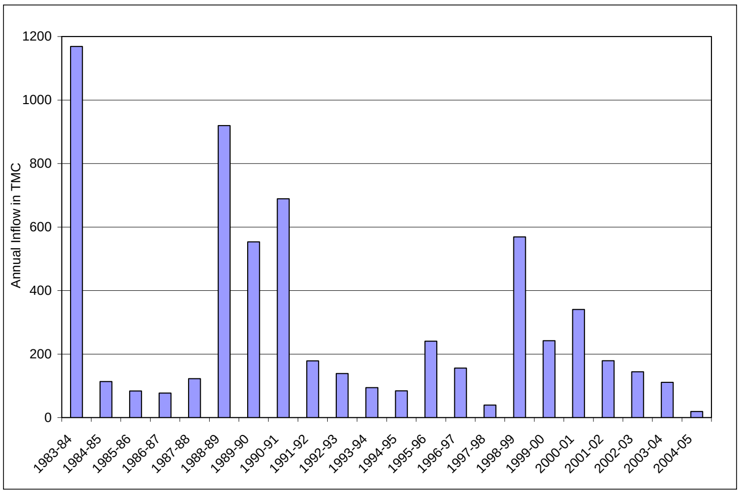
Table 8.1: Annual Rainfall, SRSP (mm)

Year	Rainfall
2000/01	577
2001/02	498
2002/03	426
2003/04	516
2004/05	463

Note: Water years from June to May

Annual inflows to SRSP show a rather different picture, as illustrated in Figure 8.2. The 2004/05 value is the lowest in the period of record, though not substantially lower than the previous lowest in 1997/98. The recent sequence of low values is of a similar magnitude to those in 4-year periods starting in 1984/85 and 1991/92.

Figure 8.2: Annual Inflows to SRSP



Annual spill values are as shown in Table 8.2. This shows that 2004/05 was the second year in the last ten when the reservoir did not spill. Other data suggests that in 1997 the maximum storage was less than 50% of reservoir capacity and only a little higher than that in 2004. There is also a clear difference between spills in other years from 1995/96 to 2000/01 and those in the last four years. However, as noted earlier, there have been earlier 4-year periods which look to have had broadly similar inflows to those of the last four years. Understanding the causes of the variation in inflows remains the key to making an estimate of return period[241]; this requires further information on Jaikwadi reservoir so that the significance of its inflows and operational procedures can be assessed.

[241] ie. the frequency with which it can be expected that the reservoir will not fill

Table 8.2: Annual Spill Volumes (Mm^3)

Year	Volume
1995-96	89
1996-97	95
1997-98	0
1998-99	403
1999-00	86
2000-01	186
2001-02	27
2002-03	2
2003-04	4
2004-05	0

(ii) Kakatiya Main Canal

The procedure for planning rotations was described earlier (section 7.2.3), but for various reasons this has not been followed. The Irrigation Department planned a rotation for *rabi* 2003/04, which due to the water shortage just provided for one wetting in December, two in January and one in February, each for 8 - 10 days (Table 8.3).

Table 8.3: Rotation schedule for the SRSP during *rabi* 2003-04

Area	Watering 1	Watering 2	Watering 3	Watering 4
Above the LMD	10-17 Dec	2-8 Jan	20-27 Jan	10-17 Feb
Below the LMD	15- 22 Dec	6-13 Jan	27 Jan- 3 Feb	19-26 Feb

During the subsequent *kharif* and *rabi*, these schedules were not drawn up due to the severe water shortage and the low possibility of irrigation.

Due to extreme shortage of water, no water was released for irrigation during *kharif* 2004, but some water was released in the Kakatiya canal from SRSP on 6th to 12th September 2004 to supply drinking water to Warangal town[245] and its neighbourhood. Surface water bodies and tanks enroute were allowed to be filled for storing water for drinking purposes. This provided D-86 (in the study area) with 20 m^3/sec from 9th to 11th September 2004. Another exclusive release for drinking water purpose to fill one main tank in each village was made on 25th Feb - 4th March, 2005, which is discussed in more detail in section 8.4.5.

(iii) Distributary D-86

The supply to D-86 is highly erratic, but is always less than the allocation (the maximum flow ever recorded is 25m^3/sec (93% of design discharge). Originally this area was cultivated with rice, but the localisation was changed to ID crops when the system was extended. However, as a result of political pressure, the traditional rice cropping pattern is still tolerated. Thus in much of the canal (including in

245 a major town in the lower part of SRSP which is dependent on the KKC as a source of drinking water

M30R) the dominant crop is rice (although this is still unofficial), and water is insufficient to reach the tail of D-86.

The offtake to M30R is gated, but the measuring structure is only partially complete and is not operable. The gate is also damaged and leaks. There is limited control possible and measurements of flow can only be done by current metering, which would not be practical on all of the large number of outlets along D-86 in a similar condition. There is no local desire to monitor flows as they grow so much rice, and measurements are likely to indicate excessive use.

Both the distributary canals and the minors are operated intermittently. D-86 received water for four 10-day periods in *rabi* 2003/04, and M30R which is in the mid reach of D-86 and should have received water for 4 days out of these 10 days. In practise it also received some water on the remaining 6 days because the gate is damaged. In this season they planned to deliver 21 m3/sec (80% of design) to D-86 and to irrigate 58% of the total area (19,200 ha) roughly uniformly spread among the three DC areas (27%, 33% and 40% in head, middle and tail respectively) - Figure 8.3. Actual delivery was quite different from the plan. We do not have quantitative data on water distribution but we did observe that the bottom 25% received no water in *rabi* 2003/04.

Figure 8.3: Rotation schedule for D-86 in Rabi 2003-04 (cusecs)

Area (km)	**1st Wetting** Dec (10th -17th)		**2nd Wetting** January (2nd -11th)		**3rd wetting** January (21st to 30th)		**4th Wetting** Feb (11th to 20th)	
0 -15	200							
15-35.3	380	176	380	176	380	176	380	176
35.3-54.6	70	424	70	424	70	424	70	424
Total	**650**	**800**	**650**	**800**	**650**	**800**	**650**	**800**
	8 days		**10 days**		**10 days**		**10 days**	

This water release was planned in accordance with water rights and was intended to cover ID crops only, so these figures are naturally much less than is required for rice. They are equivalent to about 360-390 mm/season or about 35% of the requirements for rice. Successful cultivation of rice – which is the dominant crop in the upper part of D-86 - thus depends on access to groundwater or illicit access to surface water.

Distribution at this level – between WUAs along the distributary canals was clearly stated by many WUAs as well as the I&CADD, in our initial consultations during *rabi* 2003/04 to be the main problem of water management. Until this is resolved, the WUAs feel that they have little scope for improving internal water distribution because they consider the supply to be too inadequate and unreliable for it be worthwhile attempting internal management[246]. Responsibility for management of

[246] This might well be a valid belief for the tail outlets which received much less than their allocation: they could be justified in devoting their energies towards lobbying the I&CADD to give them a better supply. The excuse seems less valid for outlets further upstream which receive a better supply (possibly even greater than their allocation. However, even those who do get sufficient water might receive it at unpredictable times.

distributary canals remains with the I&CADD and there is no longer even a distributary committee to co-ordinate between WUAs and liaise with the I&CADD. The only mechanism available is for individual WUAs to lobby directly with the I&CADD, or for influential individuals to approach them directly. Local politicians may play a significant role in this

It is believed that 30R, which should take 225 l/sec, in fact takes significantly more at times (although it requires illicit intervention in the D-canal to achieve this). As SRSP is designed (retrospectively) to the structured system, the minor gates are intended to be either fully open or fully closed, but fluctuations in the D-86 water level which has no cross-regulators and a discharge which is lower that design means that the discharge into 30R is very variable as can be seen from the description of *rabi* 2005 below. As noted above, D-86 was closed throughout *kharif* 2004 apart from a brief period in September, when M30R received some water.

8.3.6 Summary of bulk supply in case studies

The bulk suppliers to the WUA have, with the exception of SRSP, generally delivered water in accordance with their obligations, although in all of our study areas, constraints on total water availability due to weather patterns, river flow, or the size of the command area that the system is expected to irrigate, have meant that this supply is less than demand for water: this has been a source of dissatisfaction among water users (at least in some years and in some parts of the year).

There is also a problem with the timing of supplies – even in cases where the supply is greater than the requirement, it may not be delivered in accordance with a schedule or the schedule may not be communication to the WUA or water users. This results in wastage within the WUA, as described below. Managing an unpredicatable supply, even if it is in fact sufficient, is difficult and depends on good communications with users. The users may not be able to make good use of the water if the timing conflicts with other elements of their livelihoods strategies: there may be unnecessary watage.

8.4 Observations of supply from WUA to outlets

8.4.1 Introduction

In this section we will consider:

- KIS – supply from the main canal to the branch canal and then the outlet;
- SMIP – supply from SS9E to T5 and then its watercourses;
- Obu Haet and Jany Aryk – supply from the inter-farm canal to the on-farm canal to the outlet;
- SRSP – supply from Minor 30R to the pipe outlets

8.4.2 Khageri

(i) From main canal to branch canal

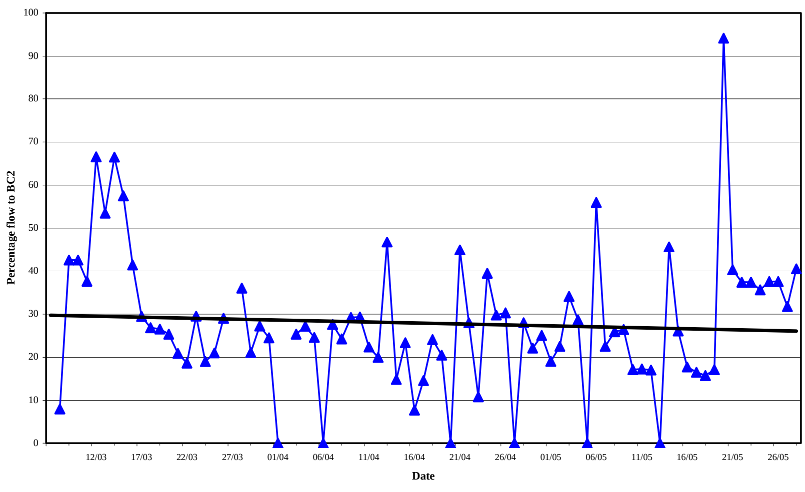
Flow from the main canal to the branch canals in the spring season is for the most part well-planned and implemented. There is a clear water-sharing agreement between the branches, which is monitored and performance is generally in compliance with the agreement. In this section we compare distribution with the agreement, although as noted in Chapter 7, this agreement is weak in two areas:

- Abstraction by upstream users is ignored (direct outlets between the intake and the first branch canal); and
- Requirements by downstream users have increased since the agreement was reached, and these changes have not been reflected in the formal planning procedures.

The first weakness is formally covered by the terms of this agreement since it requires sharing of the available flow in the main canal (in a way such that BC-1 (including BC-0) receives 75 % and BC-2 25 %) – even if some has been diverted by upstream users. It causes significant dissatisfaction, however, since quite a large flow is diverted, and some downstream users question the right of Kaparkhori farmers (who are not represented in the WUA) to take this water. Accommodating the second weakness requires the WUA to break the agreement, but as the amount of water is small this should cause few problems in practice, provided that it is communicated clearly and in a timel manner. It did cause dissatisfaction during the study season amongst some farmers (see box 6-12), but they do not yet regard it as a serious problem provided that the farmers are informed of the revisions to the plans by the WUA.

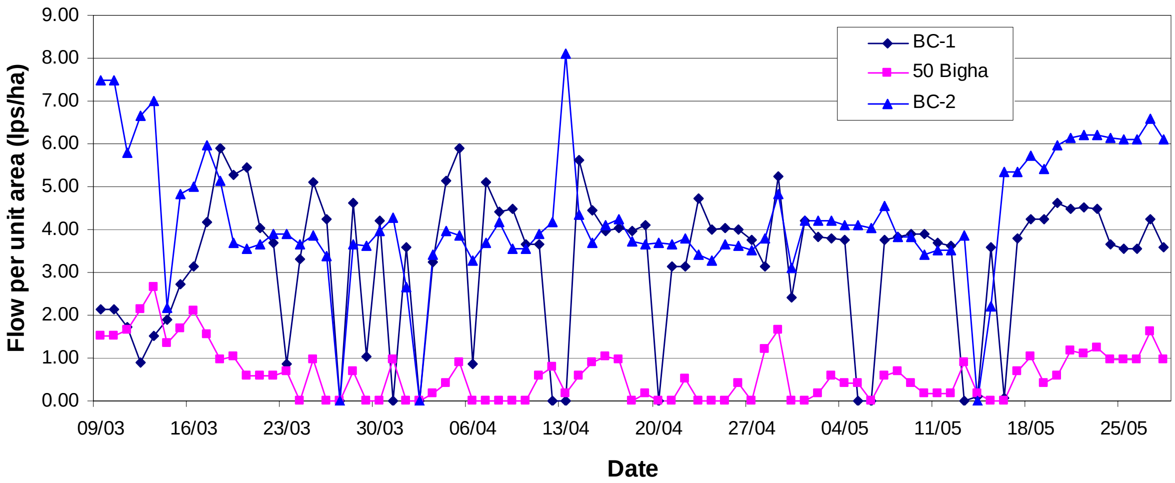
In the present context, we are interested in the extent to which this rule is complied with (ie. whether the actual distribution conforms to the allocation rule). As noted earlier, the water control structures are complex, so monitoring of this water share is not transparent and many farmers suspect that it is not complied with - farmers from each BC blame the other farmers for influencing gate settings. Gate operation is formally the responsibility of DOI jointly with the WUA, but in practice it is managed by the WUA. The water is shared by operating the cross regulator gates at 28,500 RD and 32,000 RD (see Figure 4.3) which is done by the *dhalpa;* members of *karyadal* are aware of these operations, but general farmers have some disbelief. The flow record of 2004 spring shows that the distribution of water between BC-1 and BC-2 was approximately in agreement with the norm (25% for BC-2) over the season, although there are considerable variations on a daily basis (Figure 8.4). The share for BC-2 was slightly higher at the start of the season when BC-1 was not ready to start irrigating because they were still growing wheat: BC-2 had access to water then that would otherwise have been wasted.

Figure 8.4: Percentage water taken by BC-2 at Khageri



The actual flows in BC-1 and BC-2 per hectare are presented in Figure 8.5 together with the flows in *pachas bigha kulo*. *Pachas bigha kulo* is a major direct offtake from the main canal and is under the responsibility of BCC-2. The average duty in BC-1 and BC-2 is very similar, as would be expected from the analysis above. It is high compared to the water requirements of rice. The duty in *pachas bigha kulo* is much lower and will be discussed below.

Figure 8.5: Flows per unit area in BC-1, BC-2 and *Pachas bigha kulo*



The water sharing agreement between the branches is based on volume of water, but, the areas of land where rice is successfully grown are a more visible and understandable proxy indicator of whether the agreement is followed since the whole area is under rice. This is much easier to observe than the rather esoteric calculation[244] of flow volumes that are needed to assess water sharing - although it is surprisingly difficult for farmers to estimate the total area irrigated (since the unirrigated areas in BC-1 are isolated patches at the tail of outlets). It is also a little misleading since the water requirements of *ghol* and *tandi* land are so different: considerable areas of *ghol* can be grown with little direct release from the canals and may only need canal water for transplanting, whereas *tandi* is fully dependent on irrigation and may fail totally if it is not irrigated after transplanting.

The approximate areas transplanted in 2004 are presented in Table 8.4, and it can be seen that the areas reflect the good compliance with the agreement. The slight deviation in percentage of areas is probably due to land topography since BC-1 has a higher proportion of *tandi* land and thus a greater water requirement.

Table 8.4: Rice transplantation area in KIS

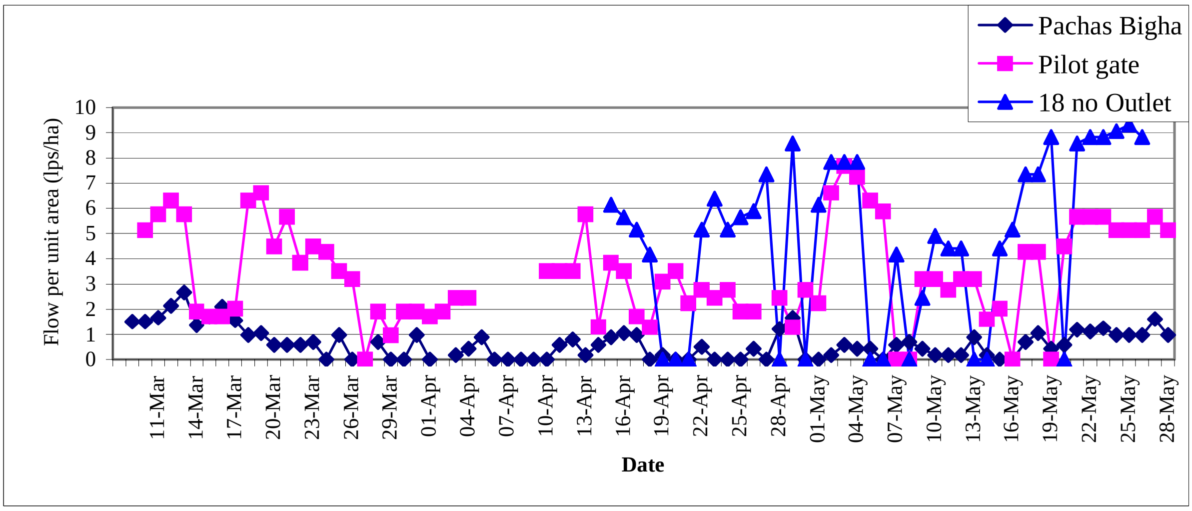
Canal	Total command area (ha)	Area of irrigated spring rice (ha)	Share of total spring rice area (%)
BC-1	234	182	66
BC-2	575	95	34
Total	809	277	100

[244] These structures operate under partly submerged conditions. They had been calibrated at the time of management transfer and checked during this study. Calculation of flows depends on measuring gate openings and upstream and downstream water levels, and pplication of faily complex equations. This is a more complex process than the WUA are willing to undertake

(ii) From branch canal to outlet

Flows to the outlets (either from the branch canal or direct outlets from the main canal) in aggregate must comply with this sharing, but individually they show a very large variation as indicated in the flows per unit area in the three outlets studied (Figure 8.6). Management of this is the responsibility of the BCCs, although as will be discussed below, they are reluctant to take on this role. The average flows are 0.6 l/sec/ha in *pachas bigha kulo*, 3.4 l/sec/ha in Pilot gate west and 4.8 l/sec/ha in O18: striking variations, particularly since farmers in *pachas bigha kulo* are generally more satisfied with water supply than those in outlet 18.

Figure 8.6: Comparison of flows to outlets at KIS



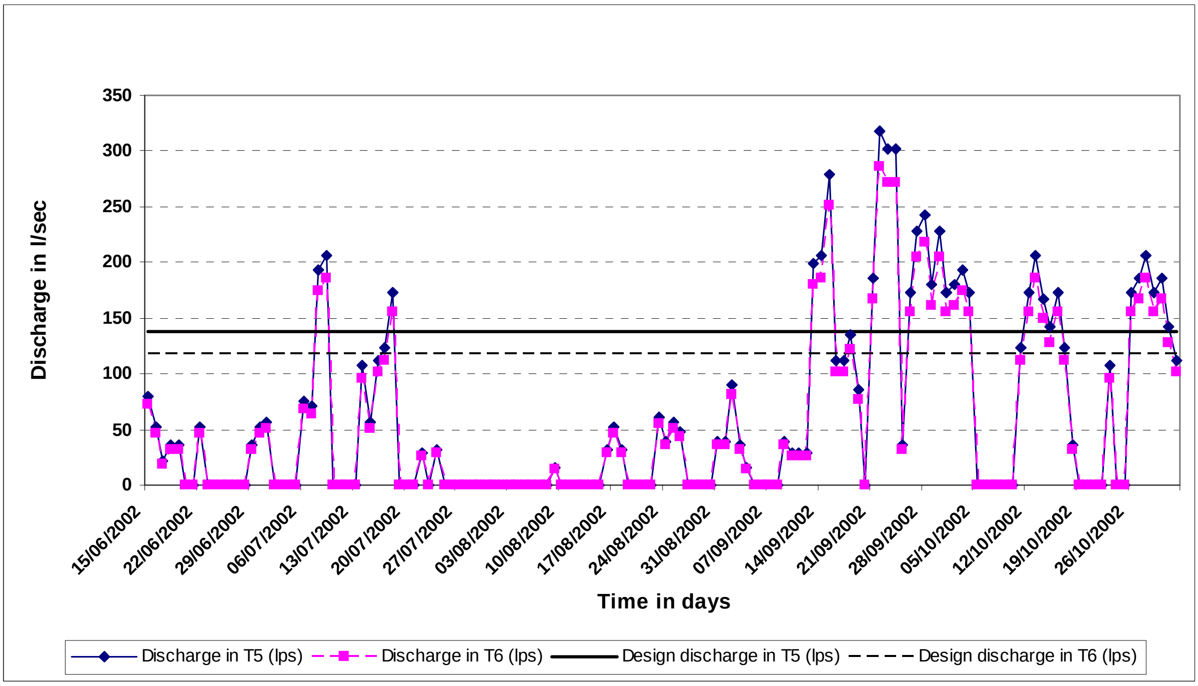
It is clear that delivery of water to the three areas is not equitable from the perspective of land area. However, despite the very low flow to *Pachas bigha kulo*, few farmers felt water scarcity in this area. As this is a lowland area the water requirements are lower than BC-1, and direct irrigation 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. The small direct outlets from the LMC had discharges ranging from 2.3 l/sec/ha to 5.9 l/sec/ha.

Outlets contain a mixture of well-being groups, and even tail-end outlets contain well-off farmers.We have noted that poverty does increase downstream within some outlets – this is very noticeable in Outlet 18. It is not true of *pachas bigha kulo* where there are many well-off farmers towards the tail, but very few plots in this outlet faced significant problems of water supply.

8.4.3 SMIP

T5 is at the tail of SS9E and was designed to irrigate 116 ha (16%) of the total area of the sub-secondary canal. T6 branches off SS9E at the same point and irrigates about 12 % of the total area. Thus for equity by land area almost 30% of the flow at the head of SS9E should reach the tail. Operation of this canal should be managed by the WUC and should only require policing of the canal – no gate adjustments are necessary. In practice the WUC does not do this policing, and many individuals or small groups of farmers intervene by blocking the canal or cutting illegal outlets. Thus, in practice, only a much smaller proportion of the water reaches the tail: the discharges in T5 and T6 in 2002 compared to the design are presented below in Figure 8.7.

Figure 8.7: Comparison of Flows in T5 and T6 with design



T-5 and T-6 occasionally reached design discharge in the early part of the season, which helped during land preparation but in general the design discharge was only achieved at the end of the season, when most upstream farmers no longer needed water. Some farmers close to the head reach of T5 and T6 were able to get water as needed but the majority largely relied on rainfed cultivation. The changes that were achieved in 2004, during implementation of this study are presented in Chapter 10.

The situation is mirrored in the flows to the four WCs, as is illustrated in Figure 8.8 in the case of WC-3 which is one of the tail pair of watercourses. The water shortages here are even more marked, and no water was received for a period of eight weeks. Areas of water scarcity are indicated on Figure 8.9.

Figure 8.8: Comparison of flow in T5-3 with design

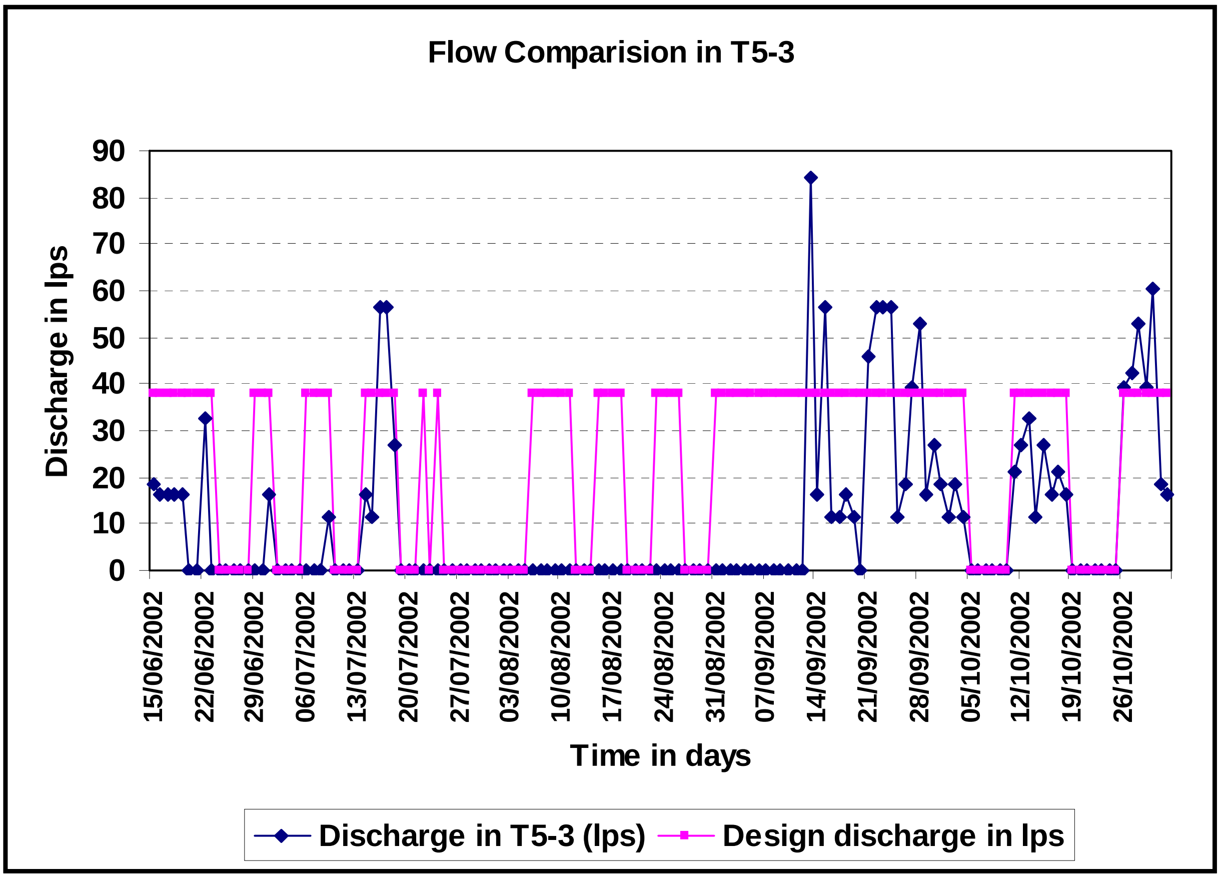
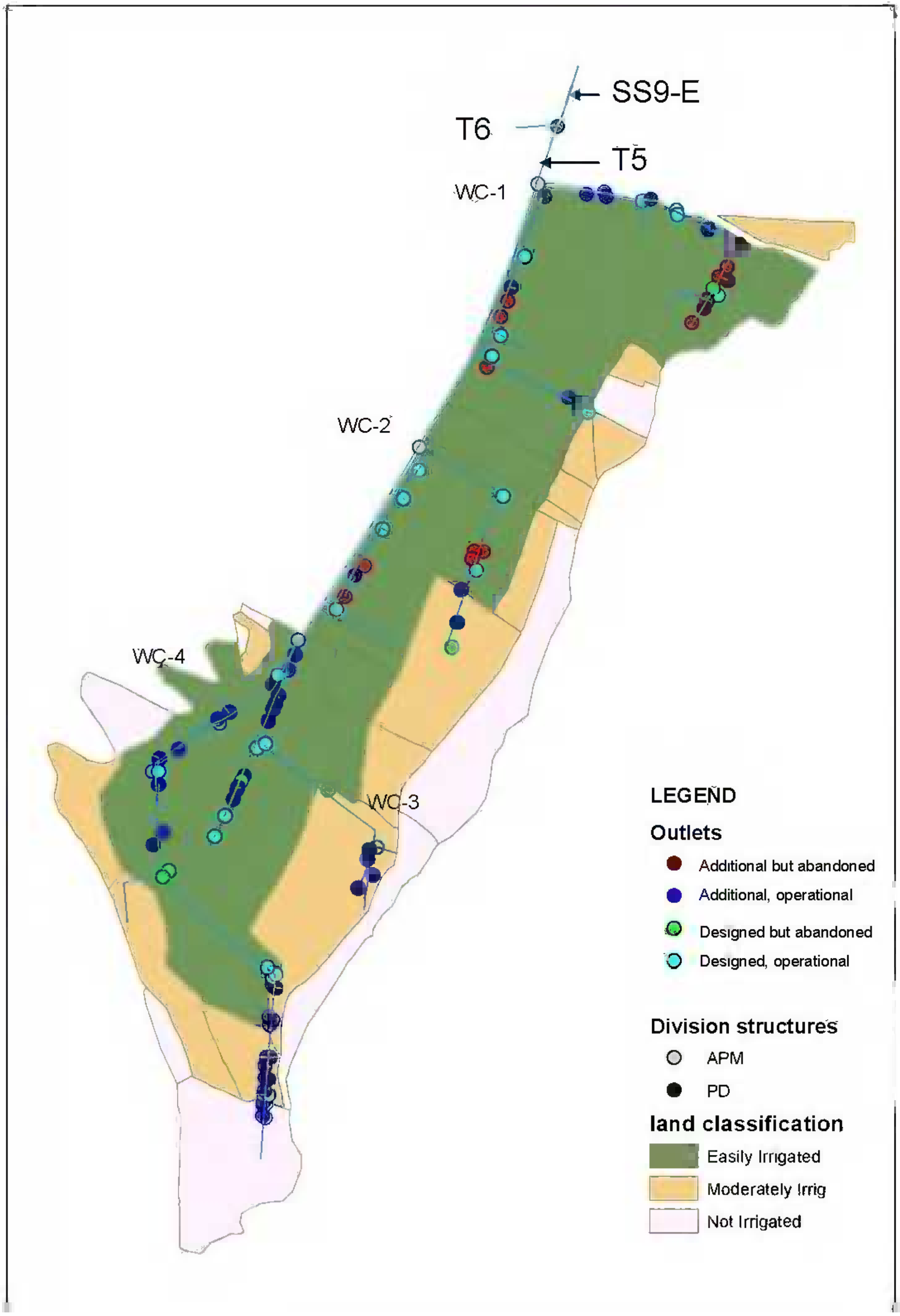


Figure 8.9: Status of irrigated land at SMIP



8.4.4 Obu Haet and Jany Aryk

Although the Buvakul canal command area appears to be hydrologically distinct, many farmers (almost 20 %) obtain some water some of the time from adjacent areas – either through uncontrolled drainage from neighbouring irrigated land, or by deliberately taking water from other canals. About 12,600 m3/ha were supplied by the *Raivodkhoz* into Buvakul. This actual amount of water distributed (through the official canal) differs slightly from the planned amount, as summarised in Table 8.5.

Table 8.5: Comparison of allocation and distribution of water for Buvakul canal in 2004

Month	Planned (*1000 m^3)	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 was distributed. The plan does not take account of rainfall, and thus actual flows can usually be reduced slightly – this was notably the case in July. These figures also do not include the return flows from other areas or amounts taken from other canals and the values are therefore below the real amount of water that was directed into the area. They do however represent the amount that the farmers pay for.

There are 57 outlets along the 4 km canal, serving an average of 2.5 ha/outlet. Accurate measurement of flows into each outlet is thus not practical. Outlet 2 for example takes water at a small brushwood weir where it might be possible to measure flows with a small flume, but some of the water sometimes flows back into Buvakul downstream of this point. Similar complexities apply for many outlets and the sheer number of outlets would make sophisticated techniques impossible. This analysis thus focuses on the flow in the head, middle and tail reaches of Buvakul.

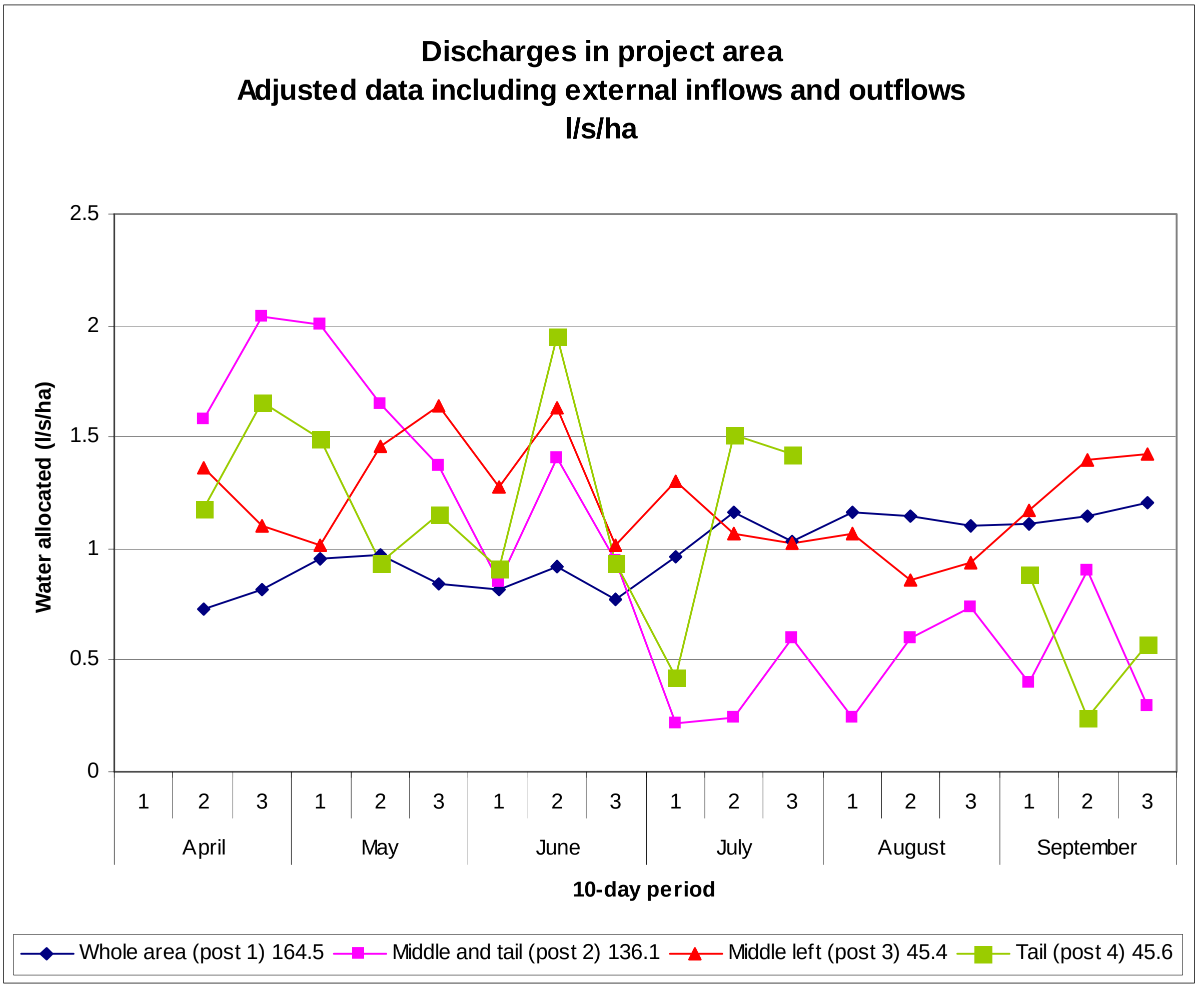
After allowing for estimates of inflow from other sources, the volume supplied in the three reaches are estimated as follows

Table 8.6: Irrigation volumes (m^3/ha) in Buvakul

	Section of command area		
	Head	Middle	Tail
Area (ha)	28	91	46
Flow volume (m3/ha)	22,800	9,000	18,800

The amount used in the tail reach is estimated to be about 10,700 m^3/ha because of uncontrolled drainage outflows. This weak relationship between canal flows and volumes actually used in each canal reach makes it difficult to use volumetric measurement as a basis for water management. The timing and location of these flows is such that the water cannot be used effectively in the tail, which consequently suffers from shortages at certain times despite an apparently ample supply. Although the flow into the area as a whole is quite uniform against time, the flows to the tail are much more variable (Figure 8.10). This variation is compounded by marked diurnal fluctuations, due to snowmelt in the early part of the season. Management of irrigation by middle and tail end farmers is thus much more difficult than for head farmers.

Figure 8.10: Discharges into Buvakul (l/s/ha) through the season



There is also a very pronounced variation along the length of the canal in Jany Aryk (Table 8.7), although again it is not quite as extreme as the following figures suggest since the tail zone is able to draw water from the Selpo canal as well (this is the next offtake downstream from the AABC, and thus has a generous water supply).

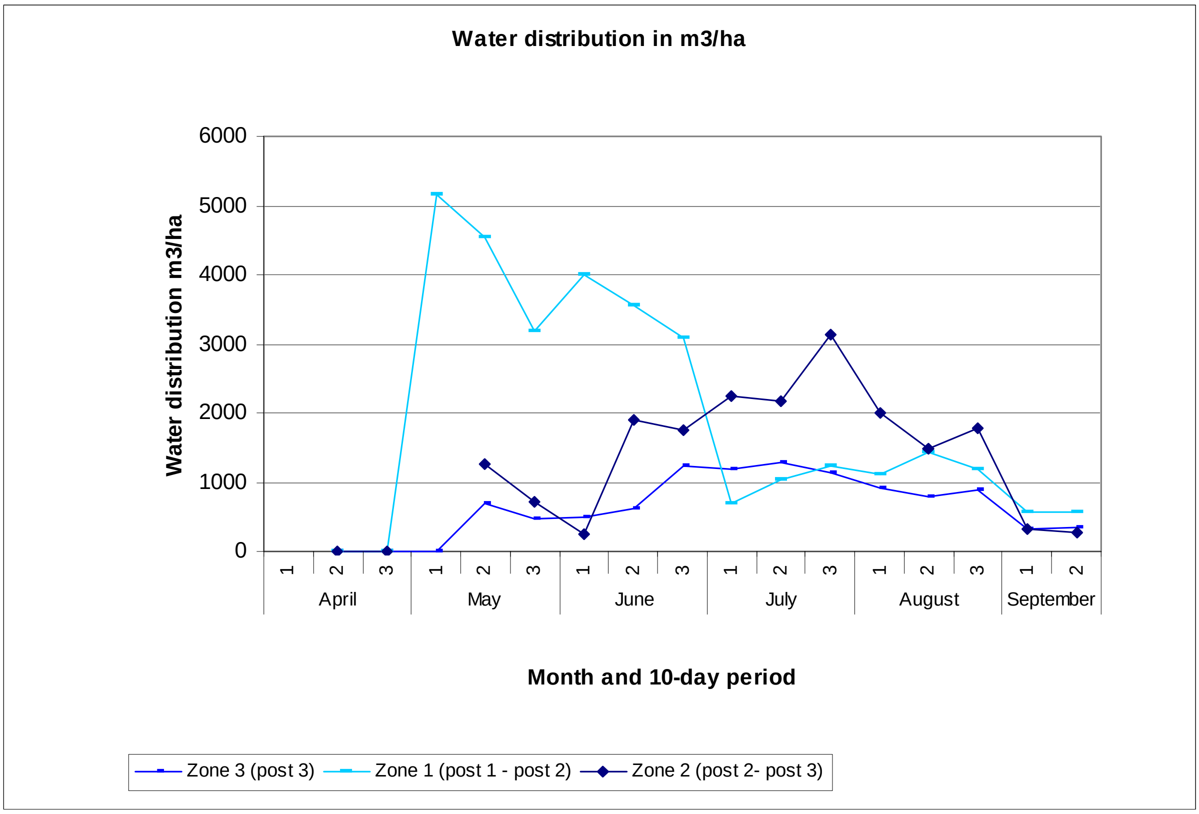
Table 8.7: Irrigation volumes (m^3/ha) in Jany Aryk

	Section of command area		
	Head	Middle	Tail
Area (ha)	36	71	92
Flow volume (m3/ha)	23,700	18,000	10,400

The overall volume per hectare at Jany Aryk is about 10% more than for Buvakul in Obu Haet, reflecting its favoured location at the head of a major canal,. This difference at Buvakul is partly offset by inflows from other areas.

Short term fluctuations in supply to Jany Aryk are not as pronounced as at Obu Haet (Figure 8.11), but the head has a much better supply in the early part of the season: supplies to the middle and tail do not reach their peak until late July which is after the main period when water is needed for the crop grown here (predominantly maize):. The need for improved canal management is again apparent.

Figure 8.11: Water distribution to Jany Aryk (m3/ha)



There are a smaller number of larger outlets in Jany Aryk than at Obu Haet, but it is still impracticable to measure flows into them. The canal is also used as a source of drinking water for the village, and for vegetable gardens in houseplots.

Although there is a significant difference in access to water according to location in the system, this does not appear to be correlated to well-being: rich and poor are equally likely to be located anywhere in the system. This is discussed further in section 8.6.4.

8.4.5 SRSP

There was no canal water released for irrigation in 2004 but a small amount of water was issued for drinking water and some reached M30R. This was used for filling the tanks and some illicit irrigation. Although the tanks predate SRSP and previously relied on natural runoff, most tanks now receive water indirectly from the SRSP (from percolation, from overflow from fields, or direct flows from the minors or pipe outlets). Most of the minors and pipes have tanks at the tail to capture drainage runoff.

As a result, the tanks which used to dry up soon after the monsoon now have water all the year. Farmers do not consider overflow from the fields as wastage since it recharges the tanks. Thus they have no incentive to be efficient in their irrigation – indeed they have an incentive to be inefficient since any losses are retained locally. If canal irrigation efficiency was improved, there would be more water available for WUAs further downstream, but less water would be available locally for domestic and livestock uses.

With the failure of irrigation in 2004, there was a shortage of drinking water for livestock. The severity of the problem led to a water release for filling up tanks essential for the survival of the cattle and other animals and in some places for village drinking water supplies. Water was therefore sanctioned for Erracheruvu for Kadambapur, but not the other tanks in the WUA. A complication in this case was that the WUA boundaries had been changed in 2003 - previously this tank was supplied water through 29R, which now is a part of Gattepally WUA. Hence, the WUA now had to ensure that channels were dug from 30R as well as convince the Gattepally people to allow water to Erracheruvu through the old channel. This proved to be more difficult as there was conflict of interest between the two villages with each aiming to fill their own tanks. Further, there was an attempt to divert water into sub-minor M30-IL to fill another tank in Kadambapur WUA - Mancheruvu. Apart from the conflicts on which tank to fill with the limited supply that was available, there were illegal diversions for irrigation of standing crops. Significantly, the WUA was not involved in the process of selecting tanks to be filled.

As the release in *kharif* 2004 was made for drinking purposes, there was no official communication to the WUAs. However, water was diverted and used by some farmers. The timing, lack of information and poor state of the crops meant that it benefited only a few of the farmers (about 15%). Although there had been no irrigation during the season until then, apart from groundwater, the release came just after a period of rainfall so few needed water for irrigation – most farmers had given up the attempt to grow crops, and the few who were cultivating had just benefitted from rainfall. A few farmers with dug wells took the opportunity to fill their wells with a view to using the stored water later.

No further release was made until *rabi* 2004/05 in February 2005. This was planned by the Irrigation Department and villages were informed on 24th January at a meeting attended by village secretaries. WUAs were again not invited, although some attended. The tanks allocated water and the authorised means for filling the tanks were announced at this meeting. This was highly controversial, and did not appear to be rational – some tanks were not close to villages, and some of the channels leading to the selected tanks were not in good condition. Some farmers threatened to divert some of this water illegally. The TCs arranged to clean and repair the canals, as required – even though the WUA was not officially involved in water planning or delivery. Actual delivery of water was supervised by the irrigation department, revenue department and police – the WUAs were not involved, but there were many instances of illegal tapping of water for irrigation. The recorded discharges were as follows, indicating the very large fluctuations in flow – both in supply to D86 and supply along D86.

Table 8.8: Discharge (m^3/sec) at head of D86 and at Km 15+0 (*rabi* 2005)

Date	Discharge in D86		Notes
	head	Km 15	
24 Feb, 2005	24.0		
25 Feb, 2005	23.5	13.6	Reached M30 at 7pm, but flow drecreased rapidly at 9pm due to upstream tapping, and no further water entered M30R
26 Feb, 2005	12.0	4.4	Flow remained low
27 Feb, 2005	7.3	3.3	Flow dropped to 2.4 m3/sec, and Kadambapur WUA started blocking D-86 but could not divert water in M30R
28 Feb, 2005	15.3	5.6	Farmers broke sill at M30R intake to ensure free flow at 6pm, but monitoring task force caught them and took the tools away. Started diverting water into Mun cheruvu (not authorised but requested for livestock – although real reason believed to be for irrigation in M30-1L, as flow in sub-minor stopped after irrigation was completed. Dharmagundam (also not authorised) then requested water seeing how Mun cheruvu took water. Water diverted into wells and fields Making arrangements for water to Yerra Cheruvu – the only authorised tank Many obstructions in D86 near M30, much water wasted
1 Mar, 2005	14.6	5.3	50-75 l/sec in M30, used by 15 farmers. Sultanabad farmers then breached D-86 banks to fill another tank, taking 20 hours to repair with sandbags
2 Mar, 2005	12.0	8.3	Water finally reached Yerra Cheruvu
3 Mar, 2005	25.1	9.4	Yerra Cheruvu filled to 30% of capacity – sufficient for 3 months
4 Mar, 2005	7.3	3.9	

Farmers felt that planning and execution was very weak and led to unecessary canal breaching and diversions, and the WUA were not given any role. There were cases in Kadambapur where the TC members attempted to stop farmers from tapping water illegally but were unable to do so until they got assistance from village *sarpanch*. Individual farmers who diverted water to their own fields unofficially said that other farmers did not object as they could see the critical status of the crop, and it was evident water was not going to the stipulated tank as the plan was confused (and it was not clear whether water for the tank would be delivered through 29R or 30R). They said that wide discrepancy between the expected discharge as informed by officials and the real flow of water in the canal (both volume and duration) indicated the failure of the irrigation department to manage water, and made it essential for farmers to divert the required water for saving their standing crops[245]. There was a gap in communications between the police, revenue and irrigation departments who formed a task force: the village secretary was not in evidence and the *lakshkars* were asked to work with the irrigation department engineers, rather than their normal duties at minor canal level. The decision to give water to just one tank in the village was made by the Irrigation Department without any consultation, and caused much local hostility. For these reasons, no water reached further downstream in D86 than Km 28.00.

[245] Most farmers had not attempted to grow crops in this season, as they did not expect canal water

8.5 Sources of water accessed by end-users: official canal system and alternative sources

8.5.1 Overview

We have discussed above the process and practice of delivery of water from the source (river or reservoir) through the various levels of the canal system. The end users then should access water from the lowest order canal, and the WUA should be responsible for managing this delivery. Many farmers, however, do not take water from these official canal sources, and may take water illicitly from other canals or from a variety of alternative sources – particularly groundwater, but also including seepage and drainage flows from other areas - rather than negotiate with WUA over supplies from the outlets (which are as described above in section 8.4). Before considering distribution by the WUA, we first need to identify the various sources which farmers do use.

In our sites in Kyrgyzstan about a fifth of the cultivators we surveyed obtained water from a canal other than the one formally serving their command area, and three-fifths got water from other fields. This meant that, despite unauthorised usage by upstream irrigators, some farmers in the middle and tail of our study sites were able to get a satisfactory water supply to their crops.

In KIS farmers in the middle reach were socially discouraged from installing wells that would give them greater independence from the irrigation system, and make them feel they had less of a stake in it. However, one new group well was installed in the middle part of *Pachas Bigha Kulo* in 2003. There are also three wells installed by well-off land owners at the tail of *Pachas Bigha Kulo*, to compensate for the unreliability of the supply from the official outlet[246]: water from these wells is sometimes sold to neighbours. As noted earlier, drainage flows from irrigated rice fields increased the soil moisture in other nearby areas. This was an advantage if it was sufficient to allow a rice crop. But if it was not sufficient, it caused problems since cultivation of upland crops would be impossible if the soil was excessively moist through uncontrolled seepage.

Box 8. 1: KIS: – A user of a shallow tube well

***Mrs D. G., farmer of extreme tail of Pachas Bigha Kulo*:** migrated from Gaidakot-4, Nawalparasi three years ago. She has 4 *kattha* of land (0.13 ha) and she cultivates another 5 *kattha* (0.17 ha) as sharecropper. She irrigates one time using canal water and three times from the shallow tube well. As she is very far from the main canal, it is very difficult to go for canal irrigation, especially at night. Twice she and her daughter asked for help from a male neighbour (who is a relative) and went for water at 4 am, but they were only able to get water on the first occasion and did not think it was worth trying again, after the second attempt failed,

In her view the committee is unable to provide effective services to the farmers, and she does not attempt to get help from it. Farmers themselves also do not organise discussion and action. The farmers below the road are deprived from irrigation facilities, so they are less active in the canal activities. There is some frustration among the farmers because big farmers, who actually need more water, are inactive in the canal activities.

She agrees that a chaukidar (water guard) would be good arrangement for equitable distribution of water. If there were a *bighatti* system (cash contribution), she thinks farmers would be active and improve the situation. She gave some examples from where she came from in Nawalparasi.

Other farmers in this area were so dependent on other livelihoods activities that they could not put in sufficient effort to capture water and hence their yields were extremely low.

[246] In the past some people have also pumped water from drains in this area, but this has been discontinued as it is too expensive. However, some other parts of BC-2 divert water by gravity from drains, and pumping from drains is done in other parts of KIS

In SMIP, there are no functioning wells in our study command area. But here too the relation between location along a canal and access to irrigation is not straightforward. A farmer who has land at the tail reach of the tertiary but at the head reach of a watercourse could have a better water supply than a farmer at the tail of a watercourse drawing water from the head reach of the tertiary. More than half of farmers said that they relied partly on drainage or seepage from other fields for irrigation water, so access to water depended on the nature of flows in surrounding land, as much as on their position relative to the irrigation canal.

SRSP has the greatest variety of potential arrangements. Here the installation of wells has been positively encouraged to supplement the canal water supply, and almost half of the cultivators had access to at least one individual well, while another 13% said they had access to a common well. Groundwater recharge is limited and largely dependent on recharge via seepage from the canals. Many wells are also filled directly from the canals and used as a means of storing surface water (Figure 8.12 and Figure 8.13 illustrate the distribution of wells in our SRSP study site). This has had a significant effect on how people use the water from the irrigation canal, as irrigators have drawn water not only to irrigate their fields, but also to recharge the storage in the well for future use.

The range of these options is illustrated by consideration of the fields that were cultivated during the drought in 2005 in P5 (Table 8.9). This demonstrates that at times of extreme shortage some farmers are able to make other arrangements – although these alternatives do still ultimately depend on the canal system.

Table 8.9: Fields in P5 cultivated in *kharif* 2004

Irrigation source	Rice	ID	No crop
Well filled directly from canal	7	1	0
Groundwater well	4	3	0
Canal only	1	10	30
Abandoned well (now only canal irrigation)	0	0	5

8.5.2 Differences between well-being groups

In all of our study sites a significant proportion of all categories had access to alternative sources of water – they are most reliant on the canals in the main irrigation system for their water supply. In our sites in Kyrgyzstan, the medium group most frequently drew on another canal and/or other fields. But the poor and the well-off appear to be equally likely to use these other sources.

Box 8.2: Kyrgyzstan – Jany Aryk: a poor farmer who draws water from an alternative source

Mr. A.K. – has 0.35 ha in Field VII. His access to water is classified as ‘medium’. He only grows maize in his irrigated field, although he cultivates some potatoes in his garden for home consumption. He reported that he mainly takes water for his maize from the Selpo Canal since it is very difficult to obtain water from Katta-Khaz-1 (his official source of irrigation). He stated that more than 10 ha in Field VII take water from Selpo (Field VII has a command area of approximately 19 ha). When he needs water he goes to the field and diverts water from an outlet. Sometimes there are disputes between farmers of Katta-Khaz-1 and Selpo. Guarding water supply is necessary. If the respondent needs more water from Selpo, he negotiates with guard at Selpo to release more water.

Figure 8.12: Land ownership and location of wells in SRSP: P2 and P5

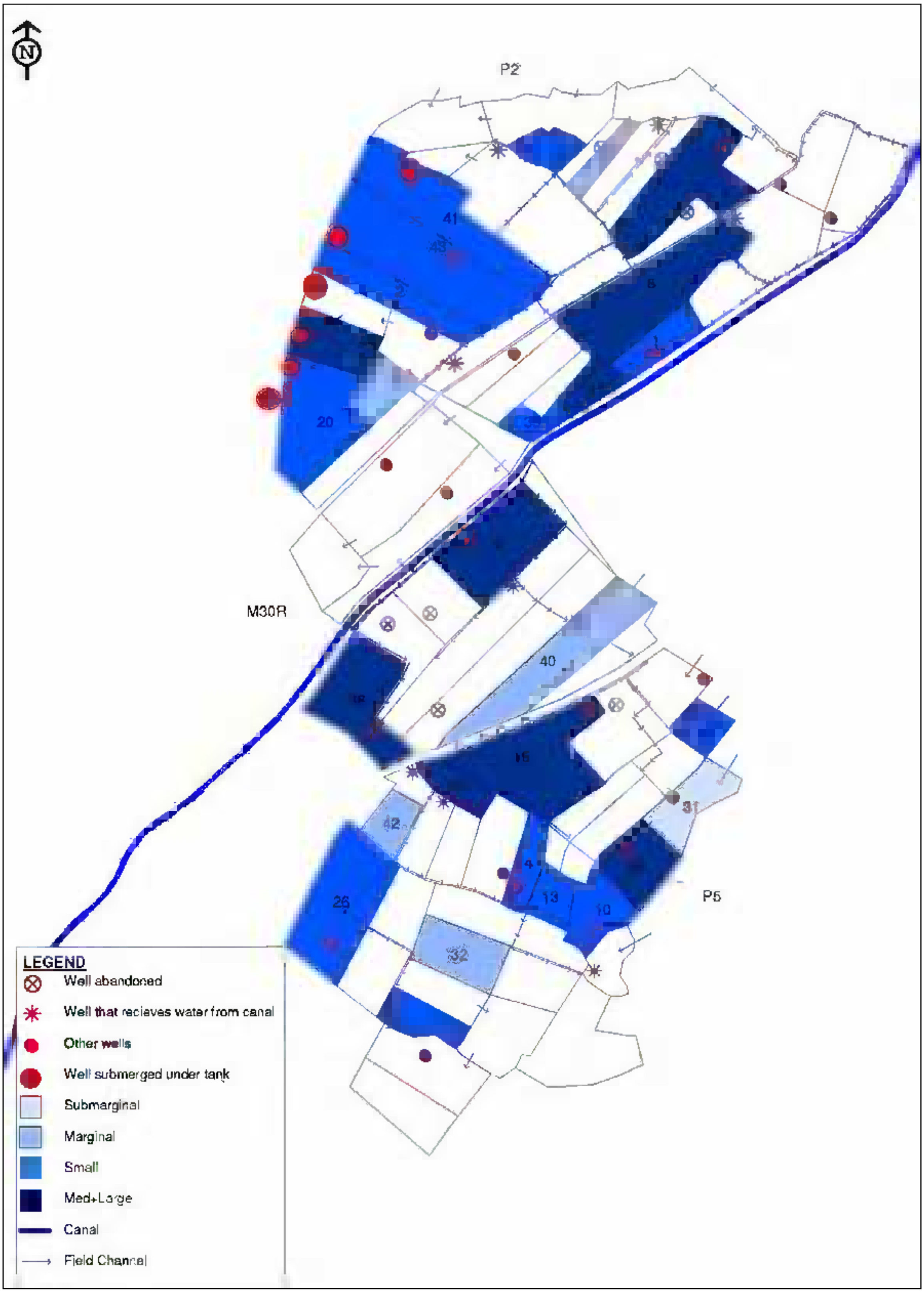
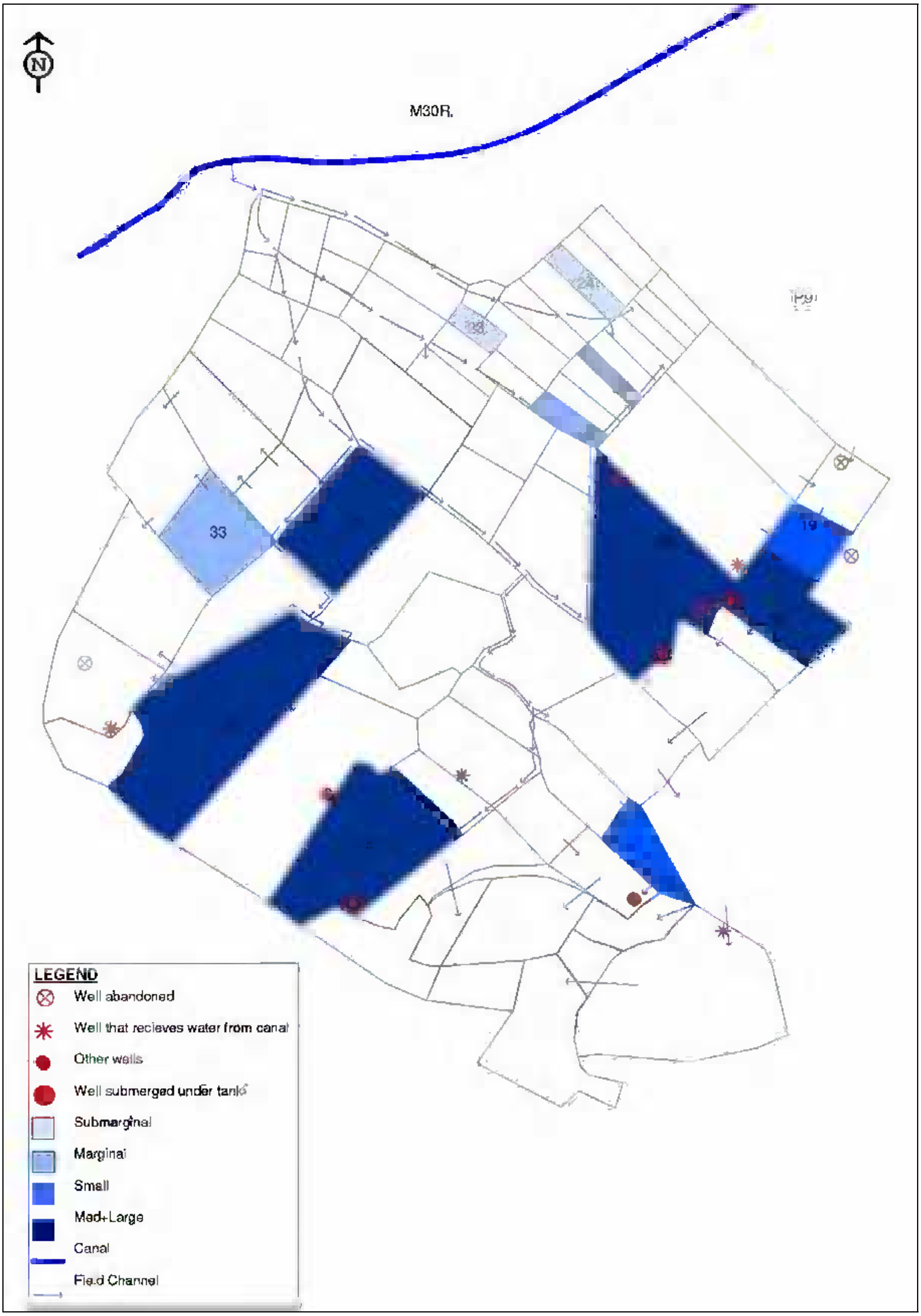


Figure 8.13: Land ownership and location of wells in SRSP: P9



In SMIP the medium and well-off were more likely than the poor to be able to access water via a field channel – which is the official route. The poor often complained that they found it difficult to get better off neighbours to agree to the use of field channels that crossed their land. Poor farmers were also more likely to have land that is not linked to the canal system at all. These farmers depended entirely on alternative sources of water for their crops. Only a very small proportion of respondents reported drawing water from the tertiary, which is not surprising since this is not supposed to be done. But it is interesting to note that it is the medium and well-off who reported this source.

In SRSP less than half the marginal landholders had access to an individual well, whereas more than three-quarters of small landholders had access to a well. Interestingly the proportion is higher for the small than the medium+ landholders. This may reflect relatively better access by medium+ landholders to canal water, or some of the medium+ landholders may have invested in a well to irrigate land which is not in the study command area. Access to water from shared wells follows a similar pattern. No sub-marginal farmers had access to well water – reflecting their location in the extreme tail where there is negligible recharge, and their almost total reliance on other activities.

Table 8.10: Alternative sources of irrigation water, by well-being group and study area

Study Area	Sub-Area	Poor	Medium		Well-off	Total
Kyrgyzstan	Another canal	14%	23%		9%	19%
	from other fields	39%	71%		43%	61%
KIS	Well	n/a	n/a		n/a	15 farmers in 4 wells
	Other fields	n/a	n/a		n/a	
SMIP	Tertiary	0%	3%		3%	2%
	Field Channel	29%	46%		62%	45%
	Relying ONLY on canals	23%	17%		24%	20%
	Relying on BOTH canal and alternative sources of water (other than rainfall)	38%	67%		70%	59%
	Not linked to canal system - water only from rainfall or general seepage	40%	17%		5%	21%
SRSP	*Type of well*	*Sub-Marginal*	*Marginal*	*Small*	*Medium +*	
	Individual well	0%	45%	86%	53%	45%
	Common well					13%
	Other fields	n/a	n/a	n/a	n/a	

Box 8.3 SRSP: well construction and cases of conflict over water diversion

Mr. D.M. has 4.5 acres (1.8 ha) in P-9. He has been cultivating for the last 12 years. In previous years there was enough water, but now it is decreased. This year he dug a well because there is no canal water. The total investment was Rs 75,000 including the motor and pipe. The depth of the well is 36 feet. He can irrigate 15-20 guntas (0.15 – 0.2 ha) of rice with the support of well water. If the land is a little wet then he can irrigate up to 2 acres (0.8 ha) with the available water. He gets 25-30 bags (1,750 – 2,100 kg) from one acre (4,200 – 5,200 kg/ha). He says that he gets better yield in the *Rabi* than *Kharif*, the reason being more disease in the *Kharif* compared to *Rabi*. When there was water in the canal his entire land was getting irrigated.

Once some years ago when he went to get water to his field, he found another person diverting the water. They had an argument over water and the other person hit him with his shovel (phauda) and he had to have six stitches on his head.

In another instance, a person named M. (5 acres [2 ha] land) took water from a canal which served D.M.'s land, even though M. has a separate canal which comes to his land from another side. To get water from the other side of the canal M. has to work a little more and it takes around an hour for water to reach his land. But water reaches his field from the canal which serves D.M.'s land within 10-15 minutes. When M. takes water in this way 5-6 farmers whose land is adjacent to D.M.'s land suffer because of water shortage. Whenever they tell M. he should get water from the other side of the canal he agrees to do that. But once everybody leaves the field, again he takes water from the canal that serves D.M.'s field. Whenever D.M. and other farmers complain about this matter to TC members M. says that he will stop taking water from this canal and take it from the other side; but he continues to draw water from the same canal. After breaking the bund and diverting water to his field he gets one of his female family members to look after irrigation. This makes it difficult for D.M. and his associates to fight with them, as they are reluctant to fight with a woman.

8.6 Supply to users from canal outlets managed by WUAs

8.6.1 Introduction

Adequacy of the actual water supply to individual users is ultimately how farmers judge the performance of an irrigation scheme. Very crudely speaking, those at the tail of irrigation canals tend to be at a disadvantage in receiving an equitable share of irrigation, compared with those upstream. But a range of intervening factors complicate the analysis. Drainage flows, access to wells, topography (high land vs low land), and position of the canal within the overall irrigation system, all have an influence and can mean that irrigators who are apparently at the tail of the command area have a better water supply than others who are relatively upstream. As we have noted above (section 8.5) some users have access to alternative sources of water, not all of which are managed or controlled by the WUA. In this section we examine the delivery of water in outlets managed by the WUA, but this includes (or is affected by) water supplied from these alternative sources.

Unfortunately it is very hard to quantify delivery to end-users on smallholder irrigation where land holdings are fractions of a hectare and water flows through a network of tiny earthern channels and also from field to field as well as by sub-surface seepage. In the case of KIS we made a detailed study of field moisture conditions in individual outlets in order to quantify the effectiveness of the water distribution system. This is relatively easy to do by direct observation of fields in a rice irrigation system. We undertook a comparable exercise in the Kyrgyz Republic, where we asked farmers for their perceptions of the timeliness and quantity of irrigation deliveries. We were then able to relate these observations to the location of the plot and the well-being of the farmer, as well as other key parameters such as land tenure and importance of irrigated agriculture in livelihood strategies. In the case of SRSP, there was no irrigation so we could not make observations of actual deliveries although we could get an indication of past performance through discussions with farmers[247]. Simple soil measurements (tactile or physical tests) are possible and are an interesting topic for further investigation for crops other than rice.

8.6.2 Khageri

(i) Location of land

In two of our study canals in KIS, *Pachas Bigha Kulo* and Pilot Gate West, the water allocation by the BCC-2 Chairman meant that most land in these canals had an ample water supply in our study season[248]. Only an area at the extreme tail of *Pachas Bigha Kulo* suffered from an unreliable and inadequate water supply from the canal; as noted earlier, many farmers mitigated this by use of groundwater. On the other hand, irrigators in our study area in Outlet 18 of BCC-1 did suffer from water access problems. In fact difficulties with water distribution meant that only 23 out of 35 irrigators were able to cultivate spring rice. The largest proportion of non-cultivators were poor.

Table 8.11: KIS - % of Households by location of Land: Head (H), Middle (M), or Tail (T) and by Canal and well-being category

Position in Canal	Canal and Well-being Category											
	Outlet 18				*Pachas bigha kulo*				Pilot Gate West			
	Poor	Med	Good	Total	Poor	Med	Good	Total	Poor	Med	Good	Total
Head	3%	25%	50%	50%	10%	37%	0%	50%	77%	59%	39%	50%
Mid	19%	19%	50%	13%	37%	11%	28%	13%	8%	21%	17%	13%
Tail	47%	56%	0%	35%	40%	48%	72%	35%	15%	21%	44%	35%
Extreme	0%	0%	0%	0%	13%	4%	0%	3%	0%	0%	0%	0%
Nos HH	31	11	3	35	30	27	7	64	13	29	18	60
Nos HH growing rice	13	8	2	23	30	27	7	64	13	29	18	60
	42%	73%	67%	66%								

(ii) Delivery of water

The water supply to individual farmers was assessed by observing the field water conditions: a field with standing water in all corners of the field was assigned a score of 1, and a dry and cracked field a score of 5. Farmers believed that fields should be irrigated before they dry out (score 4), and thus the percentage of time that a field has a score of 4 or 5 gives a measure of the farmers perceptions of under-irrigation. However, rice is fairly resilient and can recover if the duration that a field is dry is short (less than one week): thus the maximum number of consecutive days is an important indicator.

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[247] We did not attempt this at SMIP since our efforts in this project were aimed at improving the situation. Through our work an earlier project we had quantified baseline conditions down to the outlet level, which indicated a highly inequitable distribution. This would inevitably be reflected (and probably magnified) at field level

[248] See Chapter 7 for a discussion of how water was allocated in the Spring season in KIS.

These parameters are summarised below by well-being of farmer for two outlets, by considering both the average of all plots and the worst plot in each category. Khageri is, by general consensus, a relatively well-managed scheme in Nepal[252] and thus we would hope that on average water supply is fairly uniform across well-being and location (within the small areas irrigated by outlets). Poor management is, however, likely to affect a few individuals particularly badly and thus examining water supply to these 'outliers' should be most revealing. The conclusions are summarised in Table 8.12. This data covers a total of 67 farmers.

Table 8.12: Field Water Conditions in Outlets at Khageri Irrigation System (distinguished by well-being category)

Outlet	Percentage time fields are dry			Maximum duration of dry fields (days)		
	Poor	**Medium**	**Well-off**	**Poor**	**Medium**	**Well-off**
Average of all plots						
Outlet 18	21%	14%	12%	7.4	6.1	5.5
Pachas Bigha Kulo	7%	10%	6%	1.7	2.0	1.7
Combined	12%	12%	9%	3.6	4.4	3.2
Worst plot						
Outlet 18	30%	39%	14%	10.0	11.0	7.0
Pachas Bigha Kulo	61%	14%	10%	10.0	3.0	2.0
Combined	61%	39%	14%	10.0	11.0	7.0

This is a revealing analysis, confirming that in all respects and in both of these outlets, the well-off farmers have the best water supply – although in some cases the differences are small. The differences are greatest at the tail (as will be seen from

Table 8.13) and poor farmers are not so disadvantaged if they have land in the upper parts of the system. But averages are misleading, and there are many people who do much worse than the average: the worst plots farmed by the poor have a much poorer supply than the worst plots farmed by the rich. When we consider that poor farmer's plots are much smaller, it would take a relatively small redistribution of water to improve their water supply to an acceptable level.

In Outlet 18 poor farmers have dry fields for the greatest proportion of the time (this is illustrated on Figure 8.14 and Figure 8.15), although the maximum duration of dry days is more similar for each category – suggesting that they face greater difficulties in accessing water, but are able to mitigate this partly. They presumably achieve this by making careful use of small supplies at irregular intervals. Well-off farmers have a slightly better supply on average, but the difference is much more striking when comparing the worst-supplied farmers in each category.

Everyone gets an adequate supply in *pachas bigha kulo* on average (thus providing a small degree of confirmation for the common view that KIS is quite well-managed), but the worst plots have an extremely poor supply – much worse than in Outlet 18 which is overall a more difficult outlet to manage. There might be a tendency for poor farmers to have land towards the tail of the outlet (see Table 8.11) so we also examined this data by location within the outlet command area. The well-being of farmers in Outlet 18 is shown on Figure 8.15, and shows how this deteriorates down the canal. We

[252] This is obviously a subjective and indicative statement. However, our observations and comparisons at system level with SMIP, in this project, and earlier studies (HR Wallingford, 2003) support the view that although there are clearly weaknesses it is better-managed than many other projects

should also note that the tail of outlet 18 (which accounts for more than half of the outlet command area) received no water at all and is predominately owned by poor farmers.

Pachas bigha kulo, does not show the same trend, but this is a better irrigated area and there is not the same disadvantage in having land at the tail.

Table 8.13 presents this data (combined for the two outlets). The extreme tail of this outlet, which is not shown on this table, does however show a slightly different and confusing pattern. It was originally owned by one landlord who did not need field channels. It has since been subdivided, but partly as a result of the unreliable water supply the network field channels has not been developed fully. The farmers consider that water supply for the spring season is too unreliable so they do not pay ISF for this season, although they do for the monsoon season when they get sufficient water largely by seepage. Those who are locally resident and active can get sufficient water from the canals or tubewells, but some non-resident sharecroppers were only able to grow an extremely poor crop.

Figure 8.14: Duration of dry or very dry fields (KIS - BC1 outlet 18)

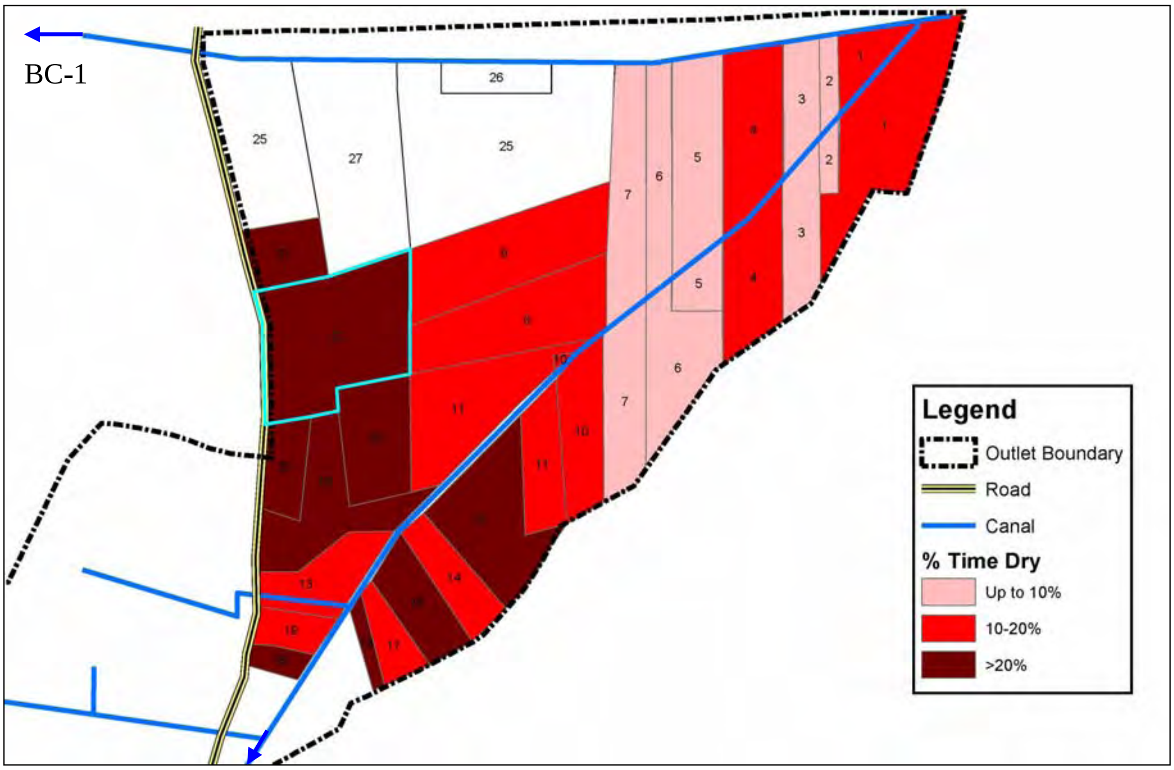


Figure 8.15: Well-being of farmer (KIS – BC1 Outlet 18)

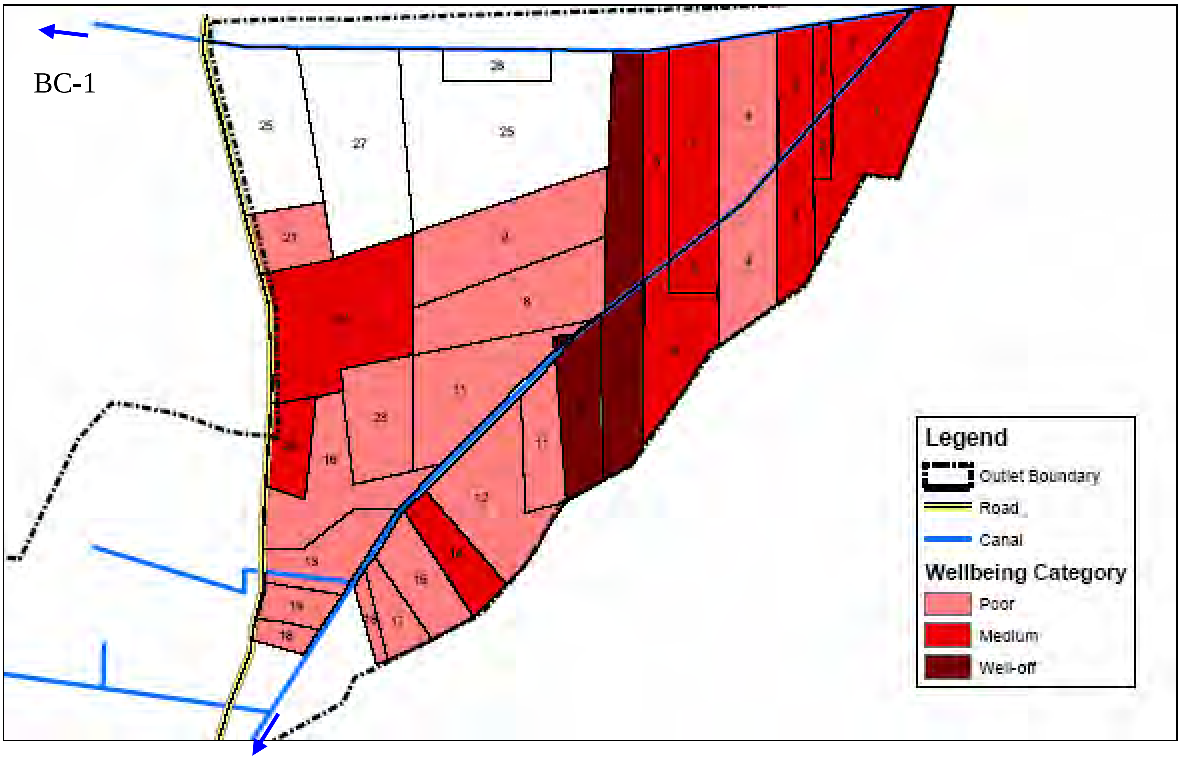


Table 8.13: Field water conditions at KIS distinguished by location and well-being

Location	Percentage time fields are dry			Maximum duration of dry fields		
	Poor	Medium	Well-off	Poor	Medium	Well-off
Average of all plots						
Head	7%	8%	8%	2	4	3
Middle	10%	12%	14%	3	4	7
Tail	24%	23%	4%	8	7	1
Worst plot						
Head	19%	15%	10%	7	7	4
Middle	61%	14%	14%	10	7	7
Tail	30%	39%	4%	10	11	1

This shows a dominant trend of water supply deteriorating towards the tail, but also a deterioration by well-being. Well-off farmers at the tail have a much better supply than poor farmers at the tail: the prolonged duration of dry periods for other farmers is likely to affect their crop production significantly. Even at the head, the worst supplied poor farmers are twice as likely to have dry fields as compared to the well-off.

This poor supply to the outlet is in sharp contrast to the high duty per unit area recorded in Outlet 18 (see Figure 8.6) and is a consequence of the configuration of the outlet and the small streamflow: there was a small trickle of water which was wasted and rarely reached to the tail – although it was sufficient to irrigate the upper part. A larger but intermittent flow would have made it possible to irrigate a larger area with the same or a smaller amount of water.

(iii) Timing of cultivation

We also looked at transplantation date in one outlet (*pachas bigha kulo*): early transplanting is usually reflected in better crops and thus within an outlet farmers usually seek to plant their rice as soon as possible. This is also influenced by access to inputs and draughtpower[250], but access to water is a key factor. This did not reveal any significant differences by well-being (Table 8.14). All farmers transplanted within a 12 day period and 41 out of 44 within 7 days – this level of crop staggering will not have any significant impact on crop outcomes.

Table 8.14: Date of transplanting at Khageri (*pachas bigha kulo*)

Date of transplanting	Well-being category		
	Poor	Medium	Well-off
Early (15 March or earlier)	52%	22%	50%
Late (after 15 March	48%	78%	50%

We only have data on the time of transplantation for one outlet, but we have data on harvest dates for two outlets. This is closely related to transplant date (with an average here of 89 days for crop growth with a range of 83 to101 days). These two outlets (*pachas bigha kulo* and O18) show a greater degree of crop staggering (6th June to 29th June with the exception of one tail-end medium sharecropper (with a poor landowner) who harvested on 6th July. However, this again shows little difference by well-being category, although the well-off farmers are more likely to harvest late and thus to have transplanted late

Table 8.15: Date of harvest at Khageri (*pachas bigha kulo* and Outlet 18)

Date of harvest	Well-being category		
	Poor	Medium	Well-off
Early (15 June or earlier)	48%	50%	25%
Late (after 15 June	53%	50%	75%

When we look at this data from the point of view of location within the outlet, the head is not transplanted earlier in *pachas bigha kulo*: factors other than water supply are apparently more important (availability of draught power, other inputs, etc), but all plots are transplanted quite quickly (Table 8.16). The situation is the reverse in outlet 18, where transplanting is much more prolonged and the tail is much worse supplied with water (Table 8.17).

Table 8.16: Date of transplanting at Khageri (*pachas bigha kulo*)

Date of transplanting	Location		
	Head	Middle	Tail
Early (15 March or earlier)	10%	73%	80%
Late (after 15 March	90%	27%	20%

[250] harvest date of the previous season's crop is also significant, but this linked to the same factors of input availability and water supply in the previous season.

Table 8.17: Date of harvest at Khageri (BC-1 Outlet 18)

Date of harvest	Location		
	Head	Middle	Tail
Early (15 June or earlier)	86%	57%	20%
Late (after 15 June	14%	43%	80%

Table 8.18: Date of harvest at Khageri (BC-1 Outlet 18 and *pachas bigha kulo*)

Date of harvest	Location		
	Head	Middle	Tail
Early (15 June or earlier)	42%	65%	18%
Late (after 15 June	58%	35%	82%

There are many other factors which influence access to water, such as land tenure, well-being/status of landowner, some of which we consider further in Chapter 5. At system level, water supply appears to be good, with only small areas adversely affected. However, for the individual affected households, the situation does not look so good. Poor farmers have too little land to depend on it, so they need to work in other areas hence they cannot get involved in managing their land/water better – or they may lack skills to do so, or resources (eg for land levelling which would reduce their need for water). However, it is a crucial part of their livelihoods, and thus a more reliable and more predictable water supply would be very beneficial to them.

8.6.3 Sunsari Morang Irrigation Project

We do not have such detailed data on delivery of water to individual farmers at SMIP as we do for KIS, although the overall picture is illustrated on Figure 8.9. This makes it more difficult to elucidate the relation between access to water and well-being. It is, however, apparent that position within the watercourse, as well as within the tertiary, does have a bearing on the quality of access to irrigation water. We can deduce the nature of this relationship by considering the relation between access and location (as discussed in section 8.4.3), together with the relationship between well-being and location, for which we do have some data.

WCs are mixed with respect to well-being, and usually with respect to ethnicity. Villages are often ethnically fairly homogeneous (with small communities of dalits and other vulnerable groups on the periphery), but the land is irrigated by several different canals, so that individual canals serve several villages and ethnic groups. This is because villages are on high land between canals, and residents have land all around the village – which therefore falls in several different canal commands. T5 and T6 irrigate land farmed mainly by people in two villages (Sattarejhora and Hattimuda). Sattarejhora lies between T5-1/2, and T6. Hattimuda lies between T5-3/4, and Shankarpur secondary canal. From the perspective of Sattarejhora, T5-1 are the head and T5-2 are the tail of the tertiary canal system; there are also slight differences in access to water between the head and tail of these watercourses. From the perspective of Hattimuda T5-3 is (relatively) head and T5-4 is the tail, although both are disadvantaged as compared to T5-1 and T5-2, and differences within the watercourses are much greater (partly because the watercourses also serve larger areas)

Medium well-being cultivators seem to be fairly evenly distributed across the four watercourses in T-5 although 60% are in watercourses 1 and 2. Poor cultivators seem to be concentrated in watercourses 2 and 4 (which are the 'tail' areas for Sattarejhora and Hattimuda villages respectively). Well-off are disproportionately represented in watercourses 1 and 3, which are 'head' areas for the same villages.

Table 8.19: SMIP - Distribution of households by Watercourse and Well-being Category

Watercourse	% of Households by DL/AP Well being Classification			
	Poor	Medium	Well-off	Total
1	22%	46%	32%	100%
2	47%	40%	14%	100%
3	20%	53%	28%	100%
4	32%	46%	22%	100%
Total	31%	46%	24%	100%

As differences in access to water are also pronounced within watercourses, we also need to look at land distribution within watercourses (particularly for WC-3 and WC-4, where the tails are severely disadvantaged). It is evident from Table 8.20 that poor farmers tend to be disproportionately concentrated in the tail reaches of canals WC-1, WC-3 and WC-4. WC-2 is an exception, with more than 90% of poor cultivators in this watercourse holding land in the head and middle reaches, while half of the well-off are at the tail.

Box 8.5 SMIP: A Tail ender in WC-4

Mr. D. C. is the real tail ender of WC-4. He lives in Hatthimudha and has 4-5 kattha (about 0.15 ha) of land as house-yard and kitchen garden. He sharecrops two bigha of land (1.4 ha) for the last two years on an *adhiya* basis i.e. fifty-fifty sharing. Canal water seldom reaches his field, and he relies totally on rainfall. There are more than 5-6 bigha (about 3.7 ha) of land in his WC which have not received canal water since its construction (this is a large WC with a designed command area of 35 ha). He has not been informed for canal desilting. D.C. does not know about equitable water distribution in watercourses.

A significant proportion of land is farmed by informal tenants and sharecroppers rather than by the owners, as there are several large absentee landlords in this area[251]. Thus the cultivators may change relatively frequently, but poor households appear to find it consistently more difficult to gain land with a reliable supply of water. The frequent changes in tenancy mean that the farmers are often not aware of the rules and the WUG does not know all of the water users – with inevitable consequences of poor management.

Table 8.20: SMIP - Distribution of households within Watercourses

Location	WC - 1				WC - 2				WC - 3				WC - 4				Total
	Poor	Med	Good	Total	Poor	Med	Good	Total	Poor	Med	Good	Total	Poor	Med	Good	Total	
Head	14%	35%	42%	33%	40%	18%	17%	28%	13%	43%	27%	33%	8%	47%	25%	30%	31%
Mid	29%	29%	33%	31%	50%	35%	33%	42%	38%	14%	27%	23%	33%	29%	38%	32%	32%
Tail	57%	35%	25%	36%	10%	47%	50%	30%	50%	43%	45%	45%	58%	24%	38%	38%	37%
% of Cult by WB	22%	46%	32%		47%	40%	14%		20%	53%	28%		32%	46%	22%		

[251] Although reliable data on such ownership patterns is difficult to collect – see Chapter 3

8.6.4 Jany Aryk and Obu Haet

(i) Location of households

There is little relationship between location and well-being of farmers in the Kyrgyz study sites. Land has recently been allocated and this appears to have been done on a fairly equitable basis. In some cases, farmers have been given several small plots to ensure that they all have access to some good land. The situation is summarised in the following tables.

Table 8.21: Number of Households by Position in Study Command Area

Location	Number of Holdings - Jany Aryk				Number of Holdings - Obu Haet			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Head	3	13	2	18	7	30	7	44
Mid	20	103	20	143	12	51	40	103
Tail	29	166	34	229	5	10	3	18
Total	42	224	48	314	24	91	50	165

Table 8.22: Percent of Households by Position in Study Command Area

Location	Number of Holdings - Jany Aryk				Number of Holdings - Obu Haet			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Head	7%	6%	4%	6%	14%	33%	29%	27%
Mid	48%	46%	42%	46%	80%	56%	50%	62%
Tail	69%	74%	71%	73%	6%	11%	21%	11%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Access to water

Our figures indicate that in Jany Aryk poor irrigators are not systematically more likely than better off irrigators to have poor access to irrigation in an average year. On the other hand in Obu Haet, it appears that in average years poor households are disproportionately likely to have a poor water supply, while the medium and well-off have a better chance of getting a good water supply. The slightly disproportionate representation of well-off irrigators with poor irrigation access in Obu Haet is accounted for by a small group of well-off farmers who are cultivating land at the tail reaches of the study canal. The respondents' assessments indicate that in Jany Aryk the poor farmers considered that the study irrigation season was about the same as average, whereas some medium and well-off respondents considered that their access was poorer than average. In Obu Haet most respondents considered that irrigation access in the study season was better than average.

Table 8.23: Kyrgyzstan – Quality of Access to Irrigation (average year)

Quality of water supply	Percent in each WUA and well-being category							
	Jany Aryk				Obu Haet			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Good	22%	24%	29%	24%	10%	38%	50%	31%
Moderate	67%	59%	57%	61%	50%	44%	17%	41%
Poor	11%	18%	14%	15%	40%	19%	33%	28%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 8.24: Kyrgyzstan – Quality of Access to Irrigation (this year)

Quality of water supply	Name of Irrigator Association & Wellbeing Category							
	Jany Aryk				Obu Haet			
	Poor	Medium	Well-off	Total	Poor	Medium	Well-off	Total
Good	22%	24%	43%	27%	30%	56%	50%	47%
Moderate	67%	47%	29%	48%	60%	38%	50%	47%
Poor	11%	29%	29%	24%	10%	6%	0%	6%
Total	100%	100%	100%	100%	100%	100%	100%	100%

There was a degree of subjectivity in the assessment of access to water, and thus one outlet in each WUA was monitored intensively to ascertain the equity of distribution within that outlet. The results are summarised below (Table 8.25). In Jany Aryk the outlet served 5 ha and was entirely cultivated with Maize.

Table 8.25: Water delivery by well-being category (Jany Aryk outlet 14)

Well-being category	Delivery as a percentage of requirement				
	none	<75%	75-125%	125-175%	>175%
Well-off		75%	25%	0%	0%
Medium		36%	36%	7%	21%
Poor		0	0	0	0

The outlet in Obu Haet served 32 ha and was mainly cultivated with cotton, with small areas of rice and sunflower. Here the well-off farmers apparently have a worse supply than the others. It is curious that 21% of medium farmers take so much more than their requirements - which may even harm their crops. Even though irrigation water is available on demand, farmers appear to deviate considerably from the crop requirements. Irrigation is not done in a systematic order and thus outlets may be left open longer than is necessary, without the next farmer closing them. Many farmers work in the town of Osh as well, and thus do not devote much effort to optimising agricultural practices.

Many people here were not traditionally farmers and had different jobs prior to the break-up of the Soviet Union. Such farmers may lack the skills to manage crops and water well, so water use may not be optimal, regardless of availability.

The situation at Obu Haet also shows little relationship with well-being (Table 8.26). This is predominantly a cotton-growing area, which is very sensitive to the amount and timing of water: it is interesting that so few deliveries are of the correct quantity – medium farmers are most likely to achieve this, presumably because they are most careful with their irrigation management, but only one third manage the correct quantity and the remainder are equally likely to over-irrigate as to underirrigate.

Table 8.26: Water delivery by well-being category (Obu Haet outlet 16)

Well-being category	Delivery as a percentage of requirement				
	none	<75%	75-125%	125-175%	>175%
Well-off	0%	80%	0%	20%	0%
Medium	4%	30%	33%	19%	15%
Poor	5%	48%	14%	33%	0%

Similarly, there is little pattern in water availability when considered by location within the outlet. Tail farmers are able to get some water from drainage or other outlets. Access to water in this outlet appears to be more related to individual efforts (and perhaps relations with other farmers since irrigation within this large outlet is largely negotiated privately, and relations with the *mirab*) than either location or socio-economic status

Table 8.27: Water delivery by location (Obu Haet outlet 16)

Location	Delivery as a percentage of requirement				
	none	<75%	75-125%	125-175%	>175%
Head		53%	21%	16%	11%
Mid	10%	45%	15%	25%	5%
Tail		21%	36%	36%	7%

Thus we can conclude that there are inequities within outlets, but that the reasons for this cannot be found simply in socio-economic status or location in the system. The reasons need to be sought in the ways farmers cooperate with each other and with the WUA staff, as well as the place of irrigated agriculture in livelihoods strategies, as we discuss in Chapters 5 and 6.

8.6.5 SRSP

(i) Location of land

There is no simple relationship between location of land and well-being category at SRSP, with the exception of the group of landless or virtually landless people in P9 who subsist mainly by stone-breaking rather than agriculture. The distribution by pipe is presented in Table 8.28.

In addition to the a concentration of sub-marginal farmers from the Muslim ethnic group in P-9, three of the four largest farms in our sample are also located within the P-9 command area. Otherwise the marginal and medium+ size classes are fairly evenly distributed across the pipes, with a concentration of the small size group in P-5..

Table 8.28: SRSP - Distribution of cultivators by pipe and land holding size

Pipe	Sub-Marginal	Marginal	Small	Medium +	Total
P2	5%	34%	27%	29%	25%
P5	0%	37%	59%	35%	33%
P9	95%	29%	14%	35%	41%
Grand Total	100%	100%	100%	100%	100%
Nos cultivators	22	38	22	17	99

(ii) Access to water

There was little or no irrigation during the study period, so our observations of access to water are based on recall of previous seasons. The situation in previous *kharif* seasons is summarised in Table 8.29.

This illustrates the common perception that water supply deteriorates down the minor: P9 at the tail faces shortages even in good years (when the head outlet has more water than it needed). However, P9 also has surplus water in some years – this is likely to be unwanted excess water at times when the crops do not need irrigation. It is revealing that no one in P9 reported receiving the right amount of water. The excess can be stored in Dharmagundam *cheruvu* and used for domestic purposes, livestock, recharging wells and irrigation – although the irrigation is not in the P9 command but in the land immediately downstream which is also owned by people in the same village (Kasipally) – see Figure 4.7.

Table 8.29: Adequacy of water supply to individual farmers, by pipe

Water availability	*Kharif* 2002			*Kharif* 2003		
	P2	P5	P9	P2	P5	P9
Too much	70%		35%			
Enough water	30%	75%		40%	50%	
Too little water		25%	65%	60%		65%
No water					50%	35%

When asked more generally about problems with access to water, most irrigators gave a more positive response. However, the proportion of respondents indicating a problem increased between P2 and P9. Not surprisingly, the proportion citing upstream water diversion as a problem increased between P2 and P9. About half of the farmers in P-9 mentioned upstream diversion as a problem. One-third of the sub-marginal landholders reported upstream diversion to be a problem, although most said they had not cultivated their fields for some years.

Table 8.30: SRSP: Problems with water access for cultivators in each pipe and land holding size

Type of problem	Pipe and Size Class															
	P2					P5				P9					Grand Total
	SM	Marg	Sm.	Med+	Total	Marg	Sm.	Med+	Total	SM	Marg	Sm.	Med+	Tot	
No Problem	0%	92%	67%	60%	0%	50%	62%	83%	61%	62%	36%	67%	17%	49%	60%
Slow or diverted Flow	100%	8%	33%	40%	100%	35%	39%	17%	33%	38%	64%	33%	83%	51%	38%
No water received	0%	0%	0%	0%	0%	14%	0%	0%	6%	0%	0%	0%	0%	0%	2%
Grand Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

(iii) Cropping intensity kharif 2004

A sample of 29 farmers (covering the three pipes and shown on figures Figure 8.12 and Figure 8.13, identifying their location and well-being category) was interviewed during the season. This shows that the cropping intensity in the season was low, and is summarised in Table 8.30.

Although the sample is small and does not fully represent the command area it confirms our field observations that poor farmers are less able to grow crops, and if they can grow any crop it is less likely to be rice

Table 8.31: Cropping intensity in kharif 2004 by well-being category

Pipe	Well-being category[252]				Average
	D	D	B	A	
P2	44%	6%	27%	60%	35%
P5	25%	25%	68%	17%	31%
P9	10%	15%	9%	50%	20%
Average cropping intensity	22%	21%	28%	48%	28%
Proportion of farmers able to grow any crop	38%	67%	100%	85%	72%

The immediate reason for this can be seen in the ownership of irrigation wells, which is presented in Table 8.32: the poorest farmers are much less likely to have access to a well.

[252] a slightly different classification was used in this case: class D are the poorest farmers, and roughly corresponds to the 'marginal' land holding size category; class A are the richest farmers

Table 8.32: Irrigation well ownership

Pipe	Well-being category				Average
	D	C	B	A	
P2	50%	50%	50%	50%	35%
P5	50%	80%	100%	100%	31%
P9	0%	50%	100%	100%	20%

Very poor farmers may be less likely to have wells because the location of their land is less suited (eg they are unable to link the well directly to a canal, or recharge is lower), but more importantly they are less able to justify the cost of the well as they have so little land and hence both capital and operating costs are disproportionate to the benefit. Sale of water to their neighbours would not be sufficient to compensate for this cost. Electricity is charged at a flat rate per season (Rs 91 per month for a 3hp motor) independent of the amount pumped – thus this favours the larger farmers who able to make most use of their pump. Surface water is charged per hectare (Rs 500 per hectare for rice and Rs 375 for ID crops).

Given the dependence on agriculture and hence irrigation, the consequences of the 2004 drought on the livelihood of all categories of farmers was severe: most of them had to leave a substantial part of their land fallow in both *kharif* and *rabi* 2004, and with agricultural labour as their secondary occupation, they were very vulnerable. This is highlighted in the following tables on land utilisation.

Table 8.33: Land utilization in P2 (ha)

Category	*Kharif* 2003	*Rabi* 2003/04	*Kharif* 2004
Marginal	6.5	3.4	1.6
Small	6.5	3.8	1.8
Medium	6.5	1.4	1.0
Large	0	0	0
Total	19.5	8.6	4.4

Table 8.34: Land utilization ha P5 (ha)

Category	*Kharif* 2003	*Rabi* 2003/04	*Kharif* 2004
Marginal	8.2	6.8	3.6
Small	8.2	7.2	3.4
Medium	6.5	5.5	2.7
Large			
Total	22.9	19.5	9.7

The cropping intensity and crops grown in *kharif* 2004 in the three pipe outlets is illustrated on the maps below.

The drought in SRSP in 2004 made it a particularly difficult year, and we need to look at both *kharif* 2003 and *kharif* 2004 for a better understanding of cropping preferences amongst different well-being groups. Looking at these two seasons allows us to compare the effect on different well-being groups of a very difficult period, *kharif* 2004, in contrast with a relatively typical *kharif* 2003 when water access was fairly easy.

In *kharif* 2003 more than three-quarter of marginal and larger farmers grew rice -- with the proportion greater in the two larger size classes. Those in the 'small' size class grew rice on a slightly smaller proportion of their land than the marginal and medium farmers, but they grew "Irrigated Dry" crops[253] on a higher proportion of their land. Sub-Marginal farmers had the highest proportion of land left fallow. The proportion in the Sub-marginal size class who grew rice remained the same at 5% in all the seasons we are considering – as we have said, the majority of landholders in this group have not cultivated their land for the last 5 years or so.

Looking at the distribution of rice production by pipe, in *kharif* 2003 farmers with land irrigated by the pipes nearer to the head reach of the system, P-2 and P-5, were most likely to cultivate rice. Within pipe P-9, the pipe with the poorest water supply, farmers with larger land areas were most likely to do so. This applies to both proportion of farmers and to proportion of land area. The pattern is less clear in P-2 and P-5. This probably reflects the influence of access to well water and the complexity of water flows in these pipes.

[253] The "Irrigated Dry" (ID) crops grown included green gram, maize, groundnut, and other legumes.

Figure 8.16: SRSP - P2 and P5: Crops grown in *kharif* 2004

Figure 8.17: SRSP - P9: Crops grown in *kharif* 2004

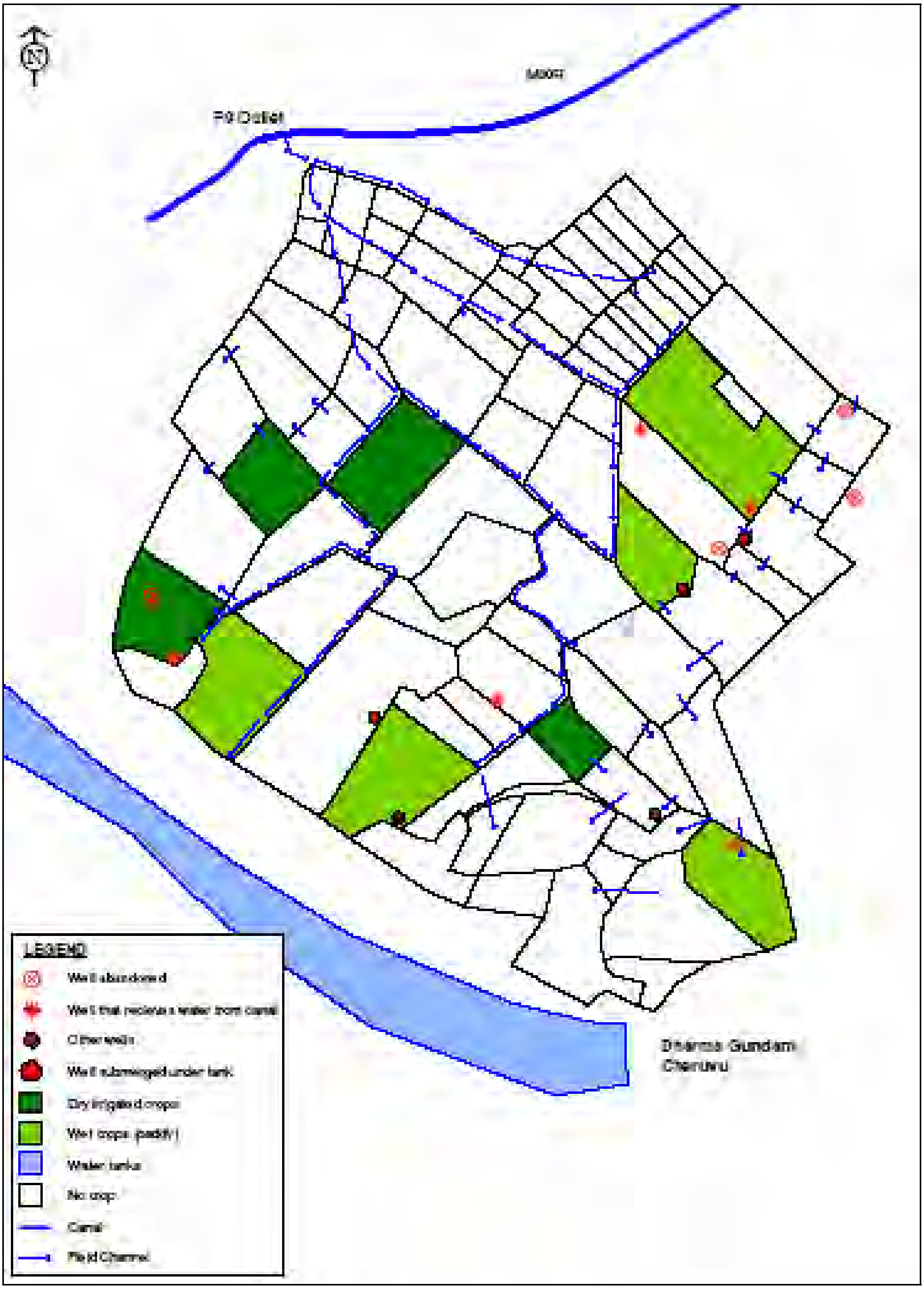


Figure 8.18: SRSP – P2 and P5: Cropping Intensity (kharif 2003)

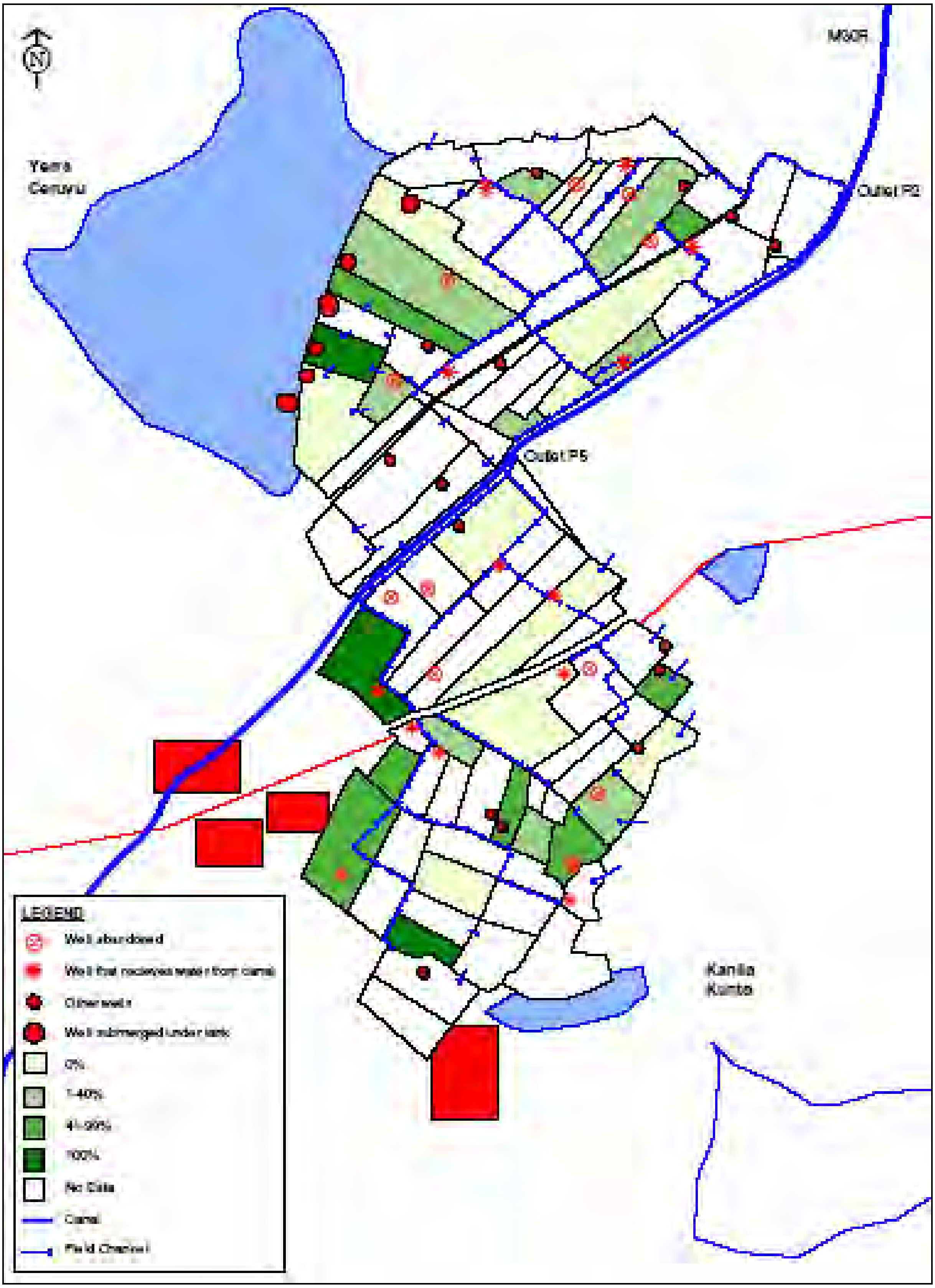
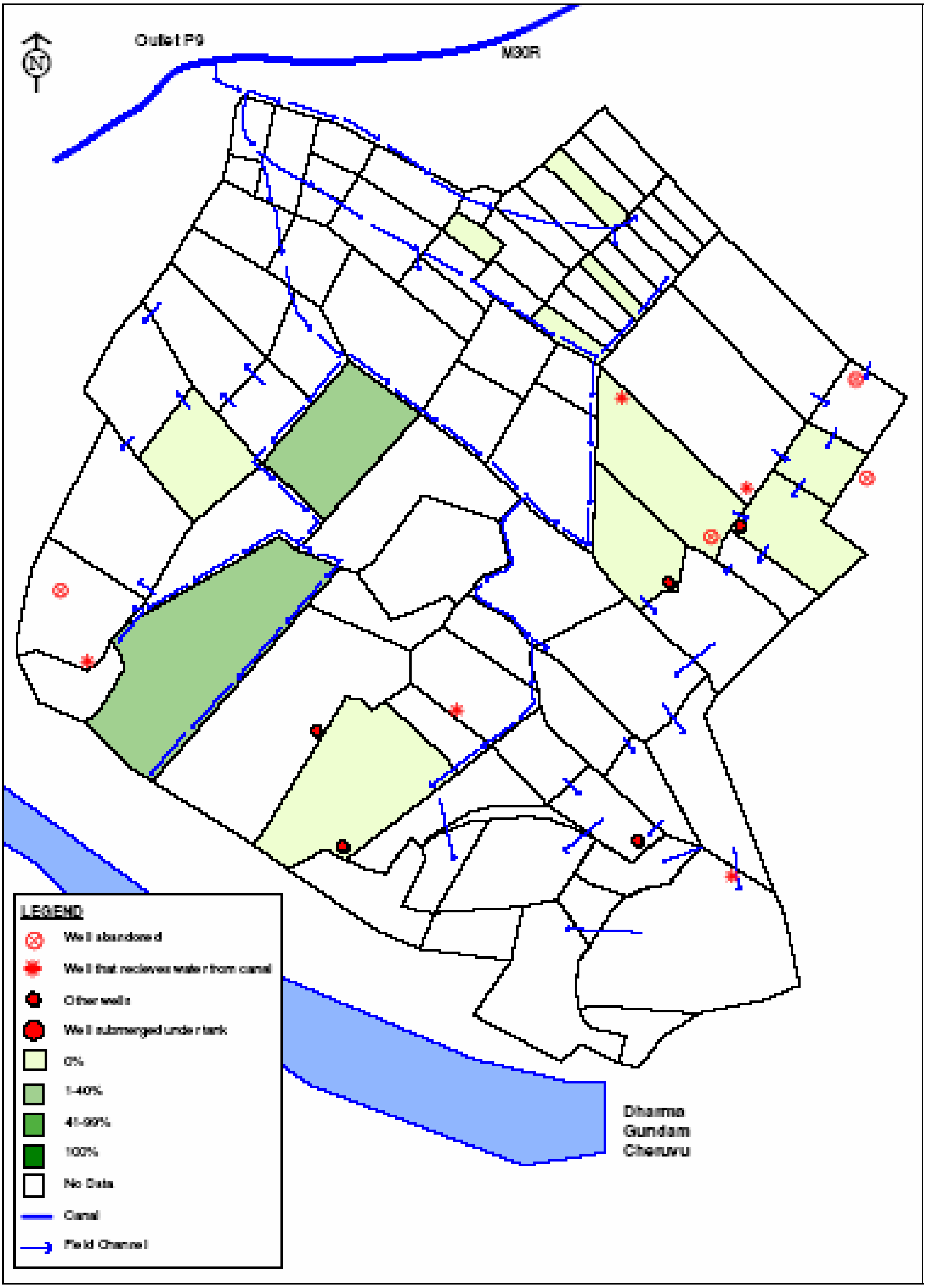


Figure 8.19: SRSP – P9: Cropping Intensity (kharif 2003)



Between *kharif* 2003 and *kharif* 2004 the proportion of farmers growing rice in P-2 and P-5 went down by 36% and 18% respectively. In *kharif* 2004 the area under rice in P-2 was 20% that of the previous year and in P-5 it was 40%. P-5 was less severely affected, probably because of the number and type of wells in its command area. The reduction affected all size classes, with even the large growers who had grown rice in previous years either not growing rice, or reducing the rice area. The farmers in P-9 were most dramatically affected, with half the number of growers planting rice on less than one-third the area.

Table 8.35: SRSP: Comparison of cropping pattern *kharif* 2003 and *kharif* 2004

Percent of farmers and land area under each crop, *kharif* 2003

Main crop	Per cent of farmers growing rice					Percent of Area Under Rice				
	SM.	Marg.	Small	Med +	Total	SM.	Marg.	Small	Med +	Total
Rice	5%	74%	86%	94%	65%	5%	76%	70%	82%	74%
ID	5%	3%	23%	12%	9%	12%	2%	9%	4%	5%
Fallow	91%	24%	0%	0%	31%	83%	22%	21%	14%	21%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[1] Note: column percentages exceed 100% because some farmers had land under more than one crop and/or fallow. .
[2] Fallow includes land reported as 'fallow', 'not cultivated' and not reported as either under rice or Dry Irrigated crops.

Percent of farmers and land area under each crop - *kharif* 2004

Main crop	Per cent of farmers growing rice					Percent of Area Under Rice				
	SM.	Marg.	Small	Med +	Total	SM.	Marg.	Small	Med +	Total
Rice	5%	47%	59%	71%	44%	5%	24%	27%	24%	24%
ID	0%	13%	28%	24%	15%	0%	9%	10%	8%	8%
Fallow	95%	45%	36%	24%	51%	95%	67%	63%	68%	67%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[1] Note: column percentages exceed 100% because some farmers had land under more than one crop and/or fallow. [2] Fallow includes land reported as 'fallow', 'not cultivated' and not reported as either under rice or Dry Irrigated crops.

Percent of farmers growing rice and area under rice - *kharif* 2003

Pipe	Per cent of farmers growing rice					Percent of Area Under Rice				
	SM.	Marg.	Small	Med +	Total	SM.	Marg.	Small	Med +	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%

Percent of all farmers growing rice and area under rice - *kharif* 2004

Pipe	Per cent of farmers growing rice					Percent of Area Under Rice				
	SM.	Marg.	Small	Med +	Total	SM.	Marg.	Small	Med +	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%

8.6.6 Summary of factors influencing acess to water in study sites

Many farmers take as much water as they wish (by exerting their social influence or exploiting their physical position), and sometimes apply more than the crop really needs, or waste unused water in the process (e.g. by allowing water to run over roads). Water users often use “illegal” measures such as pumps directly into the canals, temporary bunds in the canal, and cuts in the canal to access water. These practices often mean that water flows are delayed and erratic, and that those downstream do no get their “fair share” according to the combined principle of delivery proportional to irrigable land area and **approved** crop grown. Furthermore, even if downstream users are ultimately able to get the quantity they are entitled to, they may have had to spend time removing upstream obstructions and guarding the flow to their fields in order to achieve this. The unpredictability of water flows also creates problems for them when planning their agricultural activities.

The influence of main system management, location and well-being on access to water in the study sites is summarised in Table 8.36 below.

Table 8.36: Factors influencing access to water in study sites

Factor	KIS	SMIP	OH	JA	SRSP
Management of main system	Good – predictable supply to BC	Sufficient but untimely supply to SS canal, leading to very poor supply to tertiary canal	Predictable supply to Buvakul	Predictable supply to Khatta Khaz 1	Inadequate and unpredictable supply to D-86 and M30R, due to insufficient water in river (despite the reservoir), large number of outlets and lack of cross-regulation
Location of outlet	outlets (along BC) face increasing shortages downstream	Tertiary canals and watercourses face increasing shortages downstream	Deteriorating trend mitigated by drainage reuse. Tail farmers face greatest difficulty but are also the most active with good relations with the *mirab* which offsets their disadvantaged position	Deteriorating trend mitigated by drainage reuse – outlets close to but not at the tail face greatest difficulty	Outlets (along minor) face increasing shortages downstream

Factor	KIS	SMIP	OH	JA	SRSP
Location within outlet	Some outlets manage good internal distribution, others face shortages at the tail: depends on outlet configuration, topography and internal social relations	Deteriorating supply towards tail, but mitigated by drainage reuse. Extreme tail only gets water from other fields – essentially rainfed	Little pattern – depends on cooperation within outlet, which perversely affects those at the head who rely mainly on individual efforts	Little pattern – depends on cooperation within outlet	Shortages at tail mitigated by use of wells - for some people and in some outlets
Well-being status	Tail farmers within 'bad' outlets more likely to be poor; poor farmers with off-farm activities face difficulties in managing water	Well-off / influential more likely to have illegal offtakes, poor farmers' land tends to be unfavourably located. Rich able to exert influence to get water which may benefit others as well, and better able to rely on others to manage irrigation for them if they work elsewhere	No apparent simple relations, but subtle impacts due to migration and off-farm employment. Those working full-time as farmers and with good social relations with mirab are favoured	No apparent simple relations, but subtle impacts due to migration and off-farm employment.	Poor farmers have less good access

8.7 Conclusions – equity of access to water

In this chapter we have reviewed the impact that the pre-existing systems for managing and monitoring water distribution had on access to water by different categories of stakeholders and in different parts of the system.

Supply to WUA: both the large systems (SRSP and SMIP) had a very unreliable and unpredictable supply. Whilst this can be partly be explained by uncertain climatic factors, the unpredictability is largely due to weaknesses in high level management. The water availability in the river at SMIP is much greater than the irrigation requirements. Rainfall was average at SRSP, which is also backed by large reservoirs. However, the river crosses state boundaries (Maharasthra-Andhra Pradesh) making the water availability to AP very low (there appears to be poor cooperation over water distribution between states). In both cases the large deviations between planned supplies and actual deliveries to the individual WUAs meant that the WUA felt that effective management was impossible. At SMIP the bulk supplier delivered at least the correct volume but the timing was not as planned, resulting in considerable wastage.

Within WUA to outlets: Any lack of reliability in supply to WUAs is magnified downstream within the WUA. This is very evident at SMIP, where the variations in supply to WUGs (100-150 ha) was much greater than in supply to the WUC (722 ha). It was difficult to observe these trends systematically during the study period at SRSP due to the lack of supply in *kharif* 2004, but was apparent in *rabi* 2003/04. In the smaller systems in Kyrgyzstan, supplies within WUAs to the head of branch canals (typically 100-200 ha) was close to the plan, but delivery to outlets along the branch canals decreased from head to tail.

From outlets to individuals: Inequities are further magnified within outlets. In some cases, there are clear patterns with a good supply at the head decreasing to poor or non-existent supply at the tail as for example in outlet 18 of BC1 at KIS. Elsewhere there are more complex influences, reflecting a combination of location and topographic variations, as well as the well-being of water user. In most cases, poor farmers have land in less-favoured locations, and in some cases poor farmers even get a worse supply than rich farmers in equivalent locations.

Alternative sources of water: Many farmers rely on alternative sources rather than depend entirely on the canal system. It is generally the rich famers who have best access to formal alternative sources – such as in SRSP where there are many privately-owned wells some of which are directly connected to canals. Poor farmers are more likely to rely on indirect sources – general seepage, flows through other farmers' land, drainage from adjacent WUAs, or informal access to canals in other WUAs.

Indicators of equity: One of the objectives of the project is to improve equity of access to water without depending on unrealistic routine data collection and flow measurement. This made it difficult to quantify the existing situation, but we did develop some proxy indicators which used for comparative purposes. These were observations of field water conditions (ie existence or depth of standing water) in rice fields, and date and duration of transplanting at KIS; user perceptions of timing and volume of delivery in Kyrgyzstan supplemented by direct measurements in sample outlets; and location of land cultivated by rice and ID crops at SRSP. We observed a strong locational influence on water distribution at SMIP, and related this to land ownership and tenure patterns.

Equity of distribution: The resulting observations on equity of access to water as related to the well-being of the farmer/water user are summarised in Table 8.37.

Table 8.37: Equity of access to water

Category of user	KIS	SMIP	OH	JA	SRSP
Poor	Poor farmers at the tail of the sub-system find it difficult to access water. Where they own land at head or middle of the sub-system they often get as good a supply as better-off farmers. But much depends on their livelihood strategy. Those who work outside the village lack the social networks to take advantage of water as it arrives or influence the WUA to deliver as needed. Poor farmers at the head suffer from worse supply than the worst-supplied rich farmers	Location is the dominant influence on access to water, with the tail of all watercourses suffering from shortages. However, the process of land distribution over the past 50 years has resulted in highly skewed access to good land (whether owned, share-cropped or on informal fixed contracts. Poor farmers are more likely to have land at the tail or which is otherwise poor quality (poor drainage, difficult access to water, etc)	Land distribution is recent and fairly equitable by well-being category – there is no obvious correlation between well-being and access to water. Contact with the *mirab* is the most important single factor, and this favours those with good social relations with the mirab, and those who most active locally (rather than dependent on working away from the area)	Similar to OH, but land holdings are smaller and off-farm employment more readily available locally. Overall very good access to water. Local problems caused by disorganised water distribution within large outlets which is managed informally by users with negligible involvement of WUA. Timing of irrigation linked to concurrent agricultural activities (fertiliser etc), which can be more of a constraint (ie the cash to purchase inputs).	Highly stratified access to water, with poor most likely to have poor quality land, and to have worst access to water within any given area. Poor and very poor farmers had a much lower cropping intensity in *kharif* 2004 as canal supplies failed and they had few alternative sources. The very poor are unable to depend on agriculture and do not expect to receive water – they rely on other activities (mainly stone quarrying)
Medium	Medium and well off farmers have very similar access – unless they are at	Medium and well-off farmers have similar access to water, and this is	Medium farmers appear to have best access to water, but the differences are	Medium and rich farmers have very similar access	Medium and well-off have similar access, generally much better than the

Category of user	KIS	SMIP	OH	JA	SRSP
	the tail. A rich and active farmer at the tail is much more likely to have good access. Medium farmers are more likely to depend on irrigated agriculture and have influence and strength to ensure good supply	generally much better than poor farmers. Medium farmers are more likely to farm their own land than the well-off who may rent out their land to contractors or sharecroppers	small. Factors other than location and well-being appear to be less important than contact with *mirab*		poor regardless of location but dependent on their ability to tap alternative sources of water
Well-off	Active well-off farmers are able to use their influence to offset even the worst locations. However, if they do not farm the land themselves, they may not exert their influence on behalf of their tenants – this depends on their livelihood strategies. If they live locally they are likely to take a interest, but those working elsewhere may not bother.	Active well-off land owners seek to maximise their income by renting their land to middle-income tenants or family members, and then use their influence to ensure a good water supply. Less active owners, particularly if non-resident are less likely to ensure a good water supply and more likely to give land to poor informal tenants.	Greater variation in water supply than for medium farmers, but on average equally likely to be satisfied as medium farmers	Apparently worse supply than poor farmers, possibly because of the extensive local off-farm employment opportunities	Able to grow the largest area of rice in a normal year, which reflects their favoured access to water. Less likely to devote much effort to struggling for water in an extreme year than the medium farmers as they have greater off-farm sources of income.

9 Processes adopted for water management improvements

9.1 Introduction – Diagnosis of Problems

9.1.1 Background

Our strategy for water management improvement is based on our analysis of the livelihood possibilities and priorities of different categories of irrigators, the management performance of the WUA, irrigators' understanding of the WUA and its role in irrigation management, irrigators' relationships with each other and with the WUA, and the technical constraints presented by the irrigation systems.

Our research with water users revealed that water distribution in our study areas was both unreliable and inequitable, as shown in Chapter 8. Key findings were:

- **Poor water distribution performance**: water users experienced problems with quantity and predictability of delivery. This was to some extent related to position within the canal (head/tail), but not consistently. Sometimes drainage flows and the availability of wells meant that water users in the middle reaches were at the greatest disadvantage.
- **Adverse effect on all well-being categories – but especially on the poor**: these problems could cause inconvenience for all water users – even those at the head had to make a considerable effort to maintain the "illegal" measures they used to get water -- these needed to be repeatedly repaired after they were removed by frustrated downstream users. But the poorer and weaker members of the community were least able to defend their entitlement, or to access alternative sources of irrigation water, such as a well.

This statement of the problems is not sufficient to identify solutions, and it is first necessary to analyse the multiple causes of these problems, and how they interact with the livelihood assets and strategies of irrigators from different well-being categories.

9.1.2 Livelihoods assets and access to irrigation – differences between well-being groups: summary

In previous chapters we have observed patterns in the interaction between irrigation and livelihood strategies for different well-being categories, and it is useful to review these patterns when developing an approach to intervention.

Poor well-being irrigators represent a significant proportion of irrigators in our study sites: between 1/6th and 1/3rd of irrigators in our Kyrgyzstan study sites, about 1/3rd of irrigators in our Nepal sites, and about 2/3rd of irrigators in our SRSP, Andhra Pradesh, India site. We have seen that poor irrigators in our study sites have the poorest education. Women in all of our sites are traditionally dependent on men for decision-making on irrigation matters. Poor women irrigators lacking a man to defend their interests appear to be a fairly small minority in our sites, but they are at a particular disadvantage. Poor irrigators rely on kin and caste networks as a safety net. But these networks are unlikely to help them to influence irrigation management in their favour.

The poor have the least amount of land – and in our Nepal sites this is often held on an insecure tenancy or as an informal sharecropper. Most poor households rely on livestock to make a contribution to household consumption and income, but they tend to have a relatively small number of animals. They are least likely to own their own draught animals, which makes them more dependent on others to provide traction for land preparation and other operations. They are then least able to coordinate cultivation with water availability. It also means they cannot offer a promise of compost manure – often a pre-requisite for being considered a suitable sharecrop tenant. They are least likely to have access to wells, and are the most dependent on irrigation from canals, as well as drainage from neighbours' fields, to water their crops. While in Kyrgyzstan they have adopted a somewhat mixed cropping pattern, in Nepal and India they are heavily dependent on rice production. But they cannot meet all of their family's food needs from what they grow. Their limited agricultural assets make them financially vulnerable and most households supplement their farm income with off-farm employment. In Nepal and India agricultural labouring is an important source of off-farm employment.

All of these circumstances make the poor most vulnerable to the consequences of unpredictable water supply. They are the least educated and so find it difficult to read written announcements of irrigation schedules, etc. They have the weakest social networks within the community. They are least informed, and least able to influence water distribution decisions. Inadequate or unreliable water supply can reduce their limited food production. If they have to devote time in attempts to protect their water supply this can take time away from their other livelihood activities, such as livestock husbandry, and off-farm employment. And, as we saw in SRSP, an inadequate supply of irrigation can affect their potential employers, and reduce off-farm employment opportunities.

Medium well-being irrigators are better educated, and may have more influential social contacts. However, their irrigation networks are likely to be relatively small, and they are as likely to operate individualistically as in a group.

They own more land, and they may increase the area available to them by renting land in – from landowners of all well-being and size categories. They often also have some livestock. They are more likely than the poor to have their own draught animals; some may have a tractor. But they also often rely on contractors for mechanised operations, and this may act as an incentive to coordinate their crop choice and field operations with others. They are reliant on canal irrigation, but they are more likely than the poor to find alternatives to their official canal irrigation source -- this may be a well, another canal, or "illegal" diversions which are tacitly accepted – at least by their social associates. Farmers in this group are better able to meet household food needs from their production, and they are more likely to have a commercial orientation in their cropping. But many do not consider the income from farming alone to be sufficient to provide a satisfactory livelihood, and so they are also engaged in off-farm occupations – mostly outside agriculture.

This group is better able to cope with shortcomings in water distribution. They have more access to traction and other inputs, and so have more flexibility to adjust to vagaries in irrigation water supply. They have better social networks with their neighbours and can collaborate with them to organise water distribution. But they also may prefer to act independently, and without regard for their neighbours. In fact the lack of discipline sometimes give them room for manoeuvre, allowing them to take as much water as they want, when they want it. This means that if their fields are suitable, they may grow crops that require more water, depriving others of their official share. Nevertheless, they are inconvenienced by undisciplined water distribution because they may have to guard the delivery to their fields; and those who suffer from the indiscipline of those at the head either have to accept restricted crop choice, or poorer yield; or they have to invest resources to compensate for this. This investment may take various forms: in resources to build and operate a well, in time spent trying to stop upstream users from taking water when they shouldn't, or in money to hire an irrigator/water guard.

Well-off irrigators[254] represent at most a quarter of users, and less than 5% in our SRSP site. They have the most resources in education, land, machinery, and financial assets, as well as social and political influence. They have many of the same advantages described for the medium well-being category, and have great flexibility to cope with lack of discipline, and irregularity, in irrigation water distribution. Their social status and political influence often have resulted in their being disproportionately represented on WUA committees. Yet their off-farm interests may make them less willing to spend time in the field, and they often let their land to tenants or sharecroppers. However, when it suits them they can use their influence to ensure that they get as much water as they, or if they are interested in them, their tenants, feel they need.

9.1.3 Social factors

We observed a complex interaction of social factors in our study sites. These influence how water users relate to the management of the system and how the water managers respond to their responsibilities.

- Individualism – indifference, or feeling of disconnection, between individual actions and the effect on others – particularly if disadvantaged users are located beyond the boundaries of one's immediate social circle. A relatively small number of people are willing or able to benefit from collaboration. Either by choice or force of circumstance, most cope by being individualistic; for reasons of routine, convenience, or a sense of futility they often find it easier to continue with their present bad practices than change habits. This was evident in all sites.
- Social division along lines of caste or ethnicity – indifference to the needs of, or rivalry with, other social groups for access to irrigation. This was particularly evident in our SMIP site, but also played a role in KIS and SRSP.
- Land tenure - land has value as a social as well as productive asset, so that some farmers may not wish to maximise production or may choose to grow crops which do not optimise use of the natural resources. The type of tenure and the location and relationships between farmer and owner influence the intensity of cultivation and processes for accessing water. This was particularly true in KIS and SMIP.
- Unwillingness to change established practices as schemes are developed and expanded incrementally. In the case of SRSP this expansion required the farmers to change from growing rice to irrigated dry crops - which they refused to do.
- Differences in objective of cultivation - some may want to maximize crop production, but some may simply want to minimize resources required for cultivation. This is often related to differences in livelihood strategies, and was evident in all sites.
- Lack of commitment by the WUA leadership to fulfilling the responsibilities of leadership, to unite membership or to provide a good irrigation service for all water users. In all sites we found that much depends on the personal motivation and commitment of key individuals. For example, they may:

[254] Mnay of the well-off do not cultivate their land but rent it out (formally or otherwise) to others to operate. Some remain resident locally and are active in using their influence to help their tenants. Others may take little interest and may only return at the time opf harvest. This is a much more common situation in South than Central Asia, where there have been fundamental changes in land tenure.

- Have insufficient time - they may not be paid enough to work full time, or other jobs may take priority – eg in local government, in other user groups, in personal farming activities, or as a contractor;
- Be reluctant to get involved in day-to-day management and may concentrate on the high status decision-making role, reflecting political interests or relations of power and patronage; or
- Assume others will solve problem (donor, government, other).

- Disconnection between leaders and water users, which was most evident in SMIP and SRSP - leaders take actions without concern for the interests of water users; water users do not respect the authority of leaders.
- Lack of confidence - belief (both by individuals and WUA) that technical improvements are a pre-requisite before they can improve management, and/or that greater technical skills than they possess are needed. They may not know of ways that they can make a difference, and in the absence of a directive or training may be scared to do anything about water management for fear of standing out in the crowd – ‘since nobody is doing anything what can they do’ attitude. This was common in all our sites.

9.1.4 Institutional factors

The way that WUAs have been introduced - from the top down and without sufficient technical and organisational back-stopping - has contributed to their failure to gain support and commitment among a “critical mass” of water users. Water users have not “bought in” to the WUA. They do not feel it represents their interests, or that they have any responsibility to respect its authority. This is true for all well-being groups. The poor have tended to be overlooked, those in the middle have not had confidence in the leadership, and the better off have either used it to advance their own interests or disregarded it. This lack of support from water users has contributed to the inability of WUAs to manage the irrigation service effectively:

- Difficulty in reaching agreement on water sharing rules that will be respected by most water users.
- Inability to enforce penalties on those who break water sharing rules.
- Inability to influence cropping decisions to promote the best use of available water.
- Inability or unwillingness to control individual land management decisions that have an effect on the water access of others – such as the conversion of high land to rice land.
- Inability to generate and administer funds to cover the cost of monitoring water distribution, maintaining the canals, and enforcing penalties on those who break the rules.

We found that in some cases the structure of the WUA is not suitable to meet management objectives or it does not match the infrastructure. Responsibilities are not well-defined (especially the division of responsibilities between successive tiers of the WUA, and with the irrigation department). The WUA committees and assemblies set up for these purposes remain unclear of their responsibilities. Even if they are aware they are unable to take action, knowing that it will be difficult to enforce their decisions. This sometimes requires them to change their own or related persons’ behaviour in ways that they do not wish to do. Water users lack knowledge of the representatives and their duties, and distrust their willingness and ability to act in their interests

9.1.5 Technical factors

There is a hierarchy of technical issues which we found to influence the performance of the systems that we studied:

- Standards of design, construction and maintenance of infrastructure are very variable. We found examples of canals overgrown or sedimented and structures too complex to operate, too crude to control water as required, damaged, or simply non-existent.
- Fluctuations in inflow to the system (including predictable seasonal or diurnal variations, and unpredictable variations due to rainfall and sediment inflows – natural variations may be exacerbated by upstream management).
- Informal interventions to cope with problems of infrastructure, including ‘illegal’ checks and bank cuts in canals, semi-authorised additional outlets, damage to structures to increase discharge capacity, and so on.
- Variable demand for water - to cope with crop and climatic variations, uncertainties in supply, and sediment load – which can greatly increase the complexity of management, making rigid ‘*warabandi*’ type systems unacceptable to many users.
- Lack of definition of operational objectives.
- Difficulty in developing technical procedures and indicators which are equitable and/or acceptable to users and can be implemented with the available infrastructure and resources.
- Insufficient human resources or skills to manage the system (by both WUA executives and individual farmers) as required: the benefits of irrigation and the financial resources of the farmers limit the amount that can be spent on the system – whether in cash or time.

These issues are however, not purely technical. They are closely related to the social and institutional factors which influence how rules are designed and enforced, and hence how irrigation is managed.

9.1.6 Summary of performance of WUAs

We observed that WUAs had been established to improve water management in all study sites, but that none had yet fully solved the problems of distributing water to all users in an equitable manner - although the extent to which they were successful varied. More specifically we found that there was:

- **Inadequate involvement of WUAs in promoting orderly water distribution:** the WUAs have generally demonstrated a willingness, and ability, to manage the acquisition of water from the bulk water supplier into the portion of the system for which they are responsible. But they have not taken on the responsibility of working with the water users to introduce measures, including agreed and enforced procedures and rules, to address problems of water distribution among the water users within their part of the system. They have also made little effort to ensure that all water users are informed of water distribution schedules – and of changes to those schedules.
- **Inadequate leadership by the WUA to ensure maintenance of the canals**: despite the statement of responsibilities in their constitution, the WUAs, particularly in our study sites in Nepal and Andhra Pradesh, have not done enough to ensure that the canals have been maintained, particularly at the lower levels of the system. Damage and obstructions introduced in order to access water “illegally” have not been prevented or repaired. Removal of silt and other routine maintenance such as canal bank repair, have depended on informal and expedient activities by individuals or small groups of water users. This has undermined efficient and equitable water distribution.

- **Social relationships and WUA performance:** water users in our study areas have not developed confidence in, or respect for, the WUA. This has applied not only to matters related to water distribution, but also to their willingness to contribute to the operation and maintenance of the system – through payment of fees or contribution of labour. As a consequence they tend to act individualistically, or in relatively small common interest groups, with scant regard for the effect their actions may have on others. The WUA leadership has, at least so far, done little to encourage water users to work toward a more orderly and equitable system of water distribution which could improve the situation for all of the WUA members.

9.2 Specific steps undertaken in each country

9.2.1 Introduction

With this background, our study intervention was based on the premise that water distribution performance could be improved by engaging water users in finding appropriate solutions for themselves. We aimed to provide a platform for water users, and their WUA representatives, to observe and analyse their water distribution practices, and to identify solutions that they considered appropriate and workable. In order to promote inclusiveness we made a concerted effort to involve water users from all reaches and all well-being groups.

Our action research approach included the following elements:

- "Bottom-up" engagement with water users, but working through the WUA committees as our starting point. Our aim was to draw together the water users and WUA committee members to tackle the issue of water distribution; with a special view to giving the poorer water users a greater voice and influence than they have had in the past.
- Involvement of water users from all well-being categories – working with the WUA, a local NGO helped identify a small group as Farmer Observers (FOs), and as participants in focus group discussions.
- Engagement of FOs as observers, recorders and analysts of water distribution practice.
- Reporting of action research findings by FOs for discussion in community meetings – with an effort to promote attendance at these meetings by water users from all well being groups
- Use of locally resident facilitators/researchers to encourage, support and guide the work, and to act as champions for the poorer water users.

9.2.2 Approach in the various case study sites

We were able in SMIP to build on the groundwork done in our previous project (GGG) where we established relations with the same WUA and worked through the same local NGO. This enabled us to work in the most comprehensive manner possible with the WUA to achieve the objectives of the study. In the case of KIS, there has been a lot of related work done by other agencies which both facilitated and hindered our work: the WUA was relatively strong and dynamic, but it was also to some extent fatigued by the involvement of outsiders and their new ideas. We were able to resolve this initially by focusing on BC2 which has had fewer external activities than BC1; but ultimately it proved to be BC1 that had greatest need of assistance.

The two projects in Kyrgyzstan had relatively new WUAs, which had been supported through the On-farm Irrigation Project. These had not developed the strong links between users and WUA which had been created in SMIP under GGG. We also had to build a new local team to use participatory methods on these two sites[255].

In the case of SRSP we had the least groundwork in place: the WUA was newly formed following elections in late 2003 and largely untrained and unsupported, and our local NGO had no specific experience of the approach for developing the irrigation management institutions which we had developed in Nepal through this and the predecessor project, although they were skilled in the underlying methods and had worked on the implementation of the IMT programme in AP.

We undertook the following specific steps in the five case study sites, with some variation between sites to suit local conditions

Table 9.1: Interventions in the five case study sites

	KIS	SMIP	OH and JA	SRSP
Reconnaissance of the irrigation system and making contact with the WUA and water users	Spring season 2004	Monsoon season 2004	2004 crop season	2003/04 *rabi* and 2004 *kharif*
Joint diagnosis of water distribution practices and issues	Throughout spring 2004 (Feb-June), with WUA, BCC and users	First part of season (June-July 2004, following on from separate but related studies in previous year (GGG) , with WUCC, WUC, WUGs and users	Throughout season (April – September 2004) with WUA, *mirab* and users	Only reconnaisance study possible (undertaken with WUA and users) due to lack of water and complete failure of irrigation in 2004 *kharif* and 2004/05 *rabi*
Systematic observation and analysis of water distribution practices in one season	Flow measurement in main and branch canals and observations of water distribution down to field level, combined with studies of livelihoods of users	Observations from sub-secondary level down to watercourse level in 2002/03 as part of previous project (GGG) with follow-up measure-ments July-Oct 2004	Flow measurement and observations of water distribution down to field level (Aug-Sep), combined with studies of livelihoods of users (Jul-Oct)	Limited information gathered by discussion and interviews with farmers in *kharif* 2004 and *rabi* 2003/04 and 2004/05
Identification and introduction of changes to water distribution practices	Objective was to learn lessons which would be applicable elsewhere, but in process identified a number of potential improvements. WUA and BCCs introduced a number of these measures in the following season	Package of measures leading up to improved water distribution identified at the start of the season and refined and introduced gradually through the season (July 2004)	Package of measures leading up to improved water distribution identified by the end of June so that the key elements could be introduced for the critical dry period in the latter part of the season (Jul-Aug 2004)	Unable to introduce new water management practices in the absence of irrigation
Evaluation and adjustment	Workshop before start of spring 2005, so that lessons could be refined and incorporated by WUA in planning for that season	Workshop at end of season to review achievements and so that lessons could be refined for application in the following season	Impact of measures evaluated and discussed with participants, with a view to providing guidelines for subsequent years.	Workshop held with farmers to discuss findings

[255] This team included key national and regional members of the OIP team, supplemented by a full time institutional development specialist

9.2.3 Planning process: SMIP

(i) Introduction

This component built on the experience gained from implementing water users' schools to improve WUA governance under the GGG study at SMIP. The slightly different process we followed in the other sites is described in section 9.3

The steps in the EIP process included

- Initial visits, liaison with WUAs, project office and other local stakeholders and identification of a representative group of users, also known here as Farmer Organizer (FOs) with one lead FO per watercourse (WC) and one Key FO (KFO) for the tertiary canal. The selection of FOs took into account well-being / tenancy / gender etc. FOs were involved in preparing, implementing and monitoring the action plan for improvements;

- Preparation of an action plan by farmers / water users: this involved several steps;

- Implementation of the agreed action plans, and monitor their outcome and outputs through periodic meetings to review progress and options; and

- Evaluation of the results by users and WUA through a concluding workshop.

This was facilitated by a locally-based NGO who had worked on the previous project, with technical assistance from the study team. We undertook this component of the study most comprehensively and systematically at SMIP throughout the monsoon season 2004, but we did similar activities on a more limited scale at Obu Haet in the latter part of the main cropping season to suit the more limited scope of the measures that could be identified and implemented during this study.

(ii) Preliminary Activities

We first organised a general meeting at the level of tertiary canal T5, chaired by the SS9E WUC chairman and attended by 60 farmers, at which we explained the objective and methodology of the study, and then selected farmer observers to represent each watercourse and well-being group, and including some WUG members, and WUS participants according to criteria agreed in this meeting.

It was apparent from our earlier work that we would need to unravel a number of inter-related technical and institutional problems and that some of these would be highly contentious as problems of poor management were deeply entrenched. This observation was confirmed in the preliminary meeting, and led on to series of meetings to develop detailed action plans at the level of watercourses and tertiary canal.

(iii) Development of action plans

The action plans were developed in two stages: an initial action plan (IAP) at watercourse level, which was then synthesised in an agreed action plan at tertiary level. Preparation of the IAPs entailed three sets of meeting in each watercourse:

- The first meeting with the FOs aimed to:
  - Brief participants about the program;
  - Discuss existing water management practices at watercourse and tertiary level with a focus on water allocation / distribution, system maintenance, resources mobilization etc, drawing on the outcomes of the water users' schools in the previous year;
  - Discuss water management principles and methods used elsewhere in Nepal and other case study countries;
  - Identify and document physical features (present and future area[256], improvement works to be done, and vulnerable area for immediate maintenance) through transect walks.
- The second meeting was conducted on the following day, in which small group discussions were held separately with FOs divided into well-being categories, to understand and record opinions of each group with different backgrounds and interests, focusing on:
  - Identification of specific rules and regulation to improve water management; and
  - Preparation of a simple and workable plan of action for the concerned watercourse and tertiary canal.
- The third meeting involved the general assembly of the watercourse, in which the individual action plans prepared at the second level meeting was presented for wider consultation. The FOs took the lead role in facilitating the discussions, and synthesised the discussion to prepare an Initial Action Plan (IAP) for improving water distribution management in watercourses and the parent tertiary canal.

The same process was repeated for all the watercourses, and then a general meeting was organized at tertiary level. All FOs of watercourses, interested farmers of the area, and WUC members of SS9E, participated and the KFO led the meeting, which was facilitated by the research team[257]. In this meeting, each watercourse presented their initial action plan (IAP) for their own watercourse, which was ratified (with minor changes wherever needed) after discussion. The meeting then focused on the action plans for the tertiary canal prepared by each watercourse. After intensive discussions, these plans were synthesised with some addition and deletion. Finally the meeting approved the integrated agreed action plan (AAP), which is presented in Appendix G.

(iv) Key elements resulting from development of action plans

The process of developing the action plan was itself part of the reform process and further activities were identified as the programme was implemented. The summary below thus includes more than the items listed specifically in the originally agreed action plan. The details of these activities were refined during implementation, as described in section 9.2.4. This was an iterative process as potential solutions were proposed, tested, modified and approved – with some items discarded or not fully resolved during the study implementation period

Institutional reform

- Engage with users to build willingness to comply with rules and penalties;

[256] Future area refers to that area that could be brought under irrigation with improved water management practices.

[257] The KFO paid a key role in this process – he did not have a formal role in the WUA but he was active, influential and respected, whereas the WUC was disillusioned with the WUC. However, the objective was to use the KFO to motivate and reinvigorate the WUC, rather than to create a parallel organisation. Under more favourable circumstances, the WUA chairman could take on the role of KFO.

- Establish improved rules and procedures for operation and maintenance as described below;
- Revitalise WUC by establishing *ad hoc* tertiary committee, monitoring sub-committee and improving communications with WUGs and WUCC, and with users from all well-being categories – defining terms of reference and responsibilities, encouraging them to act on these and observe the benefits that they can achieve; and
- Stimulate greater involvement in management by WUC and WUG executive members through pressure from well-motivate user representatives who can see the impact of their actions.

Organisational structure

- Modify the structure of WUA, following the awareness-building and institutional reform described above, including establishment of a sub-committee of the WUC for each tertiary canal; and
- Employ seasonal *dhalpa* or make alternative arrangements for monitoring compliance with rules such as forming a monitoring sub-committee to WUC[258].

Communications

- Improve communications and co-ordination within WUA and with the state service provider – ie. between WUG, WUC, WUCC and SMIP;
- Improve communications between WUA and users: improve knowledge of and agreement with water delivery schedule within water courses, and information on planned deliveries in sub-secondary canals.

Maintenance

- Establish and implement rules for maintenance of sub-secondary, tertiary and watercourse level canals, including rules for resource mobilisation;
- Reduce need for and opportunities for water theft - remove illegal outlets and dig field channels from legal outlets or make alternative 'legal' arrangements – this should all be done in consultation with affected users so that they don't simply reinstate the illegal outlets.

Operation

- Introduce flexible operating system for secondary canals (authorising the WUCC to vary the flows and duration of rotation turns for SS9E and other sub-secondary canals along S9, so that they can make better use of the total volume of water in S9). In the JMA the required flow is stated to be 931 l/sec. This will require that the WUCC coordinate operations of SS9E with other sub-secondary canals;
- Agree principles for managing water (only from authorised outlets, with no checks in canals and all watercourses to flow simultaneously) – ie confirmation of the design concept, once the farmers had fully understood it and reviewed the alternatives;
- Develop schedules for irrigation within the watercourse;
- Agree indicators for monitoring operation (define indicators of time and depth for normal operation and time/duration for water-short periods).

[258] there is provision in the constitution for such a monitoring sub-committee but it had never been formed prior to this project

9.2.4 Implementation of reform - SMIP

The action plan that resulted from the process described above can be summarised as developing sound and locally appropriate institutional arrangements, with active support of users to:

- ensure that physical systems are maintained properly;
- remove illegal outlets and temporary flow obstruction in canal;
- ensure reliable and fair supply of water to all the branching canals of the sub-secondary and tertiary canal, especially towards their tail ends;
- develop rules for operation of canals and for sharing of water;
- monitor canal operation for equitable water distribution; and
- monitor compliance by all users with all rules and penalising defaulters.

We helped implement this process by facilitating a series of meetings and providing technical assistance on key topics.

In each watercourse, the local NGO organized a weekly meeting of FOs and some other key farmers (ensuring adequate representation by the WUG[259]) to facilitate and monitor the implementation of the action plan. In each meeting, they reviewed the benefits, problems, and constraints of implementation of the agreed action plan. They suggested suitable modification where needed, or referred issues that they could not solve at watercourse level to be discussed at the tertiary level. Actions taken by these meetings are presented in chronological order in Appendix G. Rules and procedures for water management were formulated at the regular meeting of FOs, through intensive discussion among farmers. These discussions addressed issues or conflicts over irrigation management raised by farmers who attended the meetings in relation to the implementation of the agreed action plan.

On a similar basis, tertiary level meetings were held monthly (or as required) with all FOs, members of the WUC, and other key farmers to solve problems in the tertiary canal. In the first of these meetings, held on 28 July, farmers formed an *ad hoc* tertiary level management committee[260], with the concurrence of the WUC Chairman. Unlike in the case of watercourses, where the WUG is responsible in managing water, there is no organizational setup to manage water at the level of the tertiary canal so the farmers themselves first formed an *ad hoc* committee from among the FOs to implement the agreed action plan. This held meetings on 4th and 17th August, 31st September and 17th and 31st October to monitor progress with the action plan implementation.

Although the *ad hoc* committee was set up to manage the tertiary canal, in practice it also took over much of the overall management of SS9E forming a monitoring committee to monitor operation of SS9E on a daily basis. Their activities included liaison between farmers and WUCC/SMIP, and other tasks that are the responsibility of WUC. They worked with the WUC chairman to ensure that he takes

[259] There were between 9 and 11 FOs per WC, including 2 WUG members. Of the 40 FOs in the 4 WCs in T5, 35% had attended the WUS programme the previous year, 20% were female, 40% were sharecroppers/informal tenants, 42% were from the poor well-being category, 40% from tail, 35% from middle, and 25% from head of their WCs. Such representation would be suitable for the WUGs if they were to be re-formed – WUGs have 9 members, but many existing members are no longer resident in the area and others have little interest in their duties.

[260] According to the WUA constitution, activities needed at tertiary level were to be done by the WUC, possibly by a tertiary-level sub-committee. This was not effective at SS9E and sub-committees had never been formed although the reasons are not fully clear. Among the likely contributory factors – the WUC was inactive, there are a large number of offtaking canals making management more difficult, and there was some disagreement over responsibilities between the agency (project office), WUC, and WUG.

on a more active role in those functions which cover the whole of SS9E rather than specifically the tail (which was the focus of this study).

Whilst weekly meetings were required at first in order to resolve a backlog of problems, it is not suggested that they are needed in the long-term. The frequency of meetings was gradually reduced during the season. Farmers in general seek to minimise the number of meetings.

(i) Sub-secondary canal

The division of responsibilities between the WUA and the project office for management of this canal are, at best, ambiguously defined which left room for expectations that SMIP could be persuaded to step in to resolve whatever problems might arise. The *ad hoc* committee initially focused on identifying actions that they wanted others (ie. the SMIP project office) to implement for them:

- raising the height of the banks as far as T2;
- removal of illegal outlets;
- allocation of additional water (raising the design water level and changing the rotation duration from 4 to 6 days);
- installing water gauges in canals for monitoring water delivery, with monitoring by SMIP staff;
- removing sediment and re-excavating parallel tertiary canals and watercourses where they had become defunct;
- recruiting water guard (*dhalpa*); and
- in addition they sought a supplementary water source from the Jwala River for tertiary canal T5, and rehabilitation of the tail end of watercourse WC1A, which had been washed out by Thalaha River.

Following a general meeting with SMIP and the WUA, they decided to share these responsibilities:

- Farmers would remove all illegal outlets from SS9E themselves within one week, and if necessary make alternative arrangements for some farmers;
- SMIP engineers would arrange resources for essential maintenance that had been neglected (eg maintenance of T2 which had been badly silted for a number of years and was now beyond the capacity of farmers to clean) and they would jointly desilt the sub-secondary canal which could be done by manual labour;
- WUCC Chairman agreed to increase the duration of each rotation in SS9E from 4 to 6 days, and to adjust the frequency and magnitude of the supply to SS9E by introducing flexibility into the operation plans so that other sub-secondary canals would not be adversely affected; and
- To install gauges to monitor water level at the intake of watercourses. These gauges and the flows in the sub-secondary canal to be monitored by the FOs.

The more major items – recruitment of staff, and additional infrastructure - were not resolved at this meeting although it was tacitly understood that they would not be made available by the project office.

(ii) Tertiary canal

The responsibility for maintaining different stretches of T5 was assigned to the farmers of concerned watercourses as delineated in the Action Plan. The maintenance programmes also aimed to remove all illegal outlets.

At the first meeting, participants also tried to identify indicators for monitoring distribution of water from the tertiary to watercourses on equitable basis. There was considerable debate on whether it should flow continually or on rotation. They eventually decided on continuous flow, with improved maintenance to ensure that sufficient water reached the tail and strict rules against any intervention in the tertiary canal by the two upstream watercourses. This is in accordance with the design, and it is revealing that such a lengthy process of negotiation was needed to reach a consensus which might seem intutitively obvious but was controversial to the farmers.

Specific agreements were:

- To define the portions of T5 that members of each WC were responsible for, and penalties for those who did not participate (NRs 100 per day, with water being stopped until the penalty was paid);
- To close all illegal outlets in T5 (although negotiations on two small outlets are still in progress, as alternative legal means of irrigation have not yet been identified), with a penalty of NRs 500 for subsequent default, and for the concerned farmers to construct field channels;
- Tertiary committee to ensure that water flows freely through tertiary canal without any obstructions – this was an agreed indicator for monitoring tertiary canal performance; and
- Tertiary committee to be responsible for monitoring water distribution from SS9E intake to T5 intake, and for liaison with WUCC for adjusting and communicating to T5 farmers the forthcoming delivery schedule to SS9E.

(iii) Watercourse level

The interventions undertaken at WC level included identifying lead farmers (from amongst the FOs) to implement the action plan; develop norms for system maintenance, resources mobilization, water distribution (closure of illegal outlets, development of field channels and preparation of a roster for equitable distribution of water); penalizing those who ignore the agreed norms; develop monitoring indicators for water distribution;, and developing rules to control livestock along the canal bank.

The specific agreements were to:

- construct field channels to enable irrigation of all fields, after closure of illegal outlets from T5 as described above. Progress on construction of field channels is summarised in Table 9.2.

Table 9.2: Status of field channels in the watercourse after EIP

Name of watercourse	Length of field channels (m)	
	Existing	New
WC-1A	355	45
WC-1B	110	0
WC-2A	220	115
WC-2B	30	0

Name of watercourse	Length of field channels (m)	
	Existing	New
WC-3	150	50
WC-4	400	165

- clean each WC twice per year (or three times if there is excessive sediment accumulation during the monsoon) – the rate charge to individual households varied by WC, as some adopted a fixed contribution per household (1 person day) and others related it to land holding. Any illegal outlets would be blocked during maintenance, with a penalty of NRs 251 for subsequent default, and field channels to be constructed by the concerned farmers;
- design water distribution rules, through an iterative process of designing, testing and modifying rules through the season. The conclusion was different arrangements for three situations, and they were slightly different in each watercourse:
  - Land preparation and transplanting,
  - Normal operation during crop growth stages,
  - Operation at times of scarcity.

  Landholdings served by WC 3 and 4 overlap the two watercourses, so they divided the combined command area into four blocks each to be irrigated for one day;
- Require each farmer to be present during his turn and to pay penalty of NRs 151 if they irrigate out of turn;
- Manage sub-watercourses systemtatically: WC1 and 2 both have 2 branches (A and B): whenever WC1 remains on, both its branches would operate continuously without obstruction of flow in any of the branches would not be permitted and division of flow would be guided by shape and size of the permanent bifurcation structure. WC2 by contrast would operate in turn: WC2-A would get 33 per cent of the total timeshare, while WC2-B would get 67 per cent of the timeshare;
- Prepare a roster for equitable distribution of water etc: this was a defined order of irrigation for normal application, with specified times of irrigation to be applied at times of shortage. They developed the following rules for distributing water to farmers within a watercourse:
  - During the period of rice transplantation, as diversified water demand exist and farmers do not all require water simultaneously, mutual consultation would be the basis for distributing water to farmers. The basis of mutual consultation would depend heavily on the local context.
  - After the completion of rice transplantation in the area, water would be distributed to farmers based on timeshare rotation. This method would be adopted especially during a period of water scarcity (during long dry spell).
  - When water is not that scarce, water would be distributed to farmers in turn. In this method, there is no fixed time-share and irrigation starts from head to tail. In irrigating by turn, water from one farmer’s field would be diverted to another farmer’s field only after the former completes irrigation in his land. This is also a simple method and is easily understandable by farmers.

Many discussions were held to finalize these rules. Farmers then decided to adopt timeshare rotation of water during the period of scarcity, but they raised concerns regarding methods for accounting for characteristics of land and crop (such as lowland, highland, geographical location, soil type, crop stages, etc) while making schedule for timeshare rotation of water. They concluded that in the interests of simplicity they would not take these factors into consideration at times of scarcity. However, at other times they felt that irrigation by turn should be adopted: this enables more equity in water distribution as this method takes into account land type, crop stage, geographical location of land, stream size etc. But the judgment on the sufficiency of water in one's plot is subjective and leads to conflict unless there is a single person to monitor the sufficiency of water in each plot and they did not think that they could afford that. For this reason they only decided to adopt the irrigation by turn system at times of relative abundance.

After the completion of the study period, a concluding workshop was organized at the system level to review the activities conducted and progress made. Those attending included those participating in the earlier meetings plus officials from higher tiers of the WUA, SMIP and NGOs.

9.3 Identification process and outcomes in other study sites

9.3.1 Khageri

The purpose of the study in Khageri was to understand the system of water management in a scheme which is considered to be relatively well-managed, with a view to applying similar principles elsewhere. However, in the process of observation we found that this relatively well managed scheme itself showed scope for improvement. We therefore helped the local water users to design some measures which could lead to better water management in the spring season. This is a time when there are evident inequities and strains over the way water is shared. These include:

Main system

- Operating rules (with appropriate institutional arrangements) for offtakes at Kaparkhori (to control the timing and level of stoplogs) to implement a water sharing agreement between Kaparkhori, BC-1 (including BC-0) and BC-2, and thereby lead to fewer unpredictable fluctuation in the water flows to BC-1 and BC-2;
- Establishment of a participatory pre-season planning process for crops and water distribution, and communication of agreed plans;
- Establishment of a suitable maintenance mechanism, especially for vulnerable infrastructure which includes canal banks in the forest zone (which breaches frequently), and the gates for both the head and cross regulators (to enable better control of water levels in LMC).

Branch canals - BC-1

- Determination of required stream sizes and durations for irrigation of each outlet - in view of varying relative branch canal bed levels and FSL, outlets (size and level), outlet channels and critical fields, flow volume and duration to irrigate the entire outlet command area will vary – this would need to be worked out as a participatory activity organised by the BCC and Outlet Committee, with some initial external technical assistance.
- Re-establishment of a three staged rotational water distribution system at BC-1 for distributing water to its outlets: this will need to be designed in conjunction with the above point, taking account of the reasons for the collapse of this rotation, and will entail a greater involvement by the BCC in water management at BC level[261].

[261] Rotations were used prior to rehabilitation, but they lapsed after rehabilitation: the improvements to the canal meant that, even without a rotation, they could irrigate a much greater proportion of the land than they had previously and it was simpler to let the rotation lapse. However, they now realise that further improvements are possible if they reinstate this rotation. Whist this will benefit the tails of outlets particularly where poor and/or low caste people are predominant and who appear

- Initiate a monitoring system to ensure compliance with this rotational system, including provision of water guard or alternative system such as forming a rota amongst OCs, coordinated by the BCC.

Branch canals – BC-2 and pachas bigha kulo

- Development of water sharing mechanism so that all farmers can receive an appropriate and predictable share of water. This should take account of available sources of water (eg tubewells in the tail, and seepage flows) but should not rely on disadvantaged farmers having to find alternative sources.
- Regular spring season rotations in *pachas bigha kulo* are unlikely to be workable because informal processes for canal management, supplemented by natural seepage flows, are adequate for most of the time. What is needed is an agreement and recognition of the rights of all users[262] to water, so that a water-sharing process which would only be instituted at critical times can be designed. This is likely to take the form of an order and duration of irrigation for each plot for different flows through the outlet from the main canal. Earlier attempts to institute formal rotations were reported to fail because of fluctuations in the main canal water level, so improving the management of LMC may also simplify systematic management at critical times.

Outlet level

- Establishment of a rotational water distribution system at the farm level with appropriate monitoring indicators (target water depth in field or duration per plot, procedures and responsibilities for monitoring).
- Coordination system with BCC and adjacent outlets to ensure stream size sufficient to irrigate whole outlet within single rotation period.

These ideas were developed into specific interventions, and the potential impact of these are summarised in Chapter 10. These areas of improvement were identified on the basis of participatory studies conducted during February to July, 2004, and the farmers have subsequently initiated some of the improvement works. For example, an organizational link has already been established between the Kaparkhori Outlet and rest of the system and a new committee is being set up. We did not, however, plan to implement these activities during this project.

The main objective of this part of the study was to learn lessons from the relatively good performance of KIS. The key strengths that we noted were:

- a good system of communications from DIO through the WUA and BCCs to the users,
- clearly defined and understood responsibilities at each level,
- a strong system of sharing water at main system level, which is equitable and agreed by the WUA, BCC and users.

Despite these strengths, we did notice some institutional gaps – such as the confusion of responsibilities between OC and BCC, and a common perception that “other people” always break the rules. These gaps led to weaknesses in water management, in particular:

resigned to the inevitability of a poor supply, there are also many rich people who will also benefit, including some WUA representatives, and the idea of reinstating rotations has been given more impetus by them.

[262] Most farmers get an adequate supply in this outlet, but there are a small number of individuals who do not, for various reasons (eg. female-headed households, with no male members, unwilling to guard supplies; household mainly dependent on off-farm activities, etc)

- Difficulties in defining rules for solving problems that are either short-term in nature or affect small numbers of people (especially if they are relatively poor);
- Unpredictability and individualistic behaviour at field level;
- The need for a management structure designed to cope with the constraints of the infrastructure at the branch canal level.

9.3.2 Kyrgyz Republic

A key finding in the Kyrgyz Republic was that although the WUAs appear to be active and to function relatively well, the farmers do not have a clear understanding of the role of the WUA. They see the WUA more as an external management agency rather than an organisation that they should be involved in or that they have a role in governing – developing rules, and being responsible for observing those rules. The WUA fills a gap created by the abolition of state and collective farms and is not regarded as a community-based organisation. This is both a strength (as it is uncontroversial and does not require awkward changes in responsibilities) and a weakness (as it is not embedded in or 'owned' by the community).

Most people appear to be unaware of who their representatives are; the zonal representatives themselves are not clear of their responsibilities. The general assembly is thus a weak body and does not provide an effective role in WUA governance. Much therefore depends on the conscientiousness and dedication of key individuals in the WUA Directorate; essentially (in our study areas) the Director, the *mirab* (OH) and the accountant (JA).

These general observations apply to both WUAs but both the performance and the scope for improvements was better at Obu Haet, largely because of the greater interest shown by the *mirab*. Although the Obu Haet *mirab* was already doing a good job, he was able to see how management could be further improved – and also ways of making his own job easier to carry out. At Jany Aryk, the *mirab* was less interested and the director was busy in other activities.

Our findings confirm the observations of World Bank (2006b) that these WUAs are effective, but we do feel that the issues outlined in this section need to be addressed to ensure the sustainability of the WUAs – there is a risk that the WUAs in Kyrgyzstan could collapse as they did in SMIP, although the risk is mitigated by the higher standards of education and professionalism at village/WUA level in Kyrgyzstan.

(i) Obu Haet

As described in Chapter 8, there is a large number of different crops grown and plot sizes are small: this results in a patchwork of small plots under different crops. The lack of any logical order to irrigation, other than the order of farmer requests, results in a considerable volume of water being released directly to drains rather than used locally – this leads to local shortages even at times when there is sufficient water available and results in obvious waste such as water flowing across roads.

There is a strong system of sharing water which is managed by the *mirab* for Buvakul. This system relies heavily on the capability and commitment of the *mirab*, and the respect that people have for him. In this case he has earned respect by carrying out his job conscientiously and fairly.

The *mirab* operates the system essentially according to his own judgement, just keeping in contact with the WUA to request more or less water than the previous day or week: farmers request water, the *mirab* delivers. There are some problems with implementating this. Water may be taken by some farmers when they have not been authorised to do so by the *mirab*: some farmers just take water when they see water in the canal and do not first request this formally from the *mirab*. Downstream users who have been authorised to take water may still have to go upstream to remove unauthorised water diversions to ensure that they get sufficient supply. At some times there is sufficient water so that this does not cause problems to others, but at other times it means that too little water is available for those who are authorised to take it. If this illegal water use is excessive (in the judgement of the *mirab*) he takes action and closes the gate. The *mirab* has too little time to monitor water use by all farmers. Farmers, in general, do not know who is authorised to take water, so disputes arise about who is entitled to take water.

There is a shortage of water, which limits the scope for cultivation of rice - a very popular crop. There are strict limits (which are enforced) on the area that any individual can grow, but this means that rice is cultivated in small plots scattered throughout the command area. This is very difficult to manage as it requires water every day (given the highly permeable soils).

There is a Conflict Resolution Committee but this exists only on paper and is not effective in resolving disputes. The zonal representatives are also unclear of their role, and do not provide the governance role that is required of them

Finally, we noted that technical skills in irrigated agriculture were very variable, and some farmers who were involved in other activities before land allocation in 1995 were not as able to manage water efficiently as those who traditionally were farmers. There is a need to improve skills, and we distributed some brochures and other material for this reason. This is particularly true for cotton irrigation, as some farmers reported a tendency (by others) to over-irrigate cotton and thereby reduce yields.

For these reasons, the farmers proposed several measures:

- Installation of a blackboard in a central location, where the *mirab* would write each day who was authorised to take water and for how long;
- Approval and use of an ‘act’ which would penalise people found breaking the rules for water distribution, although it transpired that neither the *mirab* nor the farmers were willing to be so openly critical of their neighbours and they wanted the *Raivodkhoz* to implement this. The act was thus established but not used;
- Recruitment of an additional part time, short-term *mirab* to improve implementation of field level activities and so that the WUA could better monitor flows at critical times;
- Agree rules for co-ordinating rice and cotton irrigation, by allocating all water to rice every day from 5 AM to 7 AM, and then sharing water between other crops for the remaining 22 hours per day. This would reduce the risk of damage to the cotton crop in particular, which is very sensitive to irrigation timing and volume. This was agreed but barely put into practice since it was only agreed towards the end of the season when there was sufficient water available (from rainfall) to make it uneccessary. Some farmers doubted whether it would be practical;
- Although the need to improve the sequencing of irrigation of other crops was recognised (so that water passes from one farmer to his/her neighbour, rather than at random within the outlet according to the order of requests from individuals), it was not practicable to change this within a single season. We aimed first to improve understanding of water sharing within large outlets, in

order to encourage farmers to request water in a more logical order, and to encourage all farmers to close outlets at the end of their irrigation; and

- Provide technical advice on field irrigation activities, particularly cotton irrigation.

(ii) Jany Aryk

Jany Aryk shares a pattern of problems and solutions with Obu Haet. But there are important differences of detail, which can be attributed to:

- The location, which is close to Osh city, where there are many options for off-farm activities;
- The land allocation was much smaller so that some people rent land from others who then work elsewhere;
- The WUA is less active, with the director being engaged in local government and the *mirab* much less involved in day-to-day water management. Many farmers do not know who the *mirab* is, and he makes little effort to control illegal water use;
- The farmers have an even weaker understanding of what the WUA is, and believe that it should just arrange for extra supplies from the *Raivodkhoz* rather than attempt to control internal water use. Some farmers feel that they can divert water directly from the *Raivodkhoz*-managed canal;
- There is a greater water supply per unit area, and the amount that can be made available to farmers is constrained more by maintenance than supply: they believe maintenance is still to be the responsibility of the *Raivodkhoz*[263],although accept that they will have to take up the responsibility;
- More uniform cropping pattern, with maize being the dominant crop. No rice or cotton is grown, although there are some vegetables;
- Unlike at Obu Haet there is no system of daily indenting of water by farmers, and there is thus less contact between the *mirab* and farmers resulting in less involvement in planning and more ad hoc use of water and greater inequities between head and tail, although this is mitigated by the generous overall supply of water;
- There is a smaller number of outlets, which tend to be larger than at Obu Haet (there are 19 outlets at Jany Aryk as opposed to 57 at Obu Haet for a similar area); and
- The village is located within the irrigated area rather than on the outskirts.

In common with Obu Haet, there is scattered irrigation within outlets – this is on demand and not in accordance with a schedule, resulting in high transit times and losses. It is complex to manage as outlets are large and there are numerous farmers. Nevertheless there is some solidarity and co-operation within outlets. Irrigation is thus dependent on good social networks within outlets, which may exclude some people. Furthermore, there is little if any collaboration between outlets, (which contributes to erratic and unreliable water flows across the system). Inequity is accepted as normal and tail farmers believe that it is inevitable that head farmers will take more than their share – people will complain, but are reluctant to express problems formally and they recognise that they would do the same if they had the opportunity. Some even acknowledged the 'right'of head farmers to steal water, and said they would only intervene to stop such actions at night. The *mirab* has a formal role in managing supplies to outlets although in practise these all flow continuously without external management.

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263 some rehabilitation of the main supply canal was planned for the following year, so the farmers saw little need to maintain it this year

The WUA itself has a formal role in managing the Khatta Khaz canal, in accordance with their agreement with the *Raivodkhoz* ,and it is relatively active in this task since this affects the amount that they have to pay for water[264]. The farmers by contrast seek to keep this open as long as possible, and indeed their main reason to contact the *mirab* was to ask for help in opening the gate from the Khatta Khaz canal when they want water – (sometimes without the authorisation of *Raivodkhoz*).

Measures that were proposed to tackle these problems included:

- Regular communication between water users and *mirab*, including a system of water requests and/or coupons, and better planning and record keeping.
- Posting of watering turn at accessible locations (using a blackboard) for each water user (probably within each outlet, as these are each quite large areas with large numbers of users)
- Introduction of rules and procedures that are respected by the water users, and ensure that defaulters are reported and penalised
- Better maintenance after rehabilitation is complete.

It was not possible to adopt these because of the weak links between the users and the WUA, and the limited involvement of the *mirab* in routine operation. Further work (such as we undertook in GGG on SMIP) to establish these crucial links would be a prerequisite for a substantive improvement in water management.

9.3.3 SRSP

The problems at SRSP are more difficult to solve than in any of our other study sites and require a substantial improvement in management at main system level as well as (and preferably before) changes in management of water distribution at WUA level. Even though there is a large reservoir to modulate the irrigation supply, the inter-annual rainfall variations cause a very unpredictable supply to the system. The storage volume in the Sri Ram Sagar Reservoir at the start of the season gives an indication of how much water can be supplied for that season, but the actual inflow to the reservoir is dependent on rainfall and water use in Maharasthra (and the operation of the upstream Jaikwadi reservoir). These are all out of the control of the I&CADD: in dry years (such as 2004) rainfall and upstream water use affect the ability of the I&CADD to predict water availability even **within** the season. Nevertheless, the I&CADD does make a prediction, which can be communicated to the WUAs and farmers and which can be used as a basis for farmers to plan their cropping. There is some evidence to indicate that during the WUAs' first term of office, some committees were effective in improving the communication of this information to farmers. But during the gap between the end of the WUAs' first term of office and the second round of WUA elections, and during our study seasons when the newly-elected TCs were untrained and unsure of their responsibilities, this information did not reach many farmers in our study areas.

The lack of regulating structures in the distributary and minor canals makes it difficult to manage the canals at times of low flow and means that it cannot yet be managed according to the 'structured irrigation' concept. The resulting highly variable flows in minor canals inspires an individualistic, almost anarchic, response by many farmers and rational water management is difficult. Regulating structures in the distributary canals were designed as part of the rehabilitation of the system but have

[264] They even closed the outlet for a prolonged period in the middle of the season, with little reference to the farmers and without informing them of the reason (see Box 6-9)

not yet been built. Some farmers are able to mitigate the effects of this unpredictability by supplementing surface irrigation with well water, but access to groundwater is very variable.

The problems with unreliable water flows caused by the technical constraints and the shortcomings in management of the main system , combined with the total failure of the 2004 *kharif* season, meant that we were unable to work with the WUA and users in the same way as we did in our other study sites. Without a predictable supply of water it was not possible to ask water users to consider and plan for tangible improvements at minor canal level which could be adopted during this study. A number of general issues emerged, but these are still at the level of topics for discussion. Considerable negotiation is still needed – such as we undertook at SMIP – before practical measures can be implemented effectively. The conclusions of the final workshop held with the WUA president, TCs and farmers as well as *Gram panchayat* representatives included a number of topics that need to be resolved:

- Crop choice: there is potential for alternative high value crops, but farmers lack knowledge of them. If some farmers grow rice it makes it difficult for others to grow ID crops. The agriculture department needs to be involved more closely with helping farmers and the WUA to adopt water-efficient, and financially attractive, cropping systems and practices;
- Information: there is little information made available to the WUAs and farmers on the planned water deliveries;
- Canal cleaining: minor canals need to be cleaned before release of water into them, and other repairs are needed (eg M30R intake);
- Canal obstructions: no canals should be obstructed or banks cut, and penalties should be imposed on those who break this rule;
- The *warabandi* system needs to be consistent at minor and outlet levels: if there is a regular weekly system at farm level, the timing of distributary and minor canal deliveries needs to correspond to this. It might be possible to have a tail to head order of irrigation in outlets. Field channels will need to be restored so that each farm has access to the outlet channel;
- Cooperation: individualism by some farmers makes life difficult for others: there needs to be a more cooperative approach. There is scope for diversifying livelihoods, with greater emphasis given to livestock;
- The role of the WUA: this should meet frequently and monitor water use; and
- Consistency in attitudes regarding PIM among officials: there has still been no DC election (18 months after the WUA elections) and the WUAs have not had any recent training. WUAs also have very limited powers for enforcement and have to get approval from the ‘competent authority’ for many activities.

These problems mirror those at SMIP but are more complex. The SRSP irrigation system is much larger and more complicated and improved equity and efficiency in water sharing would require a change in cropping patterns. As in Nepal, the management reforms in AP were driven by financial pressures and strongly promoted by influential donors. But in AP the financing constraints were probably less severe and the donors’ influence less. Strong support at the highest level in AP (by the Chief Minister) was important, but there has been less pressure on the I&CADD to withdraw from field activities. There is still an AE assigned as ‘competent authority’ to each WUA and *lashkars* are still employed to operate gates. This is a very high staffing level but the I&CADD is still keen to retain an involvement in the details of management, and it possibly leads to a lack of clarity in allocation of responsibilities. It is not clear to all interested parties what responsibilities belong to the AEs and *lashkars* and what responsibilities belong to the WUA (or are shared). This confusion may be in the short term interests of the individuals on both sides – leaving them with status and influence without clear responsibility. As at SMIP, there has been a combined effort at both reforming management and rehabilitating infrastructure but the pressures to extend the area irrigated were stronger than those to modernise the system in the existing area.

However, there are many parallels between the social and institutional problems that the SRSP and SMIP face. These include, for example, a hierarchical society with strong patron-client relations, a reluctance to speak out against perceived inequities, and a WUA which has been externally imposed with limited support. The solutions may thus be sought in similar ways, and could include a programme to embed the WUA in the community, and to help the users to identify and tackle problems that they can solve internally, whilst simultaneously lobbying for help in resolving the external problems.

A particular challenge faced by SRSP - which SMIP appears not to suffer from - is the difficulty in supplying a predictable amount of water (in both time and volume) to the WUA at the head of the minor canal given the uncertainty in supply and the lack of canal regulation[265]. This makes it more difficult to design a water sharing mechanism within the minor – for example, if a *warabandi* system is adopted, each farmer is likely to receive a different amount of water per unit area. However, the flexibility demonstrated in SMIP by the WUA when it adopted different water-sharing arrangements (eg. fixed duration of irrigation, defined order of irrigation, agreed depths, etc) under different situations suggests that the problems may be soluble at SRSP as well: simplicity and ease of implementation are more important than precision.

It is difficult for the users at SRSP to improve their water management until the new WUAs are given some training and develop effective working relations with both the 'competent authority' and the water users. Election of the distributary committees would also make it easier to resolve the problem of predictable delivery to the minor canal described above. However, this is clearly not sufficient since despite the relatively good support given to WUAs in their first term of office, they were still not able to carry out a number of basic WUA responsibilities at the minor, pipe, field channel and on-farm levels (such as developing and implementing rules and discipline in water sharing, canal cleaning, information about water delivery schedules, advising farmers about on-farm water management and crop-choice). The EIP Farmers' Workshop indicates a starting point, analogous to the report-back after the DL/AP under GGG, and the planning meetings under EIP in SMIP. There now needs to be a systematic programme to promote the continuing involvement of water users in planning and implementing the tasks listed in the bullet points above – with WUA TCs providing leadership.

9.3.4 Problems and solutions -- common features

(i) The problems – "asymmetric information" and "opportunistic behaviour" [266]

The problems identified reflected "asymmetric information" which contributes to "opportunistic behaviour" and distrust among water users and between water users and water distribution staff –

[265] D-86 operates on a 10 day rotation cycle, but it is a very long canal which means that filling times are long and fluctuations in water level very pronounced over this time period. These variations are magnified down the system into the minor canals.

[266] Cf discussion on the subject re. the "New Institutional Economics". Asymmetric information arises when one party or group in a relationship has information that the other party does not. Opportunistic behaviour arises when one party is unable to monitor and enforce the performance of another party in meeting its obligations. (Morrison *et.al*. "Sustainable Livelihoods and New Institutional Economics". DFID/IDS Livelihoods Connect web site)

particularly ditch riders (*mirabs, lashkars,* and *dhalpas*). In addition to asymmetric information, there is also an absolute lack of information, with all farmers unable to find out when, and how much, water will be reaching them. This affects different people in different ways. The problems included:

- Not having reliable information on the amount of water being delivered at different points in the system – particularly in canals below a gate operated by a ditch rider.
- Not having reliable information on the time that other water users are authorised to draw irrigation water.
- Not being able to control the "illegal" water access measures used by other water users.
- Not knowing when, and how much, water one will be able to access for one's own crops: this contributes to a 'hoarding mentality' – which is possible in rice areas, or where on-farm storage is possible (as in SRSP).

Some farmers are better able to cope with inadequate or unreliable information than others. For example, a medium farmer at KIS who is locally resident can be around to cope with water whenever it comes, whereas a poor sharecropper may not be present when water is available.

(ii) The solutions - promoting social connections, trust and technically sound water management

The solutions identified with water users operated at several levels. They aimed to:

- Relieve the constraint on the absolute availability of water in their part of the system by
  - influencing higher level management to release more (or more timely) water to them,
  - improving the conveyance efficiency by better maintenance or physical improvements to the canals, and
  - closing illegal outlets and removing illegal checks;
- Promote better communication and trust amongst water users;
- Promote acceptance of the need to comply with rules for operation, maintenance and financial management; and
- Establish rules for sharing water and indicators to monitor compliance at all levels

(iii) Summary of solutions identified

The interventions proposed or implemented in each case study area, are summarised in Table 9.3. These are grouped under varius headings; those in bold were successfully implemented

Table 9.3: Proposed interventions in the five case study sites

Intervention		**KIS**	**SMIP**	**OH**	**JA**
Institutional reform	Engagement with users	**Improve confidence that rules will be enforced fairly and consistently**	**Strengthen process of engagement started under GGG**	**Engage with users and WUA to build willingness to comply with rules and penalties:** use of 'act' against defaulters	**Engage with users and WUA to build willingness to comply with rules and penalties**: use of 'act' against defaulters
Organi-sational: structure and staffing of WUA	Awareness (and definition, if needed) of roles, responsibilities, willingness to discharge responsibilities	**Initiate representation of Kaparkhori on WUA**	**Revitalise WUC by establishing ad hoc tertiary committee, monitoring sub-committee and improving communications with WUGs and WUCC well-being categories**	**Create awareness of the role and responsibilities of WUA, GA and users**	**Create awareness of the role and responsibilities of WUA, GA and users**
		Improve representation of BCC on WUA, and reform relationship between OC and BCC	**Stimulate greater involvement in management by WUC and WUG executive members**		Stimulate greater involvement in management by WUA executive members
		Employ seasonal *dhalpa*	Employ seasonal *dhalpa* or establish monitoring sub-committee to WUC	**Employ part time *mirab* at critical times**	Improve performance of *mirab*
Commun-ications	Communications within WUA and with service provider	**Improve communications between WUA, BCC and OC**	**Improve comm.-unications between users, WUG, Tertiary Committee, WUC, WUCC and SMIP**		
	Communications between WUA and users	**Facilitate awareness of LMC operating systems**	**Facilitate awareness of S9/SS9E operating rules**		
		Improve communications of management decisions to users: crop plans, water delivery schedules	**Agreement and awareness of water delivery schedule within water courses. Information on planned deliveries in sub-secondary canals**	**Publicise irrigation schedules and names of those authorised to irrigate each day on a centrally located blackboard**	Introduce coupon system, as at OH and publicise daily schedule on a centrally located blackboard
Maint-enance	Establish and implement rules for maintenance, including for resource mobilisation	Improved systems for timely maintenance of key components of main system.	**Develop rules for mobilising resources and implementing maintenance of sub-secondary, tertiary and watercourses**	Introduce systems for regular maintenance of inter-farm canal by WUA and outlet channels by users	Introduce systems for regular maintenance of inter-farm canal by WUA and outlet channels by users

Intervention		KIS	SMIP	OH	JA
	Reduce need for and opportunities for water theft		**Remove illegal outlets and dig field channels from legal outlets**		
Operation	Implement systematic procedures for operation of canals and structures	Introduce systematic operating rules for Kaparkhori outlets: coordinate operation of KK and LMC	**Introduce flexible operating system for sub-secondary canals: coordinate operation of SS9E with other sub-secondary canals (change rotation cycle and water levels)**		
		Establish and implement target water levels in LMC		Coordinate rice and cotton irrigation	
		Design and implement improved rules and procedures for rotational operation of BC-1	**Agree principles for managing water (only from authorised outlets, no checks in canals, all watercourses to flow simultaneously)**	**Agree principles for managing water (no unauthorised checks in canals, measures to control those at head taking more water than they should**	**Agree principles for managing inter-farm canal, and for which outlets to be rotated and which to flow continuously**
		Improve water sharing within large outlets at times of shortage: detailed rules for critical times	**Develop rosters for irrigation at times of shortage and order of irrigation with indicators of target depth for other situations**	**Encourage better coordination between users within outlet to irrigate in a logical sequence and to close outlets at the end of irrigation**	**Encourage better coordination between users within outlet to irrigate in a logical sequence and to close outlets at the end of irrigation**
				Provide technical advice on optimal water management techniques, especially cotton which is vulnerable to over-irrigation	
	Establish indicators for monitoring operation	Define indicators of time and depth for normal operation and time/duration for water-short periods	**Define indicators of time and depth for normal operation and time/duration for water-short periods**		

10 Outcomes and Implications of EIP Intervention

10.1 Introduction

The purpose of the study was to improve livelihoods through more equitable access to water. Within the livelihoods framework, access to water is an element of natural capital. But we found that human and social capital assets were an important key to achieving improved access to this natural resource. Thus in order to achieve our study purpose we needed to take measures to achieve the following human and social capital outputs:

- we first had to strengthen skills and understanding of how to achieve better water management amongst water users from all well-being categories [most training had previously been addressed to WUA committee members, and sometimes to 'lead farmers']; and then
- enhance social capital and relationships so as to improve practices that affect water distribution.

These changes in human and social capital helped, in turn, to improve the ability of poor farmers to benefit from the contribution that irrigation makes to supporting rural livelihoods. The impacts on water distribution and livelihoods are described in more detail in subsequent sections.

10.2 Human and social capital – observed outcomes

The human and social capital outputs represent key achievements of the EIP intervention, and were described in detail in Chapter 9. They are summarised below.

(i) Human resources and skills

Our intervention in this sphere covered two main categories, institutional and technical. Our work in developing institutional skills included:

- Better understanding of the role and responsibilities of the WUA, the rights and responsibilities of water users, and the importance of collaboration to achieve water users' interests; and
- Enhanced leadership and negotiation skills.

Technical skills development included:

- Better understanding of the design of the irrigation system and of the constraints this imposes on the way the system can be managed and on the way water can be supplied to irrigators;
- Improved understanding of water flows: depth-discharge relations;
- Awareness of flow monitoring techniques; and
- Ability to design irrigation schedules.

A further technical aspect - improving skills in the use of water, through better on-farm water management - is also very important. This enables farmers to make better use of limited supplies. However this was outside the scope of this project and is adequately covered by other programmes (such as the FAO on-farm water management programmes)

(ii) Institutions, organisations and social capital

We realised that knowledge and skills were not enough. In order to translate knowledge and skills into improved procedures water users had to be willing to change a number of practices at a group level. So we took measures to foster changes in relationships and to improve social capital. These resulted in:

- Better defined roles within WUA (including internal restructuring), and willingness to discharge these duties;
- Better sharing of knowledge about water management, including flow monitoring at local level and the inter-relations between local and system-level aspects of water management;
- Improved relationship between WUA committees and water users;
- Improved relationship among water users – greater mutual understanding and willingness to cooperate;
- Increased willingness to observe rules for water distribution; and
- Increased willingness to maintain and protect canals for better water distribution (or to pay others to do so).

10.3 Water distribution – observed outcomes

10.3.1 SMIP

Our observations at the end of the season at SMIP indicate that there were definite improvements in actual water distribution. Quantitative data on the changes observed between 2002 and 2004 are given for each level of the system in subsequent sections of this chapter – although it should be noted that the nature of the infrastructure in SMIP and uncontrolled variables such as climate mean that a longer study would be needed to confirm the magnitude of the improvement in water flows. But we can also report tangible changes in various aspects of system management which have a direct bearing on improved water flows. The changes are summarised below and described in detail in subsequent sections.

(i) Overview of changes in water distribution

Quantitative data are given in the following sub-sections: this introductory section provides an overview of the nature of the changes observed

Supply to SS9E and management down to T5

- Better supply to the sub-secondary canal, though improved coordination with S9 (WUCC and SMIP). This enabled variable supplies to meet the specific needs of each of the sub-secondary canals off S9. This was an improvement over the previous practice of strictly following the rigid and inappropriate design rotation. It was achieved as a result of good coordination between the *ad hoc* tertiary committee formed during the study and the WUCC chairman. However, the *ad hoc* tertiary committee does not conform to the provisions of the WUA constitution and will not be sustainable unless it is formalised (probably as a subcommittee of the WUC). In the long run coordination should be between the WUC and WUCC.

- Fewer illegal outlets in middle/upper reaches of the sub-secondary canal. These were either closed or reduced in size, and the official outlets and canals were made workable through the combined efforts of SMIP, WUCC and the *ad hoc* committee.
- Better maintenance of canals. This improved conveyance efficiency in the sub-secondary canal.
- More reliable water supply to tail of SS9E. More water, with more predictable timing of delivery reached T5 and T6. Water flows were monitored by the *ad hoc* committee (indicators were defined and these were monitored daily) and illegal actions were stopped by this committee.

Management within Tertiary canal T5

- Illegal actions were stopped by the ad hoc committee, and maintenance improved – leading to greater conveyance efficiency.
- More reliable water supply to tail of T5. More water and more predictable timing of delivery to WC3 and 4. Water flows were monitored by the *ad hoc* committee and visually verifiable by the farmers (indicators were defined and these were monitored daily).

Watercourses

- More field channels were dug to enable irrigation from proper outlets and reduce losses in transit from watercourse.
- Larger streamflow to individual farmers was achieved by farmers irrigating in turn rather than simultaneously – this led to quicker irrigation and fewer field losses.
- More systematic procedures for defining turns, order and duration of irrigation.
- Fewer conflicts (whether expressed as formal disagreements, or simply regarded as inevitable consequences of an unequal society).

(ii) SMIP – supply to SS9E and management down to T5

Reliability of water to the tail of SS9E

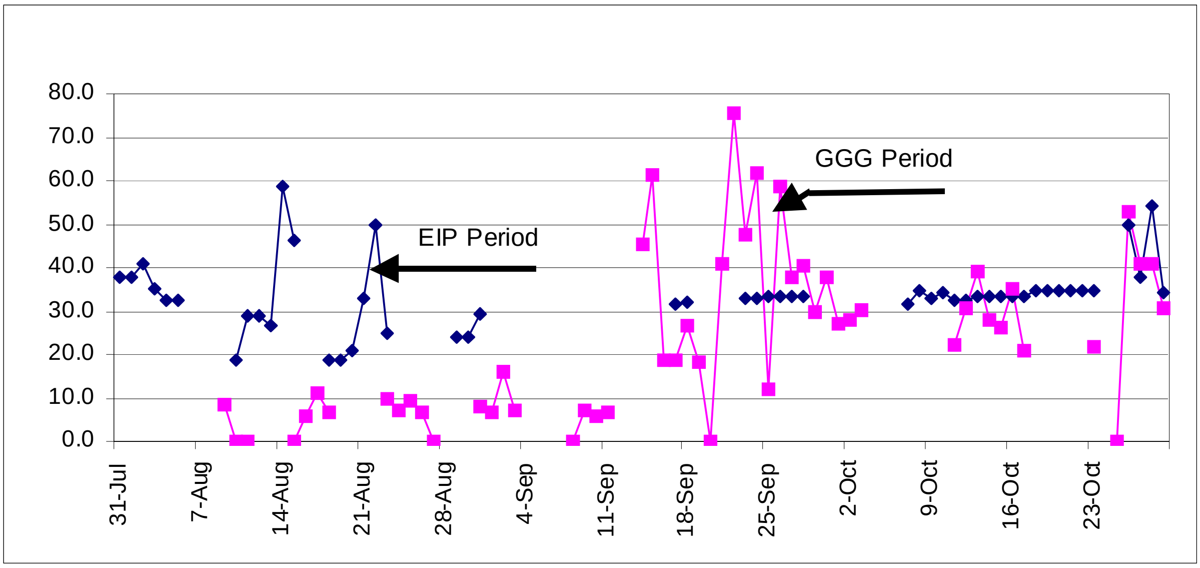
In 2004 as part of the measures described in section 9.2.4 the SMIP project office and WUCC introduced flexibility into the operation of the secondary and sub-secondary canal. Flows up to 1200 l/sec and rotation durations up to 6 days were permitted and negotiated between the users and the WUA. This resulted in a significant improvement in access to water, without increasing the overall supply. This can be seen by comparing the following figures for water deliveries during the crop growth stage (31st July – 30th October) in 2002 and 2004

In 2002 (before this project was implemented), water was scheduled to be delivered at 931 l/sec on 44 days – equivalent to 4,900 m^3/ha. In fact it was only delivered on 34 of these days, when 4,000 m^3/ha was supplied. However, it was also supplied on a further 20 unscheduled days, giving a total supply of 6,100 m^3/ha for the actual flows measured.

In 2004, over the same period a total volume of 4,900 m^3/ha was supplied, spread over 50 days. This is just 80% of the volume supplied in 2002 and yet, as will be seen below, there was a much better supply to the tail. Greater flexibility in operation (with shorter duration higher intensity flows) thus permitted greater efficiency in water use. This flexibility does place higher demands on operating staff, but the WUCC chairman did not see any difficulty in carrying this out[267].

The improved water flows to T5 and T6 are graphically illustrated below. According to area, T5 and T6 should together receive 28% of the water in SS9E. Figure 10.1 shows that in 2002 (grey line, labelled GGG period, referring to the season before implementation of that project) they rarely received more than 10% of the flow in the early part of the season. In the latter part of that season the flow at the tail approximated to the requirement on average, but with considerable fluctuation. After the implementation of the study (2004) even in the early part of the season the flow (black line, labelled EIP period) averaged around 30%, as required, and in the later part of the season was very uniform at just over 30%.

Figure 10.1: Percentage of incoming flow reaching tail of SS9E



Rainfall was different in the two years so these figures are only indicative, and it is difficult to draw rigorous conclusions about how this may have affected crop production. Nevertheless the implications are clear: following EIP implementation, water supplies to T5 and T6 improved both in reliability and quantity.

Illegal outlets in the Sub-Secondary canal

Illegal outlets in SS9E have long been a source of dispute. They were seen to be the main cause of defective operation and of dissatisfaction with the way water was shared within the sub-secondary. Earlier attempts to remove them (eg in 2001) had failed as the concerned farmers simply reinstated them. It was recognised now that a more sophisticated approach was needed: the abandoned parallel canals had to be reinstated in two critical locations which ran parallel to SS9E[268] -- at the head of T2

[267] Relations between the WUCC chairman and the SS9E WUC and farmers had been soured a few years ago because of perceptions of corruption over a poorly-implemented programme for lining some sections of watercourse. The improved communications established during this project helped to restore a good working relationship.

[268] These parallel canals were constructed in order to reduce the number of direct outlets and hence make irrigation more efficient – but the farmers were not aware of their rationale and regarded them as an inconvenience with heavy maintenance requirements. They merely opened additional outlets. These illegal outlets were completely uncontrolled and took even more

and of T3-1A (Figure 10.2). Once the canals had been re-excavated and two large open bank cuts replaced by small concrete pipes, the *ad hoc* committee and many other farmers removed six illegal pipe outlets (numbered 1 – 6 in the figure below). Following discussions with the concerned farmers it appeared that most did not object to removal of their illegal outlets once the canals had been restored and their purpose understood.

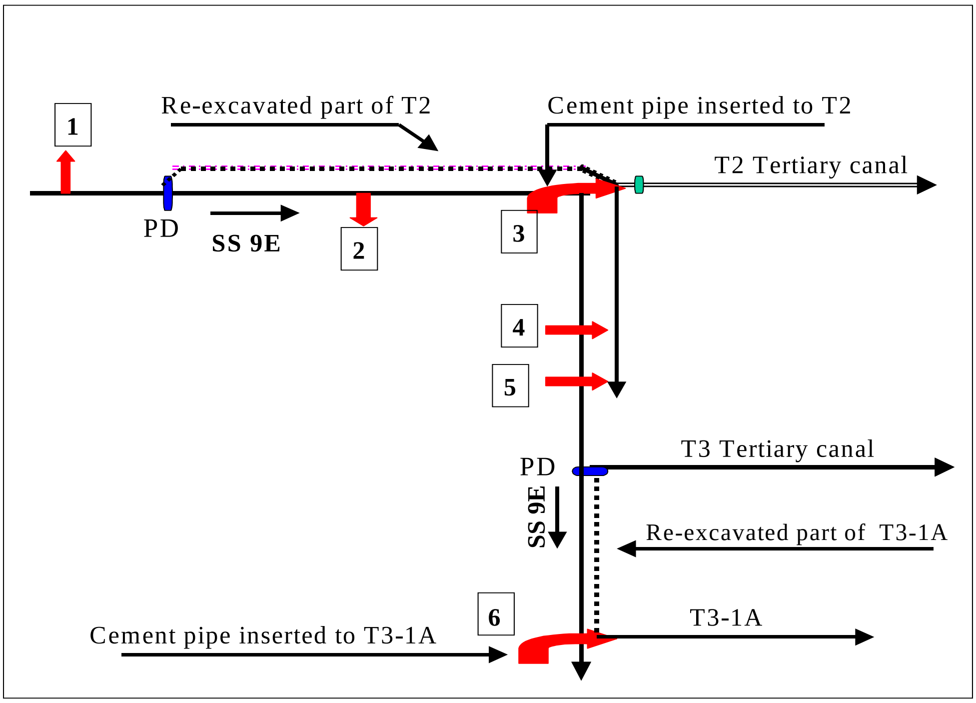


Figure 10.2: Layout of SS9E indicating illegal outlets

Maintenance of the sub-secondary canal

In the present context, it was important that SS9E should be cleaned without disrupting irrigation: this was managed by the WUCC using the funds that it had collected in the past from ISF[269]. Although the joint managment agreement (JMA) is clear that the WUC should be responsible for maintenance of the sub-secondary canal, this is not consistent with practice throughout SMIP where the project office sometimes maintains these canals. The respective responsibilities of SMIP and WUC for sub-secondary canal maintenance still need to be clarified. The JMA should be reviewed, and roles and responsibilities of both the parties should be defined so as to reflect this clarification. However, there is now a recognition that the WUC can and should take on this task.

water than would have been the case if official ones had been built. The parallel canals were designed to reduce water use, but in fact increased it.

[269] Funds are collected by the WUC and passed to the WUCC which is the registered body. Curiously the JMA is with the WUC rather than the WUCC, as the sub-secondary canals were handed over at different times.

(iii) Management within Tertiary canal T5

Illegal outlets

Removal of illegal outlets from the tertiary canal was the highest priority activity identified by the farmers attending meetings held at this level. In practise, it was highly contentious and difficult to operationalize, as these outlets were long established and the original channels had lapsed. Of the five illegal outlets at the start of EIP, three were closed. The other two have been allowed to remain, until they find acceptable alternatives for irrigating these areas.

Maintenance

Good maintenance is essential for efficient canal operation, and was a very visible defect prior to the start of these projects (GGG and EIP). But there was neither clarity nor awareness of who was responsible for maintenance of the tertiary canal – was it the WUC or SMIP[270]? No one had informed or organised farmers to play their part. Through the meetings organised under EIP, the farmers agreed that they would maintain the tertiary canal, delineated the responsibilities according to watercourses, and established penalties for defaulters. The achievement is summarised in Table 10.1.

Table 10.1: Progress with Maintenance of tertiary canal T5

Segment of tertiary canal	Responsible WC	Initial participation (households)		Later participation by defaulting households	Maintenance completed on
		Present	Absent		
First	WC1	19	10	10	31 July
Second	WC2	20	6	6	31 July
Third	WC3	28	7	7	30 June
	WC4	27	8	8	30 June

Rather than impose financial penalties on those not present on the designated days, the defaulters were in fact asked to participate later. All complied with this requirement.

Establishment of equitable water distribution mechanism and monitoring indicators

The issue of equitable water distribution was discussed among farmers at length. This was a topic on which it was very difficult to reach a consensus. In the past supply to the tertiary had been very limited but, as described above, this situation improved considerably during the implementation of this study. The farmers' thinking on how to manage water within the tertiary evolved during the season, as they saw the impact of improved management of the sub-secondary canal. This enabled them to agree on the very simple principle that:

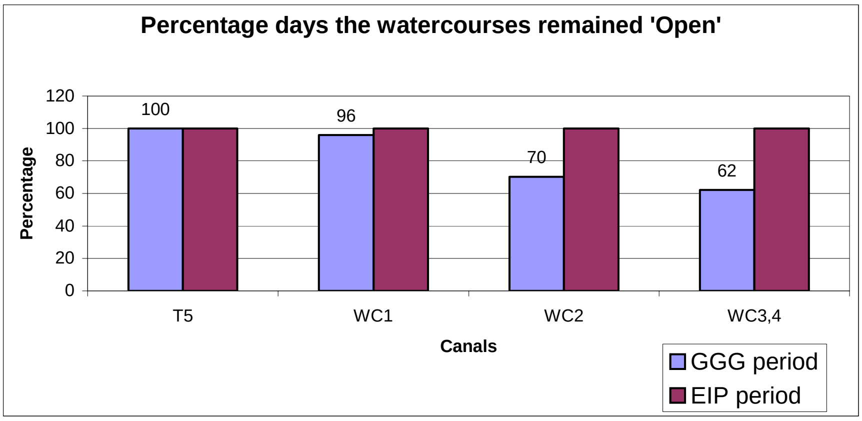
> *Nobody is allowed to put any kind of obstruction across the tertiary canal T5. If such action is found, person involved would be charged Rs 500 as penalty*

Through the EIP discussions water users took on board a basic principle of the structured irrigation system design. All watercourses are entitled to receive unrestricted flow as guided by the control

[270] The JMA suggests that this was the WUA responsibility, but current practice suggests SMIP or no one.

structures built on the canal. Thus, whatever may be the total quantity of water in T5, the flow that reaches the inlet of each watercourse in an unrestricted manner is considered to be its share. This was monitored by observing the days that the watercourses were flowing as compared to the pre-project (GGG) period (Figure 10.3). This indicated that only WC1 came close to achieving this target before the start of the study. By the end of the study all WCs had achieved continuous flow.

Figure 10.3: Percentage of days when watercourses are flowing



(iv) Perceptions of the changes

In the final meetings at the end of the study, the participants were asked for their views on the programme and the problems of sustaining the improvements. Not surprisingly, given the context, they were all in favour of the work that had been done and generally believed that it would be sustained. There were slight differences in opinions by well-being group as summarised in Table 10.2.

Table 10.2: Perceptions of reforms: impact and sustainability

Component	Activity	Poor	Medium	Well-off
Institutional arrangements	Tertiary level committee established, WUGs revitalised	Water users should assist committees	Very effective. Need to rationalise committees and meetings to reduce time commitment by key individuals. Needs formalisation	Will need to be formalized
Operation of SS9E	Flexible operation introduced: to be managed by WUCC in coordination with WUC/Ad hoc committee.	Concern that it will not be sustained Flexibility of new operation not fully understood: expected to have constant higher flows	Concern that it will not be sustained Flexibility of new operation not fully understood: expected to have constant higher flows	Concern that it will not be sustained Flexibility of new operation not fully understood: expected to have constant higher flows
Monitoring of water levels at SS9E, T5 and WCs	Monitoring sub-committees set up	All farmers should be involved in turn	Will need further training	Will be continued

Component	Activity	Poor	Medium	Well-off
Operation within WCs	Operating rules agreed and applied	Need mass meeting in each WC before start of season to agree winter season plan	Need mass meeting before start of each season to enforce this	Better planned and implemented: beneficial and will be sustained. Will need regular meeting
	Penalties for defaulters		Effective. Need to give warnings first in meetings. List of defaulters should be published. Socially very useful	Effective
Maintenance	Rules for maintenance	Effective	Effective	Effective
	Resolution of illegal outlets and field channels	Defaulters should be penalised by not providing water		Not complete but in progress
	Penalties for defaulters	Need strict enforcement of rules	Partly effective	Effective

10.3.2 Obu Haet

As the improvements were introduced part of the way through a single season, it was not possible to make an objective assessment of the effect on water distribution. However, we were able to make some initial observations of the impact of the new measures adopted. The two key new activities were

- Recruitment of an additional *mirab*; and
- Use of a blackboard to publicise the names of those authorised to irrigate and the schedules.

Although an additional *mirab* was contracted, in practise he worked alternately with the main *mirab*. This allowed the main *mirab* to spend more time on his own farming and other activities (such as building a new house). The net result was that even with the new recruit only the equivalent of one full time *mirab* was on duty. Furthermore, the new *mirab* was not as well respected or as knowledgeable about the system, so this was not a highly regarded improvement (Figure 10.3). This underlines a weakness with the existing WUA – a dependence on respected, motivated and well-informed individuals, who are in practice difficult to find given the limited resources available to the WUA. Despite these shortcomings, tail farmers still saw the need for an additional *mirab*. But they recognised that this would have to be paid for. They doubted that all farmers in the canal command would be prepared to contribute for that, so they had little confidence that this would be continued (Figure 10.4).

Table 10.3: Percentage of farmers who thought additional *mirab* effective

Well-being category	Access to water		
	Good	Medium	Poor
Well-off	50%	0%	0%
Medium	10%	50%	50%
Poor	0%	0%	0%

Table 10.4: Percentage of farmers who thought additional *mirab* would work next year

Well-being category	Access to water		
	Good	Medium	Poor
Well-off	50%	0%	0%
Medium	10%	25%	50%
Poor	0%	67%	0%

The blackboard, however, was widely welcomed and believed to be effective in improving communications which farmers considered to be a particular problem. Farmers seemed to appreciate this tool as they felt it had increased transparency in water distribution (Figure 10.5). It is a simple concept, easy to apply and most believed it would continue to be used (Figure 10.6) even if no further support is given – but given the relatively low percentages, it is clearly desirable that this should be encouraged systematically.

Table 10.5: Percentage of farmers who thought blackboard effective

Well-being category	Access to water		
	Good	Medium	Poor
Well-off	100%	50%	100%
Medium	80%	50%	100%
Poor	75%	67%	67%

Table 10.6: Percentage of farmers who thought blackboard would be used next year

Well-being category	Access to water		
	Good	Medium	Poor
Well-off	100%	50%	0%
Medium	60%	50%	100%
Poor	50%	67%	67%

As part of our research programme, we helped the FOs to monitor flows at three points along the on-farm canal through the season. Givern their technical and educational background, they were well able to do this, and the WUA has the skills to calculate discharges from water level measurements. However, uncertain inflows from adjacent areas and outflows to drains, make it difficult to use this information to monitor and manage actual water flows. Because of these technical difficulties, we believe that it would be most useful just to monitor the flow into Buvakul (as this is a point of transfer of management responsibilities) but not in other locations. Monitoring and management of water distribution within the command of the secondary canal can be done most effectively by the farmers themselves, working with the *mirab*. More attention is needed to observe when water is wasted to drains, and close outlets accordingly.

10.4 Impact on livelihoods – immediate outcomes

10.4.1 SMIP – Observed outcomes

The water distribution outcomes described in section 10.3 can be expected to have several impacts on livelihoods. These fall into three categories: social capital/relationships; time needed to manage irrigation; and agricultural productivity. When considering these categories, water users particularly stressed, the benefits in terms of relationships. They particularly valued the reduction in unresolved (or even unexpressed) social conflicts - difficulties which often caused considerable dissatisfaction and social disharmony.

(i) Relationships and social capital

Even though the problems are rarely expressed formally (e.g. to the WUA or other official complaints procedures), it was evident from farmers' informal complaints and behaviour that poor water management is a recognised source of considerable social tension. This can adversely spill over into other areas where co-operation is needed. Thus improved water management can be expected to have a wider benefit – beyond the impact on crop productivity. Positive impacts on relationships and social capital included:

- Awareness of the role of the WUA, with a growing willingness to participate in its activities, and recognition that the WUA is a valuable organisation which can serve the interests of everyone.
- Recognition that the job of a WUA leader is important, but not easy, and that water users should work to help rather than criticise the leader.
- Enabling the poor to express views and explain their problems, and promoting recognition that the WUG should work to solve the problems of the poor, as well as of better off and more influential farmers. This experience gave poor irrigators greater confidence to participate in other local institutions (eg Shanti Devi Uraw, a poor female household head, with no male members in her household, is now able to participate in village-level *panchayati* meetings.
- Better relations with neighbours – fewer unresolved conflicts/disagreements. This encourages cooperation in other activities.

(ii) Time saving

Time saving and predictability of timing are important as most people are dependent on off-farm income for a large part of their income (see Chapter 5). Any time saved is available for productive use in other sectors. Poorly managed irrigation forced some farmers to waste a lot of time on unproductive activities – guarding their own supply, removing blockages and illegal outlets upstream, spending extra time in the field due to uncertainty over when water will reach one's field, quarrelling with other users. The changes introduced led to savings in time due to:

- Less effort needed in *ad hoc* maintenance efforts to solve problems during the season;
- Less effort needed to manage irrigation, as deliveries were regular and scheduled rather than something to be struggled for. Night irrigation simplified/made safer (this was important given the difficult security situation and fear of both Government and rebel forces); and
- Irrigation made quicker due to larger stream flow, requiring less effort to guard and control irrigation.

(iii) Crop productivity

Enhanced crop productivity is a direct benefit from irrigation, and is the normal objective of programmes for improving irrigation systems. However, in a scheme such as SMIP, which is designed for supplementary irrigation, this benefit may be smaller for most people than the others mentioned earlier. Most people in most years are able to get an adequate yield – although they may need to struggle unnecessarily to achieve this. A relatively small number of people will suffer reduced yields: in our study, it was mainly the poor farmers who reported that inequitable water distribution caused low yields. Improved crop outcomes (avoidance of crop failure, more timely crops, better yields) can thus be expected for those on the social and physical margins of the system.

Given the small areas in total farmed by marginal users, this benefit may be less significant than the other social and livelihoods benefits outlined above – even though productivity enhancement is often expected to be a major rationale for improving management.

10.4.2 Obu Haet – Observed and anticipated outcomes

As the measures were introduced late in the season, the immediate impact on livelihoods was small and could not be observed directly. Farmers did, however report an immediate impact in terms of improved relationships and reduced conflict over water.

We can anticipate that next year, the improved management will also be reflected in higher cotton yields for some farmers, and some reduction in the time taken to struggle for and guard water supplies for many. This will benefit livelihoods through a more satisfactory management of time between irrigated agriculture and other activities. If properly channelled by the WUA, this can also help to strengthen the relationship between water users and the WUA, and contribute to wider irrigation operation and maintenance benefits.

10.4.3 Khageri - Anticipated outcomes

Our research plans did not allow us to implement the measures identified by farmers during our study period at KIS. Consequently the outcomes listed below could not be observed. However, we did record farmers’ expectations regarding the immediate impact of the measures which they designed (Table 10.7). the list below gives a useful indication of what can be expected as a result of the changes adopted through the EIP interventions.

Table 10.7: Anticipated outcomes at KIS

Intervention	Impact on water distribution	Impact on livelihoods		Risks
		Poor	Medium/well off	
Implementation of Kaparkhori (KK) operating rules (including new institutional arrangements for KK)	Less waste at KK and less conflict between KK and downstream users (rules to be designed so that flows to tail of KK not reduced).	Less fluctuation in water supply in branch canal, mainly benefiting tail areas - improved cropping and coordination with off-farm activities at tail of large outlets	Less time needed to negotiate with KK farmers. Less time to guard supplies: more reliable water to those with outside off-farm activities	KIS farmers are unable to exert the necessary pressure and/or offer sufficient inducement for KK farmers to change their behaviour
Target water levels in LMC	More predictable flows into pilot gates and direct outlets, less disruption to downstream flows in BC-1, greater reliability of flow	Longer duration of flow in BC-1, so larger proportion of O18 can be irrigated	Less change than for poor as they are mostly in head or *ghol* areas within outlets.	Difficult to manage at the same time as the BC-1:BC-2 split.
	More predictable flow into PBK (subject to operation of *thel* in the head reach of PBK)	More practicable to establish aformal water sharing mechanism at times of shortage – benefits mainly poor farmers with off-farm interests and without access to other water sources	Little change as water supply already good to these farmers	
Improved maintenance mechanisms/activities	More water to tail, reduction in seepage, control water leakage, able to serve more areas with same volume of water, adopt efficient water distribution	Poor and landless/sharecroppers more likely to get water share, increase in yield, reduction in crop damage (due to seepage moisture)		The efforts and enthusiasm of farmers may not be sustained
Awareness of LMC regulator operating procedures and monitoring systems	Reduced suspicion /conflict between branches, fewer requests to bend the rules and fewer actual gate adjustments leading to more predictable supply	More constant WL in LMC: benefits as above	Little change to water available, but improved social relations between branch canals	
Improved communication of management decision	Better dissemination of management decisions and hence enforcement of rules, water rotation practices, etc.	Less likely to break rules inadvertently, reducing risk of having to pay penalty, even outsider sharecroppers can demonstrate their equal rights, save time and it can be used for other off-farm activities	Reduced confusion over what is going on, what they are allowed to do, and what to notify their sharecroppers	WUA committee members may lack skills needed to ensure effective communication – which also takes more effort and resources (eg. leaflets, radio) than they are willing to give

Intervention	Impact on water distribution	Impact on livelihoods		Risks
		Poor	Medium/well off	
Design and implementation of improved BC-1 rotations (technical procedures plus institutional reforms)	Greater depth of flow in BC, higher stream size in outlets; enables formal water sharing in outlets	Small direct benefit unless other measures taken within outlet (below), may reduce social conflict	Small direct benefit unless other measures taken, within outlet (below), may reduce social conflict	Mid-reach farmers may take excess water, leading to direct loss to drains. BCC may not be willing to provide leadership. Water users are not willing to provide resources (time, or contribution toward employment of a chaukidar)
Systematic water sharing within large outlets in BC-1 (O18)	Regular water supply to all plots within outlet, or to a pre-determined area decided before the start of the season	Reduced seepage losses, greater area irrigated, more predictable timing of water supply. Reduced conflict within outlets	Less change than for poor as they are mostly in head or *ghol* areas within outlets, but those in tail of outlets will benefit	Those with sufficient water reluctant to change practices; those with inadequate water lack confidence or time to press for change
Water sharing at critical times in *Pachas bigha kulo* (PBK)	Better or more timely supply to outlying fields	Reliable crop production for the small number with poor supply, more able to justify purchase of inputs	Small reduction in supply at some critical times, probably not significant for yields	Small number will benefit, rich farmers may not see the need for system
Improved pre-planning of rice cultivation	Tail end farmers able to transplant rice or plan for other crops from start, no need to waste seedlings, and reduce water-related conflicts	Poor are especially benefited as command area of spring rice is increased, poor tail end farmers can plan for other crops other than rice once they know the plan, increase in food sufficiency months and improve in social security	Can cultivate more rice area, increase in solidarity among the farmers,	Head reach farmers may not cooperate for pre-seasonal planning (seing it as unnecessary or inconvenient)

10.5 Other potential outcomes - winners from improved access to irrigation water

10.5.1 SMIP

As the programme just covered a single cropping season, and involved an extended process of negotiations, some potential benefits will only be realised in future seasons. These may include

- Changes in crop varieties, and willingness to introduce improved on-farm water management practices (such as the SRI method[271]);
- Improved crop outcomes (less loss of crop from irrigation failure);

[271] 'Systeme rizicultur intensif' which has lower water requirements and uses different nursery and cultural practices but can give higher yields than traditional practices. This is is the subject of an internet discussion group, and a paper on progress in this part of Nepal is given in http://ciifad.cornell.edu/sri/countries/nepal/nepuprety1205.pdf. But improved results are only possible if water is very carefully managed. Improvements in on-farm water management can, however, be achieved with less innovative or radical methods

- More predictable distribution making it easier to coordinate irrigation management with off-farm activities;
- Improved household consumption for those with improved access to irrigation water (rice, vegetables, other food crops);
- Greater opportunities for poor farmers to cultivate crops on rented or sharecropped land. More reliable opportunities to find agricultural employment on other irrigated farms; and
- A more sustainable irrigation system as water users are more willing to cooperate to protect the infrastructure and contribute to the costs of operating and maintaining the irrigation infrastructure.

10.5.2 Obu Haet

As in the case of SMIP, the anticipated benefits include improvements in

- Social relations, and willingness to work with WUA,
- Crop productivity, and
- Time/resource saving.

There should be a gradual growth in confidence in the ability of the WUAs, leading to increase in willingness to comply with the rules. This should enhance the benefits already seen in reduced conflicts.

Better water management will increase yields as well as make crop diversification easier, resulting in improved income from crops (such as cotton, sunflower, onions).

10.6 Other potential outcomes – losers from a change in distribution of irrigation water (SMIP, KIS, Jany Aryk and Obu Haet)

It will take considerable effort to introduce and sustain changes to irrigation management. We also need to consider who will lose from changes in water management systems, as they may undermine efforts to introduce and sustain the changes. Those who have been able to use the current arrangements to their advantage, frequently better off water users, are the most likely to resist change – even though we have focused on measures which should not require them to reduce their use of water. The cooperation of these users is important as they have the greatest influence on whether reforms will be successful. They are often best placed to influence the WUA, by their committee membership or connections. They also have the greatest social and other assets which allow them to disregard rules and other measures that the WUA may try to introduce. In particular, we should consider:

- Demands on WUA leadership: they need to work closely with all categories of farmers to respond to their needs and gain their support, and supervise and enforce rules for management of the canal. This is demanding in time and effort. This implies time and costs to the WUA executives and committee members who are not reimbursed for their efforts – except in social satisfaction or recognition. In the longer term it will probably be necessary to find improved methods for remunerating or compensating WUA committee members, and any staff the WUA may need to employ.
- Demands on irrigators who have been enjoying privileged water access: those currently taking most water will need to become more disciplined in their water use. Even if they still get as much water as they need, they may well need to make more of an effort to be less wasteful. This may

mean that they need to devote more effort to managing water on their farm, or at least become more informed about the advantages of doing so. Systematic and widespread training in on-farm water management will be needed to give farmers both the skills and the motivation to use water more efficiently. It will be important to co-ordinate on-farm water management training with the WUA so that individual and system requirements are matched.

- Poor farmers may also be losers, although this is less likely. One possibility is that less land is made available for marginal sharecroppers. Land owners may decide to cultivate land which becomes better irrigated, or give it to better-off tenants (newly interested because irrigation supply is improved).

10.7 Potential outcomes in other areas (SRSP)

Among our study sites SRSP is the most demanding irrigation system to manage, and this makes it more difficult for farmers here to see that involvement in the WUA will help them. It is consequently more difficult to embed the WUA in the community.

However, even with the constraints of main system management, there is scope for the WUA to improve management within the WUA – particularly since the adverse impacts of erratic management can be moderated through a judicious utilisation of water (and to some extent through use of tanks and wells). This will result in the same positive impacts noted earlier: reduced conflict, time saving and greater productivity.

We noted that many farmers waited for water to be released before transplanting so that they took water from the canal for the most water-consuming stages of cultivation. They conserved their well water as an insurance for erratic supplies later in the season: it would be preferable to optimise conjuctive use, and use groundwater at the start of the season to augment scarce canal water. This is an area where the WUA could be involved.

These benefits would be greater if people could be persuaded to change their cropping pattern to maximise the benefits of irrigation throughout the intended command area. We recognise that this will be a long-term aim: attempts to change the cropping pattern in the short term are likely to be counter-productive. Until recently, there was no restriction on crop choice and this was only changed to release water for the new downstream areas. The earlier freedom to grow crops according to individual choice resulted in extensive planting of rice. This is very water-intensive and does not optimise water use. However, it will be a challenge to achieve a change as those currently growing rice will not welcome the possible loss of earnings and the increased labour time associated with the cultivation of crops other than rice. Nevertheless, it may be possible to change /improve irrigation practice from present flooding to SRI rice cultivation. This might later lead to a change in crop pattern or introduction of other crops which have similar returns and similar water requirements.

The present challenge would thus be to educate the farmers on the need for better water sharing to cope with the increased area. Land which was brought under command first cannot continue to expect the same deliveries and farmers must be ready to change and adapt to suitable cultivation practices. This can be aided by having incentives and disincentives put in place by the WUAs. They would then monitor field level irrigation practice of farmers. This will benefit not only the tail end areas of the system (of the minors and the tail ends of the distributaries) but also provide the WUA with some concrete activity to undertake. One of the limitations of the WUA faces at present is that it is largely limited to 'abstract' activities or functions which most farmers find it difficult to relate to.

Also, many of the benefits from a change in cropping will accrue to farmers in other WUAs along the same distributary canal, so it requires negotiation and establishment of good relationships outside the bounds of an individual WUA. This makes it important to elect and empower the distributary committees. This would increase their bargaining power and hence regulate supplies to various WUAs in an agreed manner. This should reduce present individualistic behaviour.

10.8 Sustainability and drivers of change

10.8.1 Introduction

The changes promoted through the EIP intervention can yield substantial benefits for improved water distribution, and consequently for livelihoods. Nevertheless, there are significant risks that they will not be sustained. As we noted in section 2.5.5, a strategy for sustainable change toward greater equity should consider the drivers of change – the motivations and incentives for the main categories of stakeholders to bring about more equitable water distribution.

In this section we examine each category of 'agents'[272] who have an interest and influence in the way water is distributed. We consider factors which encourage them to maintain the status quo, and the drivers – the motivations or incentives - for them to promote, or at least accept, a change. Some of the factors supporting the status quo may seem intractable. But others may be more amenable to change.

In the analysis which follows we draw on the experience of our action research to look at the position, relationships and claims of the main categories of stakeholders. We consider both their direct access to water and their ability to influence the way that water is distributed. We should clarify that when we refer to 'head', 'middle' and 'tail-end' water users we use this as shorthand for groups with particular levels and quality of access to irrigation water. As we observed in Chapter 2, inequitable access to water can occur throughout the length of the system, and those at the 'tail-end' may be able to use their influence to achieve the same supplies as those at the 'head'.

10.8.2 Risks to sustainability

Factors that can undermine sustainability, or future adoption, of the new measures include:

- The perceived overall balance of benefits to costs may not be sufficient in the short term to sustain motivation for change. This could be the case when there is a perception that only a minority of water users, or only less influential water users, will benefit from the changes; or when they only benefit in some seasons.
- Influential 'losers' may sabotage the process.
- Complications of land tenure make it difficult to involve all direct stakeholders – short term tenants, landlords, and part-time farmers who spend little time in the field are unaware of the WUA and of water management rules and procedures.
- WUA leaders are unable or unwilling to sustain the level of commitment needed to meet the demands on skills, time and motivation.

[272] See footnote 60 in Chapter 2 where we give a definition of 'agents'.

10.8.3 'Head' water users – users with ample supplies

Users at the 'head' of the irrigation system generally have a relatively good supply of water, and the way they manage water may be wasteful. Their advantageous position makes them least likely to be interested in a change in water management. But they may be motivated for change by the effort they have to devote to guarding their supplies. Also, despite their advantages, the supply they get may still not be good enough to grow the crops that they want.

There are measures they could take to improve the flow of water downstream which could demand relatively little effort on their part, or even reduce the effort they have to make to protect their supplies. These measures can both benefit others and offer better prospects for their own future access to irrigation. Water users with easy access to canal irrigation can be motivated to accept change if they are shown that:

- they can improve water management without reducing their own production. This improvement can make more water available downstream and save them the time and effort required to guard water delivery to their own fields. This need not involve a significantly greater commitment of their time to water management[273] - it mostly requires a bit more care on their part;
- they can serve their own long-term interest by complying with the rules, as this can contribute to greater sustainability of the physical infrastructure as well as reduced levels of effort and stress associated with conflict. Excess water use by the head and a shortage at the tails is likely to lead to refusal by disadvantaged water users to contribute to the costs of running the system, and to a deterioration in standards of infrastructure maintenance as well as social conflict[274]; and
- they can add to their status within the community ('cultural capital') by helping to solve water-related conflict.

10.8.4 'Middle' access water users – whose supplies may be adequate, but sometimes unreliable

'Middle' water users may generally feel satisfied with the irrigation supplies they receive. They may be inclined to be indifferent to change. They may opt for either the status quo, or a change, depending on which option appears to them to be the least inconvenient. Convenience may be evaluated from a range of points of view, including not only how it affects their farming and non-farming activities, but also how it affects their relationships with others.

They can be motivated to accept change if:

- there is a prospect of a more reliable and predictable water supply;
- there are other tangible benefits, such as better maintained irrigation infrastructure with a prospect of good supplies not only now, but in coming seasons; and
- there is a prospect of reduced social stress and enhanced status which can come from helping to solve water-related conflicts.

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[273] There are of course also measures which they could introduce to further enhance their production but which take more skills and effort on their part.

[274] This complementarity between head and tail is widely recognised on FMIS. At Rajapur, for example, farmers in the head (Janaknagar) did not restrict the flow down the Budhi kulo to the tail (Bhimapur) or attempt to create a separate small well-supplied system because they knew that they were dependent on the co-operation of the tail farmers for maintenance of the intake in years of severe shortage (Howarth & Lal, 2002). In the Kamala Uttarayani Irrigation System farmers at the tail of the system were financially more comfortable and socially and politically more influential than those at the head. Collaboration between head and tail was encouraged by interdependence for the maintenance of the irrigation system, and for accessing external resources through personal contacts (Mott MacDonald, 2004)

10.8.5 'Tail end' water users – users with inadequate supplies

'Tail-end' farmers suffer from poor supplies but they frequently feel powerless to do anything about it. They can feel that water distribution problems are inevitable: they see no solutions, they lack confidence to raise any objections, and they often believe that the problems are caused by the very people who are meant to be solving them – WUA committee members.

They may wish for major changes in the way water is distributed. But the reality of the balance of power and interests may mean that they have to accept that initially only minor improvements will be achieved. But they can be motivated to work for change if they:

- gain confidence that solutions are possible;
- have a forum where they can air their views and feel that these will be respected and acted on; and
- experience conditions where they feel that by working actively with the WUA they stand a chance of achieving a sustained improvement for all – including themselves.

10.8.6 WUA executive members

In all of our study sites water users, at some point, expressed their wish for the WUA to provide strong leadership – leadership they felt was lacking. They felt this leadership was needed to enable water users to develop and enforce rules for better water distribution, and to organise them to fulfil other requirements for effective operation and maintenance of the irrigation system. In fact, strong leadership of WUAs is widely recognised as characteristic of well-managed irrigation schemes (Kolavalli & Brewer, 1999).

But, as we found in each of our study sites, WUA executive members have often felt either powerless or not responsible for solving irrigation management problems. For reasons related both to the way the WUAs have come into being and to personal background, committee members and executives often see their role as more political than managerial. They have tended to devote their energies to influencing others to bend the rules in their favour, rather than to trying to solve management problems themselves. They are also discouraged by the difficulties they face in fulfilling the duties ascribed to them by a constitution which often neither they nor the water users have genuinely signed up to. The task of collecting fees and resources from the users is both unpopular and difficult to put in practice; committee members and executives have to cope with deteriorating infrastructure, and their sub-system often receives uncertain and unpredictable water supplies from the main system. It isn't surprising that many feel that they face hassle with little job satisfaction.

Those that do contest for a position on the WUA committee often do so because of the status that it confers. Election to office is often the outcome of more general political considerations, and unrelated to how well candidates will do the job of irrigation management, or indeed if they will do the job at all.

Aside from the personal and political shortcomings of some of the people who have taken WUA office, many people are not able to make the time commitment needed to fulfil the responsibilities of committee membership. As we have seen, water users from all well-being groups have a diversity of activities aside from irrigated agriculture. Few can afford or wish to allocate significant efforts to managing the irrigation system, particularly as they are given little or no compensation for doing so. Those who manage irrigation as a way of achieving political recognition will have little incentive to champion the interests of the marginal water users. It is also easy for them to blame others for any shortfall in management standards.

The question of conpensation for WUAs appears only to have been resolved at two ends of the spectrum – large commercial irrigation systems are able to pay skilled managers, and traditional FMIS can rely on the kudos that attracts well-motivated local leaders. The large number of newly-established WUAs in the middle ground face the difficult problem of how to compensate their leaders. There needs to be a subtle system, reflecting local realities.

(i) Recruitment of committed WUA leadership – elections and terms of office

There is a strong case for making provisions so that it is easier for individuals to contribute actively to the onerous duties of WUA management, but for a more limited period of time. This could be achieved by reducing the term of office, ensuring that elections actually take place regularly, and helping WUAs to draw in short-term volunteers for seasonal duties and '*ad hoc*' committees. Of course these provisions, which aim to make it less demanding for water users to take an active part in WUA management, present a trade-off -- they may result in a loss of continuity and experience. They also make it all the more critical to provide timely training and backstopping to newly elected WUA committee members and other volunteers. But these disadvantages would be offset by the fresh commitment of newly elected officers.

This was seen at KIS where elections have been held regularly, and the WUA was quite active – with some changes and some new faces each time. In SMIP, in contrast, the same jaded individuals have been in post after 10 years, and the WUA has provided no meaningful leadership for water users – particularly at the lower levels of the system. The new approach adopted in Andhra Pradesh of electing one third of TC members every two years, is an interesting approach to introducing freshly elected members while maintaining continuity. But the disillusionment setting in as training for newly elected TC members was delayed highlights the importance of timely backstopping for the WUA.

(ii) Informed water users

The selection of genuinely committed leaders requires not only sincere candidates, but informed and motivated water users who are prepared to participate and contribute to management. We found that the measures adopted to inform water users prior to the election of WUA committees in our study sites did not create sufficient understanding, or a sustainable engagement and relationship, between all categories of water users and 'their' WUA. Furthermore, although the constitutions included provisions for complaints and sanctions for WUA mismanagement, these had not been effective – partly because water users did not know about the provisions, or how to apply them, partly because they doubted the provisions would be meaningfully enforced.

Water users can be helped to see for themselves the benefits of the WUA, and their role in making it effective, by engaging them in practical activities that link their immediate interests for improved irrigation management with the functions that the WUA is supposed to perform. The response of water users to the practical issue of water distribution which we addressed under EIP illustrates this point. The activities and the way they are presented should take into account the literacy levels and priorities of different categories of water users. The simple measures we adopted could be improved with the use of visual and audio media such as radio, television or street theatre. This could make for better outreach and engage greater interest (e.g. as discussed in Braden, 2003)[275].

Water users also need to know about, and have the confidence and competence to use, the procedures available to them to hold the WUA administration accountable if it fails to fulfil its responsibilities. We found that although formal legislation and WUA constitutions included procedures to hold the WUA to account, water users either didn't know about them or doubted that they could be applied.

(iii) Informed and skilled WUA committee members

We found that brief trainings and workshops at the time of WUA establishment, and sporadically thereafter, were insufficient to maintain the necessary level of competence and commitment among WUA committee members and executives. As we have said earlier, WUA committee members should receive well-timed training, as well as continuing backstopping and encouragement to fulfil their responsibilities. The duties are less onerous than for the leaders, but so are the benefits – there is little incentive to perform well

The WUA executives will be more motivated to perform their functions if they have the skills they need for leadership and negotiation, coupled with a sound technical understanding of water management under the specific conditions faced by their irrigation system. This will help them to design rigorous and objective procedures for managing their portion of the system. Their performance will also be improved if they not only maintain good relations with the ID, but also build and maintain a relationship of confidence with the water users. This way they will be well informed of the availability of water in the system as a whole, and so know how much water their part of the system will receive and when. They can then work more effectively with users who are aware of the constraints faced by the WUA committee, and who have realistic expectations of what the committee, and the irrigation system, can deliver.

All of this will help to improve the social standing of committee members and make it more personally satisfying to take on the associated responsibilities.

10.8.7 Ditch riders and other field staff involved in water distribution

We observed how the transfer of water management to WUAs has sometimes created manpower gaps and adverse incentives which have worked against good water management at all levels.

Under the provisions of irrigation management transfer the responsibility for coordination and supervision of water distribution within the command area was shifted to the WUA. But this management function has not been one that members of WUA committees wanted to perform personally. Yet only in our Kyrgyzstan sites did the WUA actually employ ditch-riders (*mirabs*) to manage its internal water distribution. And here the *mirabs* were overstretched and poorly paid. Elsewhere the WUAs were not willing or able to employ water management staff[276]. This was despite water users' recognition that such a position needed to be filled. In Andhra Pradesh, the I&CADD

[275] Braden (2003) describes experience with using new communication technologies "to overcome the barriers that prevent semi-literate and illiterate people from analysing and negotiating their own futures" (p.1).

[276] China is, in osme places an exception. One legacy of the commune system is the widespread (although not universal) use of 'trusted people' who manage channels and deliver water to each farmer. Even after the introduction of the household responsibility system, irrigation continued to be managed by these 'trusted people' – farmers do not expect to divert water themselves from the field channels. These people are paid a nominal sum for their services.

employs *lashkars* who continue to work within the area of jurisdiction of the WUA. But in our study sites the *lashkar* was not active. This left a gap in management as no one else had responsibility or authority to coordinate and supervise water distribution at the lower levels of the system. In Nepal DOI continues to employ some *dhalpas* for main system management. In KIS the *dhalpas* work under the WUA for management of the main canal (which is jointly managed). But in both KIS and SMIP when joint management was introduced DOI stopped employing staff to work at lower levels. KIS had the advantage that some of these staff are farming within the command area and they continue to work with the WUA on a voluntary basis (they also acted as the key farmer observers in our study). Our site in SMIP was not so fortunate and no one was willing or able to coordinate and monitor water distribution within the sub-secondary command area.

In our sites in Nepal and SRSP, Andhra Pradesh irrigation management reform has also brought changes in the staffing and rewards for management tasks at levels above the jurisdiction of the WUA This has sometimes affected the quality of water management in the main system, as the "principle-agent" problem[277] has come into play. For example, poor supervision and informal incentives have sometimes made canal management staff willing to make informal and unplanned adjustments to water deliveries, or to turn a blind eye when some users tamper with gates. This makes it difficult for the WUA committee to provide credible information about water deliveries to their members.

It is outside the scope of this study to consider the way that irrigation systems should be financed, or the level of contribution that water users should make toward this cost (this has been discussed at length elsewhere, e.g. in Cornish *et al*, 2004). However, we have observed an apparent catch-22 situation[278] where on one hand water users are reluctant to pay fees if water is poorly managed and, on the other hand, without funds staff cannot be employed to implement effective local level water management.

Perhaps what is needed is a better analysis of how costs should be shared between water users and other funding sources. Rather than basing fees on presumed agricultural returns to irrigation water, this should take account of the quality of the irrigation service, and water users' ability and willingness to contribute to irrigation financing given the social and political dynamics which affect water management. As water management improves, and as water users become better informed and gain confidence in the system, they may become more willing and able to contribute to irrigation system funding.

Whatever the source of funds, the balance of incentives could be shifted by helping the WUA committee to inform water users about the costs and benefits of alternative staffing options, and to propose a realistic approach to improving WUA staffing within the resource constraints it faces. The WUA and ID can also be advised on how to modify reward systems for ditch riders and other staff so as to encourage better performance of their duties (e.g. through a combination of a basic salary and performance-related incentives).

[277] "Opportunism can also occur … when one party, *the principal*, to the contract is unable to monitor and enforce the performance in meeting contracted obligations of the other party, *the agent*. This is sometimes known as *moral hazard* or the *principal-agent* problem, and reduces the incentive for agents to fulfil their obligations, thereby leading to shirking or free riding." [Morrison, Jamie, Dorwood, Andrew, and Kydd, Jonathan. 2000. "Sustainable Livelihoods and New Institutional Economics", on DFID/IDS Livelihoods Connect web site. www.livelihoods-connect@ids.ac.uk]

[278] The expression catch-22 from the 1961 novel by J. Heller, refers to a condition or consequence that precludes success, a dilemma where the victim cannot win (OED, 2002).

10.8.8 Irrigation Department staff

Irrigation management reforms have been introduced in Nepal and India with an aspiration of making the Irrigation Department more service-oriented and "answerable" to the WUAs. Such a shift inevitably faces resistance from those who have been trained and rewarded under previous arrangements (see, e.g., Pangare, 2002).

The service-orientation aim was very clearly expressed in Andhra Pradesh (Oblitas & Peter, 1999), but it has also been particularly difficult to implement it there. For some time prior to the reforms large numbers of engineers have been employed in routine O&M on large-scale irrigation schemes. The process of redeploying them and shifting their status from influential authorities to service providers has taken time to work through[279]. This change in role and orientation represents a major cultural shift, as well as a threat to the rewards and privileges built up under the relationships that existed in the past.

In Nepal the staff redeployment problem was offset by an increase in government activities and funding to support farmer built and managed irrigation schemes (FMIS)[280]. This meant that the problem in Nepal was not so much what to do with an excess of O&M engineers, but how to change the organisational orientation of the Department of Irrigation from construction to providing institutional support.

The situation in Kyrgyzstan is rather different, as the WUAs stepped into a role that had previously been filled by the *kolkhozes* and *sovkhozes*. Often the same individuals continued with the same job, but in a different organisation – on-farm water management staff became WUA Directorate staff. The role of the *Raivodkhoz* remained essentially the same: to provide an agreed water supply to the WUA (which was previously a *kolkhoz/sovkhoz*). Nevertheless, a cultural shift is required from an approach based on top-down, often authoritarian, planning (with the principal-agent opportunities that this can offer), to a client-oriented service provider.

As with water management field staff, there needs to be a well-structured shift in the basis on which Irrigation Department staff are rewarded. The rewards to Irrigation Department staff need to be linked to their success in enabling the WUAs to fulfil their responsibilities effectively so as to provide a good service to the water users. This will entail engaging the WUAs and ID staff to negotiate appropriate and realistic indicators of success. This needs to be coupled with clearly defined terms of reference, which define tasks and responsibilities and encourage a supportive and collaborative relationship with the WUAs; and the staffs need to be trained in the skills of advising and informing, rather than instructing. At the same time WUAs need to be encouraged to use, if necessary, the measures that are in place to hold the ID staff accountable if they fail to meet their responsibilities (complaints procedures, mediation, legal redress). It is, of course, to be hoped that with the other measures in place ID staff performance will rarely make such redress necessary.

10.8.9 Politicians

As we have seen, the management of water is surrounded by many, often conflicting, interests. This makes it an intensely political activity, and inevitably politicians will exert a significant influence on water management, at both local and national levels. As we discussed above, some WUA committee members have taken on this role in pursuit of their wider political interests. Unless politicians are also

[279] Some Irrigation staff in AP even went to court to resist some of the measures incorporated in the PIM reforms (Raju, 2002, p. 93).
[280] These were generally built and managed without external assistance.

executive members of the WUA, their influence is generally indirect, except where local government legislation may give them some responsibilities for water management[281]. Aside from their activities in formal legislative bodies – making important decisions on budgetary allocations as well as irrigation policy -- politicians can use their influence to exert pressure on Irrigation Department staff or the WUA to change water distribution. They may do this to favour an individual farmer, or a particular area, such as their constituency. In pursuit of their aims they might facilitate the transfer of under-performing engineers or staff. They might also take this measure to punish individuals for personal or political reasons unrelated to their professional performance in the irrigation sector. These measures can not only undermine morale, but also disrupt efforts to manage water efficiently and equitably.

But while the measures pursued by politicians sometimes undermine the aims of good water management, their motivations are complex and they can also be positive agents for improvement. Their personal and political interests may encourage them to press for overall improvements in water management in a whole irrigation system, or indeed the irrigation sector as a whole. But despite their activities and influence, politicians are often not included in institutional development programmes for WUAs, except perhaps on ceremonial occasions.

Politicians are more likely to make a positive contribution if they are given the opportunity to see and understand, through site visits, and other information activities, the reasons for deficiencies in the performance of irrigation schemes, the constraints to solving these, and the measures that can either be helpful or make matters worse. This understanding will enable them to make more informed decisions not only in respect to irrigation policy, but also when they decide how to respond to the requests and petitions of their constituents. Their decisions on financial allocations are critical for ensuring that sufficient funds are available to take the other measures which are necessary, as outlined in the following chapters, to promote equitable irrigation management[282].

10.8.10 Strategy adopted under EIP

Within the time and scope of EIP, the detailed design of the programme in each site took account of the ‘drivers of change’. Simple measures were identified which could be implemented easily, and which did not provoke opposition. Before these measures were put into practice, care was taken first to make contact with the full range of stakeholders and to address their motivations. In the course of the programme we aimed to strengthen their relationships.

In SMIP the groundwork was done under a preceding project (GGG). In that project the Water Users Schools made a significant contribution to developing social capital and a commitment to following rules. EIP built on this foundation by facilitating the introduction of simple – even if slightly inequitable - irrigation schedules, and of some relatively minor modifications to the physical layout and to canal maintenance. These measures were the outcome of extensive negotiation with all concerned parties, and the formation of inclusive informal committees to encourage and monitor implementation. Local politicians, as well as SMIP staff, were invited to join meetings with water users and the WUA committee members to discuss water management issues and solutions.

In Obu Haet, only a single initial measure was identified to improve the communication of irrigation schedules to the water users. In this case we relied on the existing social capital to support this

[281] This can sometimes conflict with aspects of national water resources legislation

[282] The Chronic Poverty Research Centre (2005) is one source of discussion of approaches to influencing policy, and politicians, when addressing poverty issues.

innovation. But our participatory methodology involved a substantial proportion of the population in its planning and evaluation. Further measures to strengthen the WUA and embed it in the community are urgently needed here. The WUA is effective and interested, but there is a risk that it will become jaded and ineffectual -- as was the case at SMIP prior to our programme. A more extensive programme of institutional strengthening will allow additional improvements to be introduced.

In both cases the measures we helped to introduce were “no loser” solutions – we aimed to eliminate unproductive losses. Losses are often used by downstream users – a situation very apparent in KIS and our Kyrgyz sites. Our aim was to improve equity of access by all users, and not to do so at the expense of those who previously benefited from the ‘losses’. We also aimed to promote water use efficiency skills by using methods which minimised the time and other commitments needed for water management.

This experience shows that, despite the risks, water management can be made more equitable -- provided the necessary care and resources are applied to support water users to develop and implement measures that suit their circumstances. However, in the time available for this study, it was only possible to make a start. In order to make these changes sustainable, and to expand on them, it will be necessary to further advance the strategy, based on the ‘drivers of change’, as we have discussed above.

The detailed design of the EIP programme in each site took account of these specific risks. Simple measures were identified which could be easily implemented, and which did not provoke opposition. Before these measures were put into practice, care was taken first to strengthen social capital and relationships.

11 Summary of findings and outline of recommended approach

11.1 Introduction

In this chapter we review the findings of our study, highlighting the relations between irrigation and livelihoods. We then outline our recommended approach for improving water management and thereby supporting the livelihoods of poor farmers. In Chapter 12 we will build on this outline as a basis for more general guidelines for application elsewhere. The guidelines themselves are presented as a separate short report.

Our case studies cover very different social and physical environments:

- a relatively homogeneous 1960s settlement scheme in sub-tropical lowland in the Nepal *tarai;*
- socially heterogeneous and stratified irrigation developments in drier areas of Nepal and Andhra Pradesh, India; and
- very homogeneous locations with a continental climate of hot summers and cold winters, which until recently operated as centrally managed farms, in the western lowlands of Kyrgyzstan.

Our sites also share the features of being part of large irrigation systems which have been operating for decades, functioning to some extent, and meeting the needs of different categories of water users to varying degrees. Some people are getting the water they need and others are not; some benefit from the status quo, and others suffer. All schemes have been the subject of efforts to establish water users' associations, and to transfer local level water management responsibilities to these associations. Their differences, as well as their common features, allow us to draw conclusions that have a general applicability[283].

We used a Sustainable Livelihoods Approach to analyse the livelihood assets and strategies of water users from different well-being categories – broadly classifying water users according to well-being as either 'poor', 'medium', or 'well-off'[284] (Chapter 5). In the course of our action research programme we found that despite the provisions of their constitutions, the WUA committees and their members had a limited ability to perform their responsibility to distribute water equitably (Chapter 6). We saw that this interacted with the physical characteristics of the irrigation system, and water allocation procedures (Chapter 7) to make water distribution often unreliable, and also inequitable when there were water shortages (Chapter 8).

Drawing on these observations we adopted the steps set out in Chapter 2 to work with irrigators from all well-being categories to identify potential improvements to water management and ways of introducing them (Chapter 9). Our examination of the potential impact of these improvements on livelihoods showed that many farmers were enthusiastic about introducing the measures and they had a degree of confidence that the improvements would be sustained. But we also observed that there are

[283] We believe that the principles underlying these guidelines also have a wider applicability to the management of other common property resources, such as forests, and indeed to other services to the community and other sectors, such as drinking water or schools. In all of these there are widespread moves to transfer management responsibilities to "communities". And in all of these it will be important to ensure that effective programmes, incorporating variants on the measures we propose, with the resources to implement them, are put in place. Without such programmes and resources, user associations are likely to be empty shells, and the poor will be at the greatest disadvantage.

[284] Our criteria for classifying water users according to well-being, taking into account their livelihood assets, are set out in Chapter 5.

winners and losers from these changes, and this brings challenges to both the introduction and the sustainability of the changes (Chapter 10). Our experience has shown how the complexity of managing large-scale irrigation schemes, involving multiple organisations, and a range of often conflicting interests, makes it a challenge to promote change in the direction of greater equity.

In this chapter we present our strategy for introducing such change under complex circumstances. After a summary of our study findings, we draw on concepts from the 'Drivers of Change' approach and the New Institutional Economics[285], to consider the conditions which can make the advantages of adopting change greater than those of maintaining the status quo. We then recommend specific measures which we consider to be effective to create the conditions for positive changes in irrigation management. The recommendations cover technical, social and institutional measures. Finally, based on the changes we observed or anticipated in our study sites, we consider how to increase the chances that these improvements will be sustained, and lead on to further improvements. .

11.2 Livelihood assets, strategies and water management practices

11.2.1 Livelihoods and their analysis (SLA)

Our analysis showed that irrigated agriculture makes an important contribution to livelihoods for all water users – poor, medium and well-off. But it is only one part of a range of livelihood activities, including off-farm occupations as well as non-irrigated farm enterprises such as livestock production. This diversified strategy has a bearing on how water users with different levels of livelihood assets are able to manage their access to irrigation, and how they cope with unreliable supplies.

Water users have to share their time between agricultural activities and off-farm occupations. Cropping activities include water distribution and associated tasks, such as the demands of WUA membership. The way they manage water is guided partly by their access to information about when and how much water will be available to them, and their level of technical knowledge. Thus water users' human resources are influential, both in terms of basic literacy and in terms of technical knowledge about what can be expected from the physical infrastructure and how it needs to be maintained, and about on-farm water management practices appropriate for different crops. Yet the delivery of information and training to water users has been inadequate – and has failed to take account of the lower literacy levels of the poor.

Furthermore, the willingness and ability of water users to influence water distribution is constrained by social and political factors. These factors include their relations with other water users, their social status, their political influence, and their vulnerability to the actions of others who are more powerful than they are. In all of our study sites water users complain about the indiscipline of others, and they observe that water distribution rules are flagrantly being broken. But they are reluctant, or feel unable, to do anything about it. They do not want to 'rock the boat' with their neighbours, or fear some form of retribution, perhaps from a landlord or otherwise socially powerful person. They look to 'someone else' to provide the leadership to make and enforce rules. In SMIP (Nepal) and SRSP (AP – India) they had little confidence in the leadership offered by the WUA. In KIS (Nepal) and in our sites in Kyrgyzstan they had more confidence, but still had reservations about the WUA's ability to prevent water theft by the influential.

285 cf. our discussion in Chapter 2

11.2.2 Equity of water distribution and the adverse effects of inequity

Water users generally acknowledged that each farmer is entitled to a fair share of water -- generally considered to be proportionate to the area of his land. But actual practice has resulted in an unfair distribution of water, with the inequity increasing down the system. Farmers recognise that access to water is unfair, but they regard this as inevitable and essentially a problem to be solved by others. This causes local disputes and conflicts. These may not be overtly expressed but they contribute to a background of ill feeling. This has far-reaching impacts, for example by feeding into more fundamental conflicts such as the 'maoist' insurgency in Nepal. This underlines the wider social and political importance of improving irrigation management, not only for the sustainability of the irrigation system itself, but also for the society as a whole[286].

We found that shortcomings in water distribution affect all categories of irrigators. Off-farm demands make it difficult for water users to cope with erratic and unpredictable water flows to their field. These demands also often mean that there are fewer opportunities to make in-field contact with their farm neighbours. Complexities of land tenure may also mean that they have few social ties with their farm neighbours and may lack stable rights to land or the opportunity to build relationships. These factors may reduce both the opportunities and the incentives to cooperate and agree on water distribution rules. Unpredictability of water supply, the need to fit irrigation in with other activities and weak ties with other water users all make for an individualistic and opportunistic approach to accessing water. This contributes to a downward spiral of deteriorating water distribution.

Those who suffer bear the cost of unreliable and undisciplined water management in:

- time – to acquire and guard supplies as well as to obtain information about if and when water will be available;
- money –in the loss of sunk input costs, such as rice seedlings, and other inputs applied to a crop that subsequently fails due to inadequate irrigation, or in the cost of employing an irrigator;
- inconvenience and opportunity cost – when they have to choose between being on the spot to control irrigation or pursuing their off-farm occupations;
- aggravation – from the stress of tense or conflicted relationships with other water users; and
- productivity – loss of yield due to water-stressed crops.

While these costs affect all who are disadvantaged by poor water management, the poor, who have fewer assets, are likely to suffer most.

11.2.3 Implications for the poor

With their more limited access to all forms of livelihood assets/'capital' poor farmers find it more difficult to adopt the measures used by medium and better-off water users to work around water management shortcomings. Their lower level of financial resources, confidence, social contacts and influence make it more difficult for them to secure a water supply through measures such as installing a well, taking water "illegally", or using personal contacts to improve their supply. This adds to their vulnerability, when they already have an often-precarious livelihood.

[286] See Jared Diamond's book, Collapse: How Societies Choose to Fail or Survive (2005) for a discussion of the interaction between resource conflicts and wider political and social consequences.

Poor farmers are more likely to depend on casual labour or to have little flexibility over the time that they can return to work on the land. They are less able to influence the timing of supply to suit their individual needs, to obtain information on when water will be available to them, or to get local people to guard their share or irrigate their fields if they need to work away from the village. They lack stable access to land and hence the ability to build social relationships with their neighbours.

11.2.4 Water distribution and women

In all of our study areas women contribute a significant amount of labour for agriculture, particularly for traditional tasks such as transplanting rice, weeding, and harvesting. Yet while irrigation is traditionally a male activity in all of our study areas, women must often manage the irrigation of the crops, particularly when there is no male in the household to do this task. This is the case not only in female headed households, which seem to be in a small minority in our study sites, but also in households where the male has migrated for work on either a short or a long-term basis; something which is increasingly common. However, with few exceptions, decision-making on irrigation matters is dominated by men, and as WUA membership is associated with land ownership or tenancy, this is also dominated by men[287]. Poorer women, who are less likely to have influential male contacts, and who have the poorest level of education, find it most difficult to protect their water supply. This can have consequences for crop performance, subsequent yield, and benefit to the household.

11.3 Institutional context – WUA history, relationships and rules for water distribution

We observed a common pattern to the development of WUAs in our study areas: they were all established within the wider context of government legal and institutional reform of the water sector, and they all have centrally standardised constitutions which define their entitlements and obligations. Despite the local differences, there is a remarkable similarity in the way they were set up – perhaps reflecting the ubiquitous influence of donors and the relatively small number of people involved in advising on irrigation reforms[288].

Certain characteristics are particularly relevant here:

- WUAs have been introduced in a top-down manner, generally as part of a project which included a substantial construction component; and
- 'Institutional development' activities have focused on the formation of organisations and on developing administrative and technical competence. Insufficient effort has gone into addressing social and power relationships or on strengthening the ability to design and enforce rules which will be accepted by water users.

We found that the WUAs in our study sites are local organisations which are rarely as democratic as anticipated (at least as aspired to 'on paper') - they tend to be dominated by local elites who continue to attend to their own access to water while neglecting most of their other responsibilities. The needs of the poor have received little attention. We also found that although the need for technical training

[287] Some WUAs in Nepal have adopted a policy of 2 members epr household to improve female involvement, but with little impact so far as women are reluctant to challenge or even speak out in from of men. In China, an attempt to entitle all adults to membership was rejected on the grounds that variations in household size would result in other problems of inequity.

[288] Although we haven't done a systematic analysis of the number of people who have advised on irrigation sector reform, our own engagement in related activities has given us an impression of 'what a small world this is'. A more rigorous examination of this social network and its influence would be interesting.

of farmers has often been recognised in programmes to promote WUAs, the level of implementation of information and training was inadequate and was mainly given to executive members of the WUAs.

Many water users had a limited understanding of the WUA and how they were supposed to relate to it. Insofar as they knew about the WUA, their experience often gave them a negative or indifferent attitude toward the organisation. Poor management of irrigation delivery made water users from all categories dissatisfied and cynical with the WUAs and the main service supplier. Unless this situation improves, users become unwilling to comply with its rules, or to contribute time and money to its operation and maintenance costs. In this context, we found that the requirements for equitable management which we set out in Chapter 2 were inadequately satisfied:

- **Rules defining indicators for fair/equitable water distribution**: Water rights are often politically contentious, and entitlements to water are not rigorously defined in any of the study sites.
- **Organisations willing and able to enforce rules**: The WUAs, who had been given the responsibility for enforcing the rules, were limited in their willingness and ability to enforce what rules there were. This was particularly true at the lower levels of the system. WUAs have had difficulties in meeting their obligations (as laid down in their constitutions and by-laws), and their performance has been dependent on the motivation, dedication and ability of the leaders. While in our Kyrgyzstan and KIS (Nepal) sites the leaders showed these attributes to some extent – particularly at the higher levels of the system, this was much less the case in SMIP, Nepal and in SRSP, Andhra Pradesh.
- **Water users willing and able to enter into institutional arrangements for fair water distribution**: Actual water distribution in our sites was primarily determined by individual or small group actions, and the relations between individual users and the WUA executives rather than by the WUA. The overall performance of the WUA as an organisation played a much more limted role. In our sites, farmers assumed that they were entitled to as much water as their crop requires and that the system should be able to supply this – they had little appreciation of the costs or constraints of achieving this. There was little concept of pre-season planning of either crops or water (with the limited exception of imposing some restrictions on the areas of rice in Kyrgyzstan but not in SRSP). Farmers saw planning to be a theoretical exercise unrelated to actual distribution of water.

11.4 Water distribution at the local level – technical and management performance

11.4.1 Physical layout of the system

The physical layout is an important constraint to management of the system, although we found that knowledge and understanding of the layout by water users is equally important. There was a major rehabilitation at SMIP which was based on a logical and coherent management system and should have made it easy to operate. But the strong design advantage of the system was undermined by a lack of awareness by the end users of how it was supposed to be operated. They did not understand the design concept and disrupted the system, rather than attempt to work within it. Even those who were aware of the design principles did not fully accept them. The presumption of the designers that it would be a ‘self-policing’ system was therefore not valid.

In the other sites, which were not so extensively restored, there were more mismatches between infrastructure and ease of management by the WUA and farmers. For example, in all other cases there were a large number of outlets with few control structures on the canal; but there was no effective and coherent system for managing these outlets. The mismatch between physical layout and organisational boundaries caused difficulty in some cases: WUA boundaries and membership did not always conform to logical hydrological units. Equitable water distribution under these conditions demanded skills and management resources which the WUAs we studied did not have.

11.4.2 Procedures for distributing water

We found the WUA hardly engaged in solving local level water distribution problems and committee members gave greater emphasis to other tasks, such as lobbying the main system management to increase total supply or more specifically to promote particular interests related to contracts or water delivery as requested by influential individuals. Actual distribution of water at field level used a combination of *warabandi*, defined order, on demand and *ad hoc* methods, with different systems in different outlets or at different times. The procedures for sharing water were weak – mostly decided by individual farmers rather than through consensus or by the WUA. Past attempts to introduce systematic rules have rarely if ever been followed throught, and we encountered several attempts, for example, to introduce rotations which had lapsed after a single season. This was because they did not fully address the complexities of land tenure or local variations in water requirements. There was little enthusiasm to resolve these details.

Design of effective rules requires a more carefully-nuanced approach taking account of detailed field-level realities. We found this difficult to achieve and only possible if it was done with strong local participation. We also found that complex rules are only needed at critical times, and that they can be simplified for times of greater water availability or less critical crop requirements. Even at critical times, rules that are transparent and easy to enforce are seen to be most important. Informal rules which permit farmers considerable flexibility are adopted at times of surplus and enable farmers to fine tune irrigation to match the supply with their crop needs. At times of scarcity, a simple rule which can be rigorously enforced and approximates to the crop needs is considered more important.

We found poor communications to be a crucial weakness in all study areas during this study, although some WUAs did do better than others. Performance was much better in WUAs which had relatively good communications with the supply agency as a reliable supply to the WUA is so important. At KIS (Nepal) a proportional share between branch canals (but not the absolute quantity) is fixed and this agreement is well-known and adhered to. In Kyrgyzstan the water supply is in effect based on the previous years' contract between WUA and supply agency which is known by the farmers and so is fairly predictable[289].

However, good high-level communications are not a sufficient requirement for effective performance as they do not necessarily even lead to good internal communications let alone good internal management. Many WUAs regard that communications with higher levels is more important than internal management, but this results in poor performance. Sound and agreed internal communication systems and operating rules are essential, and we will discuss the process for developing these in Chapter 12.

[289] These small schemes are backed (or partially backed, in the case of Obu Haet) by a large reservoir which reduces the variation in supply due to climatic factors, but other systems in Kyrgyzstan may have a less reliable supply.

11.4.3 Measurement of flows

There is a common belief that water measurement is a pre-requisite for effective management. However, the technical difficulties in measuring water to a sufficient degree of accuracy should not be underestimated. There are three broad methods of measurement in common use on smallholder irrigation.

- Use of measurement structure: either a dedicated measurement structure or a calibrated control structure. This is both the most accurate and the simplest but it requires the existence of a suitable structure and sufficient head available across the structure[290];
- Calibration of depth of flow in canals, so that the flow can be related to the depth of water - but this is dependent on the way the canal is maintained and operated[291]; and
- Direct measurement of flows by current metering or use of floats. These are potentially accurate methods, but are very time-consuming and rarely done well on a regular basis.

We observed the need for a reliable and predictable supply to the WUA, based on an agreed plan of entitlements to water. This supply normally needs to be measured, using techniques that are understood by the WUA. In some cases, delivering a known percentage of the total flow may be sufficient, even if the quantity of water is not known. Again the procedures should be transparent and understood. For this reason, the WUA should receive its water from one point (or a small number of points) – otherwise management becomes too complex.

The need for flow measurement within the WUA is more difficult to assess. We have found that routine measurement within WUAs is too demanding to be widely practical – a combination of technical difficulties, limited accuracy and operational costs make it difficult to apply. The design of operational rules needs to reflect these problems. Unmeasured inflows and outflows within the WUA also make it difficult to use flow data, as we observed in Kyrgyzstan (section 8.4.4). As well as being more practical, proxy measures (such as depth or time) are better understood by farmers and relate better to their requirements – farmers are aware of the depth of water that they require in their fields for a crop of rice, for example, but they do not find it easy to relate this to a volume of water applied[292].

We found in this study that simple proxy measures were more appropriate than actual measurements to individuals or groups of farmers. Depth or duration of irrigation are much easier to measure and comprehend that flow rates. We noted the common practice in China of allocating water by volume which is seen to increase transparency and trust, and can also be related to payments which are ostensibly calculated on a volumetric basis. We did not evaluate this system in China, but concluded that even if successful there it would be difficult to transfer such a system to our other study countries.

11.5 Action research interventions

We found that water was not distributed fairly. But while there were physical constraints to the management of the system, there were also potential management changes which could bring about a

[290] Farmers commonly misunderstand measurements structures, and believe that they reduce the flow. Such structures are thus often damaged.

[291] Operation of structures further downstream, or poor standards of maintenance (sedminetation or weed growth) can make the measurements inaccurate or even totally meaningless

[292] Even in places where water is nominally sold on a volumetric basis, such as parts of China, farmers still judge the adequacy of supply on the basis of their own perceptions.

fairer distribution of water – even with the existing infrastructure. The adoption of these management changes required changes in the institutions which influence water distribution – the rules, and the specific agreements and practices on the ground.

While the WUAs are the organisations which have been given the responsibility of bringing about these rules and arrangements, it became apparent through these case studies that the WUAs are not sufficiently 'embedded' in the community to fulfil their role[293]. They are not understood, not trusted, and cannot make or enforce rules. The WUAs vary in the specifics of their relationships with water users, and in their strengths and weaknesses. But broadly speaking, their roles and responsibilities are ambiguously defined, or if clearly defined formally, not well understood; and even if understood they are not fully agreed with by either the executive members or the water users. Finally, despite the training programmes provided, WUA executives often lack key technical skills to manage water effectively.

Our analysis of water users' livelihood strategies and of the history and performance of the WUAs highlighted two key areas for intervention to promote more equitable water distribution: improved knowledge of technical and organisational aspects of water management ('human capital'), and changes to the nature of water management relationships amongst water users and between water users and other relevant agents - the WUA, the irrigation department and politicians (i.e. addressing the bonds, bridges and links that make up 'social capital').

For our work we developed a participatory diagnostic process which aimed to increase levels of knowledge and communication, and to facilitate better water-sharing relationships amongst water users, and more effective engagement between water users and the WUA. Also, although constrained by the time and scope of our study, we initiated changes in the links with the irrigation department and politicians. By following the steps which we listed in Chapters 2 and 9 of this report we helped water users (and our teams) to monitor existing performance and to identify ways of addressing the technical and managerial, social and institutional problems which influenced equity in water distribution.

Using this information water users were able to develop action plans to solve these problems. We were able to implement this process most completely in SMIP, where we had the benefit of the foundation laid under a previous DFID-funded study, GGG (Mott MacDonald 2004). The water users prepared and implemented an action plan for maintaining canals, removing illegal structures, monitoring canal operation and ensuring the correct supply to the tails of canals, developing rules for distributing water, monitoring compliance with all rules and penalising defaulters. This involved an intense process of discussion and negotiation amongst the users and with the WUA. It built on our experiences in running water users' schools which helped to build good relations between users and the WUA in the previous season. The planning and implementation of improvements to water distribution were made possible by following this coherent and comprehensive process.

In SMIP, Nepal the outcome of this process was to help the WUA to make a marked improvement in access to water amongst disadvantaged users. In Obu Haet, Kyrgyz Republic, we only worked for a single season, so there was little time to identify and implement measures for improving water management. But here farmers reported that even the simple measures that could be adopted, focusing on improved communication and coordination, yielded immediate benefits. In both locations the

[293] By embedded, we mean that the WUA should be established in a way that takes account of local history, culture, residence patterns etc and is locally accepted so that it can estabslih and enforce rules. We did not prejudge the nature of the organisation, the way leaders are selected or the way members should be represented. The nature of the organisation may change with time, perhaps gradually becoming more professional.

improvements offered the prospect of benefits in improved crop productivity and income, time saving, and better social relations.

11.6 Drivers of Change

The outcome of our intervention was to achieve an improvement in water distribution, but we also recognise that there could be ‘losers’ who might resist, or make it difficult to sustain, the changes which were initiated with the outside intervention of our teams. Irrigators previously enjoying privileged access to water under existing arrangements may be unwilling to sustain the additional effort and possible inconvenience needed to change in cropping patterns to suit the change in water availability if water is managed on a more equitable basis. Some poor farmers may also be losers: poor tenant farmers might fear that they could be displaced from the land they are cultivating if water management improves. The WUA leadership could fail to make available the additional time and effort needed to work with farmers, gain their support, and supervise and enforce rules for fairer water management. Staff from the irrigation department may fear losing power, or opportunities for rent-seeking. The same may be true of politicians.

Thus a risk to sustainability of the changes initiated under this study is that the relevant ‘agents’[294] may not consider that the benefits of greater fairness in water sharing merit the effort, and possible costs, involved in bringing it about. Lack of support from the WUA leadership, possible sabotage from influential ‘losers’, and difficulty in engaging all stakeholders who could influence water distribution – for better or worse – all pose a threat to the improvements initiated under this action research programme. There needs to be an analysis of the ‘costs’ and benefits for each agent, so that the programme can be designed in a way that results in a net benefit for each stakeholder. This is decribed further later in this report (chapter 12).

On the other hand, our analysis of the ‘drivers of change’ shows how the range of relevant stakeholders can be motivated to promote changes toward fairer water distribution. ‘Head’ water users, with ample supplies, can benefit from savings in time and effort to protect their supplies, from reduced social conflict, and from enhanced status in the community. ‘Middle’ water users with adequate, but sometimes unreliable supplies, can be attracted not only by the same benefits as appeal to those at the ‘head’, but also from more reliable and predictable supplies, and from the prospect of a more sustainable irrigation infrastructure and irrigation service. Those at the ‘Tail’ with inadequate supplies may have to accept that initially they don’t experience as much improvement as they would like, but they can be encouraged by gaining confidence that solutions are possible, and that their interests are being attended to. They can also benefit from the improvements that motivate those who are ‘upstream’ from them.

Despite water users’ scepticism of the effectiveness of the Water Users’ Association, they consistently declare a wish for ‘strong leadership’. WUA executives and committee members can become more motivated to provide this leadership if terms of office are limited, elections are held regularly, and if there is adequate training and technical support to enable them to perform their functions effectively[295]. The water users will be motivated to select and support sincere candidates if they are

[294] As we noted in Chapter 2, by “agents” we mean all the people who have an effect on how water is distributed. The “agents” include not only the water users, but also others who are involved with irrigation management, such as ditch riders and other officials, politicians, etc.

[295] the system of ‘rolling elections’ in AP (described in section 10.8.6) is an interesting approach to retaining skills within the WUA, but it had been newly introduced and had not been followed through with TC training by the time of the study so it has not been possible to evaluate its impact yet.

properly informed about the responsibilities, and actual authority, of the WUA officers and committee members, and if they understand the technical possibilities and limitations of the irrigation system and the management constraints faced by the WUA and the irrigation department. They will also feel more confidence in the WUA if they know that they can enforce procedures to hold the WUA to account.

Both the water users and the WUA committees rely on irrigation field staff (whether employed by the WUA or by the government irrigation agency) and the irrigation department for information, coordination, monitoring and water control at some level. These staff can be motivated to provide a good irrigation service to the WUA and all water users through appropriate financial incentives, clearly defined responsibilities, and an authority structure and orientation which makes them accountable. Our focus in this study was on internal management by the WUA, and we believe that they can improve management even within existing constraints but further progress will be dependent on better relations with better motivated field staff.

It is useful to highlight the different types and natures of WUAs, as discussed in Chapter 6. In Nepal as in India, establishment of WUAs was linked to a transfer of responsibilities (and hence power and possibly resources) from the ID to the community. This is regarded by many as a potential or actual threat to their jobs and livelihoods[296]. In Kyrgyzstan, the WUA fills a void created by the vacuum formed when collective and state farms were abolished: there was no transfer of power and no threat, and all parties welcome the existence of the WUA. The replacement of the commune system in China by the household responsibility system did not leave the same void to be filled by a new WUA, and thus the creation of WUAs in China has not followed the same simple course as in Kyrgyzstan[297].

Finally politicians can be motivated to provide financial and policy support, while not interfering negatively in the operation of the irrigation service, by the promise that reliable, predictable and equitable water delivery will make irrigation systems more viable and sustainable, and can help to reduce social conflict.

11.7 Conclusions: support needed for sustainable WUAs able to promote equitable access to water

11.7.1 Introduction

Shifting the balance from top-down, “un-embedded” WUAs, to organisations which are engaged with the grass-roots whislt remaining well-connected with the service provider, takes a sustained effort. The methods, time and resources required will vary considerably from place to place. But we can draw some insights from our case studies to estimate the level of support needed.

[296] There may not be a large change in the number of jobs since WUAs require considerable support, but the n\ature of the work by irrigation departments will change and possibly the rewards available to them. Shah el al (2004) believe that some Water Resources Bureaus in China have been reoriented to support WUAs rather than to manage water without a resulting reduction in staff, but they do not provide specific evidence. This is a rather different view to that held by Mollinga et al (2005) who found little change in the role of the bureaucracy in the schemes they studied.

[297] The process and progress of WUA development in China is complex and varied, and poorly documented in English. In the present context it is the relations between the water management stations (part of the government bureaucracy at township or village level) and the water users associations which is critical. There was a much longer time interval between introduction of the household responsibility systems/land reform and establishment of WUAs in China than in Kyrgyzstan – it is these interim arrangements which may be at most threat from the establishment of WUAs.

We summarise our observations in this section, and then give more detailed guidelines in Chapter 12 – which are drawn particularly from our experience at SMIP where we were able to follow the most comprehensive and systematic approach.

11.7.2 SMIP

The WUA in our study site at SMIP was set up a decade ago and clearly demonstrates the pitfalls of failing to make sufficient effort to socially “embed” the WUAs. In the absence of sufficient commitment to establishing a good understanding, confidence and internally generated support for the WUAs among water users, and other stakeholders, WUA committees in our study site have been hardly effective, at best. When the WUAs were set up their success was mostly measured in terms of establishment of WUA committees on paper, and the ability of WUA-based contractors to complete certain externally-funded civil works. But because of the way these works have been executed, WUA committee members are still often seen to be ineffective or corrupt. So the performance of WUA committees may even have corroded not only the relationship between water users and the WUA committees but also social relationships for water distribution.

Our presence here was spread over two years. The first year was part of a separate project - GGG. The preliminary work included a rapid participatory planning study – the ‘entry point’. This was followed by a water users’ school (WUS) completed in the course of one cropping season (Season 1). The WUS was needed to recover from a situation in which the users had lost all confidence in the WUA, and to develop new links between users and the WUGs. At the end of this programme, the situation was that

- water users had a good understanding of the irrigation system and its constraints;
- all categories of users were engaged to varying degrees;
    - they recognised their role in its management;
    - they identified key gaps and problems; and
    - they were able to resolve some of these and were prepared to participate actively in tackling others.

We were, however, unable to make sufficient progress in improving water management in the first season for this improved understanding to be translated into a sustained improvement in performance

In the second year, therefore, we implemented a one-season-long programme under EIP (Season 2), focusing specifically on measures needed to improve water management. These included:

- control of illegal activities in canals and outlets;
- improved maintenance; and
- introduction of systematic field level operating rules.

Considerable progress was achieved by the end of the season: users had improved management and made a commitment ot further improvements in the next year. But the agreement and initiation of concrete actions took place in the course of the irrigation season. This meant that some tasks still remained to be completed. For example, people were reluctant to give up land for construction of temporary field channels once they had transplanted rice. But they were willing to do so before the start of the coming season.

Water users still needed a third season (Season 3) of support to address outstanding technical and institutional issues and to put measures which were initiated in the second season on a stronger, and more sustainable, footing. Considering technical and social elements, this would include helping the WUA committee members to work with volunteer farmer water monitors and water users, to prepare pre-season plans more systematically, and allow sufficient time to control illegal actions and to agree suitable alternatives with the farmers who have taken them. Support for the institutional element could encourage follow through with activating the WUC, as well as WUGs, including the formalisation of a tertiary sub-committee. The WUA committee members could be helped, with training and technical backstopping, to work more effectively with water users and to provide water users with the leadership not only for water distribution, but also maintenance, which they clearly wish for.

This experience indicates that three seasons of relatively intensive support spread over 2 to 3 years is needed to introduce effective operating systems. We fear that curtailing this programme, even after two seasons, could leave a high risk that measures are agreed in principle but not implemented. However, we have observed that the intensity of support needed (types of activities, number of support staff from different disciplines, frequency of visits) declined between the first and second season, and we would anticipate that it would be less, again in the third season. After the third season a much lower level of background support, with periodic visits and specialist consultancy on call, would be needed in the longer term. This would help to ensure that progress is sustained, and that the WUA committees receive the advice they need to help them solve problems as they emerge.

11.7.3 Obu Haet and Jany Aryk (Kyrgyz Republic)

Our experience in these WUAs is very different from SMIP. Here we worked from the level of WUA development as we found it. We did not implement an initial programme of water users' schools to engage with the WUA and the users (i.e. no 'Season 1' programme). This seemed appropriate because in both cases the WUA was relatively newly registered, was receiving support under the On-farm Irrigation Programme and faced fewer challenges compared with the WUA in SMIP. The irrigation system is simpler, the social structure is more homogeneous, and land holdings more uniform. Most importantly the WUA is new, still dynamic and has not become jaundiced by a decade of increasingly unproductive effort. As we noted earlier, these WUAs were set up to fill in a newly-created void in the management structure and did not threaten existing roles. So it seemed appropriate to start at 'Season 2' as outlined for SMIP above.

In the course of our work in these two sites we observed that, while off to a good start, the WUA is not 'embedded' in the community. Water users did not feel the WUA is "theirs". They had a very limited awareness of their role in the governance of the WUA, or of their responsibility to enable it to distribute water reliably and equitably. If the WUA Directorate was able to deliver water on demand according to their wishes – fine. If not they would do what they could on an individual basis to get the water they needed. The reasons for this incomplete engagement between water users and the WUA are quite different from the case of SMIP; although here too they can be found in the history of WUA development. Here the management role has been transferred from one, now discredited and discontinued, external organisation – the *kolkhoz,* to another apparently external organisation - the newly formed WUA; without the users coming to feel that they 'own' the WUA.

From these observations we conclude that the WUAs here too need be strengthened through a programme similar to that of the WUS – but adapted to the skills, relationships, and interests that prevail locally. If such a programme is put in place now, the water users can get oriented at an early stage to develop their own rules for water sharing, and establish self-generated discipline in water sharing. That will be an important investment for the future sustainability of the WUA, the irrigation system it is supposed to operate and maintain – and for the continuing ability of the irrigation system to contribute to farm livelihoods.

The aim of this WUS would be to help the WUA to engage with the water users while, simultaneously, designing and implementing measures to improve the operation of the system. In view of the institutional groundwork established under OIP, this could be combined in a single season. The relatively high educational standards mean that this can be delivered in more straight-forward ways than were appropriate in Nepal, and can include printed leaflets and other written materials,. The field school concept which we used in Nepal is an excellent one which could be adapted for use in Kyrgyzstan. It would still be necessary to allow for a follow-up season (Season 3 in SMIP), to provide backstopping for the implementation of measures identified in the previous season. This would then be followed by a lower level of long-term support as indicated for SMIP.

Here an associated programme will be needed to improve crop husbandry skills. We found that a large proportion of the farmers in our study sites had very limited experience in smallholder irrigated agriculture, and many could benefit from technical skills training in this area. This could linked to the WUA strengthening programmeas we did in the WUS in Nepal (Mott MacDonald, 2004a)

11.7.4 Khageri (Nepal)

This WUA has received almost continuous support, in one form or another, since 1986. This support has particularly focussed on the WUA's joint activities with the Irrigation Department at main system level. This has borne fruit, as water users seem fairly satisfied with the way the WUA has allocated and managed water distribution between branch canals. This is at a relatively high level in the system, a level which would be between rather than within WUAs in other countries. This reflects the fact that IMT has progressed further in Nepal than in the other study countries and WUAs manage or are involved in management of much larger parts of the system.

But the WUA is in more difficulty where there has been less support – at branch and outlet level. This is more equivalent to the level at which WUAs in Kyrgyzstan, for example, are most involved. Here, the WUA promoters simply assumed that the WUA and farmers would sort water distribution out themselves. In fact this has been the assumption in all of our study sites. But here, as elsewhere, internal rules, discipline and equity have not been spontaneously achieved to cope with a situation when of water shortage. Rather, individualistic behaviour and inequity have been common, and this has undermined confidence in the WUA. So despite its relatively good performance, even in KIS the WUA needed help to work out a way of improving water distribution at times of shortage.

The experience of the WUA in KIS illustrates the potential pitfalls of extended, but inadequately structured and phased support. Here we found that repeated contact with relatively uncoordinated support programmes has stimulated a sense of dependency on outside projects rather than a willingness by water users to support the WUA in taking its own initiatives for improved water management. The tendency has been to expect outsiders to continue to come with help - perhaps with new ideas - as we did in response to their concerns about water allocation between BC1 and BC2 and about water diversion at Kaparkhori..

Since KIS has already received 15-20 years of institutional support, work here could be completed in a 'Season 2' activity, with emphasis on encouraging an increased level of initiative and independence of the WUA. This would then be followed up with a fairly low level of support to address specific implementation issues in Season 3; and access to consultancy advice as needed thereafter.

11.7.5 SRSP

In SRSP we were not able to go beyond the beginning of the 'entry point' activity. We concluded our study programme here with a report back of our survey findings to a Farmers' Workshop. This workshop provided an opportunity to establish the initial consensus regarding the need for improvements in water distribution, and identification of some measures that could make progress possible. Once the TC members have received their initial training it would be appropriate to initiate a three season programme, with long-term backstopping, as discussed for SMIP.

Resisteance to change by influential farmers, local politicians and the irrigation department is of greater significance here than in the other case study sites. This can provide an opportunity, as the I&CADD has skilled manpower able to help, which needs to be focused on its new role, and local politicians would alsoe benefit from better water management as this is so closely linked to livelihoods and their own electoral prospects. However, this is clearly a challenging project to reform.

11.7.6 Summary

These observations indicate that a programme for improved water distribution in a locality should be implemented over two to three seasons, with provision for continuing technical backstopping and consultancy thereafter. The general programme for each season would be:

- **Season 1**: a rapid participatory planning study, to achieve a good understanding of the irrigation system and its constraints. This is followed by an activity, such as a Water Users' School, to engage all categories of users in activities that enable them to recognise their role in the management of the irrigation system, to identify key gaps and problems and ways to resolve them, and to be prepared to participate actively in tackling them.
- **Season 2**: a follow-up but still intensive, programme focused specifically on measures needed to improve water management – technical, social and institutional
- **Season 3**: a less intensive programme which aims to help the WUA and water users to address outstanding technical, social and institutional issues and to put measures initiated in the second season on a stronger, and more sustainable, footing.

The precise content and duration of the activities which are included in each season of activities will depend on the history of WUA development and the type of irrigation scheme. We give specific recommendations based on our experience in implementing this process in Nepal and Kyrgyzstan in the next chapter.

12 Practical measures to promote more equitable irrigation management

12.1 Introduction

In this chapter we recommend specific measures which we consider to be effective for creating the conditions for positive changes in irrigation management. The recommendations cover technical, social and institutional measures. Based on the changes we observed or anticipated in our study sites, we comment on the critical resource requirements needed to increase the chances that these improvements will be sustained and lead on to further improvements.

It is clear from our study findings that irrigation management is complex, and needs to be addressed not only technically, but also socially and institutionally. Our findings have shown that by adopting measures that work with each of these aspects in a complementary way it is possible to achieve tangible improvements in the reliability and equity of water distribution.

In all our study sites we found that under the status quo farmers were willing to blame others for shortcomings in the system. But it was rare for them to take responsibility for rectifying these problems. The contributors to these problems included:

- Technical constraints – farmers blame Irrigation Departments or WUA contractors for bad design or construction.
- Unrealistic expectations – farmers assume that the irrigation system should always provide them with as much water as they want.
- Social relations – those deprived of water blame those who take too much. Those with ample supplies feel themselves unwilling or unable to respond to those who are deprived. A complex set of power, cultural, and other relationship factors are operating to bring this about.
- Institutional relations – farmers and WUAs blame irrigation departments for supplying too little water or at the wrong time; farmers blame the WUA for not imposing and enforcing rules for strict and fair water distribution; irrigation departments and WUA committee members blame farmers for being unruly; politicians sometimes intervene to favour particular interests, with outcomes at odds with the rules and provisions for fair water distribution.

The problems seemed too intractable for farmers, and even for the WUA, to attempt to solve themselves.

Our approach is to help farmers and the WUA committee members to work with the Irrigation Department, and politicians if necessary, to get beyond the stalemate of apparent intractability; to make a start on implementing practical improvements. Initial successes can then be built on in a virtuous circle of improvement.

The measures we propose are structured around four core elements:

- Entry to the irrigation system to diagnose water management arrangements and problems with water users and WUA committee members.
- Technical skills development to improve understandings of the possibilities and constraints of the irrigation system, and to identify technically practical ways of improving water distribution and related cropping activities.

- Strengthening social relationships (bonds, bridges and links) to promote understanding and mutual consideration of how water management affects different categories of users, and willingness to cooperate to implement measures to improve water distribution.
- Improving and embedding institutional arrangements for better WUA governance.

But the first step, even before initiating work on the ‘four core elements’, is to identify who will take on the task of implementing the change programme. That is, who will be ‘championing’ the aim of promoting greater equity in water distribution, and particularly the interests of the poor.

These elements are listed as discrete items, but they are actually interlinked. They must be helped to develop together, in a mutually reinforcing process. Furthermore, it is important that while incorporating these elements, each programme is adapted to the specific water management arrangements, problems and needs of each location. So we do not intend our guidelines to be treated either as a blueprint or a comprehensive list. We present our lists of measures as an indicative menu - to be drawn on, adapted and added to.

In the following sections we discuss the role of the ‘champions of change’ and the ‘four core elements’. In each section, after an overview, we give illustrations from our study sites and then offer general guidelines for how to apply our recommendations. The separate guidelines provide detailed procedures, based on our experience for implementing each of these steps.

12.2 Champions of change

12.2.1 Overview

In section 2.5.2 we referred to the difficulty that poor people have to negotiate arrangements to their advantage, and in 2.5.5 (iii) we referred to the observation made by Bird and Grant (2005) that pro-poor change requires, amongst other things, effective lobbies and strong political leadership. We also noted the findings of Kolavalli and Brewer (1999) that external agents played an important role in acting as independent arbiters to build consensus and to stand up to “existing power bases” on behalf of weaker sections of the community.

Thus the first step is to identify and provide strategic support to activists who are willing to take on the role of ‘champions’ of more equitable water distribution.

12.2.2 Illustrations from our study sites

For the purposes of this study, we set up teams in each country where the field work took place. Through these study teams local level contacts were made with an NGO (in Nepal and India) or WUA development workers (Kyrgyz Republic) interested in working with water users and WUA committee members and staff to develop ways of improving water distribution. The local level teams then systematically worked through the process we have described in this report to develop trust, and an in-depth understanding of the processes and relationships surrounding existing water distribution practice. This enabled them to help the water users and WUA committee members to develop their solutions; and to help water users to make contacts with the irrigation department as needed to further the effectiveness of their solutions.

The implementation of this programme took time and effort on the part of the study teams, and also required other resources to conduct the work programme. Under our programme the teams received the following preparation and logistical support:

- Team formation and work planning: discussion with national level stakeholders on the objectives and methods of the programme, leading on to identification of potential sites; site visits, liaison with WUAs and other local stakeholders, confirmation of site selection and collection of base data; planning of activity implementation strategy.
- Backstopping: progress reviews and assistance with planning future work; information on related work being done in other countries.
- Logistical support: provision of funds to cover salaries/living expenses of NGO team members[302], and other costs such as transport, meeting organisation, stationery and other sundries for training programmes.

By working through the four elements discussed in subsequent sections, our teams were able to act as catalysts and to encourage local champions -- WUA committee members, individual water users, and irrigation department staff members – to carry the work forward. Although in our case politicians were not involved, they too represent a potential source of support for this work.

While it was not possible within the scope of our study to prove what would have happened without the intervention of our teams, we did observe the frustration with water distribution which was expressed by water users at the initiation of the teams' activities. And we were able to demonstrate the new initiatives that came out of the work of our teams during their period of engagement. We feel this validates the value of identifying and supporting appropriate 'champions' as part of a strategy to promote more equitable water distribution.

12.2.3 General guidance

At the very outset of any initiative to promote more equitable water distribution the question is: who wants it? Following on from this: what are they able to do about it? Whose help do they need to implement a programme of change? This can lead to the identification of the combination of 'agents' who can be brought together to act as 'champions of change' for more equitable water distribution, and the interests of the poor. These could include groups and individuals from a range of spheres of activity, for example:

- Civil society activists, including workers in NGOs and International NGOs
- WUA committee members
- Committed individual water users
- Irrigation Department staff members – including those specially assigned to promote this aim
- Politicians

While undoubtedly those who become involved will bring their own mixture of motives and incentives, the fundamental requirement will be a commitment to the aim of equitable water distribution – and to furthering the interests of the poor. These activists might be drawn from a range of levels from the most local to the international. It will be valuable to have a good spread of

[302] We did not meet any WUA costs, or pay for their participation in any way – we aimed to help them set up sustainable financial systems from the outset.

connections, to facilitate changes at all relevant levels. But a key will be to establish a strong local base, with local knowledge and an ability to communicate and establish trust.

The implementation of the programme is likely to require a significant investment of time, at least at the outset, and funds will be needed to compensate key activists for the work they put in, and to offset basic transport and other materials costs. We will discuss the resources needed and the financial costs for this work in chapter 12.7.

12.3 Identification of entry points

12.3.1 Overview

The first challenge when beginning work in a locality is to identify an effective entry point to initiate the process of improvement. The task at entry – i.e. when initiating activities to support improved water management -- is to establish a critical minimum level[303] of interest and commitment amongst water users, the WUA committee members, and irrigation department. This requires:

- consensus that improvements in water distribution are needed,
- confidence that some progress is possible, and
- willingness to take part in developing and trying out measures to make improvements.

12.3.2 Illustrations from our study sites

An important initial activity in each of our study sites was the preparation of a listing of all water users, with a simple classification of water users according to well-being category[304]. This listing was an important reference for us in our effort to make sure that water users from all well-being categories, and particularly poor water users who are frequently overlooked, were included in our activities.

In the case of SMIP, we initiated the process under a previous project (GGG - Mott MacDonald, 2004), with the same team following through under EIP. The team began work in the study area with a rapid participatory diagnostic learning exercise. This led to a season-long programme of water users schools (WUS). The content of the WUS programme combined institutional development, evaluation of irrigation system operation and maintenance, and agricultural skills development. It relied heavily on practical observations and discussions amongst participants, taking account of the fact that some were not literate. The agricultural and on-farm water management training included ongoing activities on a small study plot. Work on this plot, and the discussions associated with it, provided a focus for the more intangible work of building relationships to make improvements at levels above the individual farm. The participants in the WUS were carefully recruited to represent men and women from all well-being categories. This included some WUA committee members. At the end of the one-season WUS the participants had developed their knowledge, relationships, and commitment to change[305]. But they felt they lacked the leadership and confidence to carry this forward. They were

[303] What is the "critical minimum level", is a matter of judgement for those implementing the programme. But it is not necessarily a prerequisite that all the interested parties are 'on board' before work can begin. It just needs to be 'enough' to move forward. Others can be drawn in as the momentum is gained. At the same time, it will be important to be aware of the interests that may try to sabotage the process, and work out a strategy for dealing with this.

[304] Grandin, Barbara. 1988. Wealth Ranking for Smallholder Communities: A field Manual. ITDG.

[305] A detailed description of the methods used can be found in Mott MacDonald, 2004.

uncertain about their ability to make the physical and institutional changes that they thought were needed to improve water management. Under EIP they were given added support to make these changes.

In Kyrgyzstan the on-going work by the On-farm Irrigation Project (OIP) provided a convenient entry route. Staff from the local WUA Support Unit had established good relations with the WUA Directorates and committees, and they had worked with the WUAs to evaluate irrigation operation and maintenance requirements. This helped in meetings with irrigators. At these meetings water distribution was discussed and a programme was set up for farmers to monitor and evaluate water management, and to identify measures for improvement during the study season. These advantages were offset to some extent by the fact that farmers were looking to OIP-funded physical improvements (yet to be carried out) to solve many of their water distribution problems. This made farmers less inclined to think about developing rules for water sharing since they did not know what problems they would face, if any, after the physical improvements were complete. Nevertheless, they did recognise that they faced water distribution problems, and they were prepared to make observations and engage in discussions about how they, and the WUA, could play a part in resolving them in the future.

The WUA at KIS has received external support in varying ways since 1986, and we were able to build on the relationships (and personal contacts) which had been established over previous years. When EIP was introduced WUA committee members and farmers already had water management issues which they wanted the study to address, such as water sharing between BC1 and BC2. This usefully led into an examination of wider water management issues.

In SRSP the history of WUA inactivity in managing water, the lack of informed and active TC members, and severe water shortage from drought, made it particularly challenging to 'make an entry' in our study sites. But it was possible to complete some initial groundwork. The baseline and follow-up surveys conducted by our study team gave an opportunity to learn about the livelihood assets and strategies of the water users; and the information this produced was presented for discussion in a Farmers' Workshop. With the survey information as a background participants in the workshop looked forward to measures they, the WUA and the Irrigation Department, could take to improve the way water was shared and used in the future. The WUA President and TC members attended this workshop and they were active and enthusiastic participants. The President promised that he would do his utmost to improve water distribution, and farmers requested a 'community organiser' to help them to improve water management and sustainable agricultural production (cf. our earlier discussion on the role of an external 'champion' of change).

12.3.3 General guidance

Taking into consideration previous activities in the area, including the status of the WUA, it is necessary identify an appropriate entry point activity. This should provide the foundation for building relations to achieve more comprehensive reform, and get the process started. The discussions and diagnosis of water management problems at this stage are important for deciding what should be included in the other three elements which make up these guidelines – developing technical skills, strengthening relationships, and improving institutional arrangements.

We found in Nepal that development of farming skills, through carefully targeted and implemented training programmes is a good entry point, and our observations in Kyrgyzstan suggest this would be equally applicable there.

Although we call this element an ‘entry point’, we do not mean to suggest that it can be completed as a one-off activity. Developing a consensus and confidence that improvements can be achieved is a process which may require work with different interest groups at different times, and for different periods of time. The specific procedures for making this entry, and for keeping it going, have to be identified as appropriate to each particular circumstance. But it is important to identify and include all the stakeholders – those who can either drive, or inhibit, change. A listing, and well-being classification, of water users is a valuable tool for ensuring that the poor are enabled to participate actively in the programme to improve water distribution.

12.4 Technical skills development – general

12.4.1 Overview

Irrigation systems are most obviously technical interventions to supply water, so it is not surprising that those using and managing irrigation look first to a “technical fix” for their water delivery problems. Some basic technical knowledge and skills are therefore needed so that all the interested parties have a common understanding of the possibilities, and limits, of technical solutions.

12.4.2 Illustrations from our study areas

In each of our study areas we used a combination of activities to improve water users’ technical understanding and water management skills:

- joint evaluation of the physical system through transect walks and practical exercises,
- recording and reporting of system performance by “Farmer Observers”, and
- meetings for group discussion and learning of skills.

The joint evaluation of the physical system was conducted most systematically in SMIP as part of the participatory appraisal, and as an activity in the Water Users Schools. Here water users undertook practical activities, such as completing an inventory of the condition of the canals and offtakes, and identifying the location of “illegal” outlets and blockages in the canal. This provided a basis for discussing how the structured irrigation system is supposed to work, and how the condition of the infrastructure, as well as illegal measures, affected the performance of the system. In our other sites, the procedure was more informal, and involved the team in meeting farmers in the field to make observations with them of the physical characteristics of the system, and of their experience with the way it operated.

The Farmer Observers (FOs), selected in each of our study sites in consultation with the WUA and water users, received practical training in the second season from our study teams in observing and recording water flows, and in using other simple methods of assessing water distribution – such as grading field water conditions on a scale of 1 to 5 (as was done in KIS), and in using gauges (as was done in Jany Aryk and Obu Haet as well as in the Nepal sites). In KIS and SMIP they then had an opportunity to report their findings to other water users. This helped to improve local technical capacity. The oral reporting and discussions led by the FOs also helped to improve water users’ understanding of system operation and constraints.

These "report back" meetings, as well as other briefing meetings were an occasion for water users to improve their understanding of how individual practices affect others, and to provide technical information and guidance on practical measures they could adopt to manage water more efficiently.

12.4.3 General guidance

Practical field exercises with farmers, training of volunteer farmer water monitors, and group discussions can provide effective avenues for improving the technical knowledge and skills of water users. The information provided by a list of farmers classified according to well-being can be used to ensure a good representation of all well-being groups in these activities[306]. We have identified a number of specific topics which could be usefully included in the Technical Skills element:

- Awareness of the effect of individual water management practices on others. Improved knowledge of how individual water management practices affect others, and how they themselves will be affected by others in the longer term. Encourage people to recognise the consequences of what they do, and their responsibility to modify their practices to reduce wastage or other inefficiencies;
- On-farm water management: optimal water application rates (avoidance of 'hoarding mentality') and new techniques such as SRI method for rice; benefits of land-levelling; and guidance on furrow length and grade selection;
- Impact of maintenance on operability and performance of canals; procedures to improve performance; and the contribution water users need to make so that those procedures are put into practice;
- Canal management monitoring and procedures: relations between depth/level and discharge, impact of submerged outlets (and how to cope with them); how to interpret and apply this information for improved coordination between farmers, and more efficient water use on the farm;
- Agreement of operational objectives and design of corresponding suitable technical rules for sharing water at each level of the canal system; and
- Development of indicators for monitoring implementation of these rules and ensuring compliance; development of appropriate and socially acceptable graduated sanctions for those who infringe the rules.

A number of the technical improvements, such as use of in-field furrows and more careful application of water according to crop needs, can be implemented by farmers on an individual basis, without reference to the actions of other farmers – and these can have an immediate beneficial impact on water availability.

The method of providing the training is important. An adequate level of understanding and competence in some of the related skills can be achieved through relatively short activities such as training days and demonstrations conducted in the course of one or two seasons. Othe skills may require a more intensive effort. We found the WUS to be a very effective method for training and dissemination of new skills.

[306] We have found that often field workers who lack previous experience with the well-being ranking method are initially reluctant to complete this exercise. They may not be sure how to conduct the work tactfully and feel awkward about asking others to make this classification. However, with training and encouragement, they have gained confidence, and completed the listing and classification – with great benefit to our action research programme. The information gained through this listing can be critical for ensuring inclusiveness. Although it by no means guarantees success in reaching the poor, without it the programme is more likely to fall into the common pitfalls of only including 'the usual' participants.

But in order to ensure that the improvements are sustained, other more comprehensive measures are needed:

- Provision of sustained technical support to the WUA, working with farmers, to design, test, implement and modify operational procedures (irrigation schedules, rotations, indicators, etc).
- Information campaigns tailored to complement other measures to encourage crop diversification -- crop-specific information on optimal water use, such as: timing, appropriate depth of water applications, impacts on productivity of over-use of water.

12.5 Technical skills development - improving water management through better monitoring by WUAs

12.5.1 Overview

This study aimed to help WUAs to identify methods to improve water management. This can be achieved by improved monitoring of water distribution either by direct flow measurement or by use of proxy indicators of water delivery. But such measures cannot be introduced in isolation. They must be part of the package of social, institutional and technical measures outlined in this chapter. In each of our case study sites we came across examples of attempts to introduce new water management systems which had failed because they were introduced in isolation.

As well as not being developed in an appropriate institutional framework, it was also evident that the failed solutions oversimplified technical requirements and were not appropriate for the settings where they were introduced. We therefore present some guidance here on key technical considerations when designing water monitoring measures.

The objectives of measurement should be clear before designing any monitoring programme. Flow measurement can be done for several reasons – for example, to improve equity of water distribution (the focus of this report), to enable charging for water according to water use, or to encourage more efficient use of water. The measurement technique, as well as the way it is operated, is not necessarily the same for all three of these objectives.

It should also be noted that unless the WUA is able to control or adjust the flows, flow measurement will only enable the WUA to document management performance but not to improve it.

12.5.2 Illustrations from our study areas

The design of monitoring systems needs to take account of a number of practical realities.

(i) The technical problems of measurement

We have discussed the technical difficulties of flow measurement earlier in this report. Three points are particularly relevant when designing a monitoring programme for a WUA.

- **Measurement Skills**: Measuring the flow of water is difficult, expensive and time-consuming: it requires suitable infrastructure, and can easily be inaccurate. It is much easier to build on and improve existing practice, such as in Kyrgyzstan where there is a tradition of flow measurement, than it is to introduce the idea to WUAs which have no experience of the topic. But in general methods which rely on velocity measurements (whether by current meter or floats) are too time-consuming to be done on a regular basis in the countries we studied.

- **Damage to structures**: Both the objectives and methods of measurement are mistrusted by many (if not most) people and structures are vulnerable to manipulation or even sabotage. Measurement is often associated with (increased) water charges or plans (whether stated or not) to reduce water deliveries. Measurement structures are perceived to reduce flows and are thus often damaged in order to augment supplies at times of shortage. Obviously these interventions undermine the technical operation of the measurement system.
- **Data management**: Flow monitoring if done systematically can generate vast amounts of data, with attendant problems of storage, quality control, analysis/use, etc. None of the case study WUAs had data management systems capable of coping with the volume of data that systematic monitoring would generate – even for measurement of deliveries to the WUA, let alone at additional points within WUA. At SMIP, some farmers were aware of the correct gauge reading at the WUC intake (serving 722 ha), and were able to observe whether the schedule was being complied with, but they did not record the data before this study began.

We helped the WUAs, FOs and farmers learn the skills needed to use gauges and measurement structures and to understand the purpose of the measurements so that they could implement a realistic monitoring programme consistent with their interests and capability.

(ii) Relating deliveries to the WUA with water use by individuals or groups of farmers

There is a consensus among outside observers, and some water users, that measuring deliveries to the WUA is a valuable exercise, and important for improving water management. This information is needed by both the WUA and the main system managers. It can be used, for example, for monitoring a supply contract, ensuring that farmers are aware of the actual deliveries, creating awareness of the value of water. Also, IMT transfers the problem of fair (or efficient) distribution to WUAs, and this monitoring provides the WUA with basic information needed to manage water sharing amongst its members. But this does not solve the problem of how a WUA might achieve equity. It is difficult to relate water deliveries to the WUA to actual water use by individuals for a number of reasons:

- Local reuse of drainage flows, seepage, field-field irrigation and unofficial sources mean that individuals irrigating within the same unit may draw very different amounts of water from the official channels. This is almost always the case with rice irrigation, but we also observed this problem in Kyrgyzstan. Here, 80% of farmers reported using other sources at least part of the time. We found it very difficult to relate canal flows to volumes used by individual farmers, and this could not be done by the WUA on a routine basis;
- Locally all sources of water (wells, canals, and tanks) and all uses (agriculture, domestic use, livestock, etc) are important. WUAs are commonly set up just to manage the canal system, and with a focus on irrigation use. They may informally take account of other sources and uses. However, other institutions may also be involved in managing these (eg PRI in India). Optimising conjunctive use from a local perspective may be very different from the requirements of the canal system – since losses from the canal system can be retained locally in tanks or used to recharge groundwater rather than being made available to downstream canal users. There is an apparent conflict between local and system objectives. This was most apparent in our case study in AP.
- WUAs are very variable in their size, layout, number of canals to manage, and the number of farmers they represent. In many cases they are supplied with main system water from several different points as they manage a series of small canals from a single main canal which serves several WUAs.

With this background, we observed that quantitative flow measurement to individuals or small groups of farmers is not practicable. We concluded that measurement down to minor level (300 Ha) in SRSP (AP), tertiary/branch in SMIP/KIS (100-250 ha) and on-farm canal in Kyrgyzstan (200ha) is the best that can be achieved.

(iii) Indicators for water use by individuals

We found that within this area water distribution relied very heavily on individual efforts and individual assessments of when irrigation is complete, although it might be negotiated with neighbours or (less commonly) mediated by the WUA or local government.

We helped the FOs in each of our study sites in consultation with the WUA and water users, to develop proxy indicators which they could then use for improving equity of distribution:

- grading field water conditions on a scale of 1 to 5 (at KIS);
- understanding when flow depth in canals can be used as a proxy for flow volume (i.e. understanding the difference between normal flow and situations when water level is influenced by downstream obstructions);
- developing irrigation schedules at SMIP, defining the:
    - order of irrigation for situations of ‘normal’ water supply;
    - order and duration of irrigation for situations of ‘scarce’ water supply.

12.5.3 General guidance

As noted above (section 12.4.3) there are many technical factors which influence equity of water distribution. In this section, we give guidance for aspects specifically related to monitoring water delivery to farmers.

- The supplies to the WUA should be based on a formal agreement between the bulk supply agency and the WUA and should be jointly monitored and documented. Reliable delivery to the WUA and timely communication of the delivery schedule (and sudden changes necessitated, for example by sediment control measures) can help the WUA to manage water well.
- The management system within the WUA should take account of all sources and uses of water, even if they are not all formally the responsibility of the WUA. Institutional relationships may then need to be developed as described elsewhere in this report.
- Flow measurements within WUAs will only be possible at a small number of points – one measurement site per 100-250 ha is likely to be the best that can be achieved. These points may only need to be monitored at times of shortage, and it may not be necessary to record the data (but there should be wide awareness of the method of measurement).
- The objectives and methods of measurement should be clearly defined and well-understood by all farmers, so that they do not damage structures or intervene to influence measurements.
- WUAs usually manage several, and possibly a very large number of subsidiary channels. The first step in improving management is to improve the distribution of water and the monitoring of this distribution between canals. This may require division of the canals into groups or sections for irrigation in turn, or if the system is so designed (as at SMIP) it may be possible by continuous proportional flows. It is very important that the water users understand, and agree to, the basis for grouping and the rules being followed in water allocation between canals or groups of canals.

- Irrigation may be on-demand or in accordance with a pre-defined schedule. In either case there needs to be agreement on how to determine the timing and duration of irrigation – and proxy indicators for monitoring should be specified. Schedules should be drawn up by the WUA with participation by the actual irrigators (who may be informal, unregistered tenants). These schedules may distinguish between 'normal' and 'water short' situations, and should take account of the requirements for minimum stream flow for efficient irrigation.
- Rotations where the entire flow is taken by individuals for a short period (*warabandi*) are more transparent and easier to monitor than sharing the flow between several units, but they are not always practical. The alternatives should be explored and agreed with the irrigators.
- Formal proxy indicators can be based on
  - Depth in field channels
  - Depth in fields
  - Duration of irrigation (per unit area, distinguishing crops if necessary)
- Less formal indicators will often be sufficient, in some seasons or at some stages in the season. These rely on achieving a consensus on timing and duration of irrigation, and should be possible in many situations where the WUA is trusted and relationships between users and with the WUA are good.
- Participation in designing the monitoring system is essential, but WUAs will need technical assistance for this. It will depend on a good understanding of the intricacies of the water distribution system and clear identification of the stakeholders. The plan and monitoring system must be clearly communicated to water users. Special attention should be given to ensure that this information reaches users who can easily be left out: non-resident, poorer and illiterate, and women, irrigators.
- Farmers should be aware of the implications of their on-farm water management practices for water use – for example land levelling, field size, furrow length, bund height/condition. The WUA should be helped to develop an information programme and incentives to adopt water efficient practices, and to agree and enforce rules on how they will deliver water to farmers with different water management skills and resources.
- The monitoring programme needs to be designed to suit the resources available to the WUA, using their own resources or ability to mobilise volunteers, or their access to government subsidy to cover the costs of monitoring staff.

12.6 Social relationships ('social capital')

12.6.1 Overview

Improved social relationships, including the bonds, bridges and linkages associated with the term 'social capital', are the key to sustaining the improvements in water distribution which we outlined in the previous section. While on-farm water management changes are important, at least as critical is a shift from a focus on individual or small group interests to a strengthening of social relationships within and across stakeholder groups. This is necessary so that farmers all accept the need to follow the rules formulated by the WUA. In our study sites we saw that without this confidence and commitment to the rules of the group, even well-informed individuals found it hard to resist acting individualistically. They saw others breaking the rules, and felt bound to break the rules themselves – if they could. And even well-intentioned WUA committee members were unable to impose discipline when water users were unwilling to discipline themselves.

12.6.2 Illustrations from our study areas

The potential impact of measures to change social relationships and strengthen group water discipline was demonstrated most effectively by the Water Users' Schools and the follow-up activities implemented under EIP at SMIP. The WUS provided a forum where male and female water users from all well-being groups and ethnicities were able to discuss their experience of the way water was managed. This established better communication, understanding and trust across social groups. It enabled us to make more rapid progress on improving the technical aspects of water management under EIP than was possible at other study sites. We found that the forum created by the WUS had the following benefits:

- Improved observation, diagnosis and analysis of the effects of current water management on all affected groups.
- Identification of common interests and forging of more collaborative social relationships.
- Opportunity to champion the interests of the voiceless (poor, women), while recognising their vulnerability and dependence on other social groups within their community.
- Enable "tail end" users to put more social and psychological pressure on "head end" users, the WUA committee, and ID staff. Here the members of the GGG/EIP team played an important role as facilitators and champions. They did this by helping to organise meetings between users from different parts of the system, by helping tail enders to identify points of leverage, such as control over maintenance measures affecting "head enders", and by helping tail enders to lobby WUA committee members and ID staff. While doing this, the team was conscious of the risk of making water users dependent on them. They progressively encouraged the water users to take their own initiatives, without relying on the team.

12.6.3 General guidance

Measures are needed which aim to build water users' awareness of their own responsibility to promote good water distribution, both individually and by supporting the WUA. These measures should help water users to establish connections across interest groups and to see that irrigation need not be a zero-sum game - everyone can benefit from improved management. The best approach to achieving this will vary according to the local context, but it can include:

- Implementing a sustained and targeted programme to inform water users from all well-being groups of what the WUA can do for them, what they need to do to make it effective, and to develop a commitment to supporting the activities of the WUA.
- Consciously and systematically implementing measures to identify and involve all interest groups in the governance of the WUA, by well-being, caste, ethnicity, gender, etc.
- Recognise that it may not be possible to reach all water users in the "normal" way – i.e. through the WUA committee members, minutes, posted notices, newspaper announcements, etc.
- Use the media in a sophisticated way appropriate to the information channels commonly used by these groups – taking into account low levels of literacy amongst some categories of water users (TV, radio, street theatre, etc.)(cf. Braden, 2003).
- Make contacts through other social groups they belong to (e.g. savings, religious, etc.).
- Design group activities so as to combine development of technical skills and changes and improvements to 'social capital' linkages.
- Recruit influential people and opinion leaders to generate moral suasion for more disciplined use of irrigation water.

The WUS is again an effective approach for these tasks. Simpler methods may sometimes be more applicable depending on the scale and complexity of the problem, as well as the resistance to change. Farmer observer meetings or media campaigns may be sufficient in Kyrgyzstan where literacy is higher and resistance to change lower than in India or Nepal. But care is still needed to ensure that all groups get equal access to the programmes.

12.7 Institutional arrangements – WUA governance

12.7.1 Overview

The measures described above will help embed the WUA in the community by strengthening the sense of connection and ownership that water users feel toward the WUA. But in order to maintain the confidence of the water users, the WUA must provide the leadership, and the irrigation service, that encourage collaboration for good water management. The EIP programme made some headway in improving institutional arrangements, particularly in SMIP. But this is an area that has received far too little attention since the WUAs were set up, and it needs a significant improvement in the support given to it.

12.7.2 Illustrations from our study areas

An outcome of the activities we listed above was the introduction in SMIP of an ad hoc tertiary committee and moves to improve other aspects of the way the WUA was operating. In KIS water users also expressed their intention to adopt some improvements to the operation and structure of the WUA. The measures that we adopted are also applicable to WUA committees in general:

- Make users aware of the constraints to water supply and create realistic expectations of what they can expect the WUA to do about these constraints.
- Help water users and WUA committee to review the organisational structure of the WUA and identify and implement measures to modify the structure so as to make the WUA more effective.
- Help WUAs to develop an action plan to develop and reinforce a relationship of confidence and trust -- between water users and the WUA, and amongst water users. The action plan included measures to reinstate the infrastructure. This minimised the need to control "illegal" water use by resorting to punishments.
- Help the WUA committees to work with water users to agree a workable combination of incentives and rules that promote equitable water sharing behaviour amongst users.

12.7.3 General guidance

Provide funds, training, and expert backstopping to help WUA committees to build up a relationship of accountability and trust with water users, and to perform their functions more effectively. Among the activities to be supported:

- Use of public information campaigns to help water users to select interested and committed leaders for their WUA committees. They should have the time and interest in water management, as well as the social stature, to ensure compliance with rules.
- Develop skills of WUA executives in leadership and negotiations, coupled with a sound technical understanding of water management and the ability to design rigorous objective procedures.

- Create opportunities for water users to support WUA executives to develop indicators of water distribution as per an agreed plan. These indicators should show whether or not each water user is taking water as authorised. The plans, indicators, and monitoring procedures can be developed through meetings and "action research" activities such as those described in section 9.2.
- Help WUAs to develop a credible and enforceable set of punishments for those who do take water "illegally".
- Ensure that legal and policy provisions give WUA executives power to enforce financial penalties on those who take unauthorised water or otherwise break the rules; help water users to generate social backing/pressure for WUA executives to enforce penalties; and help the WUA executives to evaluate constraints to enforcement and to find solutions in consultation with water users.
- Develop good relations and a common understanding with the irrigation department responsible for managing the main system, ensuring effective communications, and coherent planning.

12.8 Water Users Schools

Considerable reference to Water Users' Schools has been made in this report. Full details of the programme, which we developed and tested in Nepal in 2002/03 are given in Mott MacDonald (2004), but a brief summary is appropriate here.

The concept of a water users' school (WUS) is not a new one, but it has been adapted from the farmers' field school approach. The fundamental approach is one of learning by doing. This has previously been used on integrated pest management schools (1995 onwards), and later adapted to irrigation through the on-farm water management in Nepal 1997 and integrated crop and water management (ICWM) in 2002. These all aimed at developing skills amongst the farmers, through an effective programme of transfer of knowledge, using adult learning techniques.

The WUS described in this report differed in some key respects from previous FFS. They

- were planned on the basis of the participatory diagnostic studies in each project, so that the approach and curriculum was tailored to local needs;
- include group activities (for institutional development, management of canals etc) as well as individual skills;
- aimed to enable participants to identify, understand and solve problems, not teach them solutions – the WUS is based on the concept of problem identification and solving, rather than transfer of knowledge;
- required purposive selection of participants to ensure representation of all stakeholder groups; and
- specifically aimed to disseminate knowledge and findings to non-participants, using the concept of Minor Schools, which were also designed to ensure a cyclic learning process.

The WUS was held in a convenient sub-unit of the irrigation system as identified during the DL/AP. It provided a forum for weekly meetings in the field, and ensured a basis for free discussion of the issues, enabling the stakeholders to get to know each other better and understand the problems in a non-threatening environment. Field activities were chosen so that the participants learn about the most important features of their system and were helped to understand and solve problems.

Water Users' Schools were envisaged as an entry point activity for involving local stakeholders in improving management and governance of the irrigation system. More specifically they were expected to:

- Increase the practical knowledge of users in sustainable irrigation management, by helping them to identify and solve problems themselves
- Help users and WUAs to identify and introduce practical measures to promote good governance in the WUA and their sub groups
- Increase participation of vulnerable stakeholders such as female-headed households and landless farmers in irrigation management
- Encourage links between water users and WUAs and other local institutions and agencies
- Make users more aware of the role of Government, and the relevant policies, legislation, rules and regulations regarding water management.

It should be stressed that they were intended to strengthen the WUAs and not to work as a substitute for them. They would only be run for a short period, perhaps one or two seasons, and help the WUA to work effectively and in the interests of all stakeholders. This accounts for intensive nature of the WUS and does not imply that the WUAs will need to continue to work on the same basis once the WUS are complete.

12.9 Costs

The precise content and duration of the activities which are included in each season of activities will depend on the history of WUA development and the type of irrigation scheme.

Our estimates for the direct costs of each of steps 1 and 2 are about US$ 25-35 per ha command area in Nepal – so the whole programme in SMIP would cost around $75 - $100/ha, which can be compared with about $1,000 per ha for the rehabilitation and command area development[307]. These costs are analysed further in the final report of GGG (Mott MacDonald, 2004). The direct costs would reduce as the process became better established, but initially the constraint would be on skilled people and organisations to facilitate the programme. A significant part of our work in GGG and EIP was devoted to developing NGOs capacity to undertake these tasks. Costs and resources in other countries will differ, but a gradual introduction of the programme would be necessary as the skills and organisations are built up.

12.10 Conclusions

In this report we have outlined the systematic process we adopted to promote a fairer distribution of water at the local level on selected schemes in Nepal and Kyrgyzstan. By working with water users, we strengthened local institutions and improved their co-ordination with external water supply agencies. We have not prejudged how the water users should want water to be shared, but we enabled a social and political dialogue amongst all classes of stakeholder on the nature of a ‘fair’ distribution and how the WUA can achieve this. We have concluded the report by summarising the findings and achievements of this study in terms of improved water distribution and livelihoods on sample projects, and by offering guidelines for the adoption of a similar approach elsewhere. These guidelines are published separately.

[307] Rehabilitation costs at SRSP were also of this order of magnitude.

We have shown that it is not effective to address water distribution as a purely technical problem - social, institutional, and policy conditions which affect water distribution must all be considered in order to work strategically with the 'drivers of change'. Based on a consideration of the 'drivers of change', there are four 'key ingredients' required to improve irrigation water management:

- Improved technical and management procedures, designed by
- Well informed and involved stakeholders, and implemented by
- A strong, 'embedded' and respected local institution, working within
- An appropriate external policy environment, which gives WUAs the necessary authority and support, and assures them of a predictable water supply.

We have shown that the methods we used are effective in helping water users and WUAs to make water delivery more equitable and to improve access to water for poor farmers. Farmers and WUAs on these schemes are committed to continuing with the management practices which were developed through this project, and believe that they will lead to sustainable improvements in performance. This can be extended to other projects using similar techniques, but this will require a commitment to reform and a sustained level of support by irrigation departments to WUAs. The costs, however, are very small compared to costs of construction or rehabilitation of irrigation infrastructure.

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Nepal

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- Visit Report (March 2004)
- Visit Report (May 2004)
- Visit Report (September 2004)
- Visit Report (January 2005)

Nepal – Case Study Reports

- Final Report – KIS
- Final Report – SMIP

Note visit reports incorporate all internal reports by local NGOs and others

Appendices (bound separately)

Appendix A **Logical Framework**

Appendix B **Irrigation Management Reforms in China**

Appendix C **Legal and Policy Background to Water Management in Nepal**

Appendix D **Development and Performance of WUAs in Ningxia Province, China**

Appendix E **Quantitative Data on Water Distribution: Nepal and Kyrgystan**

Appendix F **Livelihoods – Supporting Data**

Appendix G **WUA Action Plans, Minutes and Reports, SMIP, Nepal**

Appendix H **Formats for monitoring repairs, maintenance and water management - SMIP**